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16. ABSTRACT

This report summarizes WSDOT's 10 years of experience with "epoxy" and "Methyl Methacrylate" (MMA) thin polymer bridge deck overlays.

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Thin Polymer Bridge Deck Overlays

WSDOT's Ten Year Evaluation

by

DeWayne L. Wilson
and
Edward H. Henley, Jr.

Environmental and Engineering Service Center
Bridge & Structures Office
M. Myint Lwin
Bridge & Structures Engineer

Experimental Feature WA86-01,02,04,05,06,07,08,09
Final Report

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February 1995

Disclaimer

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Executive Summary

This report summarizes the Department's 10 years of experience with "epoxy" and "Methyl Methacrylate" (MMA) thin polymer bridge deck overlays.

WSDOT uses a 1.5 inch thick modified concrete (either Latex or Microsilica) as its primary type of bridge deck overlay. Modified concrete overlays are considered to be more durable and require less long term maintenance than thin polymer overlays. Modified concrete overlays are also preferred when the amount of deck repair is extensive, since repairs made with concrete have performed better than patching materials used with a thin polymer overlay.

In some cases a bridge's physical characteristics, such as lightweight design or narrow roadway width, will not allow using a modified concrete overlay. Thin polymer overlays provide an alternative. Thin polymer overlays offer more rapid construction, curing in 4 to 8 hours compared to 42 hours for a modified concrete overlay. Thin polymer overlays are light weight (due to their 3/8 inch thickness), approximately 5 lbs./SF verses 19 lbs./SF for a modified concrete overlay and are generally less labor intensive and require less specialized equipment than a modified concrete overlay.

In order to evaluate several different polymer overlay products, WSDOT selected eight bridges to be included in a FHWA sponsored experimental feature program that began in 1985. The purpose of the experimental feature program was to gain knowledge about field installation techniques and procedures, and to assess the performance and effectiveness of the polymer overlays over time.

The latest bond tests on several bridges show that epoxy overlays have a higher average value (274psi.) over time compared to MMA overlays (143psi.). The latest friction numbers show MMA overlays retain friction resistance very well over time, from an initial average value of approximately 40 to a value in the mid 30s after nine years of service. Test results show that the initial friction numbers for epoxy overlays starts around 70 and falls to the mid to low 20s in five to seven years.

While most thin polymer concrete deck overlays will require application of additional polymer material at 5-10 year intervals (depending on the nature and volume of traffic), they provide a viable alternative to rigid concrete overlays where rapid construction is essential, or where the addition of dead load is critical.

Polymer Overlays

The term "polymer" refers to the binder or glue in the polymer overlay similar to portland cement in a concrete mixture. A polymer is best described as a chain of similar molecules that are linked together by a chemical reaction. For bridge deck overlays, the polymers are formulated to provide an impermeable barrier against water and deicing salt intrusion, to cure quickly for rapid construction, and to have sufficient flexibility to provide a well bonded overlay.

Polymers are generally hydrophobic until they are fully cured, which means the bridge deck must be dry during the overlay construction. Polymers generally achieve a final cure in 4 to 8 hours, depending mostly on the ambient temperature during construction. The final overlay thickness is specified to be 3/8 inch to provide good deck substrate protection and wear resistance.

The two types of polymers used in WSDOT overlays are "epoxies" and "Methyl Methacrylates" (MMA). WSDOT has evaluated polymer materials from 10 different manufactures. Currently, WSDOT allows the contractor to choose a polymer from the five listed in Table 1.

Manufacturer	*Brand Name*	*Polymer Type*
Sika inc.	Sikadur 22	Epoxy
Polycarb	Flexogrid	Epoxy
Dural	Flexolith	Epoxy
Degussa	Degadur 330	MMA
Silikal	R66	MMA

TABLE 1 WSDOT list of Approved Polymer Products

The first step in a polymer overlay begins with repairing any bridge deck delaminations. The entire bridge deck must be surveyed to determine areas of concrete delamination, WSDOT uses the chain drag method as specified in ASTM D4580-86 . Once delaminated areas are located, all spalled and delaminated concrete is removed and replaced with new polymer patching material. When the amount of deck repair is extensive a special portland cement concrete (PCC) design mix may be specified in lieu of the polymer patching material.

FIGURE 1 Cleaning bridge deck with a Shotblaster.

Following the repair of bridge deck delaminations, a shotblasting machine is used to remove all surface contaminates. A shotblasting machine is designed to propel metallic abrasives toward the deck surface at a high velocity. When the metallic abrasives strike the concrete surface they rebound along with any contaminates. The metallic abrasives are recycled by collecting them with magnets while the contaminates from the bridge deck are separated into a dust collector.

Shotblasting machines can be obtained from a wide variety of manufacturers. Shotblasters are typically 10-16 inches in width and have a production rate of approximately 500 square feet/hour. The bridge deck should have a bright white appearance once the shotblasting operation is complete. A test method outlined in ACI 503R can be used to determine if the bridge deck surface has been properly cleaned. The application of the polymer overlay should immediately follow the shotblasting. If traffic is allowed on the bridge deck or it rains, the bridge deck should be shotblasted again.

WSDOT specifies the same aggregate gradation for MMA and epoxy overlays. The aggregate is obtained from a pit site near the town of Steilcoom, Wa. The aggregate is crushed, thoroughly washed, dried, and packaged by the supplier - Manufacturers Mineral CO. of Renton, Wa. The requirement of the 5/8"x1/2" aggregate size is unique to WSDOT specifications. WSDOT began specifying this larger aggregate to correct a problem with skid resistance retention found in earlier polymer overlays.

The construction procedures for an epoxy overlay verses a MMA overlay are somewhat different. A "broom and seed" method is used for epoxy overlays; this involves applying the epoxy and "broadcasting" aggregate in two lifts to attain the required overlay thickness. MMA overlays use a "slurry" method, where the MMA and aggregate fillers are pre-blended in small concrete mixers and then placed on the bridge deck in one layer.

Epoxy

FIGURE 2 Mixing epoxy.

Epoxy resin binders are usually two-component systems, with one component containing the resin and the second containing the curing agent or initiator. Mixing the epoxy components properly is very important. Epoxies are generally mixed at a 2:1 or 1:1 ratio depending on the manufacturer. Contractor's typically batch the epoxy resin in 5-15 gallons. Continuous batching machines are not allowed based on past unsatisfactory performance.

The "gel-time" of an epoxy is typically 25-35 minutes. Gel-time is defined as the time before a polymer begins its initial setup. The epoxy must be placed and spread on the bridge deck prior to the gel-time in order to achieve good bond strength. Aggregate must also be placed prior to the gel-time to prevent premature loss of aggregate and to obtain good friction resistance.

The sequence for a WSDOT epoxy overlay is as follows:

① Prime coat - 100 sq.ft./gallon
② Epoxy resin - 30-40 sq.ft./gallon
③ Aggregate - 5/8"x1/2" @ 0.75 lbs/sq.ft. & No.6 x No.10 to excess.
④ Sweep off excess aggregate.
⑤ Epoxy resin - 30-40 sq.ft./gallon
⑥ Aggregate - No.6 x No.10 to excess.
⑦ Sweep off excess aggregate.
⑧ Seal coat - 100 sq.ft./gallon

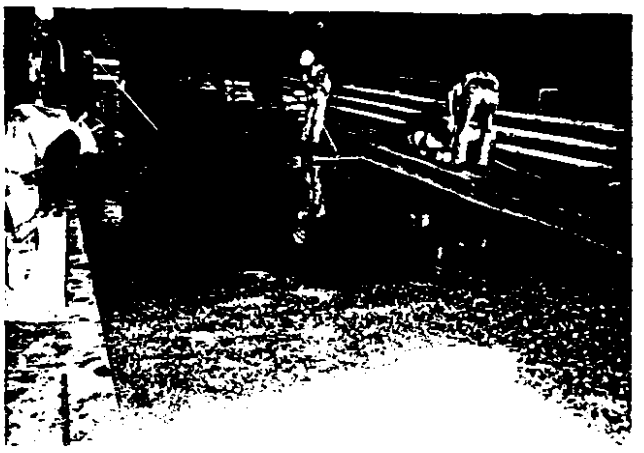


FIGURE 3 Epoxy overlay construction.

An epoxy overlay begins with the application of a prime coat. The prime coat material has a higher viscosity than the primary epoxy allowing it to fill the voids and cracks in the bridge surface. WSDOT recently began requiring a prime coat, based on premature debonding of some epoxy overlays without a prime coat.

Following the prime coat, a layer of mixed epoxy resin is applied. The epoxy is poured onto the bridge deck and spread into place with a grooved squeegee.

Aggregates are then hand spread over the epoxy before it gels, this procedure is repeated once the epoxy cures and the excess aggregate is removed. The larger sized aggregate is used in the second lift to provide good long term skid resistance.

The final surface is covered with a seal coat of polymer. The seal coat is necessary to prevent premature aggregate loss caused by vehicular traffic. Epoxy overlays may require a few more hours of application time than the MMA overlays, since they are applied in two layers compared to one for a MMA overlay. The MMA overlays typically cure faster than epoxy overlays.

Methyl Methacrylate (MMA)

FIGURE 4 Mixing MMA components.

The MMA slurry used for bridge deck overlays consists of two MMA resins, a powder hardener, and filler aggregates which are all mixed together in a small concrete mixing machine.

MMA resins are known for their distinct odor compared to epoxy resins. MMA resins require a powder hardener (initiator) to be added in order to begin the chemical reaction between the components. The amount of initiator used determines the gel time of the mixture, which is approximately 30 minutes. The amount of initiator is also adjusted during mixing to compensate for the prevailing temperature.

Aggregate filler material is mixed with the other MMA components to provide the desired consistency of the slurry. The amount of aggregate fillers used is directly related to the desired overlay thickness.

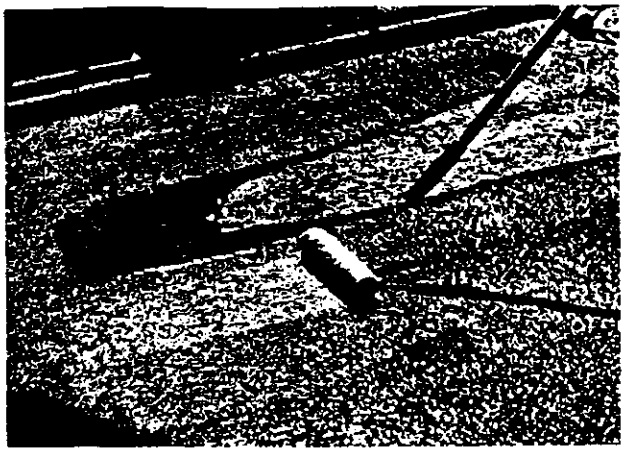


FIGURE 5 MMA prime coat application.

A prime coat of low viscosity MMA resin preceeds the application of the MMA slurry to the bridge deck. The prime coat should be "tacky" when the MMA slurry is applied.

The prime coat material is designed to fill cracks and voids in the bridge deck prior to the MMA slurry application. The prime coat also improves the bond of the overlay to the deck by preventing the withdrawal of the primary MMA resin from the slurry into the bridge deck.

FIGURE 6 MMA spread with gage rake.

FIGURE 7 Hand broadcast of aggregate.

Once the MMA slurry is properly mixed, wheel barrows are used to transport the MMA slurry onto the bridge deck. Tools with metal spikes, known as "gage rakes" are used to spread the MMA slurry over the bridge deck. On past projects, contractors used trowels to spread the MMA slurry. It appears that contractors have discontinued the trowel method due to the added labor required.

Additional aggregate is hand spread over the MMA slurry before the Gel time has been reached. The aggregate gradation is the same as specified in the first lift of an epoxy overlay; 5/8" x 1/2" aggregate at 0.75 lbs./square foot and no.6 x no.10 aggregate until the entire overlay is covered.

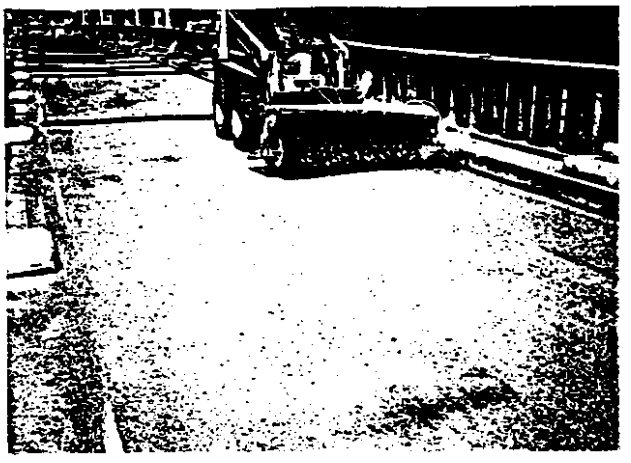


FIGURE 8 Sweeping excess aggregate.

Excess aggregate that has not bonded is swept away after the MMA has cured. Most contractors choose to use a mechanical sweeper for this process. MMA overlays only require this task at the end of the overlay, allowing a time savings over epoxy overlays that require excess aggregate to be removed twice.

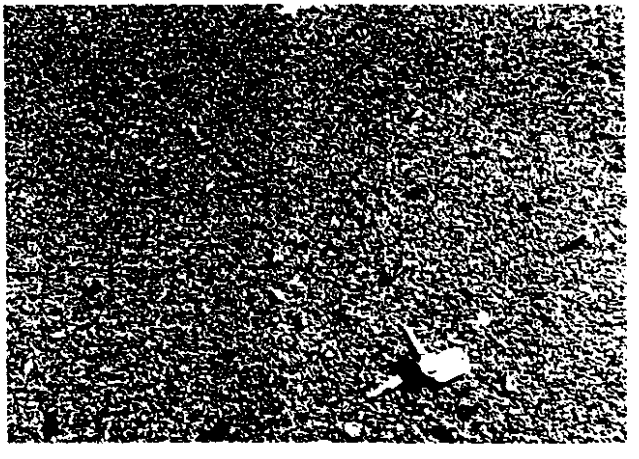


FIGURE 9 Final Polymer overlay surface.

The final overlay surface of both MMA and epoxy overlays has the appearance shown in figure 9. Note the larger aggregate protruding above the overlay surface. These larger aggregates are expected to provide better long term friction resistance than the test data reflects for pre 1992 overlays.

One concern with the use of the large aggregate is the possibility of snow plows scraping them during winter snow removal. Although these large aggregates have only been used in WSDOT polymer overlays since 1992, no evidence of snow plow damage has been noted.

When should a Polymer Overlay be used?

Bridge Deck Testing

A bridge deck survey is used to determine if a bridge deck requires a protective overlay. A WSDOT bridge deck survey consists of chloride-ion, delamination and rebar concrete cover tests. In special cases cores may also be taken from the bridge deck to obtain further information such as compressive strength and permeability of the concrete. Table 2 provides a list of values that WSDOT uses to determine if a protective deck overlay is warranted. Results above the values shown in any one of the tests will determine that a protective overlay is required.

Test	Value when Overlay Required
Chloride-ion	>20% above 2lbs/CY
Delamination	>2% of deck area
Rebar Cover	>15% of measurements are less than 1 inch

Table 2 Bridge deck survey criteria

Chloride-ion testing measures the amount of salt present in the concrete at the level of the top mat of reinforcing steel. The chloride test envolves the removal of concrete powder from the bridge deck. to be tested at a materials laboratory. Typically the number of samples are one per 750 sq.ft. of bridge deck.

A delamination survey consists of chain dragging the entire deck to determine the amount of unsound concrete. Concrete that is unsound will resonate a hollow sound due to the separation of the concrete from the reinforcing steel, caused by the reinforcing steel corrosion. Previously patched areas are considered as "temporary repairs" for deck rehabilitation program decisions.

The rebar concrete cover test consists of taking a reading from a pacometer on a 5 foot grid over the entire deck area. The pacometer, a magnetic based instrument, is used to measure the depth of the reinforcing steel below the concrete bridge deck surface.

Polymer or Modified Concrete?

WSDOT utilizes a 1.5 inch thick modified concrete (either Latex or Microsilica) as its primary bridge deck overlay. Modified concrete overlays are considered to be more durable and require less long term maintenance than polymer overlays. Modified concrete overlays are well suited to correct deck profile and minor drainage profile deficiencies and can be constructed in Washington nearly any time of the year, while polymer overlays are best suited for dry warm temperatures present during late spring thru early fall. Modified concrete overlays are also preferred when the amount of deck repair is extensive, since repairs made with concrete have performed better than patching materials used with a polymer overlay.

Polymer overlays offer more rapid construction, curing in 4 to 8 hours compared to 42 hours for a modified concrete overlay. Polymer overlays are light weight, approximately 5 lbs./SF verses 19 lbs./SF for a modified concrete overlay. Polymer overlays are generally less labor intensive and require less specialized equipment than a modified concrete overlay.

Bridge Design and Site Conditions

In many cases a bridge's physical characteristics, such as lightweight design or narrow width, will not allow using a modified concrete overlay. Polymer overlays provide an alternative. Table 3 provides a list of a few conditions when a polymer overlay might be specified.

Category	Examples
Deadload restrictions	Movable bridges
Narrow bridges	2 lane bridges < 26ft wide
Rapid construction needed	Highway ramp bridges
Vertical clearance restriction	Steel trusses < 15'6" high
improve skid resistance	Bridges with a grid deck

Table 3 Bridge physical conditions when a polymer overlay may be selected.

Bridges with load restrictions were typically built to accommodate lighter live loads compared to current criteria. Movable bridges are especially sensitive to additional dead load since their design requires any dead load be counter balanced. The original design on many of these bridges did not account for adding future dead load. A polymer overlay has been used on five WSDOT movable bridges to date.

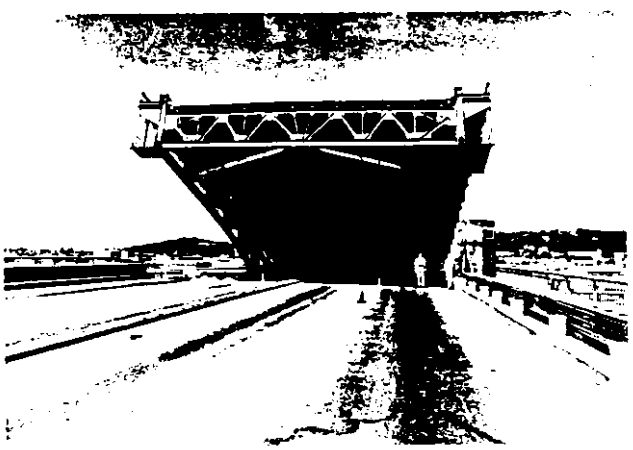


FIGURE 10 Polymer overlay on a movable bridge.

One of the first polymer overlays used by WSDOT was applied in 1985 to the Chehalis River bridge (no.101/115) near Aberdeen. This bridge has a 236 ft bascule movable span. The deck on the bascule span consists of a grid deck partially filled with concrete.

In 1985, a deck rehabilitation project was completed on the entire bridge. The steel girder and concrete box approach spans received a 1.5" thick latex modified concrete overlay. The concrete in the grid deck was "cupping" due to high volumes of truck traffic.

A thin polymer overlay was selected for the movable span, since it could not tolerate much additional deadload. To date, the polymer overlay has offset further wear in the filled concrete deck and has generally provided a good overall riding surface and improved skid resistance.

