**SPECIAL NOTE FOR 3/8” EPOXY-URETHANE WATERPROOFING OVERLAY FOR**

**BRIDGE DECKS**

Special Note for 3/8” Epoxy-Urethane Waterproofing Overlay for Bridge Decks

1. **DESCRIPTION:**

**1.1** This specification describes the Pre-treatment and Overlay consisting of multiple

layers of hybrid polymer systems and a special blend of extremely hard aggregate

designed to provide a minimum of a 3/8” thick application for the purpose of

complete waterproofing as well as providing a non-skid surface to withstand

continuous heavy traffic and extreme changes in weather conditions.

**1.2** Unless otherwise noted, Section references herein are to the Department’s

*Standard Specifications for Road and Bridge Construction*. All applicable

portions of the Department’s *Standard Specifications* apply unless specifically

modified herein.

**2.0 MATERIALS:**

**2.1 Pre-treatment:**

**2.1.1 Hairline cracks**

This two-part hybrid polymer shall be free of any fillers, volatile solvents

and shall be formulated to provide simple volumetric ratio of two

components such as one to one or two to one by volume.

This hybrid polymer system shall be formulated to provide a unique

combination of extremely low viscosity and low surface tension coupled

with a built-in affinity for concrete and steel.

**2.1.2 Partial Depth patching (if necessary)**

Class “M” Concrete. Use either “M1” or “M2”. See Section 601.

**2.1.3 Full Depth Patching (if necessary)**

Class “M” Concrete. Use either “M1” or “M2”. See Section 601.

**Overlay:**

**2.2** The two-part epoxy-urethane co-polymer system shall be free of any fillers

volatile solvents and shall be formulated to provide simple volumetric mixing

ratio of two components such as one to one or two to one by volume.

The epoxy-urethane co-polymer system shall be formulated to provide flexibility

in the system without any sacrifice of the hardness, chemical resistance or

strength of the epoxy-urethane co-polymer system. Use of external/conventional

flexibilizers are not acceptable. Flexibility shall be introduced by interaction of

elastomers to chemically link in the process of curing so that the flexibility of the

molecule is least affected during the low temperature conditions that are

confronted in actual use.

**2.3 Material Requirements**

**2.3.1 Physical Requirements of Cured *Pretreatment for Cracks* System.**

When Components A and B are mixed in the appropriate ratio, the cured

resin shall conform to the requirements of Table 1. (Test methods are

discussed in detail in Item 3 of this specification.)

|  |  |
| --- | --- |
| **TABLE 1** | |
| **PHYSICAL PROPERIES OF THE CURED PRETREATMENT SYSTEM** | |
| **Property** | **Value** |
| Compressive Strength, min. psi | 5000 |
| Tensile Strength, min. psi | 2500 |
| Elongation at Break, min percent | 30 |
| Water Absorption, percent by wt. max. | 0.5% |
| Shore D hardness, min., 25°C (77°F) | 65 |
| Gel Time, min, minutes | 15 (100gms) |
| Adhesion to Concrete | 100% failure in concrete |
| Percent Solids | 100 |

**2.3.2 Physical requirements of Epoxy-Urethane Copolymer Overlay**

**System.** When Components A and B are mixed in the appropriate ratio,

the cured resin shall conform to the requirements of Table 2. (Test

methods are discussed in detail in Item 3 of this specification.)

|  |  |
| --- | --- |
| **TABLE 2** | |
| **PHYSICAL PROPERIES OF THE CURED OVERLAY SYSTEM** | |
| **Property** | **Value** |
| Compressive Strength, min. psi | 5000 |
| Tensile Strength, min. psi | 2500 |
| Elongation at Break, min percent | 30 |
| Water Absorption, percent by wt. max. | 1.0% |
| Shore D hardness, min., 25°C (77°F) | 65 |
| Gel Time, min, minutes | 15 (100gms) |
| Adhesion to Concrete | 100% failure in concrete |
| Flexural Yield Strength, min. psi | 5000 |
| Percent Solids | 100 |
| Thermal Compatibility | Visual – No Delamination/Cracking |
| Permeability to Chloride Ion at 28 days | 100 Coulombs |

**2.4 Aggregate**

**2.4.1** Aggregate used for all layers shall be non-friable, non-polishing, clean and

free from surface moisture. It shall be durable and sound and have a

proven record of performance in applications of this type. The aggregate

shall be 100 percent fractured, thoroughly washed and kiln dried to a

maximum moisture content of 0.2 percent by weight, measured in

accordance with ASTM C566. The recommended sources of aggregate are **Washington Stone or Oklahoma Flint or an approved equivalent.**