Another example of a bridge requiring a polymer overlay due to deadload restrictions is on the Hood Canal floating bridge (no. 104/5.2) A polymer overlay was applied in 1988 to the east half of the Hood Canal bridge. A polymer overlay was selected since this bridge could not tolerate much additional deadload and the traffic volumes on this two lane route mandated rapid construction. This bridge is located in a salt water environment which creates a high corrosion potential for the unprotected reinforcing steel. The deck overlay on the Hood Canal bridge is also the largest by volume (101,388 sq.ft.) of any polymer applied to date by WSDOT.

FIGURE 11 Polymer overlay on a narrow bridge.

A polymer overlay is typically specified on narrow bridges since their construction time and traffic control requirements has less of an impact on traffic than a modified concrete overlay. Temporary cones or barrels are used for traffic control during the polymer overlay construction since the polymers cure rapidly, allowing the construction area to be opened to traffic at the end of the construction shift.

For example, in constructing a modified concrete overlay a bridge must have a minimum width of 26 feet to allow one lane of traffic to remain open during construction. The 26 feet minimum width applies because modified concrete overlays require the use of temporary concrete New Jersey barriers to be placed between the construction area and traffic. These barriers are two feet wide and the minimum allowed lane width is eleven feet.

Polymer overlays have also been very useful on movable bridges with open steel grid decks. WSDOT used a polymer overlay in the wheel paths of two such bridges; the 1st Avenue South bridge (no. 99/530) and the Albert D. Rosellini - Evergreen Pt. floating bridge (no. 520/8).

The 1st Avenue South bridge is located over the Duwamish River near the city of Seattle. The bridge was built in 1956 and carries 4 lanes of two way traffic. The wheel paths were filled with "Set-45" concrete in 1980 to offset the cracking of welds in the grid deck. In 1988 the Set-45 material was wearing and in need of rehabilitation. A polymer overlay was placed over the Set-45 material to improve the friction resistance. After 6 years in service, the polymer material is wearing in the heavily traveled outside lanes (as shown in Figure 12).

FIGURE 12 Polymer in wheel paths of a grid deck.

Performance on WSDOT Bridges

Overlay Bonding

The bond pull-off test is used to measure the adhesion force of an overlay. The American Concrete Institute's (ACI) test method 503R outlines the methods and materials required for the bond test. The test begins by coring a 2-inch diameter hole through the overlay into the base concrete. The core is left in place and a pipe cap is bonded to the overlay. The testing apparatus is then attached to the pipe cap. The tensile force required to bring about separation is then recorded. The force over the 2-inch area provides a bond pull-off value in pounds per square inch (psi).

FIGURE 13 Bond Pull-off Test.

Documenting where the failure occurs is an important part of this test. Failure can occur in the base concrete, at the bond line between the base concrete and the overlay, inside the overlay, or in the testing adhesive used to attach the pipe cap.

National polymer committees (such as AASHTO Task Force 34) have recommended that polymer overlays have a bond pull-off value of 250psi. This value should reflect good adhesion to a bridge deck that has been well prepared when a polymer overlay material that has been properly mixed and applied. It is interesting to note that most data sheets from polymer manufacturer's indicate their products bond strength will exceed the 250psi value.

Bond tests have been taken on 13 of 32 WSDOT bridges with epoxy overlays and 9 of 23 MMA overlays. Tables 7 & 8 reflect an average value of several tests taken throughout the bridge deck overlay during a site visit. The initial testing visit was usually conducted soon after the overlay was completed. Generally more initial tests were performed (typically 5 to 27) than for the follow-up testing (typically 3 to 6).

The information obtained has been be reviewed for general trends. The pull-off value seldom represents the bond strength of the overlay since the failure most commonly occurs in the base concrete. Failure in the base concrete reflects the surface strength of the concrete deck.

Results from the epoxy overlays reflect an average value (297psi.) obtained from all the initial tests which is above the recommended value of 250psi. The average value obtained from the latest follow-up bond tests (274psi.) reflects only a modest decline over time. Bridges 900/12W, 167/102, and 167/104 have average bond test values where the average value improved over the initial tests taken. The average value from the latest bond tests on the remaining bridges were less than the results from their initial tests, with all but three of these being greater than the

recommended 250psi.. On several bridges, the bond tests indicate the overlay has good adhesion yet a chain drag test shows some areas of debonding.

Bridge Number	Brand Name	Year Applied	Initial Ave. Bond (psi) {no. of tests}	Latest Ave. Bond (psi) {no. of tests}	Overlay Age @ Latest Bond test	Chain drag % of deck debonded
161/10	EPI/Flex III	1986	294 {10}	not tested		1/92 - 0.1%
82/115S	Concresive 3070	1987	392 {8}	276 {3}	3 years	4/92 - 2.5%
5/316	EPI/Flex III	1990	363 {15}	266 {5}	4 years	①
82/10S	Flexolith	1985	359 {12}	355 {5}	3 years	4/92 - 4.6%
900/12W	Flexolith	1986	201 {15}	327 {6}	5 years	8/92 - 0.3%
101/115	Flexogrid	1984	399 {6}	191 {5}	4 years	5/92 - 0.1%
12/915	Flexogrid	1986	259 {21}	252 {6}	3 years	4/92 - 2.1%
167/102	Flexogrid	1987	267 {5}	377 {3}	1 year	①
167/104	Flexogrid	1987	215 {5}	257 {3}	1 year	①
167/106	Flexogrid	1987	342 {5}	287 {3}	1 year	①
104/5.2	Flexogrid	1988	308 {27}	244 {6}	4 years	①
529/20E	Flexogrid	1988	267 {5}	187 {6}	3 years	7/92 - 0.2%
529/20W	Flexogrid	1988	207 {5}	not tested		7/92 - 0.1%
		Average	297	274		

TABLE 4 Summary of Bond Test Results from Epoxy Overlays

note ①: No chain drag test taken, no obvious debonded areas are visible.

Results from the post construction testing of the MMA overlays reflect an average value (211psi.), which is below the recommended value of 250psi. The average value obtained from the latest follow-up bond tests (143psi.) reflects a substantial decline over time. Six of the nine initial results and four of the five latest results are below 250psi.

Bridge Number	Brand Name	Year Applied	Initial Ave. Bond (psi)	Latest Ave. Bond (psi)	Overlay Age @ Latest Bond test	Chain drag % of deck debonded
5/523E	Conkryl	1988	162	not tested		①
82/114S	Concresive 2020	1987	284	258	3 years	11/92 - 12.1%
27/3	Silikal R66	1990	229	not tested		①
101/514	Degadur 330	1985	155	128	3 years	1/92 - 2.0%
4/106A	Degadur 330	1986	113	85	5 years	4/93 - 0.0%
167/21E	Degadur 330	1987	290	111	1 year	1/92 - 0.0%
512/40N	Degadur 330	1987	259	135	1 year	1/92 - 0.0%
16/120	Degadur 330	1988	189	not tested		①
97/2	Degadur 330	1989	217	not tested		6/92 - 17.0%
		Average	211	143		

Table 5 Summary of Bond Test Results from MMA Overlays

note ①: No chain drag test taken, no obvious debonded areas are visible.

Based on the results from Tables 4 and 5 it appears that epoxy overlays generally have a better bond compared to MMA overlays.

Friction Testing

ASTM E274-90 (standard test method for skid resistance of paved surfaces using a full-scale tire) provides the standard for the test procedure and equipment. The equipment requires 135 feet to perform the test, which takes approximately 2 seconds at the standard test speed of 40 mph. This equipment is primarily used to evaluate roadway pavement performance by taking friction tests at each state highway milepost.

FIGURE 14 Friction testing equipment.

Friction tests are routinely taken on selected WSDOT polymer overlays to monitor their wear over time. Repairs are made to those polymer overlays that have low friction numbers.

To evaluate the performance of polymer overlays under identical conditions a test section was established in 1989 on the outside lane of bridge no. 520/25N-120th ave. overcrossing. This bridge carries two lanes of westbound traffic on state route 520. The approximate average daily traffic (ADT) is 52,000 which calculates to 26,000 over the test section.

The bridge was divided into four equal sections and polymers from Polycarb, Degussa, Adhesive Technology and Dural were applied by the same contractor. The graph below summarizes 5 years of friction test results. The friction numbers are comparable until the fifth year where Degussa's MMA (40) is above the epoxies, Dural (30), Adhesive Tech. (18) and Polycarb (19).

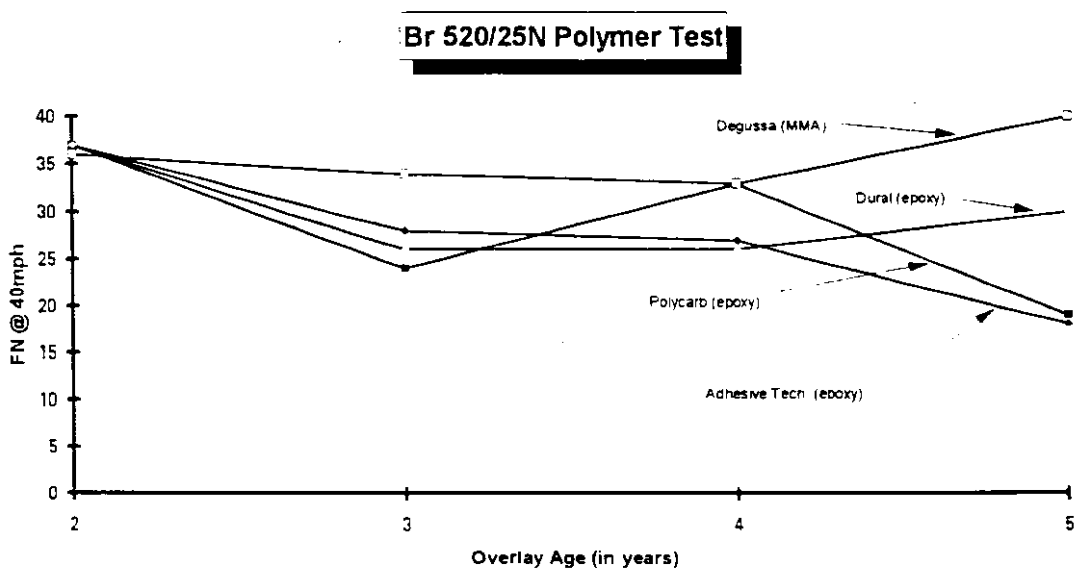


FIGURE 15 Friction Number vs. Polymer Overlay Age.

WSDOT also has as many as nine years of friction test results on other polymer overlays. The following graph represents data from three older WSDOT epoxy overlays. It is apparent that the initial friction numbers for epoxy overlays starts at 70 and falls to approximately 20 after seven years.

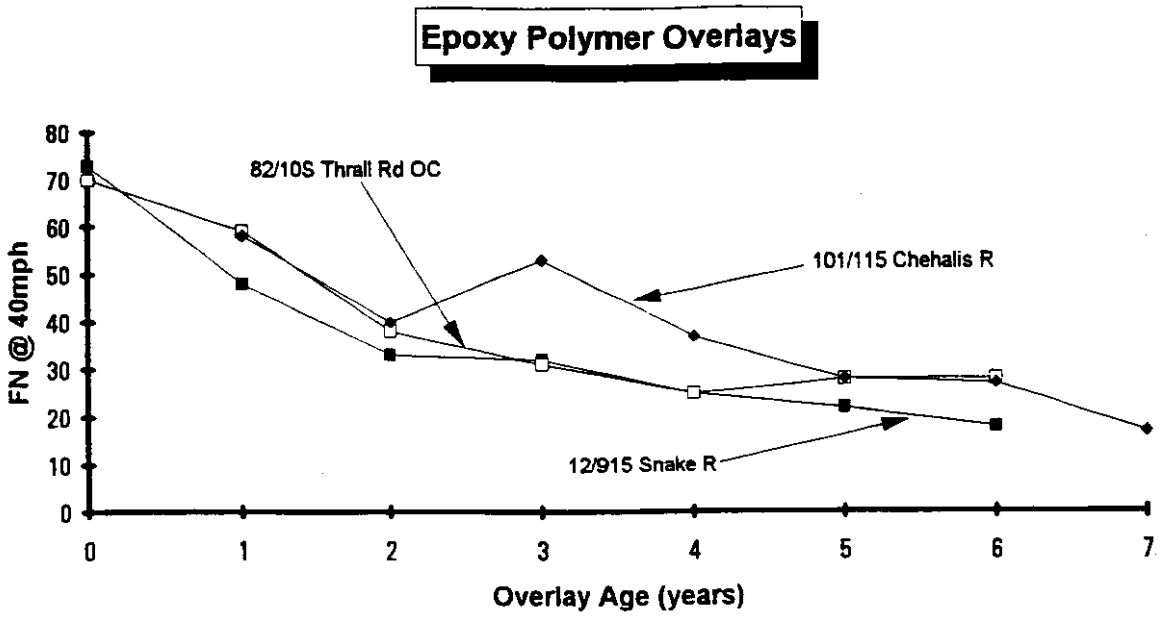


FIGURE 16 Friction Number vs. Polymer Overlay Age.

MMA polymer overlays appear to have better long term friction numbers than epoxy polymer overlays. The following graph shows that MMA overlays have continued to maintain their friction numbers over time, from an initial value of approximately 40 to a value of 39 at nine years.

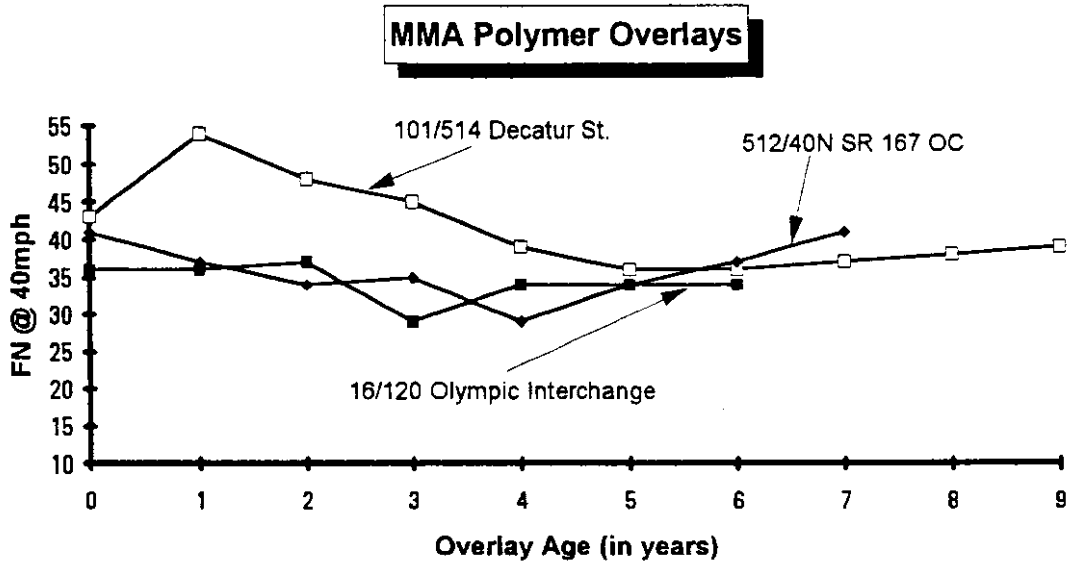


FIGURE 17 Friction Number vs. Polymer Overlay Age.

WSDOT's specifications were revised in 1991 to improve retention of friction numbers for polymer overlays. Large aggregate (1/2") at a rate of 0.75 lbs per square foot is now hand broadcast over the polymer overlay.

Chloride Permeability

WSDOT uses the test method outlined in AASHTO T-277-831 to determine the chloride permeability of overlays. This test applies a 60 volt DC electric current across a 2-inch long specimen for six hours. The amount of charge passed (measured in coulombs) provides a measure of the chloride-ion permeability. A low value corresponds to good resistance against chloride-ion penetration. The values (in coulombs) for low to high permeability are defined in the FHWA report RD-81/119. The presence of chloride ions around unprotected reinforcing steel is the primary cause of bridge deck deterioration. The chloride permeability test provides a measure of an overlay materials ability to resist intrusion of deicing salts that are used on highways during the winter season.

Chloride Permeability	Charge Passed (coulombs)
High	> 4,000
Moderate	2,000-4,000
Low	1,000-2,000
Very Low	100-1,000
Negligible	<100

Table 6 FHWA Values

Overlay Type	Range	Average
Polymer-Epoxy	0-6	3
Polymer-MMA	0-0	0
Latex Mod. concrete	101-1,117	365
Microsilica concrete	149-1,410	577
Low Slump concrete	438-2,400	1,443
Standard WSDOT bridge deck conc.	1,400-6,840	2,983

Table 7 Chloride Permeability Test Results

Chloride permeability tests have been conducted on many of the state's bridge deck overlays. The test values for epoxy and MMA overlays were obtained as part of the SHRP C103 study of nationwide polymer overlays. Six samples from epoxy overlays and five samples from MMA overlays were tested with the values shown in Table 7. Based on chloride permeability values, both epoxy and MMA polymer overlays provide excellent resistance against chloride-ion penetration compared to the other bridge deck overlay types.

Product Information

WSDOT recognized the need for a lightweight, fast construction bridge deck overlay in the early 1980's. Polymer overlays fit that need. In order to evaluate several different polymer overlay products, WSDOT selected eight bridges to be included in a FHWA sponsored experimental feature program. The purpose of the experimental feature program was to gain knowledge about field installation techniques and procedures, and to assess the performance and effectiveness of the polymer overlays over time.

Each polymer manufacturer selected was allowed to be a sole-source supplier on eight different bridges. Post construction reports were completed following the application of each polymer. A 10 year testing schedule was also established at the beginning of each project. The overlays have been tested for; Half-cell, Resistivity and continue to be tested for; bond strength, skid resistance and chloride content. A list of the products WSDOT is evaluating as part of the experimental features program is provided.

Bridge Number	Bridge Name	Polymer Manufacturer	Brand Name	Polymer Type	Year Applied
4/106A	Grays River	Degussa	Degadur 330	MMA	1986
12/915	Snake River	Polycarb	Flexogrid	Epoxy	1986
900/12W	SR 5 OC	Dural	Flexolith	Epoxy	1986
900/13W	SR 5 OC	Sika	Pronto 19	HWMMA	1986
82/114S	Yakima River	Adhesive-Engr	Concresive 2020	MMA	1987
82/115S	Naches River	Adhesive-Engr	Concresive 3070	Epoxy	1987
5/523E	So. 154th OC	Contar-USA	Conkryl	MMA	1988
5/316	Custer Way UC	Adhesive Tech.	EPI/Flex III	Epoxy	1990

TABLE 8 Polymers included in Experimental Features Program

WSDOT has also installed and field tested several polymers from manufacturers other than those in the experimental features program. Sika's and Adhesive System's epoxy and Silikal's MMA were allowed to competitively bid against other approved polymers in 1990. The Sika and Silikal overlays have both performed well to date. There were bond, wear, and construction problems with the Adhesive System's epoxy on four separate installations.

A complete list of the polymers used on WSDOT bridges and their corresponding total deck area is provided in Table 9. Information regarding WSDOT's experience from each polymer manufacturer is also provided.

Polymer Manufacturer	Brand Name	Polymer Type	No. of Installations	Total Area (Sq.Ft.)
Adhesive-Engr	Concresive 2020	MMA	1	11,360
Adhesive-Engr	Concresive 3070	Epoxy	1	11,360
Adhesive Sys. Inc.	Flexi-Clad	Epoxy	4	32,652
Adhesive Tech. Corp.	EPI/Flex III	Epoxy	2	19,297
Contar-USA	Conkryl	MMA	1	8,820
Degussa	Degadur 330	MMA	16	151,815
Dural	Flexolith	Epoxy	3	49,167
Polycarb	Flexogrid	Epoxy	9	254,580
Sika	Sikadur 22	Epoxy	13	166,645
Silikal	Silikal R66	MMA	4	13,579
Sika	Sika Pronto 19	HWMMA	1	replaced w/Sikadur 22
		Total	55	719,275

TABLE 9 Polymer manufacturers used by WSDOT

Adhesive Engineering
(Concresive 2020 - MMA)

Bridge 82/114S Yakima River

The overlay was placed in 1987 as part of the FHWA experimental feature program. The contractor used a straight edge screed to strike-off the overlay. This caused the aggregate to be covered with polymer and post construction friction testing showed low skid numbers. Subsequent friction testing has shown an improvement in the skid numbers as the polymer has worn and more aggregate in the polymer is exposed. A chain drag test in 1992 showed the 12.1% of the overlay was debonded.

Adhesive Engineering
(Concresive 3070 - Epoxy)

Bridge 82/115S Naches River

The overlay was placed in 1987 as part of the FHWA experimental feature program. Friction testing in 1992 revealed that the overlay had low skid resistance numbers. A chain drag test in 1992 showed 2.5% of the overlay was debonded.

In 1992 the debonded areas were repaired and the entire bridge was covered with a layer of Dural polymer and aggregates.

Adhesive Systems INC.
(Flexi-Clad - Epoxy)

Bridge 101/125E Hoquiam River

The polymer was formulated by the manufacturer to be machine mixed to provide a continuous flow of polymer onto the bridge deck. The machine broke down and the contractor finished the job by mixing the polymer components in standard 5 gallon batches. Six months after construction the overlay began spalling. Approximately 5-10% of the overlay has spalled in large areas through out the bridge deck.

Bridges 5/415A, 5/515, 5/521N-W

The machine mixer was used on all three of these bridges with similar results. Bridges 5/415A and 5/521N-W have many areas that have bubbled-up and some spalling has occurred. Bridge 5/515 does not have any areas of the overlay that have spalled.

Adhesive Technologies Corp.
(Epi/Flex III - Epoxy)

Epi/Flex III was used on two WSDOT bridges and has performed well to date.

Contar-USA
(Conkryl - MMA)

This product was used on one WSDOT bridge as part of the Experimental Feature Program. No problems have been noted with this installation. Conkryl has not been selected by contractors on deck overlay projects for several years and has been removed from the approved product list.

Degussa
(Degadur 330 - MMA)

Bridge 101/514 Decatur St. Undercrossing

This overlay is now nine years old. In 1991 several small areas of the overlay (totaling 10 square feet) debonded and spalled. A chain drag test revealed 2.0% (132 sq. ft.) of the overlay is debonded. Visual inspection shows the overlay has a yellowish appearance. This bridge will be widened in 1996, the Degussa overlay will be removed as part of the widening project.

Bridge 97/2 BN Railroad Overcrossing

This bridge is located near the Washington-Oregon border on state route 97. There is a steep grade across the bridge (6.5%). The bridge had extensive deck repair with pre-packaged patching material prior to the overlay application in 1989. A chain drag test in June, 1992 showed 17.0% of the overlay to be debonded and approximately 2.0% of the overlay on the center span had spalled. An ACP overlay was placed over the MMA overlay in 1993 to improve the riding characteristics and to prevent further wear of the polymer overlay.

Dural
(Flexolith - Epoxy)

Bridge 82/10S Thrall Rd Overcrossing

Several problems related to the machine mixing were encountered during this installation in 1985. A machine that mixed and distributed the polymer with aggregate onto the bridge deck was used. The construction was interrupted several times due to rain. During construction, the contractor ran out of materials. The overlay thickness was found to be 3/8 - 1/2 inch verses the planned thickness of 1/4 inch. A 120' x 15' area of the deck was completed two months after the original overlay. After construction, approximately 180 square feet were found to be debonded. A decision was made not to repair these debonded areas, but to monitor them and repair as necessary.

Friction testing in 1992 revealed the overlay had low skid resistance numbers in the main driving lane. A chain drag test in 1992 indicated that 4.6% of the overlay was debonded. In 1992, the debonded areas were repaired and the driving lane was covered with a layer of Dural polymer and aggregates.

Bridge 900/12W SR 5 Overcrossing

The overlay was originally construction in November 1986 as part of the Experimental Feature Program. During construction six areas (1'x1' to 2'x2') of uncured epoxy were found and the overlay thickness was determined to be 3/16 inches. In June, 1988 the entire bridge deck was

shotblasted, the uncured areas were removed and repaired, and another layer of material and aggregate was applied to the entire deck.

Currently there are three areas (approximately 30 square feet total) that have spalled. Recent friction tests show low skid resistance. An ACP overlay will be placed on this bridge deck in 1995 to improve the skid resistance.

Bridge 203/106 Skykomish River

Approximately 20 square feet of the overlay debonded soon after construction. These areas have been repaired.

Polycarb
(Flexogrid - Epoxy)

Bridge 101/115 Chehalis River

This overlay was applied in 1984 and was the first polymer overlay on a WSDOT bridge. In 1991, friction testing showed that the main driving lanes in both directions had low skid resistance. A layer of polymer and aggregate was placed in the driving lanes in 1991 to improve the skid resistance.

Bridge 12/915 Snake River @ Clarkston

This overlay was constructed in 1986 as part of the Experimental Feature Program. Friction testing in 1992 revealed that the overlay had low skid resistance numbers. A chain drag test in 1992 showed 2.1% of the overlay was debonded. In 1992, the debonded areas were repaired and the overlay was covered with a layer of Dural polymer and aggregates. This work was included in a polymer overlay restoration project on three eastern Washington bridges.

Sika
(Sikadur 22 - Epoxy)

Bridge 5/532.5 SR5 Overcrossing - Albro Street

This bridge carries a city street over Interstate 5. The bridge is on a steep vertical curve with stop lights at both approaches. This was the contractor's first time applying a polymer overlay on a bridge. The contractor used too much seal coat and buried the aggregate in the overlay. After construction, shotblasting was used, unsuccessfully, to improve the skid resistance. Another layer of polymer material and aggregate was added in 1992.

Sika
(Pronto 19 - MMA)

Bridge 900/13W SR 5 Overcrossing

The overlay was originally construction in November 1986 as part of the Experimental Feature Program. The contractor attempted to place the polymer to the full quarter inch depth in a single lift. The depth of the overlay was checked and did not meet the thickness specification and

additional material was applied to the entire bridge deck at no cost to the state. Post construction bond test revealed low adhesion values.

In the fall of 1987, the overlay began to debond and spall. The contractor was notified and the debonded areas were repaired and another layer of material was applied to the entire bridge deck. Nearly half of the overlay continued to debond and spall. In September 1991, the manufacturer agreed to remove all the overlay and replace it with Sikadur 22 epoxy material. The Sikadur 22 material is currently in good condition.

Silikal
(R66 - MMA)

There have been no reported problems on the four WSDOT overlays with this polymer.

Experimental Test Section on Bridge no. 520/25N

Polycarb (Flexogrid) **Degussa** (Degadur 330) **Adh. Tech.** (Epi/Flex III) **Dural** (Flexolith)

In 1989, the outside lane of bridge no. 520/25N was used for a test to compare four different polymers under the same construction and traffic volume conditions. Each polymer was applied in 94 foot lengths by the same contractor. Visually, all the polymers appear to be well bonded. Friction testing shows the Degussa MMA to have considerably better skid resistance than the other polymers in the test section.

WSDOT Bridges with a Polymer Overlay

Polymer Brand	Date Applied	Bridge Number	Bridge Name	Yr Brg Built	Bridge Type	Area (SF)	Mile post	ADT/ Lane
Conc. 2020	Jul-87	82 / 114S	YAKIMA R	1960	ST	11,360	30.78	6,667
Conc. 3070	Jul-87	82 / 115S	NACHES R	1960	ST	11,360	30.9	6,667
Adh.-Sys.	Aug-89	520 / 25N	120TH AVE NE 0C	1971	CBOX	4,512	7.25	17,333
	Sep-90	5 / 316	CUSTER WAY UC	1956	CA CTB POBX	8,177	104	1,000
	Jun-91	101 / 125E	HOQUIAM R-RIVERSIDE	1970	SL SB	13,020	87.31	5,438
	Jun-91	5 / 521N-W	N-W RAMP	1966	PCB	4,730	154.5	4,200
	Sep-91	5 / 415A	BN RR OC(NP)	1959	CS	1,512	124.6	3,750
	Sep-91	5 / 515	SR 5 UC MILITARY RD	1963	CBOX	13,390	151.2	750
Adh-Tech	Jun-86	161 / 10	SR 512 OC	1971	PCB	11,120	25.67	5,000
Contar	Aug-88	5 / 523E	S154TH ST OC	1965	PCB	8,820	154.5	16,667
Degussa	Aug-86	4 / 106A	GRAYS R ROSBURG	1947	SG-CTB	5,376	6.43	183
	Aug-85	101 / 514	SR 101 UC MOTTMAN RD	1976	PCB	6,640	366.4	7,000
	Aug-87	167 / 21E	MILWAUKEE AVE OC	1972	CS	6,864	5.72	17,500
	Aug-87	512 / 40N	SR 167 OC	1975	PCB	12,806	11.99	13,500
	Apr-88	16 / 120	OLYMPIC INTERCHANGE	1972	PCB	6,417	10.74	2,500
	Jun-89	97 / 2	BN RR OC (SP & S)	1962	PCB	5,876	0.57	2,100
	Aug-89	520 / 1	SR 520 UC 10TH	1963	CBOX	12,540	0	820
	Aug-89	520 / 25N	120TH AVE NE 0C	1971	CBOX	4,512	7.25	17,333
	Aug-91	5 / 140W	TOUTLE R	1969	SA	14,832	51.71	5,500
	Sep-91	167 / 20E	PUYALLUP R	1925	ST TTT PRC	10,017	6.4	7,500
	Sep-91	513 / 10	SR 520 OC	1962	CBOX	12,768	0	6,500
	Aug-93	7 / 25	NISQUALLY R	1953	ST CTB	6,916	16.74	2,300
	Aug-93	9 / 315	N FK NOOKSACK R	1954	ST CTB	10,660	78.87	2,000
	Sep-93	5 / 344S-E	S-E RAMP SR 5 OC	1968	CBOX	8,487	114.1	4,450
	Sep-93	5 / 455E-N	E-N RAMP	1963	CS	2,680	135.2	3,350
	Oct-93	167 / 11S-S	S-S RAMP	1963	CS	1,720	0	5,300
	May-94	529 / 10E	SNOHOMISH R	1927	SL ST CG	27,216	5.01	5,500
Dural	May-85	82 / 10S	SR 821 OC THRALL RD	1970	PCB	18,921	3.22	1,767
	Nov-86	900 / 12W	SR 5 OC	1966	CBOX	13,950	6.12	15,500
	Aug-89	520 / 25N	120TH AVE NE 0C	1971	CBOX	4,512	7.25	17,333
	Jun-93	203 / 106	SKYKOMISH R	1957	ST CBOX	16,296	23.2	4,300
Polycarb	Aug-84	101 / 115	CHEHALIS R	1955	BAS SG CBOX	13,216	83.12	3,000
	Jun-86	12 / 915	SNAKE R CLARKSTON	1939	ST SL CG	57,280	434.1	5,750
	Jul-87	167 / 102	THIRD AVE SW OC	1977	PCB	6,560	11.7	7,250
	Jul-87	167 / 104	ELLINGSTON RD OC	1977	PCB	6,520	12.26	7,250
	Jul-87	167 / 106	FIRST AVE N OC	1977	PCB	6,424	12.69	7,250
	Apr-88	529 / 20W	STEAMBOAT SL	1927	SS ST CTB	20,472	5.42	5,500
	Apr-88	529 / 20E	STEAMBOAT SL	1954	SS ST CTB	21,840	5.44	5,500
	Jul-88	104 / 5.2	HOOD CANAL	1961	CFP SB ST	101,388	14.73	6,500
	Oct-91	9 / 215	SKAGIT R	1959	ST CS	20,880	54.38	4,300

WSDOT Bridges with a Polymer Overlay

Polymer Brand	Date Applied	Bridge Number	Bridge Name	Yr Brg Built	Bridge Type	Area (SF)	Mile post	ADT/ Lane
Sika	Jun-90	5 / 534N-W	N-W RAMP RR OC	1967	CBOX	6,111	161.3	5,450
	Jun-90	5 / 532.5	SR 5 UC ALBRO	1966	CBOX	12,628	161.3	4,420
	Jul-90	5 / 534S-W	S-W RAMP	1967	CBOX	17,050	161.3	5,295
	Jul-90	5 / 534A	N-W RAMP	1967	CBOX	27,348	161.3	5,347
	Jul-90	5 / 539S-W	S-W RAMP FOREST ST	1967	CBOX CS	14,658	163.4	8,000
	Sep-90	536 / 15	SKAGIT R	1953	SS ST CTB	18,900	4.72	10,000
	Sep-91	410 / 101	WHITE R	1949	ST CTB	9,344	21.99	9,000
	Sep-91	410 / 115	SCATTER CR	1965	PCB	7,000	31.06	1,500
	Sep-91	410 / 123	SLIPPERY CR	1967	CS	2,964	42.49	1,500
	Nov-91	900 / 13W	SR 5 OC	1966	CBOX	13,950	6.58	15,500
	Sep-93	532 / 2	STILLAGUAMISH R	1949	SB CTB	12,662	3.39	7,500
	Sep-93	101 / 256	BIG QUILCENE R	1936	ST CTB	5,856	296.7	2,275
	Sep-94	532 / 6	GN RY COUNTY RD OC	1960	PCB	18,174	4.98	5,500
Silikal	Aug-90	27 / 3	MISSOURI FLAT CR	1955	CS	2,728	0.29	2,325
	Aug-92	5 / 829W	N FERNDALE OC	1963	PCB	6,384	263.5	5,333
	Sep-92	2 / 1W-S	W-S RAMP	1966	PCB	2,289	0.09	6,500
	Sep-92	2 / 2W-N	W-N RAMP	1966	CBOX	2,178	0.09	6,500

Under Construction:

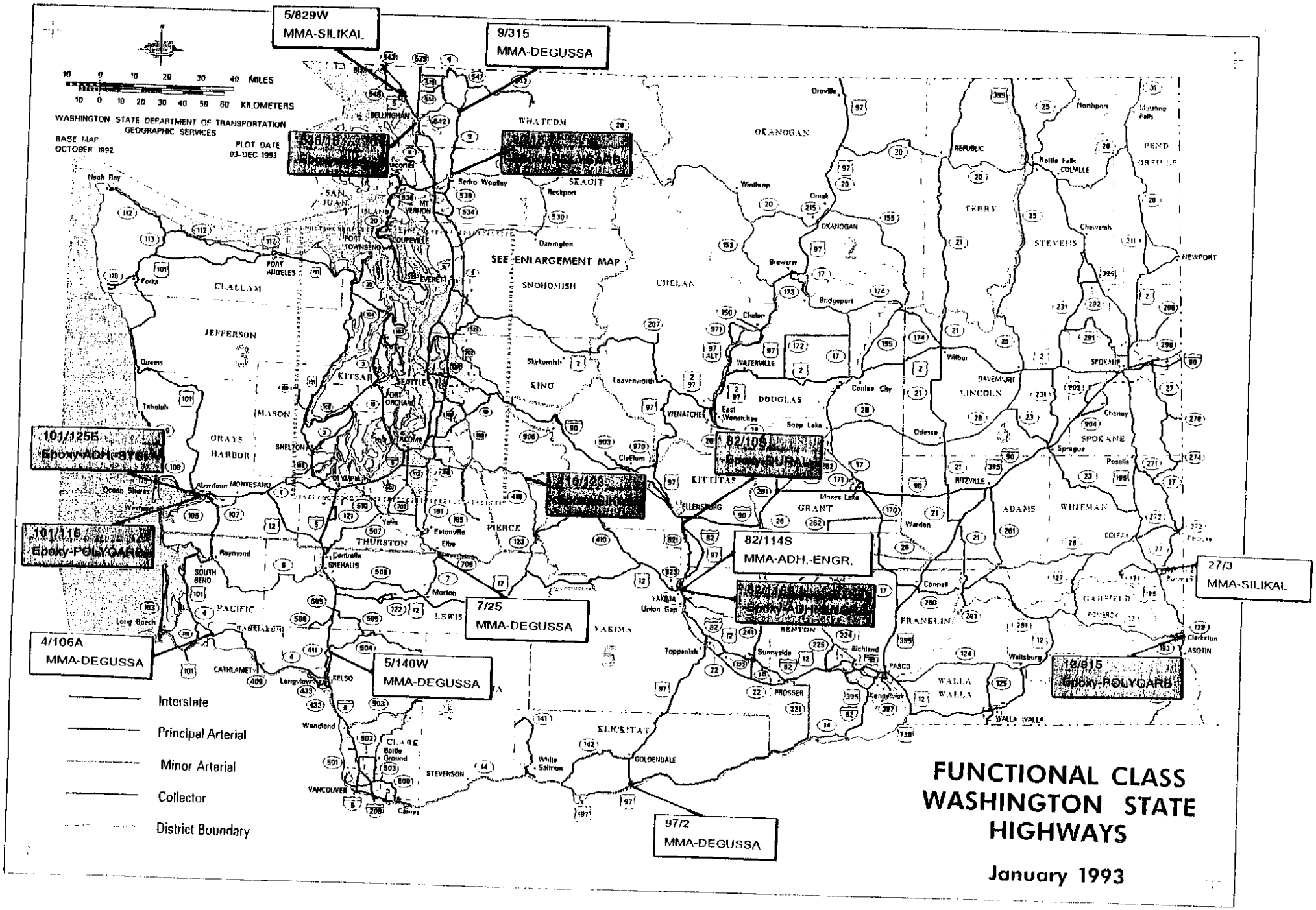
Polymer Brand	Date Applied	Bridge Number	Bridge Name	Yr Brg Built	Bridge Type	Area (SF)	Mile post	ADT/ Lane
unknown	1995	18 / 17	GREEN R	1959	ST CBOX	11,130	6.62	14,000

Polymer Test Section

Bridge Number	Bridge Name	Mile post	Yr Brg Built	Bridge Type	Polymer Brand	Date Applied	Area (SF)	ADT/ Lane
520 / 25N	120TH Ave. NE OC	7.25	1971	CBOX	**Polycarb**	Aug 89	4,512	17,333
					Degussa	Aug 89	4,512	17,333
					Adh. Sys.	Aug 89	4,512	17,333
					Dural	Aug 89	4,512	17,333