**2.4.2** Aggregate for all layers shall have a minimum Mohs scale hardness of 7.

**2.4.3** The grading of the aggregate shall conform to the requirements of Table 3

|  |  |
| --- | --- |
| **TABLE 3** | |
| **AGGREGATE GRADATION** | |
| **Sieve Size** | **Percent Passing** |
| No. 4 | 100 |
| No. 8 | 15-65 |
| No. 16 | 0-5 |

**3. METHOD OF TESTING**

**3.1** Tests shall be conducted in accordance with the following methods:

**3.1.1 Compressive Strength:** ASTM C579 Method B, *Compressive Strength of*

*Chemical Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer*

*Concretes*. The two components of the resin are to be thoroughly mixed in

their appropriate ratios specified by the manufacturer. The samples shall

then be prepared according to the conditioning requirements of ASTM

C579 and allowed to cure for 7 days at 23 ± 2°C.

**3.1.2 Tensile Strength and Elongation:** ASTM D638, *Tensile Properties of*

*Plastics*, Specimen Type I or Type II. Samples shall be cured at 23 ± 2°C

(73.4 ± 3.6°F) and 50 ± 5% relative humidity. Speed of testing shall be at

0.5 in/min.

**3.1.3 Water Absorption:** ASTM D570, *Water Absorption of Plastics*. Sample

specimens shall be prepared according to section 4.1 and allowed to cure

at 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 5% relative humidity. Tests are then

to be carried out as per section 6.1

**3.1.4 Shore D Hardness:** ASTM D2240, *Rubber Property – Durometer*

*Hardness*. Specimen shall be prepared as per ASTM D570 section 4.1 and

allowed to cure at 23 ± 2°C (73.4 ± 3.6°F).

**3.1.5 Gel Time:** The following procedure shall be used to determine gel time.

Measure 4 oz. of Part A and 2 oz. of Part B each at 25°C (77°F), into an

unwaxed paper cup and record the time and mix immediately. 100 gms of

this mixture shall be poured into a 6 oz. unwaxed paper cup and placed on

a wooden bench top. Starting twenty minutes from the time recorded

above, the mixture shall be probed every two minutes with a small stick

until a small ball forms in the center of the container. The total time,

including mixing, required for the ball to form shall be regarded as the gel

time. The test shall be performed in a room or enclosed area maintained at

25 ± 2°C (77 ± 3.6°F) and 50 ± 5% relative humidity.

**3.1.6 LA Abrasion, AASHTO T96** 35% Max

**3.1.7 Adhesion to Concrete:** ACI-503-R; Pull Out Test.

**3.1.8 Flexural Yield Strength:** ASTM D-790.

**3.1.9 Thermal Compatibility:** ASTM C884, Determination if specimens are

susceptible to debonding when subjected to temperature changes.

**4. CONSTRUCTION PRACTICE**

**4.1 Surface Preparation**

**4.1.1** Perform full depth patching in accordance with the requirements of

Section 606.03.05. All patching materials shall be in accordance with the

requirements of Section 601 and be free of Magnesium Phosphate.

**4.1.2** Patching shall be scheduled so that the bridge can be open to traffic during

all non-working hours.

**4.1.3** Partial depth patching system shall be approved by resin manufacturer and

be completed prior to the polymer overlay. Completion of Partial Depth

Patching including removal of concrete, cleaning, and placing the material

will not be measured for payment and shall be considered incidental to

“Epoxy-Urethane Waterproofing Overlay”. The pay item includes

additional quantity for partial depth patching.

**4.1.4** The entire concrete deck shall be cleaned by shot blasting to remove any

oil, dirt, rubber or any other potentially detrimental material such as curing

compound and laitances which, in the manufacturer and engineer's

opinion, would prevent proper bonding to and curing of the material.

Ensure the shot blasting has obliterated all pavement markings. Produce a

surface relief that meets the International Concrete Repair Institute (ICRI)

Surface Preparation CSP 5-7.

**4.1.5** In areas that the shot blasting equipment cannot reach (i.e., along curbs

and median walls) or cannot remove (pavement marking, asphalt, etc.),

sandblasting and walk behind grinders are permitted to an extent

satisfactory to the manufacturer and engineer. This should be performed

prior to the shotblasting whenever applicable and practical.

**4.1.6** Protect the bridge deck expansion joints, armored edges, drains, etc…

with a bond breaker that can adequately seal the joints from the epoxy.

**4.1.7** The overlay application equipment is allowed to drive on the deck surface

during application provided precautions have been taken to insure that the

deck surface will not become contaminated. For any reason traffic is to be

allowed on the deck after surface preparation, or between layers, a visual

inspection by the manufacturer and state engineer will be required to

determine if additional surface preparation is needed before applying

material.