Appendix B

Map of WSDOT Polymer Overlays


5/829W
MMA-SILIKAL
9/315
MMA-DEGUSSA
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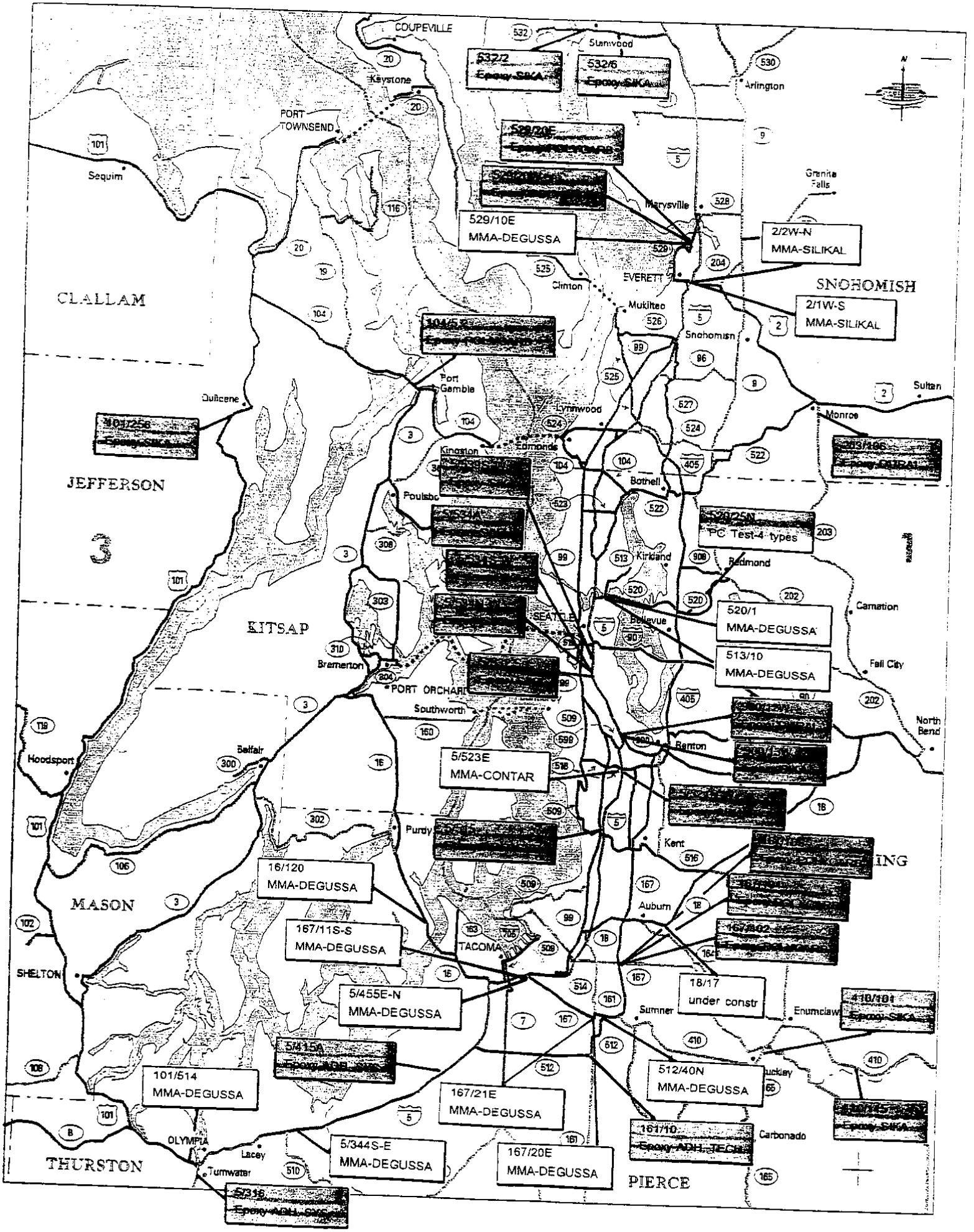
10 0 10 20 30 40 50 60 KILOMETERS
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
GEOGRAPHIC SERVICES
BASE MAP
OCTOBER 1992
PLOT DATE
03-DEC-1993
SEE ENLARGEMENT MAP
101/125E
Epoxy-ADH-ENGR.
82/10S
Epoxy-RURAL
82/114S
MMA-ADH.-ENGR.
27/3
MMA-SILIKAL
101/11S
Epoxy-POLYGARB
7/25
MMA-DEGUSSA
4/106A
MMA-DEGUSSA
5/140W
MMA-DEGUSSA
12/315
Epoxy-POLYGARB
97/2
MMA-DEGUSSA
Interstate
Principal Arterial
Minor Arterial
Collector
District Boundary
FUNCTIONAL CLASS
WASHINGTON STATE
HIGHWAYS
January 1993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Sumnvood
Keystone
PORT TOWNSEND
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Marysville
Clinton
EVERETT
Mukilteo
Snohomish
Monroe
Sultan
Lynnwood
Edmonds
Port Gamble
Dulicene
Kingston
Poulsbo
Bothell
Kirkland
Redmond
Bellevue
SEATTLE
Carnation
Fall City
North Bend
Bremerton
PORT ORCHARD
Southworth
Renton
Belfair
Hoodsport
Purdy
Kent
Auburn
TACOMA
SHELTON
Sumner
Enumclaw
Buckley
Carbonado
OLYMPIA
Lacey
Tumwater
CLALLAM
JEFFERSON
KITSAP
MASON
THURSTON
PIERCE
SNOHOMISH
529/10E
MMA-DEGUSSA
2/2W-N
MMA-SILIKAL
2/1W-S
MMA-SILIKAL
PC Test-4 types
520/1
MMA-DEGUSSA
513/10
MMA-DEGUSSA
5/523E
MMA-CONTAR
16/120
MMA-DEGUSSA
167/11S-S
MMA-DEGUSSA
5/455E-N
MMA-DEGUSSA
18/17
under constr
101/514
MMA-DEGUSSA
167/21E
MMA-DEGUSSA
512/40N
MMA-DEGUSSA
5/344S-E
MMA-DEGUSSA
167/20E
MMA-DEGUSSA

Appendix C

Summary Data

2/1W-S W-S RAMP HEWITT AVE OVERCROSSING

Bridge Information:

Milepost:	0.09
Structure ID#:	0007888A
Bridge Type:	Pre-stressed Beam
Year Built/Rebuilt:	1966
Bridge Length:	109ft.
Bridge Width:	21ft.
Bridge deck area:	2,289sq.ft.
Lanes on:	1
Average Daily Traffic:	6500

Overlay Information

Overlay Brand:	SILIKAL
Overlay Type:	MMA
Date Applied:	September, 1992
Contractor:	Eagle Crest Const Co.
Overlay Contract#:	14084
Overlay Length:	109ft.
Overlay Width:	21ft.
Overlay Area:	2,289sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	7%

Bridge Deck Testing:

Chloride

Date	*%> 2lbs/C.Y.*	*No. Samples*
6/88	60%	10
9/86	30%	10

Delamination

Date	*% of deck*	*sq.ft.*
8/92	3.3%	75
6/88	4.9%	112
9/86	3.3%	75

Rebar Cover

Date	*%< 1inch*	*Average*
9/86	0%	2.14 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*

(No Tests Taken)

Skid Resistance

Date	*Direction*	*Average*	*Range*

(No Tests Taken)

2/2W-N W-N RAMP EVERETT AVE OVERCROSSING

Bridge Information:

Milepost:	**0.09**
Structure ID#:	**0007888B**
Bridge Type:	**Concrete Box Girder**
Year Built/Rebuilt:	**1966**
Bridge Length:	**99ft.**
Bridge Width:	**22ft.**
Bridge deck area:	**2,178sq.ft.**
Lanes on:	**1**
Average Daily Traffic:	**6500**

Overlay Information

Overlay Brand:	**SILIKAL**
Overlay Type:	**MMA**
Date Applied:	**September, 1992**
Contractor:	**Eagle Crest Const Co.**
Overlay Contract#:	**14084**
Overlay Length:	**99ft.**
Overlay Width:	**21ft.**
Overlay Area:	**2,178sq.ft.**
Maximum Super elev.:	**1%**
Maximum Grade:	**4.2%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>.2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
6/88	**80%**	**10**	**8/92**	**14.9%**	**325**	**(no test taken)**		

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			**(No Tests Taken)**			

4/106A GRAYS RIVER @ ROSBURG

Bridge Information:

Milepost:	6.43
Structure ID#:	0003381A
Bridge Type:	Steel Beam & Conc. T-Beam
Year Built/Rebuilt:	1947 / 1986
Bridge Length:	1,010ft.
Bridge Width:	281ft.
Bridge deck area:	28,280sq.ft.
Lanes on:	2
Average Daily Traffic:	365

Overlay Information

Overlay Brand:	DEGUSSA
Overlay Type:	MMA
Date Applied:	August, 1986
Contractor:	Cal Floor
Overlay Contract#:	13090
Overlay Length:	192ft.
Overlay Width:	28ft.
Overlay Area:	5,376sq.ft.
Maximum Super elev.:	0%
Maximum Grade:	0%

Bridge Deck Testing:

Chloride

Date	*%>2lbs/C.Y.*	*No. Samples*
7/84	0%	25

Delamination

Date	*% of deck*	*sq.ft.*
4/93	0.0%	0
3/86	0.0%	0

Rebar Cover

Date	*%<1inch*	*Average*
3/86	0%	2.11 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
1986	113	All broke in conc. deck
1987	186	All broke in conc. deck
1989	102	3 of 4 broke in conc. deck

Skid Resistance

Date	*Direction*	*Average*	*Range*
9/86	N	52	49-54
	S	55	54-57
6/87	N	54	52-57
	S	49	47-51
5/88	N	52	49-55
	S	50	47-53
5/89	N	53	52-55
	S	57	55-59
6/90	N	54	53-55
	S	55	53-56
3/91	N	49	48-51
	S	50	49-50

5/140W TOUTLE RIVER

Bridge Information:

Milepost:	**51.71**
Structure ID#:	**0007888A**
Bridge Type:	**Steel Arch**
Year Built/Rebuilt:	**1969**
Bridge Length:	**309ft.**
Bridge Width:	**48ft.**
Bridge deck area:	**14,832sq.ft.**
Lanes on:	**3**
Average Daily Traffic:	**16,500**

Overlay Information

Overlay Brand:	**DEGUSSA**
Overlay Type:	**MMA**
Date Applied:	**August, 1993**
Contractor:	**Global Const Co.**
Overlay Contract#:	**13956**
Overlay Length:	**309ft.**
Overlay Width:	**48ft.**
Overlay Area:	**14,832sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**0.5%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
5/86	**0%**	**20**	**5/86**	**0%**	**0**	**5/86**	**18%**	**1.37 in.**

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			**(No Tests Taken)**			

5/316 CUSTER WAY UNDERCROSSING

Bridge Information:

Milepost:	103.98
Structure ID#:	0004950A
Bridge Type:	Conc. Arch - Post-tens. Box
Year Built/Rebuilt:	1956 / 1990
Bridge Length:	530ft.
Bridge Width:	36.5ft.
Bridge deck area:	19,345sq.ft.
Lanes on:	3
Average Daily Traffic:	3000

Overlay Information

Overlay Brand:	ADHESIVE SYSTEMS
Overlay Type:	EPOXY
Date Applied:	September, 1990
Contractor:	David A. Mowat
Overlay Contract#:	13361
Overlay Length:	221ft.
Overlay Width:	37ft.
Overlay Area:	8,177sq.ft.
Maximum Super elev.:	1%
Maximum Grade:	0.5%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
10/83	50%	10	4/86	0.0%	0	4/86	18%	1.49 in.

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
1990	363	All broke in conc. deck	11/90	E	78	76-82
1994	266	All broke in conc. deck		W	81	80-84
			4/91	E	62	61-63
				W	62	60-64
			6/92	W	58	53-65
			8/94	E	57	45-63
				W	49	47-51

5/344S-E S-E RAMP SR 5 OVERCROSSING

Bridge Information:

Milepost:	**114.1**
Structure ID#:	**0008100I**
Bridge Type:	**Concrete Box Girder**
Year Built/Rebuilt:	**1968**
Bridge Length:	**369ft.**
Bridge Width:	**23ft.**
Bridge deck area:	**8,487sq.ft.**
Lanes on:	**1**
Average Daily Traffic:	**4500**

Overlay Information

Overlay Brand:	**DEGUSSA**
Overlay Type:	**MMA**
Date Applied:	**September, 1993**
Contractor:	**David A. Mowat**
Overlay Contract#:	**14212**
Overlay Length:	**369ft.**
Overlay Width:	**231ft.**
Overlay Area:	**8,487q.ft.**
Maximum Super elev.:	**1%**
Maximum Grade:	**4.3%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%< 1inch*	*Average*
5/86	42%	11	1/92	0.6%	54	6/84	8%	1.68 in.
			5/86	1.2%	102			

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
(No Tests Taken)		

Skid Resistance

Date	*Direction*	*Average*	*Range*
(No Tests Taken)			

5/415A BN RR OVERCROSSING GRAVELLY LAKE ROAD

Bridge Information:

Milepost:	**124.64**
Structure ID#:	**0005943B**
Bridge Type:	**Concrete Slab**
Year Built/Rebuilt:	**1959**
Bridge Length:	**27ft.**
Bridge Width:	**56ft.**
Bridge deck area:	**1,512sq.ft.**
Lanes on:	**4**
Average Daily Traffic:	**15000**

Overlay Information

Overlay Brand:	**ADHESIVE SYSTEMS**
Overlay Type:	**EPOXY**
Date Applied:	**September, 1991**
Contractor:	**Eagle Crest Const Co.**
Overlay Contract#:	**13983**
Overlay Length:	**27ft.**
Overlay Width:	**56ft.**
Overlay Area:	**1,512sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**0%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
6/87	80%	10	6/87	12.1%	183	6/87	56%	1.08 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
(No Tests Taken)		

Skid Resistance

Date	*Direction*	*Average*	*Range*
(No Tests Taken)			

5/455E-N E-N RAMP T ST SEWER OVERCROSSING

Bridge Information:

Milepost:	135.2
Structure ID#:	0006979H
Bridge Type:	Concrete slab
Year Built/Rebuilt:	1963
Bridge Length:	134ft.
Bridge Width:	20ft.
Bridge deck area:	2,680sq.ft.
Lanes on:	1
Average Daily Traffic:	3350

Overlay Information

Overlay Brand:	DEGUSSA
Overlay Type:	MMA
Date Applied:	September, 1993
Contractor:	David A. Mowat
Overlay Contract#:	14212
Overlay Length:	134ft.
Overlay Width:	20ft.
Overlay Area:	2,680sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	6.8%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
8/87	80%	10	8/87	0.1%	3	8/87	3%	1.42 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
(No Tests Taken)		

Skid Resistance

Date	*Direction*	*Average*	*Range*
(No Tests Taken)			

5/515 SR5 UNDERCROSSING MILITARY RD.

Bridge Information:

Milepost:	151.2
Structure ID#:	0007075A
Bridge Type:	Concrete Box Girder
Year Built/Rebuilt:	1963
Bridge Length:	515ft.
Bridge Width:	26ft.
Bridge deck area:	13,390sq.ft.
Lanes on:	2
Average Daily Traffic:	1500

Overlay Information

Overlay Brand:	ADHESIVE SYSTEMS
Overlay Type:	EPOXY
Date Applied:	September, 1991
Contractor:	Eagle Crest Const Co.
Overlay Contract#:	13961
Overlay Length:	515ft.
Overlay Width:	26ft.
Overlay Area:	13,390sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	0.5%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
8/85	17%	18	8/85	0.2%	33	8/85	17%	1.49 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
(No Tests Taken)		

Skid Resistance

Date	*Direction*	*Average*	*Range*
(No Tests Taken)			

5/521N-W N-W RAMP E-E , S-E RAMP OVERCROSSING

Bridge Information:

Milepost:	**154.5**
Structure ID#:	**0007401H**
Bridge Type:	**Pre-stressed Girder**
Year Built/Rebuilt:	**1966**
Bridge Length:	**215ft.**
Bridge Width:	**22ft.**
Bridge deck area:	**4,730sq.ft.**
Lanes on:	**1**
Average Daily Traffic:	**4200**

Overlay Information

Overlay Brand:	**ADHESIVE SYSTEMS**
Overlay Type:	**EPOXY**
Date Applied:	**June, 1991**
Contractor:	**Eagle Crest Const Co.**
Overlay Contract#:	**13961**
Overlay Length:	**215ft.**
Overlay Width:	**22ft.**
Overlay Area:	**4,730sq.ft.**
Maximum Super elev.:	**6%**
Maximum Grade:	**3.8%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%< 1inch*	*Average*
9/84	0%	10	9/83	0.0%	1	7/84	34%	1.27 in.
9/83	0%	10						

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
(No Tests Taken)		

Skid Resistance

Date	*Direction*	*Average*	*Range*
(No Tests Taken)			

5/523E SO. 154TH STREET OVERCROSSING

Bridge Information:

Milepost:	154.5
Structure ID#:	0007442A
Bridge Type:	Pre-stressed Girder
Year Built/Rebuilt:	1965 / 1989
Bridge Length:	98ft.
Bridge Width:	90ft.
Bridge deck area:	8,820sq.ft.
Lanes on:	6
Average Daily Traffic:	100000

Overlay Information

Overlay Brand:	CONTAR
Overlay Type:	MMA
Date Applied:	August, 1988
Contractor:	Charles Watts Co.
Overlay Contract#:	13354
Overlay Length:	98ft.
Overlay Width:	90ft.
Overlay Area:	8,820sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	0.0%

Bridge Deck Testing:

Chloride

Date	*%>2lbs/C.Y.*	*No. Samples*
8/85	18%	11
7/82	0%	11

Delamination

Date	*% of deck*	*sq.ft.*
8/85	0.0%	0

Rebar Cover

Date	*%< 1inch*	*Average*
8/85	5%	1.68 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
1989	162	2of 6 broke in conc. deck

Skid Resistance

Date	*Direction*	*Average*	*Range*
9/88	N	41	37-45
7/89	N	37	27-46
6/90	N	38	26-48
4/91	N	31	25-44
6/92	N	36	33-40
6/94	N	36	30-42

5/532.5 SR5 UNDERCROSSING ALBRO ST.

Bridge Information:

Milepost:	**161.3**
Structure ID#:	**0007675A**
Bridge Type:	**Concrete Box Girder**
Year Built/Rebuilt:	**1966**
Bridge Length:	**287ft.**
Bridge Width:	**44ft.**
Bridge deck area:	**12,628sq.ft.**
Lanes on:	**4**
Average Daily Traffic:	**17678**

Overlay Information

Overlay Brand:	**SIKA**
Overlay Type:	**EPOXY**
Date Applied:	**June, 1990**
Contractor:	**Global Const Co.**
Overlay Contract#:	**13737**
Overlay Length:	**287ft.**
Overlay Width:	**44ft.**
Overlay Area:	**12,628sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**7.0%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
7/85	50%	17	7/85	0.0%	3	7/85	1%	1.96 in.

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			(No Tests Taken)			

5/534S-W S-W RAMP LUCILE ST OVERCROSSING

Bridge Information:

Milepost:	161.3
Structure ID#:	0007930C
Bridge Type:	Concrete Box Girder
Year Built/Rebuilt:	1967
Bridge Length:	550ft.
Bridge Width:	31ft.
Bridge deck area:	17,050sq.ft.
Lanes on:	2
Average Daily Traffic:	10590

Overlay Information

Overlay Brand:	SIKA
Overlay Type:	EPOXY
Date Applied:	June, 1990
Contractor:	Global Const Co.
Overlay Contract#:	13737
Overlay Length:	550ft.
Overlay Width:	31ft.
Overlay Area:	17,050sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	4.2%

Bridge Deck Testing:

Chloride

Date	*% >2lbs/C.Y.*	*No. Samples*
7/88	48%	23
8/85	38%	21
6/80	71%	21

Delamination

Date	*% of deck*	*sq.ft.*
7/88	2.4%	412
8/85	1.8%	307

Rebar Cover

Date	*%< 1inch*	*Average*
8/85	13%	1.57 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*

(No Tests Taken)

Skid Resistance

Date	*Direction*	*Average*	*Range*

(No Tests Taken)

5/534N-W N-W RAMP RR OVERCROSSING

Bridge Information:

Milepost:	**161.3**
Structure ID#:	**0007930A**
Bridge Type:	**Concrete Box Girder**
Year Built/Rebuilt:	**1967**
Bridge Length:	**291ft.**
Bridge Width:	**21ft.**
Bridge deck area:	**6,111sq.ft.**
Lanes on:	**1**
Average Daily Traffic:	**5450**

Overlay Information

Overlay Brand:	**SIKA**
Overlay Type:	**EPOXY**
Date Applied:	**June, 1990**
Contractor:	**Global Const Co.**
Overlay Contract#:	**13737**
Overlay Length:	**291ft.**
Overlay Width:	**21ft.**
Overlay Area:	**6,111sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**4.2%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
8/85	0%	10	8/85	0.3%	20	8/85	50%	1.19 in.
9/80	0%	10						

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			8/92	N	52	46-59
			8/94	N	33	29-37

5/534A N-W RAMP AIRPORT WAY OVERCROSSING

Bridge Information:

Milepost:	**161.3**
Structure ID#:	**0007930B**
Bridge Type:	**Concrete Box Girder**
Year Built/Rebuilt:	**1967**
Bridge Length:	**636ft.**
Bridge Width:	**43ft.**
Bridge deck area:	**27,348sq.ft.**
Lanes on:	**3**
Average Daily Traffic:	**16040**

Overlay Information

Overlay Brand:	**SIKA**
Overlay Type:	**EPOXY**
Date Applied:	**July, 1990**
Contractor:	**Global Const Co.**
Overlay Contract#:	**13737**
Overlay Length:	**636ft.**
Overlay Width:	**43ft.**
Overlay Area:	**27,348sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**0.7%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
8/85	46%	41	8/85	0.2%	4	8/85	10%	1.65 in.
9/80	35%	54						

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
(No Tests Taken)		

Skid Resistance

Date	*Direction*	*Average*	*Range*
(No Tests Taken)			

5/539S-W S-W RAMP FOREST ST.

Bridge Information:

Milepost:	**163.4**
Structure ID#:	**0007686A**
Bridge Type:	**Concrete Box Girder**
Year Built/Rebuilt:	**1967**
Bridge Length:	**698ft.**
Bridge Width:	**21ft.**
Bridge deck area:	**14,658sq.ft.**
Lanes on:	**1**
Average Daily Traffic:	**8000**

Overlay Information

Overlay Brand:	**SIKA**
Overlay Type:	**EPOXY**
Date Applied:	**July, 1990**
Contractor:	**Global Const Co.**
Overlay Contract#:	**13737**
Overlay Length:	**698ft.**
Overlay Width:	**21ft.**
Overlay Area:	**14,658sq.ft.**
Maximum Super elev.:	**8%**
Maximum Grade:	**8.0%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
8/85	55%	20	8/85	0.5%	71	8/85	1%	1.89 in.
8/80	75%	20						

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
(No Tests Taken)		

Skid Resistance

Date	*Direction*	*Average*	*Range*
(No Tests Taken)			

5/829W NORTH FERNDALE OVERCROSSING

Bridge Information:

Milepost:	**263.5**
Structure ID#:	**0006926B**
Bridge Type:	**Pre-stressed Beam**
Year Built/Rebuilt:	**1963**
Bridge Length:	**133ft.**
Bridge Width:	**48ft.**
Bridge deck area:	**6,384sq.ft.**
Lanes on:	**3**
Average Daily Traffic:	**16000**

Overlay Information

Overlay Brand:	**SILIKAL**
Overlay Type:	**MMA**
Date Applied:	**August, 1992**
Contractor:	**Progressive Contractors**
Overlay Contract#:	**14069**
Overlay Length:	**133ft.**
Overlay Width:	**48ft.**
Overlay Area:	**6,384sq.ft.**
Maximum Super elev.:	**5%**
Maximum Grade:	**2.7%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
8/88	50%	10	8/88	0.1%	7	8/85	1%	1.59 in.
8/85	30%	10	8/85	0.4%	26			

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			(No Tests Taken)			

7/25 NISQUALLY RIVER

Bridge Information:

Milepost:	**16.74**
Structure ID#:	**0004348A**
Bridge Type:	**Steel Truss - Conc. T-Beam**
Year Built/Rebuilt:	**1953**
Bridge Length:	**247ft.**
Bridge Width:	**28ft.**
Bridge deck area:	**6,916sq.ft.**
Lanes on:	**2**
Average Daily Traffic:	**4600**

Overlay Information

Overlay Brand:	**DEGUSSA**
Overlay Type:	**MMA**
Date Applied:	**August, 1993**
Contractor:	**Progressive Contractors**
Overlay Contract#:	**14242**
Overlay Length:	**247ft.**
Overlay Width:	**28ft.**
Overlay Area:	**6,916sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**1.0%**

Bridge Deck Testing:

Chloride

Date	*%>2lbs/C.Y.*	*No. Samples*
1/89	50%	10
7/85	40%	10
2/82	0%	12

Delamination

Date	*% of deck*	*sq.ft.*
3/93	0.0%	0
6/85	0.0%	0

Rebar Cover

Date	*%<1inch*	*Average*
6/85	4%	1.64 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*

(No Tests Taken)

Skid Resistance

Date	*Direction*	*Average*	*Range*

(No Tests Taken)

9/215 SKAGIT RIVER

Bridge Information:

Milepost:	**54.38**
Structure ID#:	**0005773A**
Bridge Type:	**Steel Truss - Conc. Slab**
Year Built/Rebuilt:	**1959**
Bridge Length:	**972ft.**
Bridge Width:	**29ft.**
Bridge deck area:	**28,188sq.ft.**
Lanes on:	**2**
Average Daily Traffic:	**8600**

Overlay Information

Overlay Brand:	**POLYCARB**
Overlay Type:	**EPOXY**
Date Applied:	**October, 1991**
Contractor:	**David A. Mowat**
Overlay Contract#:	**13963**
Overlay Length:	**720ft.**
Overlay Width:	**29ft.**
Overlay Area:	**20,880sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**2.0%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
6/87	53%	40	6/87	1.6%	446	6/87	0%	2.21 in.

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			**(No Tests Taken)**			

9/315 NORTH FORK NOOKSACK RIVER

Bridge Information:

Milepost:	78.87
Structure ID#:	0004542A
Bridge Type:	Steel Truss - Conc. T-Beam
Year Built/Rebuilt:	1954
Bridge Length:	410ft.
Bridge Width:	26ft.
Bridge deck area:	10,660sq.ft.
Lanes on:	2
Average Daily Traffic:	4000

Overlay Information

Overlay Brand:	DEGUSSA
Overlay Type:	MMA
Date Applied:	August, 1993
Contractor:	Progressive Contractors
Overlay Contract#:	14264
Overlay Length:	410ft.
Overlay Width:	26ft.
Overlay Area:	10,660sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	0.3%

Bridge Deck Testing:

Chloride

Date	*%>2lbs/C.Y.*	*No. Samples*
6/87	57%	14

Delamination

Date	*% of deck*	*sq.ft.*
8/93	4.1%	440
8/92	2.7%	292
6/97	0.0%	21

Rebar Cover

Date	*%< 1inch*	*Average*
6/87	0%	1.90 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*

(No Tests Taken)

Skid Resistance

Date	*Direction*	*Average*	*Range*

(No Tests Taken)

12/915 SNAKE RIVER @ CLARKSTON

Bridge Information:

Milepost:	434.1
Structure ID#:	0002348A
Bridge Type:	Steel Lift-Steel Truss
Year Built/Rebuilt:	1939
Bridge Length:	1,432ft.
Bridge Width:	40ft.
Bridge deck area:	57,280sq.ft.
Lanes on:	4
Average Daily Traffic:	23000

Overlay Information

Overlay Brand:	POLYCARB
Overlay Type:	EPOXY
Date Applied:	June, 1986
Contractor:	David A. Mowat
Overlay Contract#:	13107
Overlay Length:	1,432ft.
Overlay Width:	40ft.
Overlay Area:	57,280sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	2.8%

Bridge Deck Testing:

Chloride

Date	*%>.2lbs/C.Y.*	*No. Samples*
7/82	59%	80

Delamination

Date	*% of deck*	*sq.ft.*
4/92	2.1%	1,191
4/85	1.7%	974
4/92	0.1%	209

Rebar Cover

Date	*%<.1inch*	*Average*
4/85	9%	1.72 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
1986	259	19 of 21 broke in conc. deck
1987	253	All broke in conc. deck
1989	252	5 of 6 broke in conc. deck

Skid Resistance

Date	*Direction*	*Average*	*Range*
6/86	E	70	68-71
	W	69	65-74
3/87	E	49	40-56
	W	45	41-49
4/88	E	24	23-29
	W	27	21-30
9/89	E	25	21-30
	W	31	26-35
4/90	E	22	19-31
	W	22	20-28
4/91	E	18	17-19
	W	20	17-21
6/92	E	14	13-16
	W	18	16-19

16/120 SR16 UNDERCROSSING OLYMPIC INTERCHANGE

Bridge Information:

Milepost:	10.74
Structure ID#:	0009245A
Bridge Type:	Pre-stressed Conc. Beam
Year Built/Rebuilt:	1972
Bridge Length:	207ft.
Bridge Width:	31ft.
Bridge deck area:	6,417sq.ft.
Lanes on:	2
Average Daily Traffic:	5000

Overlay Information

Overlay Brand:	DEGUSSA
Overlay Type:	MMA
Date Applied:	April, 1988
Contractor:	unknown
Overlay Contract#:	13336
Overlay Length:	207ft.
Overlay Width:	31ft.
Overlay Area:	6,417sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	0.0%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
6/86	0%	10	6/86	0%	0	6/86	0%	1.99 in.

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
1988	189	all broke in conc. deck	8/88	N	34	33-34
				S	39	38-39
			7/89	N	34	33-35
				S	38	35-45
			5/90	N	37	35-43
				S	38	36-39
			3/91	N	29	26-37
				S	27	24-31
			7/92	N	34	24-45
				S	28	22-31
			6/94	N	34	28-47
				S	36	30-46

18/17 GREEN RIVER NEELEY

Bridge Information:

Milepost:	6.62
Structure ID#:	0006066B
Bridge Type:	Steel Truss - Conc. Box
Year Built/Rebuilt:	1959
Bridge Length:	371ft.
Bridge Width:	29.5ft.
Bridge deck area:	10,945sq.ft.
Lanes on:	2
Average Daily Traffic:	28000

Overlay Information

Overlay Brand:	under construction
Overlay Type:	N/A
Date Applied:	??, 1995
Contractor:	N/A
Overlay Contract#:	14354
Overlay Length:	371ft.
Overlay Width:	29.5ft.
Overlay Area:	10,945sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	0.0%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
10/84	64%	14	3/94	0.6%	57	3/84	9%	1.64 in.
3/84	79%	14						

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			(No Tests Taken)			

27/3 MISSOURI FLAT CREEK

Bridge Information:

Milepost:	**0.29**
Structure ID#:	**0004989A**
Bridge Type:	**Concrete Slab**
Year Built/Rebuilt:	**1955**
Bridge Length:	**62ft.**
Bridge Width:	**44ft.**
Bridge deck area:	**2,728sq.ft.**
Lanes on:	**4**
Average Daily Traffic:	**9300**

Overlay Information

Overlay Brand:	**SILIKAL**
Overlay Type:	**MMA**
Date Applied:	**August, 1990**
Contractor:	**Eagle Crest Const Co.**
Overlay Contract#:	**XE2822**
Overlay Length:	**62ft.**
Overlay Width:	**44ft.**
Overlay Area:	**2,728sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**0%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
7/86	70%	10	7/86	0.0%	0	7/86	4%	2.84 in.

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
1990	229	all broke in conc. deck	11/90	N	79	77-81
				S	73	61-79

82/10S SR 821 OVERCROSSING THRALL ROAD

Bridge Information:

Milepost:	**3.22**
Structure ID#:	**0008672A**
Bridge Type:	**Pre-stressed Conc. Beam**
Year Built/Rebuilt:	**1970**
Bridge Length:	**357ft.**
Bridge Width:	**53.2ft.**
Bridge deck area:	**18,992sq.ft.**
Lanes on:	**3**
Average Daily Traffic:	**5300**

Overlay Information

Overlay Brand:	**DURALL**
Overlay Type:	**EPOXY**
Date Applied:	**May, 1985**
Contractor:	**Dural International.**
Overlay Contract#:	**12857**
Overlay Length:	**357ft.**
Overlay Width:	**53.2ft.**
Overlay Area:	**18,992sq.ft.**
Maximum Super elev.:	**7%**
Maximum Grade:	**2%**

Bridge Deck Testing:

Chloride

Date	*%>2lbs/C.Y.*	*No. Samples*
4/83	39%	28

Delamination

Date	*% of deck*	*sq.ft.*
11/92	1.0%	198
3/92	1.0%	190
7/85	1.0%	180
4/83	1.9%	360

Rebar Cover

Date	*%<1inch*	*Average*

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
1985	359	11 of 12 broke in conc. deck
1985	355	all broke in conc. deck

Skid Resistance

Date	*Direction*	*Average*	*Range*
7/85	S1	70	68-72
	S2	76	71-81
1/86	S1	59	58-61
4/87	S1	38	37-39
	S2	62	60-64
5/88	S1	31	29-33
	S2	60	53-64
6/89	S1	25	22-27
	S2	52	49-57
4/90	S1	28	26-30
	S2	53	50-55
4/91	S1	28	26-28
	S2	45	42-46
6/92	S2	45	32-56

82/114S YAKIMA RIVER

Bridge Information:

Milepost:	30.78
Structure ID#:	0006123B
Bridge Type:	Steel Truss
Year Built/Rebuilt:	1960
Bridge Length:	284ft.
Bridge Width:	40ft.
Bridge deck area:	11,360sq.ft.
Lanes on:	3
Average Daily Traffic:	20000

Overlay Information

Overlay Brand:	ADHESIVE ENGINEERING
Overlay Type:	MMA
Date Applied:	July, 1985
Contractor:	David A. Mowat
Overlay Contract#:	13131
Overlay Length:	284ft.
Overlay Width:	40ft.
Overlay Area:	11,360sq.ft.
Maximum Super elev.:	1%
Maximum Grade:	0.1%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
6/85	67%	15	11/92	12.1%	1,374	6/85	24%	1.42 in.
			6/85	1.4%	159			

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
1987	284	all broke in conc. deck	10/87	S	31	28-39
1988	339	all broke in conc. deck	3/88	S	49	43-55
1990	258	all broke in conc. deck	6/89	S	42	38-44
			4/90	S	57	53-59
			4/91	S	45	41-49
			7/92	S	52	49-56

82/115S NACHES RIVER

Bridge Information:

Milepost:	30.9
Structure ID#:	0006123C
Bridge Type:	Steel Truss
Year Built/Rebuilt:	1960
Bridge Length:	284ft.
Bridge Width:	40ft.
Bridge deck area:	11,360sq.ft.
Lanes on:	3
Average Daily Traffic:	20000

Overlay Information

Overlay Brand:	ADHESIVE ENGINEERING
Overlay Type:	EPOXY
Date Applied:	July, 1985
Contractor:	David A. Mowat
Overlay Contract#:	13131
Overlay Length:	284ft.
Overlay Width:	40ft.
Overlay Area:	11,360sq.ft.
Maximum Super elev.:	1%
Maximum Grade:	0.1%

Bridge Deck Testing:

Chloride

Date	*%>2lbs/C.Y.*	*No. Samples*
6/85	53%	15

Delamination

Date	*% of deck*	*sq.ft.*
4/92	2.5%	286
6/85	1.1%	125

Rebar Cover

Date	*%< 1inch*	*Average*
6/85	9%	1.6 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
1987	392	all broke in conc. deck
1988	385	all broke in conc. deck
1990	276	all broke in conc. deck

Skid Resistance

Date	*Direction*	*Average*	*Range*
10/87	S	53	45-65
3/88	S	49	39-59
6/89	S	31	16-46
4/90	S	31	21-49
4/91	S	26	17-52
7/92	S	19	14-25

97/2 BN RR OVERCROSSING

Bridge Information:

Milepost:	0.57
Structure ID#:	0006774A
Bridge Type:	Pre-stressed Beam
Year Built/Rebuilt:	1962
Bridge Length:	226ft.
Bridge Width:	26ft.
Bridge deck area:	5,876sq.ft.
Lanes on:	2
Average Daily Traffic:	4200

Overlay Information

Overlay Brand:	DEGUSSA
Overlay Type:	MMA
Date Applied:	June, 1989
Contractor:	Oakridge Co.
Overlay Contract#:	13530
Overlay Length:	226ft.
Overlay Width:	26ft.
Overlay Area:	5,876sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	6.5%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
8/85	70%	10	6/92	17.0%	1,000	8/85	1%	2.19 in.
2/82	25%	12	6/89	12.9%	756			
			8/85	3.0%	177			

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
1989	217	all broke in conc. deck	8/90	N	51	50-63
				S	57	52-62
			3/91	N	44	42-46
				S	41	37-43
			3/93	N	45	42-50
				S	35	34-37

101/115 CHEHALIS RIVER

Bridge Information:

Milepost:	83.12
Structure ID#:	0004386A
Bridge Type:	Bascule, Steel Girder, CTB
Year Built/Rebuilt:	1955
Bridge Length:	2,638ft.
Bridge Width:	56ft.
Bridge deck area:	147,728sq.ft.
Lanes on:	4
Average Daily Traffic:	12000

Overlay Information

Overlay Brand:	POLYCARB
Overlay Type:	EPOXY
Date Applied:	August, 1984
Contractor:	Quigg - McDonald
Overlay Contract#:	12643
Overlay Length:	236ft.
Overlay Width:	56ft.
Overlay Area:	13,216sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	2%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%< 1inch*	*Average*

(no test taken on movable Bascule - filled grid deck span)

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
1984	399	all broke in conc. deck
1988	191	all broke in conc. deck

(Note- outside lanes of overlay resurfaced 9/91)

Skid Resistance

Date	*Direction*	*Average*	*Range*
8/86	N	40	38-43
	S	45	40-48
5/87	N	28	28-28
	S	31	30-32
5/88	N	35	27-45
	S	35	31-39
5/89	N	33	25-40
	S	42	27-48
5/90	N	32	27-36
	S	35	22-48
4/91	N	17	15-18
	S	14	13-14
9/91	N	67	66-68
	S	63	55-68
7/92	N	43	40-45
	S	37	34-42

101/125E HOQUIAM RIVER - RIVERSIDE

Bridge Information:

Milepost:	**83.12**
Structure ID#:	**0008574A**
Bridge Type:	**Steel Lift - Steel Beam**
Year Built/Rebuilt:	**1970**
Bridge Length:	**465ft.**
Bridge Width:	**28ft.**
Bridge deck area:	**13,020sq.ft.**
Lanes on:	**2**
Average Daily Traffic:	**10875**

Overlay Information

Overlay Brand:	**ADHESIVE SYSTEMS**
Overlay Type:	**EPOXY**
Date Applied:	**June, 1991**
Contractor:	**Eagle Crest Const Co.**
Overlay Contract#:	**13913**
Overlay Length:	**465ft.**
Overlay Width:	**28ft.**
Overlay Area:	**13,020sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**6%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
6/86	0%	16	8/86	0.6%	75	8/86	40%	1.28 in.
1/84	10%	10						

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
(No Tests Taken)		

Skid Resistance

Date	*Direction*	*Average*	*Range*
(No Tests Taken)			

101/256 BIG QUILCENE RIVER

Bridge Information:

Milepost:	296.7
Structure ID#:	0002060A
Bridge Type:	Steel Truss- Conc. T-Beam
Year Built/Rebuilt:	1936
Bridge Length:	244ft.
Bridge Width:	24ft.
Bridge deck area:	5,856sq.ft.
Lanes on:	2
Average Daily Traffic:	4550

Overlay Information

Overlay Brand:	SIKA
Overlay Type:	EPOXY
Date Applied:	September, 1993
Contractor:	Eagle Crest Const Co.
Overlay Contract#:	14260
Overlay Length:	244ft.
Overlay Width:	24ft.
Overlay Area:	5,856sq.ft.
Maximum Super elev.:	1%
Maximum Grade:	0.1%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*% >2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%< 1inch*	*Average*
6/86	30%	10	6/86	0.5%	30	6/86	19%	1.47 in.