**4.1.8** All surfaces to be treated shall be dry at the time of application.

Immediately before the application of any liquids, all prepared surfaces

shall be cleaned with compressed air (or vacuumed) to remove dust and

debris.

**4.1.9** The application of the system shall not be made when it has rained 24

hours before application or rain is forecast (greater than 50%) within eight

hours after application or as determined by the manufacturer (fog and high

humidity will not impede the application of or affect the performance of

the overlay). If waiting for 24 hours is impractical, then the moisture

content in concrete substrate shall not exceed 4.5% when measured by an

electronic moisture meter. Any exception shall be determined by the

moisture content present in the deck which shall not exceed 75% of air

entrainment in the mix design.

**4.1.10** Materials shall be placed when the ambient air and bridge deck surface

temperatures are greater than 55 deg F and less than 90 deg F.

**4.2 Application of Overlay System**

**4.2.1 The manufacturer of the epoxy-urethane overlay material shall have a**

**representative on the jobsite at all times who has proven experience**

**with the resin system and with guiding and assisting installers in the**

**polymer overlay system installation.** Who, upon consultation with the

engineer, may suspend any item of work that is suspect and does not meet

the requirements of this specification. Resumption of work will occur only

after the manufacturer's representative and the engineer are satisfied that

appropriate remedial action has been taken by the contractor.

**4.2.2** The overlay shall be applied on all deck areas using metering, mixing and

distribution machinery **approved by the manufacturer of the epoxyurethane**

**overlay system.** Ratio check verification at the pump outlets as

well as cycle counting capabilities to monitor output will be standard

features.

**4.2.3** The number of layers (a minimum of two), excluding the pre-treatment if

required and the application rates of the liquid in the various layers shall

be as recommended by the manufacturer in order to achieve an average

overlay thickness of 3/8”.

**4.2.4 Hand mixing of material is not permitted.**

**4.2.5 Application of Pre-treatment**

**Crack Filling (Pre-treatment as required)**

**Application of the Liquid:** After mechanically measuring and mixing of

the components, the liquid shall be evenly distributed on the clean, dry

deck surface at the rate/process recommended by the manufacturer. The

overlay application equipment may drive on this layer (prior to being

cured) when applying the overlay system. If the overlay application is

going to be applied after 6-8 hours of the pretreatments application, a

medium size coarse silica sand shall be broadcasted evenly into the pretreatment

system (prior to it curing) as directed by the manufacturer.

**4.2.6 Overlay (First and Second Layers)**

**Application of Liquid:** Prior to the application, if there exists any excess

or loose aggregate from the previous coat, such excess aggregate shall be

completely removed by vacuum or with compressed air. After mixing of

the components via the mechanical application equipment, the liquid shall

be evenly distributed on the clean, dry deck surface at the rate

recommended by the manufacturer.

**4.2.7** After the application of the liquid in the first and second coats, the

maximum time allowed before broadcasting of the aggregate is as follows:

Above 90°F . . . . . . . . . . . . . . . . . . . . . . 10 minutes

80°F to 90°F . . . . . . . . . . . . . . . . . . . . . . 15 minutes

70°F to 80°F . . . . . . . . . . . . . . . . . . . . . . 20 minutes

60°F to 70°F . . . . . . . . . . . . . . . . . . . . . . 25 minutes

55°F to 60°F . . . . . . . . . . . . . . . . . . . . . . 35 minutes

**4.2.8 No vehicle shall be allowed on the overlay during the curing period.**

**4.2.9** Broadcasting on decks shall be by truck-mounted equipment capable of

dispensing the aggregate onto the deck in a uniform manner as directed or

otherwise approved by the manufacturer of the epoxy-urethane overlay.

**4.2.10** The aggregate shall be broadcast as described below in a manner to cover

the surface so that no wet spots appear and before the co-polymer begins

to gel (see section 3.1.5). The aggregate must be dropped vertically in

such a manner that the level of the liquid is not disturbed. Reclaimed

aggregate is prohibited.

**4.2.10.1** In the first and second layers of **the polymer overlay system**,

the aggregate conforming to Table 3 shall be broadcast to

saturation.

**4.2.11 Removal of Excess Aggregate:** After the overlay has hardened, removal

of all loose and excess aggregate with a power vacuum or other method

shall be made prior to the application of subsequent coats.

**4.2.12 Joints in the Overlay:** (i.e., between two adjacent lanes) shall be

staggered 6 to 12 inches and overlapped between successive coats so that

no ridges will appear. Prior to applying the first or second layer, duct tape

shall be used to ensure a straight edge is created. The use of chalk lines

can be used when applying the first layer only.

**4.2.13 Traffic may be allowed** on the final layer (or in between layers) after the

resin has cured (as determined by the manufacturer) and after removal of

all excess, loose aggregate.