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			(No Tests Taken)			

101/514 SR 101 UNDERCROSSING DECATUR STREET

Bridge Information:

Milepost:	366.4
Structure ID#:	0009808A
Bridge Type:	Pre-stressed Beam
Year Built/Rebuilt:	1976
Bridge Length:	166ft.
Bridge Width:	40ft.
Bridge deck area:	6,640sq.ft.
Lanes on:	3
Average Daily Traffic:	21000

Overlay Information

Overlay Brand:	DEGUSSA
Overlay Type:	MMA
Date Applied:	August, 1985
Contractor:	Cal Floor Co.
Overlay Contract#:	12945
Overlay Length:	166ft.
Overlay Width:	40ft.
Overlay Area:	6,640sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	4.3%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
5/85	0%	10	1/92	1.9%	0	5/85	0%	2.12 in.
8/82	0%	10	5/85	0.0%	0			

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
1986	155	all broke in conc. deck
1986	166	4 of 5 broke in conc. deck
1986	128	none broke in conc. deck

Skid Resistance

Date	*Direction*	*Average*	*Range*
8/86	N	54	51-59
	S	47	42-52
5/87	N	48	46-52
	S	48	44-50
5/88	N	39	37-42
	S	45	39-49
7/89	N	39	36-42
	S	37	34-41
5/90	N	36	35-38
	S	39	35-49
4/91	N	33	31-35
	S	32	31-32
7/92	N	37	33-41
	S	36	32-39
8/94	N	39	38-41
	S	41	38-47

104/5.2 HOOD CANAL (EAST HALF) - W.A. BUGGE BRIDGE

Bridge Information:

Milepost:	14.73
Structure ID#:	0005710A
Bridge Type:	Conc. Floating Pontoon
Year Built/Rebuilt:	1961
Bridge Length:	3,621ft.
Bridge Width:	28ft.
Bridge deck area:	101,388sq.ft.
Lanes on:	2
Average Daily Traffic:	13000

Overlay Information

Overlay Brand:	POLYCARB
Overlay Type:	EPOXY
Date Applied:	July, 1988
Contractor:	David A. Mowat
Overlay Contract#:	13316
Overlay Length:	3,621ft.
Overlay Width:	28ft.
Overlay Area:	101,388sq.ft.
Maximum Super elev.:	6%
Maximum Grade:	4.5%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%< 1inch*	*Average*
8/86	4%	141	8/86	0.2%	242	8/86	3%	2.94 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
1988	308	all broke in conc. deck
1989	414	all broke in conc. deck
1992	244	all broke in conc. deck

Skid Resistance

Date	*Direction*	*Average*	*Range*
8/88	E	51	47-55
	W	51	46-58
7/89	E	53	51-57
	W	54	49-58
6/90	E	50	44-61
	W	45	41-50
3/91	E	41	38-46
	W	38	32-44
7/92	E	42	38-50
6/94	E	28	23-41
	W	40	27-54

161/10 SR 512 OVERCROSSING

Bridge Information:

Milepost:	**25.67**
Structure ID#:	**0009010A**
Bridge Type:	**Pre-stressed Conc. Beam**
Year Built/Rebuilt:	**1971**
Bridge Length:	**278ft.**
Bridge Width:	**40ft.**
Bridge deck area:	**11,120sq.ft.**
Lanes on:	**3**
Average Daily Traffic:	**15000**

Overlay Information

Overlay Brand:	**ADHESIVE TECH.**
Overlay Type:	**EPOXY**
Date Applied:	**June, 1986**
Contractor:	**Adhesive Tech.**
Overlay Contract#:	**13100**
Overlay Length:	**278ft.**
Overlay Width:	**40ft.**
Overlay Area:	**11,120sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**3.5%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
5/85	0%	15	1/92	0.0%	10	5/85	0%	2.12 in.
			5/85	0.0%	0			

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
1986	294	8 of 10 broke in conc. deck
1989	551	all broke in conc. deck

Skid Resistance

Date	*Direction*	*Average*	*Range*
7/87	N	49	48-51
	S	43	42-46
5/88	N	49	47-51
	S	45	40-53
4/89	?	46	43-51
4/90	N	47	45-51
	S	48	43-52
3/91	N	45	40-50
	S	38	35-41
6/92	N	36	33-41
	S	29	26-37
5/94	N	36	31-44
	S	31	25-51

167/11S-S S-S RAMP T ST SEWER OVERCROSSING

Bridge Information:

Milepost:	**0.0**
Structure ID#:	**0006779G**
Bridge Type:	**Concrete Slab**
Year Built/Rebuilt:	**1963**
Bridge Length:	**86ft.**
Bridge Width:	**20ft.**
Bridge deck area:	**1,720sq.ft.**
Lanes on:	**1**
Average Daily Traffic:	**5300**

Overlay Information

Overlay Brand:	**DEGUSSA**
Overlay Type:	**MMA**
Date Applied:	**October, 1993**
Contractor:	**David A. Mowat**
Overlay Contract#:	**14212**
Overlay Length:	**86ft.**
Overlay Width:	**20ft.**
Overlay Area:	**1,720sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**3.0%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
6/88	50%	10	6/88	0.2%	3	6/86	19%	1.47 in.
6/86	30%	10	6/86	0.0%	0			

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
(No Tests Taken)		

Skid Resistance

Date	*Direction*	*Average*	*Range*
(No Tests Taken)			

167/20E PUYALLUP RIVER

Bridge Information:

Milepost:	**6.4**
Structure ID#:	**0003960A**
Bridge Type:	**Steel Truss**
Year Built/Rebuilt:	**1925 / 1951**
Bridge Length:	**477ft.**
Bridge Width:	**21ft.**
Bridge deck area:	**10,017sq.ft.**
Lanes on:	**2**
Average Daily Traffic:	**15000**

Overlay Information

Overlay Brand:	**DEGUSSA**
Overlay Type:	**MMA**
Date Applied:	**September, 1991**
Contractor:	**Progressive Contractors**
Overlay Contract#:	**13974**
Overlay Length:	**477ft.**
Overlay Width:	**21ft.**
Overlay Area:	**10,017sq.ft.**
Maximum Super elev.:	**1%**
Maximum Grade:	**0.1%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%< 1inch*	*Average*
9/85	**31%**	**13**	**9/85**	**0.1%**	**6**	**9/85**	**9%**	**1.67 in.**
12/83	**10%**	**10**						

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			**(No Tests Taken)**			

167/21E MILWAUKEE AVENUE OVERCROSSING

Bridge Information:

Milepost:	5.72
Structure ID#:	0009075A
Bridge Type:	Concrete Slab
Year Built/Rebuilt:	1972
Bridge Length:	143ft.
Bridge Width:	48ft.
Bridge deck area:	6,864sq.ft.
Lanes on:	2
Average Daily Traffic:	35000

Overlay Information

Overlay Brand:	DEGUSSA
Overlay Type:	MMA
Date Applied:	August, 1987
Contractor:	Cal Floor
Overlay Contract#:	13183
Overlay Length:	143ft.
Overlay Width:	48ft.
Overlay Area:	6,864sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	2.1%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
10/86	0%	10	1/92	0.0%	0	10/86	0%	2.05 in.
10/83	0%	12	10/86	0.0%	0			

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
1987	290	all broke in conc. deck
1988	111	all broke in conc. deck

Skid Resistance

Date	*Direction*	*Average*	*Range*
9/87	E	44	43-45
	W	43	40-47
5/88	E	35	32-38
	W	38	35-43
4/89	W	30	28-35
6/90	E	32	30-34
	W	31	30-34
3/91	E	30	27-38
6/92	E	34	30-39

167/102 THIRD AVENUE SW OVERCROSSING

Bridge Information:

Milepost:	11.7
Structure ID#:	0010513A
Bridge Type:	Pre-stressed Conc. Beam
Year Built/Rebuilt:	1977 / 1987
Bridge Length:	164ft.
Bridge Width:	86ft.
Bridge deck area:	14,104sq.ft.
Lanes on:	4
Average Daily Traffic:	29000

Overlay Information

Overlay Brand:	POLYCARB
Overlay Type:	EPOXY
Date Applied:	July, 1987
Contractor:	David A. Mowat
Overlay Contract#:	13078
Overlay Length:	164ft.
Overlay Width:	40ft.
Overlay Area:	6,560sq.ft.
Maximum Super elev.:	8%
Maximum Grade:	1.1%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
12/85	0%	10	9/92	0.0%	0	12/85	0%	2.03 in.
1/85	0%	11	12/85	0.0%	0			

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
1987	267	all broke in conc. deck	9/87	N	66	64-68
1988	377	all broke in conc. deck	5/88	N	48	46-52
			4/89	N	42	36-46
			4/90	N	40	37-41
			3/91	N	31	28-36
			6/92	N	28	21-35
			5/94	N	22	15-44

167/104 ELLINGSTON ROAD OVERCROSSING

Bridge Information:

Milepost:	12.26
Structure ID#:	0010513B
Bridge Type:	Pre-stressed Conc. Beam
Year Built/Rebuilt:	1977 / 1987
Bridge Length:	163ft.
Bridge Width:	82ft.
Bridge deck area:	13,366sq.ft.
Lanes on:	4
Average Daily Traffic:	29000

Overlay Information

Overlay Brand:	POLYCARB
Overlay Type:	EPOXY
Date Applied:	July, 1987
Contractor:	David A. Mowat
Overlay Contract#:	13078
Overlay Length:	163ft.
Overlay Width:	40ft.
Overlay Area:	6,520sq.ft.
Maximum Super elev.:	6%
Maximum Grade:	0.6%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%< 1inch*	*Average*
12/85	30%	10	9/92	0.0%	0	12/85	2%	1.85 in.
1/85	0%	10	12/85	0.0%	0			

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
1987	215	all broke in conc. deck
1988	257	all broke in conc. deck

Skid Resistance

Date	*Direction*	*Average*	*Range*
9/87	N	71	70-72
	S	66	64-68
5/88	N	59	58-59
	S	54	51-55
4/89	N	43	40-46
4/90	N	46	43-50
	S	44	41-45
3/91	N	36	28-41
	S	29	27-30
6/92	N	28	23-32
	S	27	24-30
5/94	N	18	16-20
	S	23	19-27

167/106 FIRST AVENUE NORTH OVERCROSSING

Bridge Information:

Milepost:	12.69
Structure ID#:	0010513C
Bridge Type:	Pre-stressed Conc. Beam
Year Built/Rebuilt:	1977 / 1987
Bridge Length:	146ft.
Bridge Width:	91.3ft.
Bridge deck area:	13,330sq.ft.
Lanes on:	4
Average Daily Traffic:	29000

Overlay Information

Overlay Brand:	POLYCARB
Overlay Type:	EPOXY
Date Applied:	July, 1987
Contractor:	David A. Mowat
Overlay Contract#:	13078
Overlay Length:	146ft.
Overlay Width:	44ft.
Overlay Area:	6,424sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	0.7%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
12/85	0%	10	9/92	0.0%	0	12/85	0%	1.90 in.
1/85	0%	9	12/85	0.0%	0			

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
1987	342	all broke in conc. deck	9/87	N	68	65-71
1988	287	all broke in conc. deck		S	64	64-66
			5/88	N	52	50-55
				S	56	53-57
			4/89	N	44	41-49
			4/90	N	50	48-52
				S	45	42-51
			3/91	N	32	29-34
				S	35	29-39
			6/92	N	30	28-31
				S	25	23-29
			5/94	N	21	20-22
				S	20	18-23

203/106 SKYKOMISH RIVER

Bridge Information:

Milepost:	**23.2**
Structure ID#:	**0005294B**
Bridge Type:	**Steel Truss**
Year Built/Rebuilt:	**1957**
Bridge Length:	**582ft.**
Bridge Width:	**28ft.**
Bridge deck area:	**16,296sq.ft.**
Lanes on:	**2**
Average Daily Traffic:	**8600**

Overlay Information

Overlay Brand:	**DURAL**
Overlay Type:	**EPOXY**
Date Applied:	**June, 1993**
Contractor:	**Adhesive Systems Inc.**
Overlay Contract#:	**14227**
Overlay Length:	**582ft.**
Overlay Width:	**28ft.**
Overlay Area:	**16,296sq.ft.**
Maximum Super elev.:	**1%**
Maximum Grade:	**1%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
11/86	59%	22	7/92	1.2%	194	11/86	0%	2.32 in.
			11/86	1.4%	228			

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			(No Tests Taken)			

410/101 WHITE RIVER

Bridge Information:

Milepost:	**21.99**
Structure ID#:	**0003523A**
Bridge Type:	**Steel Truss**
Year Built/Rebuilt:	**1949**
Bridge Length:	**292ft.**
Bridge Width:	**32ft.**
Bridge deck area:	**9,344sq.ft.**
Lanes on:	**2**
Average Daily Traffic:	**18000**

Overlay Information

Overlay Brand:	**SIKA**
Overlay Type:	**EPOXY**
Date Applied:	**September, 1991**
Contractor:	**Progressive Contractors**
Overlay Contract#:	**13744**
Overlay Length:	**292ft.**
Overlay Width:	**32ft.**
Overlay Area:	**9,344sq.ft.**
Maximum Super elev.:	**1%**
Maximum Grade:	**0.2%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
11/86	45%	11	10/86	0.7%	55	10/86	0%	1.85 in.
9/80	20%	20						

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			(No Tests Taken)			

410/115 SCATTER CREEK

Bridge Information:

Milepost:	**31.06**
Structure ID#:	**0007789A**
Bridge Type:	**Pre-stressed Conc. Beam**
Year Built/Rebuilt:	**1965**
Bridge Length:	**250ft.**
Bridge Width:	**28ft.**
Bridge deck area:	**7,000sq.ft.**
Lanes on:	**2**
Average Daily Traffic:	**3000**

Overlay Information

Overlay Brand:	**SIKA**
Overlay Type:	**EPOXY**
Date Applied:	**September, 1991**
Contractor:	**Progressive Contractors**
Overlay Contract#:	**13744**
Overlay Length:	**250ft.**
Overlay Width:	**28ft.**
Overlay Area:	**7,000sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**0.1%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
10/84	75%	12	10/84	3.5%	246	10/84	19%	1.40 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
(No Tests Taken)		

Skid Resistance

Date	*Direction*	*Average*	*Range*
(No Tests Taken)			

410/123 SLIPPERY CREEK

Bridge Information:

Milepost:	**42.49**
Structure ID#:	**0008136A**
Bridge Type:	**Concrete Slab**
Year Built/Rebuilt:	**1967**
Bridge Length:	**78ft.**
Bridge Width:	**38ft.**
Bridge deck area:	**2,964sq.ft.**
Lanes on:	**2**
Average Daily Traffic:	**3000**

Overlay Information

Overlay Brand:	**SIKA**
Overlay Type:	**EPOXY**
Date Applied:	**September, 1991**
Contractor:	**Progressive Contractors**
Overlay Contract#:	**13744**
Overlay Length:	**78ft.**
Overlay Width:	**38ft.**
Overlay Area:	**2,964sq.ft.**
Maximum Super elev.:	**8%**
Maximum Grade:	**0.6%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
10/86	90%	10	10/86	5.1%	150	10/86	0%	2.00 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
(No Tests Taken)		

Skid Resistance

Date	*Direction*	*Average*	*Range*
(No Tests Taken)			

512/40N SR 167 OVERCROSSING

Bridge Information:

Milepost:	11.99
Structure ID#:	0009831A
Bridge Type:	Pre-stressed Conc. Beam
Year Built/Rebuilt:	1975
Bridge Length:	337ft.
Bridge Width:	38ft.
Bridge deck area:	12,806sq.ft.
Lanes on:	2
Average Daily Traffic:	27000

Overlay Information

Overlay Brand:	DEGUSSA
Overlay Type:	MMA
Date Applied:	August, 1987
Contractor:	Cal Floor
Overlay Contract#:	13183
Overlay Length:	337ft.
Overlay Width:	38ft.
Overlay Area:	12,806sq.ft.
Maximum Super elev.:	8%
Maximum Grade:	2.4%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%< 1inch*	*Average*
10/86	0%	16	1/92	0.0%	0	10/86	0%	1.92 in.
8/82	0%	17	10/86	0.0%	0			

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
1987	259	all broke in conc. deck
1988	135	all broke in conc. deck

Skid Resistance

Date	*Direction*	*Average*	*Range*
9/87	S	41	39-45
7/88	S	35	30-39
4/89	S	34	30-48
6/90	S	35	31-47
3/91	S	29	27-32
8/92	S	33	28-38
5/94	S	41	34-46

513/10 SR 520 OVERCROSSING

Bridge Information:

Milepost:	**0.0**
Structure ID#:	**000000NV**
Bridge Type:	**Concrete Box Girder**
Year Built/Rebuilt:	**1962**
Bridge Length:	**152ft.**
Bridge Width:	**84ft.**
Bridge deck area:	**12,768sq.ft.**
Lanes on:	**6**
Average Daily Traffic:	**39000**

Overlay Information

Overlay Brand:	**DEGUSSA**
Overlay Type:	**MMA**
Date Applied:	**September, 1991**
Contractor:	**Progressive Contractors**
Overlay Contract#:	**13953**
Overlay Length:	**152ft.**
Overlay Width:	**84ft.**
Overlay Area:	**12,768sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**0.1%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
7/87	76%	17	7/87	0.0%	0	7/87	0%	2.02 in.

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			(No Tests Taken)			

520/1 SR 520 UNDERCROSSING 10TH AVENUE

Bridge Information:

Milepost:	**0.0**
Structure ID#:	**0006861B**
Bridge Type:	**Concrete Box Girder**
Year Built/Rebuilt:	**1963**
Bridge Length:	**285ft.**
Bridge Width:	**44ft.**
Bridge deck area:	**12,540sq.ft.**
Lanes on:	**4**
Average Daily Traffic:	**3280**

Overlay Information

Overlay Brand:	**DEGUSSA**
Overlay Type:	**MMA**
Date Applied:	**September, 1991**
Contractor:	**Progressive Contractors**
Overlay Contract#:	**13953**
Overlay Length:	**285ft.**
Overlay Width:	**44ft.**
Overlay Area:	**12,540sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**8.0%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%< 1inch*	*Average*
9/86	**44%**	**17**	**9/86**	**0.1%**	**16**	**9/86**	**7%**	**1.64 in.**

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*
(No Tests Taken)		

Skid Resistance

Date	*Direction*	*Average*	*Range*
(No Tests Taken)			

529/10E SNOHOMISH RIVER

Bridge Information:

Milepost:	5.01
Structure ID#:	0006861B
Bridge Type:	Steel Lift span, Steel Truss
Year Built/Rebuilt:	1927 / 1994
Bridge Length:	2,680ft.
Bridge Width:	24ft.
Bridge deck area:	64,320sq.ft.
Lanes on:	2
Average Daily Traffic:	11000

Overlay Information

Overlay Brand:	DEGUSSA
Overlay Type:	MMA
Date Applied:	May, 1994
Contractor:	Progressive Contractors
Overlay Contract#:	13953
Overlay Length:	1,134ft.
Overlay Width:	24ft.
Overlay Area:	27,216sq.ft.
Maximum Super elev.:	1%
Maximum Grade:	3.6%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
6/88	51%	86	7/92	0.1%	59	8/86	1%	2.10 in.
8/86	37%	86	8/86	0.1%	64			

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			(No Tests Taken)			

529/20W STEAMBOAT SLOUGH

Bridge Information:

Milepost:	5.42
Structure ID#:	0000965C
Bridge Type:	Steel Swing span, Steel Truss
Year Built/Rebuilt:	1927 / 1954
Bridge Length:	853ft.
Bridge Width:	24ft.
Bridge deck area:	20,472sq.ft.
Lanes on:	2
Average Daily Traffic:	11000

Overlay Information

Overlay Brand:	POLYCARB
Overlay Type:	EPOXY
Date Applied:	April, 1988
Contractor:	unknown
Overlay Contract#:	XE2625
Overlay Length:	853ft.
Overlay Width:	24ft.
Overlay Area:	20,472sq.ft.
Maximum Super elev.:	1%
Maximum Grade:	0.1%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
7/85	28%	29	7/92	0.1%	18	7/85	5%	1.83 in.
4/82	48%	29	7/85	0.1%	20			

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
1988	207	all broke in conc. deck	5/88	N	53	48-59
			7/89	N	49	44-60
			6/90	N	44	41-49
			4/91	N	32	26-42
			6/92	N	28	24-33
			6/94	N	41	34-49

529/20E STEAMBOAT SLOUGH

Bridge Information:

Milepost:	5.44
Structure ID#:	0004373A
Bridge Type:	Steel Swing span, Steel Truss
Year Built/Rebuilt:	1954
Bridge Length:	910ft.
Bridge Width:	24ft.
Bridge deck area:	21,840sq.ft.
Lanes on:	2
Average Daily Traffic:	11000

Overlay Information

Overlay Brand:	POLYCARB
Overlay Type:	EPOXY
Date Applied:	April, 1988
Contractor:	unknown
Overlay Contract#:	XE2625
Overlay Length:	910ft.
Overlay Width:	24ft.
Overlay Area:	21,840sq.ft.
Maximum Super elev.:	1%
Maximum Grade:	0.1%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%< 1inch*	*Average*
7/85	67%	30	7/92	0.2%	50	7/85	3%	1.73 in.
4/82	83%	30	7/85	2.5%	546			

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
1988	267	all broke in conc. deck	5/88	N	55	48-58
1991	187	all broke in conc. deck	7/89	N	49	37-58
			6/90	N	44	37-50
			4/91	N	33	27-37
			6/92	N	28	25-32
			6/94	N	40	34-45

532/2 STILLAGUAMISH RIVER

Bridge Information:

Milepost:	3.39
Structure ID#:	0003666B
Bridge Type:	Steel Girder
Year Built/Rebuilt:	1949
Bridge Length:	487ft.
Bridge Width:	26ft.
Bridge deck area:	12,662sq.ft.
Lanes on:	2
Average Daily Traffic:	15000

Overlay Information

Overlay Brand:	SIKA
Overlay Type:	EPOXY
Date Applied:	September, 1993
Contractor:	Global Contractors
Overlay Contract#:	14209
Overlay Length:	487ft.
Overlay Width:	26ft.
Overlay Area:	12,662sq.ft.
Maximum Super elev.:	2%
Maximum Grade:	5.0%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
7/85	88%	17	9/92	1.7%	217	9/85	4%	1.76 in.
			7/85	0.8%	101			

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			(No Tests Taken)			

532/6 GN RR & COUNTY ROAD OVERCROSSING

Bridge Information:

Milepost:	**4.98**
Structure ID#:	**0006837A**
Bridge Type:	**Pre-stressed Conc. Beam**
Year Built/Rebuilt:	**1960**
Bridge Length:	**699ft.**
Bridge Width:	**26ft.**
Bridge deck area:	**18,174sq.ft.**
Lanes on:	**2**
Average Daily Traffic:	**11000**

Overlay Information

Overlay Brand:	**SIKA**
Overlay Type:	**EPOXY**
Date Applied:	**September, 1994**
Contractor:	**Concrete Barriers Inc.**
Overlay Contract#:	**14282**
Overlay Length:	**699ft.**
Overlay Width:	**26ft.**
Overlay Area:	**18,174sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**3.0%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
7/85	**58%**	**24**	**9/92**	**3.3%**	**598**	**7/85**	**1%**	**1.80 in.**
			7/85	**0.9%**	**164**			

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			**(No Tests Taken)**			

536/15 SKAGIT RIVER

Bridge Information:

Milepost:	**4.72**
Structure ID#:	**0004400A**
Bridge Type:	**Steel Swing span, Steel Truss**
Year Built/Rebuilt:	**1953**
Bridge Length:	**675ft.**
Bridge Width:	**28ft.**
Bridge deck area:	**18,900sq.ft.**
Lanes on:	**2**
Average Daily Traffic:	**20000**

Overlay Information

Overlay Brand:	**SIKA**
Overlay Type:	**EPOXY**
Date Applied:	**September, 1990**
Contractor:	**Eagle Crest Const. Co.**
Overlay Contract#:	**13777**
Overlay Length:	**675ft.**
Overlay Width:	**28ft.**
Overlay Area:	**18,900sq.ft.**
Maximum Super elev.:	**2%**
Maximum Grade:	**0.0%**

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
7/87	64%	25	7/87	14.0%	2,649	7/87	5%	1.85 in.

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
(No Tests Taken)			**(No Tests Taken)**			

900/12W SR 5 OVERCROSSING

Bridge Information:

Milepost:	6.12
Structure ID#:	0007678G
Bridge Type:	Concrete Box Girder
Year Built/Rebuilt:	1966
Bridge Length:	450ft.
Bridge Width:	31ft.
Bridge deck area:	13,950sq.ft.
Lanes on:	2
Average Daily Traffic:	31000

Overlay Information

Overlay Brand:	DURAL
Overlay Type:	EPOXY
Date Applied:	November, 1986
Contractor:	David A Mowat
Overlay Contract#:	13189
Overlay Length:	450ft.
Overlay Width:	31ft.
Overlay Area:	13,950sq.ft.
Maximum Super elev.:	8%
Maximum Grade:	0.8%

Bridge Deck Testing:

Chloride			Delamination			Rebar Cover		
Date	*%>2lbs/C.Y.*	*No. Samples*	*Date*	*% of deck*	*sq.ft.*	*Date*	*%<1inch*	*Average*
11/94	90%	10	8/92	0.2%	31	11/84	6%	1.73 in.
11/84	22%	18	11/84	0.0%	0			

Overlay Testing

Bond			Skid Resistance			
Year	*Ave. Pull-off (PSI)*	*Comments*	*Date*	*Direction*	*Average*	*Range*
1987	201	none broke in conc. deck	4/87	E	47	43-50
1988	199	5 of 10 broke in conc. deck	6/88	(Deck resurfaced)		
1991	327		7/88	E	59	55-63
			5/89	E	44	42-47
			4/90	E	47	43-52
			4/91	E	33	28-39
			6/92	E	24	20-32
			6/94	E	23	16-37

900/13W SR 5 OVERCROSSING

Bridge Information:

Milepost:	6.12
Structure ID#:	0007678G
Bridge Type:	Concrete Box Girder
Year Built/Rebuilt:	1966
Bridge Length:	450ft.
Bridge Width:	31ft.
Bridge deck area:	13,950sq.ft.
Lanes on:	2
Average Daily Traffic:	31000

Overlay Information

Overlay Brand:	SIKA
Overlay Type:	EPOXY
Date Applied:	November, 1991
Contractor:	Sika
Overlay Contract#:	maintenance
Overlay Length:	450ft.
Overlay Width:	31ft.
Overlay Area:	13,950sq.ft.
Maximum Super elev.:	10%
Maximum Grade:	1.6%

Bridge Deck Testing:

Chloride

Date	*%>2lbs/C.Y.*	*No. Samples*
12/84	42%	19

Delamination

Date	*% of deck*	*sq.ft.*
8/92	0.1%	11
12/84	0.0%	0

Rebar Cover

Date	*%<1inch*	*Average*
12/84	3%	1.75 in.

Overlay Testing

Bond

Year	*Ave. Pull-off (PSI)*	*Comments*

(No Tests Taken on current overlay)

Skid Resistance

Date	*Direction*	*Average*	*Range*

(No Tests Taken on current overlay)

Appendix D

Polymer Overlay Special Provisions

POLYMER CONCRETE OVERLAY

General Requirements

1.01 Description

A. This item of work shall consist of furnishing and placing a polymer concrete overlay, including cleaning and preparing the concrete, on the existing decks of bridge(s) **** as specified.

B. The Contractor shall furnish technical service through the material supplier relating to application of the material and health and safety training for personnel who are to handle the polymer concrete.

C. The overlay shall be methyl methacrylate (MMA) polymer concrete overlay or epoxy polymer concrete overlay at the Contractor's option. The overlay shall meet the requirements of this Special Provision.

D. The epoxy polymer overlay shall be of a Multiple Layer System type consisting of an epoxy polymer prime coat and multiple layers of epoxy polymer concrete having broadcast aggregate in each layer, topped and overlain with an epoxy polymer top coat.

E. The MMA polymer concrete overlay shall consist of an MMA prime coat, a premixed MMA overlay, broadcast coarse aggregate and fine aggregate and a MMA top coat.

F. The actual cure time required for the polymer concrete overlay to achieved adequate strength sufficient for traffic loads shall be determined by the Contractor and be acceptable to the Engineer. The Contractor shall determine, prior to bid, that the select polymer concrete system will cure in sufficient time to satisfy the Engineer's requirements for vehicular operations.

1.02 Submittals

A. The Contractor shall prepare and submit the following to the Washington State Department of Transportation Materials Laboratory. These items shall be submitted a minimum of 10 working days prior to placing the overlay:

1. The design mix report for the polymer concrete. The report shall include the name, type, and quantities of all concrete components in the mix, the polymer mix ratio, and the required mix ratio accuracy (%).
2. A description of the polymer mixing method and the method of placement of the overlay on the prepared deck.
3. Samples of all polymer concrete components for testing.

The Contractor shall obtain written approval of the above submittals prior to ordering any and all materials for application of the polymer concrete overlay. WSDOT shall not be responsible for any materials ordered or delivered to the job site which are not approved by the submittal approval process.

B. The Contractor shall submit each of the following to the Engineer for approval. These items shall be submitted a minimum of ten (10) working days prior to placing the overlay:

1. The design mix report for the polymer concrete, which shall include: the name and type of all ingredients; the mix ratio that will be used; and the application rate of each material.
2. A table showing the expected cure time (in minutes) at the cooresponding temperatures between 40°F and 90°F (in 10°F increments) of the polymer concrete overlay material the Contractor chooses to use.
3. A description of accelerator or inhibitor compounds (and their dosage requirements) that may be added to the polymer resins during mixing.
4. A description of the deck preparation procedures to be used following the completion of all deck repairs.
5. A description of the polymer mixing method and the method of placement of the overlay on the prepared deck.
6. The method or methods to be used, if applicable, for reconditioning the polymer materials following storage and prior to mixing.

7. A description of methods to be used to clean previous overlay lifts prior to placing subsequent lifts.
8. Certification that key personnel to be used in the application of the overlay material have experience in the application of this type of material on concrete bridge decks.

1.03 Delivery, Storage, and Handling of Materials

A. All materials shall be delivered in their original unopened containers bearing the manufacturer's label, specifying date of manufacturing, batch number, trade name brand, quantity, shelf life, and mixing ratio.

B. The Contractor shall have sufficient material in storage at the site to perform the entire polymer concrete application field preparation, so that there shall be no delay in procuring the materials for each day's application.

C. The material shall be stored to prevent damage by the elements and to ensure the preservation of their quality and fitness for the work. The storage space shall be kept clean and dry, and shall contain a high-low thermometer. The temperatures of the storage space shall not fall below $50^{o}F$ nor rise above $90^{o}F$. Every precaution shall be taken to avoid contact with flame.

D. Stored materials shall be inspected prior to their use, and shall meet the requirements of this Special Provision at the time of use.

E. All material which is rejected because of failure to meet the required tests or that has been damaged so as to cause rejections shall be immediately replaced at no additional cost to the Contracting Agency.

F. The promoter/initiator system for the methacrylate resin may consist of a metal drier and peroxide. If supplied separately from the resin, at no time shall the metal drier be mixed with the peroxide directly. The containers shall be stored in a manner that will not allow leakage or spillage from one material to contact the containers of the other.

G. Each shipment of polymer materials shall be accompanied by a Materials Safety Data Sheet (MSDS) and a Certificate of Compliance certifying that the materials conform to the requirements of this Special Provision.

H. Appropriate impermeable protective garments shall be used by all workmen who may contact the resin or initiators to prevent skin contact. If skin contact occurs, the resin or initiators shall be immediately washed off. Clothing that becomes saturated with resin shall be removed immediately.

Materials Specifications

2.01 Methyl Methacrylate (MMA)

A. The MMA concrete overlay shall be composed of the following three components:
   1. Flexibilized methyl methacrylate (Component A)
   2. Methyl methacrylate base hardener (Component B)
   3. Aggregate

B. The MMA shall be one of the following

DEGADUR, manufactured by Degussa Corp.
Challenger Road
Ridgefield Park, N.J. 07660

R66, manufactured by Silikal of N. America
10 Via Kndorra
Trabuco Canyon, CA 92679

2.02 Epoxy

A. The epoxy concrete overlay shall be composed of the following three components:
   1. Epoxy resin base (Component A)
   2. Epoxy resin base hardener (Component B)
   3. Aggregate

B. The epoxy resin base and hardener shall be composed of a two-component, 100 percent solids, thermosetting, moisture-insensitive, flexible, high-elongation compound. The compound shall be one of the following:

FLEXOLITH, manufactured by Dural International Corp.
95 Brook Avenue
Polymeer Park, New York 11729

FLEXOGRID, manufactured by Poly-Carb
33095 Bainbridge Road
Solon, Ohio 44139

SIKADUR 22, manufactured by Sika Corp.
16212 88th Place South
Mill Creek, Washington 98102

2.03 Aggregate

A. The aggregate shall be from Washington State Designated Pit Site B1 located in Steilacoom, WA The aggregate shall be 100 percent fractured, thoroughly washed, and kiln dried to a maximum moisture content of 0.2% by weight, measured in accordance with ASTM C566. The fracture requirements shall be at least one mechanically fractured face and will apply to material retained on U.S. No. 10.

Aggregate Grading	Percent Passing by Weight
(No.6 x No. 10)	
No. 6	100
No. 10	10-35
No. 16	0-3
(5/8" x 1/2")	
5/8" square	98-100
1/2" square	55-60
3/8" square	12-14
1/4" square	0-1

Equipment

3.01 General

A. All equipment for cleaning the surface and mixing and applying the overlay shall be in strict accordance with the manufacturer's requirements and approved by the Engineer prior to commencement of any work.

B. No fuel or oil from any equipment shall be allowed to reach the bridge deck. If an oil or fuel spill occurs the contaminated area shall be cleaned by a method approved by the engineer followed by shot blasting or sand blasting the area until the contamination is removed.

C. The Contractor shall be responsible for the proper disposal of all dust debris and residue generated. The disposal of all material shall meet all Federal, State and local regulations.

3.02 Grinding Equipment

A. The grinding equipment shall use diamond tipped saw blades mounted on a power driven, self-propelled machine that is specifically designed to texture concrete surfaces. The grinding

equipment shall have a blade spacing to provide grooves that are between 0.10 and 0.15 inches wide. The land area between the grooves shall be aproximately 0.125 inches.

B. Rotomilling machines will not be allowed.

3.03 Shot Blast Equipment

A. The unit shall be composed of a blasting unit and a vacuum unit, both self-propelled. All contaminants shall be picked up and stored in the vacuum unit. The unit shall be equipped with its own dust collector and shall recycle the abrasives.

B. The shot blast equipment shall use steel shot abrasives with a minimum size of 0.04".

C. The contractor shall have two (2) shot blast machines at the project site during the shot blast cleaning operation. Both machines will be in good working order. This requirement does not apply if the shot blast machine is capable of cleaning a minimum of four (4) feet per pass.

Pre-Overlay Construction Requirements

4.01 Bridge Deck Grinding

A. If bridge deck repair is necessary, it shall be done in accordance with the Special Provision titled BRIDGE DECK REPAIR USING POLYMER CONCRETE. All bridge deck repair shall be finished prior to the required bridge deck grinding operation.

B. The contractor shall not begin the bridge deck surface preparation unless completion of the overlay can be accomplished within the current construction season.

C. The entire roadway surface of the deck shall be ground using the equipment described in 3.02. The bridge deck shall be ground in a longitudinal direction between the bridge ends. Areas that are inaccessible to these machines shall be hand-chipped to the same depth.

D. The bridge deck surfaces shall be ground to a depth between 1/4" - 3/8" in order to remove the surface matrix of the concrete. The surfaces that have been ground shall be uniform in appearance with longitudinal corduroy type texture.

E. All debris generated by the grinding operation shall be removed prior to beginning the shot blast operation.

4.02 Shot blast cleaning

A. Following the bridge deck grinding operation, the bridge deck surfaces shall be cleaned using shot blast equipment specified in 3.03.

B. The shot blast operation shall remove all surface material on the bridge deck which may act as a bond breaker between the deck surface and the overlay. Acceptable cleaning is achieved by significantly changing the color of the concrete surface to nearly white.

C. Those areas of roadway deck not accessible for cleaning by the shot blasting unit shall be blast cleaned using conventional methods, subject to prior approval of the Engineer.

D. If conventional blast cleaning is required, then precautions shall be taken to ensure that no dust or debris leaves the roadway deck and that all traffic is protected from rebound and dust. Appropriate shielding shall be provided as required at no additional cost to the State and shall be approved by the Engineer.

E. If the bridge deck surface has been rained on then the bridge deck surface shall be shot blast cleaned again when it has been allowed to dry.

4.03 Pre-Overlay Preparation

A. The entire bridge deck surface shall be blown clean with compressed air following the shot blast cleaning operation. Any dust or debris on the adjacent curbs or sidewalks shall also be cleaned to ensure no debris is carried onto the deck surface during the overlay process.

B. The epoxy or MMA overlay placement shall not begin if rain is expected. If the bridge deck has been rained on it shall be allowed to dry for 36 hours prior to the polymer concrete overlay placement. The polymer concrete shall not be placed when the temperature of the bridge deck surface is less than 50°F or greater than 90°F.

C. All bridge drains and expansion joints shall be protected and sealed prior to the polymer overlay placement.

D. The Contractor shall provide suitable coverings, such as heavy duty drop cloths, to protect all exposed areas not to be overlaid, such as curbs, sidewalks, railings, parapets, etc. Any damage or defacement resulting from this application shall be cleaned or repaired at the Contractor's expense, to the satisfaction of the Engineer.

E. Concrete surfaces shall be coated with the polymer mixture after the cleaning is completed to prevent contamination of the cleaned surface. If, in the opinion of the Engineer, the surface has become soiled or contaminated prior to the application of the polymer, it shall be cleaned again to the satisfaction of the Engineer, at no additional cost to the Contracting Agency.

4.04 Field Sampling

A. Sampling and field testing of the mixed resign shall be completed during each overlay placement. An overlay placement is defined as the overlay applied during a continuous work shift. If the overlay placement is discontinued and restarted, the restart shall be defined as constituting a separate placement.

B. As a minimum, samples of the mixed resin shall be taken by the Engineer just prior to placing the initial resin on the bridge deck, at the midpoint of the placement, and just prior to placing the last resin on the deck. In addition, samples shall also be taken whenever the mixing procedure is modified, or whenever mixing equipment is replaced or substituted during the placement.

C. The samples shall be retained and submitted to the HQ Materials Laboratory for analysis. These samples will be used to verify the final properties and characteristics of the polymer overlay placed on the bridge deck. If the laboratory analysis determines that the sample properties and characteristics vary from the approved mixed design ratio, applicable overlay sections will be subject to rejection.

D. All samples will consist of fresh polymer placed in straight sided plastic 8 oz (minimum) sealed containers. Each container shall be labeled with the following:
   1) The construction project number
   2) The date, time and location taken
   3) The name of the WSDOT employee taking the sample

4.05 Mixing Epoxy Polymer Systems

A. The epoxy base resin systems shall not be proportioned by continuous volume mixing equipment.

B. Components A and B shall be stored at a temperature of 65-70°F for a minimum of 2 hours before use.

C. Component A and Component B resins shall be stirred thoroughly immediately prior to use. A low RPM mixing device shall be used. The same paddle used to stir Component A shall not be used to stir Component B.

D. Component B shall be combined with Component A at the specified mix ratio ($\pm$5%) and mixed in accordance with the manufactures' recommendations. A low RPM mixing device having blades which wipe the inside of the mixing container clean shall be used. The mixing device shall be operated to prevent the entrapment of air in the mix.

E. The Engineer shall grant prior approval to the use of any accelerators or inhibitors into the blended resin system.

4.06 Mixing MMA Polymer Systems

A. Components A and B shall be stored at a temperature of 65-70°F for a minimum of 2 hours before use.

B. The MMA concrete shall use aggregates from Pit Site B1 for filler adjustement as recommended by the manufacturer.

C. Proportion the resin and resin fillers into a resin system in accordance with the approved mix design. The powdered initiator hardener shall be added to the premixed resin system in accordance with the mix design in the mixing vessel. The mixing process shall not create air bubbles in the mix, and shall continue for the length of time as recommended by the manufacturer.

D. The Engineer shall grant prior approval to the use of any accelerators or inhibitors into the blended resin system.

Overlay Placement Requirements

5.01 Epoxy Polymer Systems

A. Prior to placing the first lift of epoxy polymer concrete, an epoxy primer shall be uniformly applied to the prepared deck using paint rollers or brooms at an application rate of approximately 100 sq.ft./gallon. The primer shall remain tacky during placement of the first epoxy polymer concrete lift.

B. The epoxy polymer concrete system shall be placed in two lifts using the broom-and-seed method. Premixed epoxy resin shall be applied uniformly to the deck, and seeded with aggregate using a hand broadcast method. Hand broadcasting shall cause the aggregate to fall vertically on to the fresh epoxy binder.

C. Aggregate shall be hand broadcast on the freshly placed polymer system to achieve the following coverage: Pit Site B1 aggregate (5/8"x1/2") at 0.75 pound per square foot and Pit Site B1 aggregate (no.6 x no.10) such that the entire surface is covered to excess.

D. When the first application has attained its initial set, the excess aggregate shall be removed in preparation for the second application. Excess aggregate shall become the property of the contractor and disposed of properly off the bridge site. Excess aggregate shall not be reused on the polymer overlay.

E. The second application of polymer and aggregate shall be applied in like manner to the first coat except only Pit Site B1 (no.6 x no.10) aggregate shall be broadcast to excess. All loose, excess aggregate shall be swept or otherwise removed from the finished overlay surface after the second application of polymer concrete has cured.

F. The method used to remove the excess aggregate from each lift shall not cause partially exposed aggregate to be further embedded in to the overlay, and shall not introduce any contaminants which act to reduce the bond of subsequent polymer applications.

G. Prior to opening to traffic a low viscosity sealer tie coat comprised of the same type of polymer as used in the overlay shall be applied to the exposed aggregate. The sealer tie coat shall be applied using paint rollers at an application rate of approximately 100 sq.ft./gallon.

H. Under no circumstances shall any polymer mixture be allowed to run into drains and expansion joints. The overlay shall be feathered a distance of 8 inches to the edge of the drain.

5.02 Methyl Methacrylate (MMA) Polymer Concrete

A. Following the cleaning operation a MMA primer shall be uniformly applied to the bridge deck. The MMA primer shall be applied using paint rollers or brooms at an application rate of approximately 100 sq. ft./gal. The MMA primer cure time shall be as specified by the manufacturer and the mix design.

B. After the MMA primer has cured, the MMA and aggregate mixture shall be applied using squeegees or trowels. Aggregate shall be broadcast on the freshly placed MMA system in the following ratio: Pit site B1 (5/8"x1/2") at 0.75 pound per square foot and Pit Site B1 (no.6 x no.10) aggregate such that the entire surface is covered to excess. All loose, excess aggregate shall be swept or otherwise removed from the finished overlay surface after the MMA mixture has cured.

C. Excess aggregate shall become the property of the contractor and disposed of properly off the bridge site. Excess aggregate shall not be reused on the polymer overlay.

D. Prior to opening to traffic a low viscosity sealer tie coat comprised of the same type of polymer as used in the overlay shall be applied to the exposed aggregate. The sealer tie coat shall be applied using paint rollers at an application rate of approximately 100 square foot per gallon.

5.03 Finished Overlay Surface

A. The final overlay thickness shall be 3/8 inch minimum, measured from the original bridge deck surface to the top of the polymer overlay surface excluding any 5/8" x 1/2" aggregate.

B. After the overlay has reached its final set, the Contractor shall provide 1/2 inch minimum diameter holes 1/2 inch in depth, for checking the actual thickness of the overlay. The Contractor shall provide one hole per lane per 100 feet of bridge length. The Engineer will designate the exact location of each hole. The Contractor shall record the location of each hole and the overlay thickness at each location after verification by the Engineer.

C. If measurement shows an overlay thickness less than 3/8 inch, the Contractor shall provide more holes, as determined by the Engineer, to determine the limits of the area with less than 3/8 inch thickness. The Contractor shall apply additional material, at no cost to the Contracting Agency, to achieve the 3/8 inch thickness in these areas.

D. The holes shall be filled with polymer concrete after the Engineer has verified the overlay thickness and has determined no additional material is required.

5.04 Bond Test

A. After the polymer concrete overlay has cured the contractor shall perform three (3) pull-off tests in each travelled lane to determine the bond strength of the overlay to the concrete substrate. All tests shall be performed in accordance with the American Concrete Institute 503R - Appendix A.

B. The Contractor shall record the pull-off test results and the amount (if any) of failure into the base concrete and provide written documentation to the Engineer. Any area with a test result less than the average value obtained during the polymer concrete test patch shall be considered a surface defect and subject to rejection.

5.04 Repair of Surface Defects

A. Overlay defects shall include, but not be limited to, unbonded areas, areas without adequate aggregate, cracks, and areas where the polymer concrete has failed to properly cure to meet the requirements of these Special Provisions.

B. The repair method for surface defects of the overlay shall be identical to the original application of the overlay.

5.05 Curing

A. The polymer concrete overlay shall be allowed to cure sufficiently before subjecting it to loads of traffic of any nature that may damage the overlay. Cure time depends upon the ambient and deck temperatures but shall not exceed 8 hours.

B. Actual degrees of cure and stability for traffic on the actual polymer concrete overlay shall be determined by the Contractor and be acceptable to the Engineer. The Contractor shall

determine, prior to bid, that its system will cure in sufficient time to satisfy the requirements for vehicular operations.

Measurement
6.01

A. Measurement for polymer concrete will be made by the square yard of overlay in place.

Payment
7.01

A. The unit contract price per square yard for "Polymer Concrete Overlay" shall be full pay to perform the work as specified.

POLYMER CONCRETE OVERLAY - TEST PATCH

Description

This work includes preparing, testing, and removing a polymer concrete overlay test patch.

Materials

The polymer concrete overlay material selected by the Contractor shall be in accordance with the Special Provision POLYMER CONCRETE OVERLAY.

Construction Requirements

The Contractor shall prepare a test patch having minimum dimensions of 1.5 feet x 3.0 feet. The location of the test patch will be in a travelled lane as located by the Engineer.

The contractor shall prepare the concrete surface and place the polymer material in the test patch area in accordance with the Special Provision POLYMER CONCRETE OVERLAY.

The contractor shall perform three (3) pull-off tests on the test patch in accordance with American Concrete Institute 503R - Appendix A. The Contractor shall record the pull-off test results and the amount (if any) of failure into the base concrete and provide written documentation to the Engineer.

The Contractor shall remove all the polymer concrete used in the test patch following the completion of the overlay bond strength verification test. All materials used in the trial overlay shall become the property of the Contractor and shall be removed from the project site as approved by the Engineer. The test patch area shall be re-prepared as outlined in the special provision POLYMER CONCRETE OVERLAY.

Payment

All costs in connection with preparing, testing, and removing the polymer concrete overlay test patch as specified shall be included in the unit contract price per square yard for "POLYMER CONCRETE OVERLAY".

BRIDGE DECK REPAIR USING POLYMER CONCRETE

General Requirements

1.01 Description

A. This item of work shall consist of preparation and repair of the bridge deck surfaces designated and marked for deck repair and as directed by the Engineer. Areas marked for repair shall be filled with polymer concrete as outlined in this Special Provision

B. No deck repair work shall begin if rain is expected. If the bridge deck has been rained on it shall be allowed to dry for 24 hours prior to starting any deck repair work.

C. The polymer concrete patching material shall be either methyl methacrylate or epoxy. The contractor shall use the same type of polymer material that will be used in the bridge deck overlay.

1.02 Submittals

A. The Contractor shall submit each of the following to the Engineer for approval. These items shall be submitted a minimum of ten (10) working days prior to placing the patching material.

1. The design mix report for the polymer concrete which shall include the name and type of all ingredients and the mix ratio that will be used.

2. A table showing the expected cure time (in minutes) at the cooresponding temperatures between 40°F and 90°F (in 10°F increments) of the polymer concrete overlay the Contractor chooses to use.

3. A description of accelerator or inhibitor compounds (and their dosage requirements) that may be added to the polymer resins during mixing.

4. The method or methods to be used, if applicable, for reconditioning the polymer materials following storage and prior to mixing.

5. Certification that key personnel to be used in the application of the overlay material have experience in the application of this type of material on a concrete bridge deck.

1.03 Delivery, Storage, and Handling of Materials

A. All materials shall be delivered in their original unopened containers bearing the manufacturer's label, specifying date of manufacturing, batch number, trade name brand, quantity, shelf life, and mixing ratio.

B. The Contractor shall have sufficient material in storage at the site to perform the entire polymer concrete application field preparation, so that there shall be no delay in procuring the materials for each day's application.

C. The material shall be stored to prevent damage by the elements and to ensure the preservation of their quality and fitness for the work. The storage space shall be kept clean and dry, and shall contain a high-low thermometer. The temperatures of the storage space shall not fall below 50°F nor rise above 90°F. Every precaution shall be taken to avoid contact with flame.

D. Stored materials shall be inspected prior to their use, and shall meet the requirements of this Special Provision at the time of use.

E. All material which is rejected because of failure to meet the required tests or that has been damaged so as to cause rejections shall be immediately replaced at no additional cost to the Contracting Agency.

F. The promoter/initiator system for the methacrylate resin may consist of a metal drier and peroxide. If supplied separately from the resin, at no time shall the metal drier be mixed with the peroxide directly. The containers shall be stored in a manner that will not allow leakage or spillage from one material to contact the containers of the other.

G. Each shipment of polymer materials shall be accompanied by a Materials Safety Data Sheet (MSDS) and a Certificate of Compliance certifying that the materials conform to the requirements of this Special Provision.

H. Appropriate impermeable protective garments shall be used by all workmen who may contact the resin or initiators to prevent skin contact. If skin contact occurs, the resin or initiators shall be immediately washed off. Clothing that becomes saturated with resin shall be removed immediately.

Materials Specifications

2.01 Resin Binder

A. The resin binder shall be either epoxy or methyl methacrylate.

B. The resin shall conform to the following requirements of ASTM D 638-82:
   1. Elongation (at 15 degrees F) min. 35%
   2. Tensile Strength min. 500 psi

2.02 Epoxy Resin Binder

A. The epoxy polymer concrete shall be composed of the following three components:
   1. Epoxy resin base (Component A)
   2. Epoxy resin base hardener (Component B)
   3. Aggregate

B. The epoxy resin binder shall be Type III Grade 1 or 2, Class A, B, or C, conforming to Section 9-26, and AASHTO M 235.

2.03 Methyl Methacrylate Resin Binder

A. The methacrylate concrete shall be composed of the following three components:
   1. Flexibilized methyl methacrylate resin base (Component A)
   2. Benzoyl Peroxide (resin base hardener) (Component B)
   3. Aggregate

2.04 Aggregate

A. Aggregate for polymer concrete shall conform to the requirements of Section 9-03.1, and the following combined aggregate gradings:

Combined Aggregate	
Sieve Sizes	% Passing
3/4"	100
1/2"	90-100
3/8"	83-100
No. 4	65-82
No. 8	45-65
No. 16	27-48
No. 30	12-30
No. 50	6-17
No. 100	0-7
No. 200	0-3

B. Aggregate retained on the No. 8 sieve shall have a maximum of 25 percent crushed particles. Fine aggregate shall consist of natural sand only.

C. Aggregate absorption shall not exceed one percent.

D. The moisture content of the aggregate shall not exceed one-half of the aggregate absorption at the time of mixing with the resin. The aggregate temperature shall be between 45 and 100 degrees F at the time of mixing.

2.05 Abrasive Sand

A. The abrasive sand shall be a commercial quality blast sand, conforming to the dryness requirements of This Special Provision and the following grading limits:

Sieve Sizes	% Min.	% Max.
US No. 8	100	--
US No. 30	97	100

Construction Requirements

3.01 Equipment

A. All equipment for cleaning the concrete and steel surfaces and mixing and applying the polymer concrete shall be approved by the Engineer prior to commencement of any work.

B. The power driven hand tools shall be operated at angles less than 45 degrees as measured from the surface of the deck to the tool. Power driven hand tools, except for the following, may be used:
   1. Jack hammers heavier than the nominal 30-pound class.
   2. Chipping hammers heavier than the nominal 15-pound class.

3.02 Deck Preparation

A. All concrete in the repair area shall be removed by chipping to a depth necessary to remove all loose and unsound concrete. If unsound concrete exists around the steel reinforcing bars, or if the bond between the concrete and steel is broken, concrete must be removed to provide a 1/2-inch minimum clearance around the steel reinforcing bars.

B. Care shall be taken in removing the deteriorated concrete to not damage any of the existing deck or steel reinforcing bars that are to remain in place. All removal shall be accomplished by making neat vertical cuts and maintain square edges at the boundaries of the repair area. Cuts shall be made after sufficient concrete removal has been accomplished to establish the limits of the removal area.

C. In no case shall the depth of the vertical cut exceed 3/4 inch or to the top of the steel reinforcing bars, whichever is less. Care shall be taken to not damage the steel reinforcing bars by cutting too deeply.

D. The exposed steel reinforcing bars and concrete in the repair area shall be sandblasted and blown clean just prior to placing the polymer concrete. Bridge deck areas outside the repair area or steel reinforcing bar inside or outside the repair area damaged by the Contractor's operations, shall be repaired by the Contractor at the Contractor's expense and to the satisfaction of the Engineer.

Placing Polymer Concrete Patching Material

4.01 Surface Preparation

A. Using the equipment, material, technique, and procedures established for surface preparation, the concrete and steel surfaces shall be prepared by removing all material which may act as a bond breaker between the surface and the polymer concrete. Surface cleaning shall be by abrasive sand blasting.

B. Precautions shall be taken to ensure that no dust or debris leaves the roadway deck and that all traffic is protected from rebound and dust. Appropriate shielding shall be provided as required at no additional cost to the State and shall be approved by the Engineer.

C. If the concrete or steel surfaces become contaminated, the contaminated areas shall be recleaned by abrasive sand blasting at the Contractor's expense.

4.02 Application of Prime Coat

A. Immediately before placing the polymer concrete, the prepared concrete and steel surfaces shall be given one coat of epoxy or methyl methacrylate resin (prime coat).

B. Immediately prior to applying the prime coat, the surfaces shall be swept clean by compressed air to remove accumulated dust and any other loose material.

C. The area to receive the prime coat shall be surface dry prior to applying the prime coat.

D. The promoted/initiated resin shall be worked into the concrete in a manner to assure complete coverage of the area.

E. If the primed surface becomes contaminated, the contaminated area shall be cleaned by abrasive blasting and reprimed at the Contractor's expense.

F. Under no circumstances shall any resin be allowed to run into drains or expansion joints.

4.03 Mixing Components

A. The polymer resin binder in the concrete shall be approximately 12 percent by weight of the dry aggregate: the exact percentage will be determined by the Engineer.

B. The mixing procedure shall be approved by the Engineer.

C. The epoxy base resin systems shall not be proportioned by continuous volume mixing equipment.

D. The Engineer shall grant prior approval to the use of any accelerators or inhibitors into the blended resin system.

E. Components A and B shall be stored at a temperature of 65-70°F for a minimum of 2 hours before use.

F. Component A and Component B resins shall be thoroughly stirred immediately prior to use. A low RPM mixing device shall be used. The same paddle used to stir Component A shall not be used to stir Component B.

G. Component B shall be combined with Component A at the specified mix ratio (+5%) and mixed in accordance with the manufactures' recommendations. A low RPM mixing device having blades which wipe the inside of the mixing container clean shall be used. The mixing device shall be operated to prevent the entrapment of air in the mix.

H. The resin binder shall be initiated and thoroughly blended just prior to mixing the aggregate and binder.

4.04 Polymer Concrete Placement

A. The polymer concrete for deck repair shall not be placed when the temperature of the bridge deck surface is less than 50°F or greater than 90°F.

B. The polymer concrete shall be placed on the liquid prime coat. The primer shall remain tacky during placement of the polymer concrete.

C. Under no circumstances shall any polymer mixture be allowed to run into drains or expansion joints.

4.05 Finished Polymer Concrete Surface

A. The finished surface of the polymer concrete shall conform to the requirements of Section 6-02.3(10).

B. The polymer concrete shall be consolidated by means approved by the Engineer. Finishing equipment used shall strike off the polymer concrete to the established grade and cross section. Forms shall be coated with suitable bond release agent to permit ready release of forms.

C. The polymer concrete patching material shall receive an abrasive sand finish. Sand shall be broadcast onto the surface before gelling occurs to effect a uniform coverage of a minimum of 0.8 pound per square yard.

4.06 Curing

A. Traffic and equipment or any new overlay shall not be permitted on the polymer concrete patching material until it has achieved a minimum strength of 3,000psi as determined by the rebound number per ASTM C 805.

B. Any polymer concrete material failing to achieve 3,000psi within 24 hours shall be removed and replaced at the contractor's expense.

Measurement

5.01 Measurement

A. The measurement of the polymer concrete patching material will be made by the cubic foot of material placed as determined by field measurements of the repair areas.

Payment

6.01 Payment

A. The unit contract price per cubic foot for "Bridge Deck Repair Using Polymer Concrete" shall be full pay for performing the work as specified.

Payment

6.01 Payment

A. Payment for the work required for bridge deck repair and the subsequent filling of the prepared areas shall be by force account as provided in Section 1-09.6 For the purpose of providing a common proposal for all bidders, the Contracting Agency has entered an amount for the item "Bridge Deck Repair Using Polymer Concrete" in the bid proposal to become a part of the total bid by the Contractor.