**4.2.14** The prepared surface may be opened to traffic for no more than 24 hours.

A light shot blast will be required prior to applying the pretreatment or

first layer. A visual inspection by the inspector and manufacturer shall

occur to ensure no additional prep is necessary to remove oil, tar,

brake/tire residue, etc. After 24 hours, prep shall be per section 4.1.4.

**4.2.15** The pretreatment with aggregate or first layer may be opened to traffic for

no more than 24 hours. Prior to application of second layer, the inspector

and manufacturer rep shall inspect the pretreatment with aggregate or first

layer to ensure no additional surface prep is required to remove oil,

brake/tire residue, etc. After 24 hours, prep shall be per section 4.1.4.

**4.2.16** Seams in the Overlay shall not be present between lanes. Driving lanes

next to shoulders must be done in the same application pass so no

additional seams/joints in overlay are created.

**5. STORAGE AND HANDLING**

**5.1 Liquid Material:** All material shall be transported and stored in their original

containers inside a dry, temperature controlled facility and maintained at a

manufacturer recommended temperature.

**5.2 Job Site Storage:** The materials shall be stored on the jobsite in a dry, weather

protected facility away from moisture and within the temperature range of 60°F to

90°F. When the materials are transported or stored on the job in the application

machine tanks, the material must also be maintained at a temperature of 60°F to

90°F. Outdoor storage is permitted with manufacturer’s approval.

**5.3 Handling of Liquid Materials on the Job:** Protective gloves, clothing, and

goggles shall be provided to workers and inspectors directly exposed to the

material if required. Product safety data sheets shall be provided to all workers

and inspectors as obtained from the manufacturer.

**5.4 Packing Requirement:** All materials must be packaged in strong, substantial

containers. The containers shall be identified as Part A and Part B and shall be

plainly marked with the name and address of the manufacturer, name of the

product, mixing proportions and instructions, lot and batch numbers, date of

manufacture, and quantity contained therein.

**5.5 Aggregate:** All aggregate shall be stored in a dry, moisture-free atmosphere. The

aggregate shall be fully protected from any contaminants on the jobsite and shall

be stored so as not to be exposed to rain or other moisture sources.

**6. SAMPLING AND ACCEPTANCE**

**6.1 Product Acceptance:** The manufacturer of the system shall provide evidence of

field performance, lab performance with infrared spectra in order to obtain state

approval of the overlay system for use on the project:

**6.1.1 Independent Lab Performance**

A nationally recognized independent lab must verify that the material:

1. Has the capability of preventing the ingress of essentially all

the chloride ions into the concrete at 1" depth when tested

according to NCHRP-244 method.

2. Has the capability to de-activate the existing chloride ions

present in the concrete specimen so that the corrosion of steel

rebars embedded in the concrete stop corroding.

3. When tested as per Tables 1 and 2 fully comply with the test

results specified for cured system.

**6.1.2 Infrared Spectrograph:** In addition to the initial certification process

each manufacturer shall furnish the state an infrared spectra of each

component of system for its permanent record and for individual

installation verification.

**6.1.3 Field Performance:** The selected polymer overlay system must have at

least two years of satisfactory performance for non-interstate use and four

years of satisfactory performance for interstate use in similar

environmental conditions as the project in which it will be used.

**6.2 Certification for Compliance:** At the pre-construction conference, the contractor

shall notify the state project engineer of the source of material.

**6.2.1 Independent Test Lab Report:** Test results certified and verified by a

nationally recognized independent testing laboratory verifying properties

of the cured system as per Table 1 & 2 shall be submitted to the engineer

for approval prior to the pre-construction conference. This certification

shall be provided on each lot number to be used on the project.

**6.2.2 Infrared Spectra:** Infrared spectra of each component from each lot/batch

number (to be used on the project) shall be submitted with the independent

lab certification.

**6.2.3 Test Sample for DOT Laboratory:** The manufacturer shall furnish at

least a one-quart sample of each component from each lot/batch to the

DOT laboratory to verify material supplied by the manufacturer. Material

shall be taken at job site.

**6.3 Performance Acceptance**

**6.3.1 Thickness Verification:** At the end of each day, the contractor will

submit to the inspector/project engineer a signed project report stating the

number of square yards applied, number of gallons used (for pretreatment

and overlay) and number of pounds of aggregate estimated to have been

used. In addition, the contractor shall verify to the State that the overlay is

an average of at least 3/8" thick at three random locations agreed upon by

the state engineer and material manufacturer representative. If 3/8”

average is not achieved, a retest shall be performed in adjoining areas.

Thin areas shall be re-coated as described above by the contractor and reverified

at no additional cost to the State. This verification may consist of

cores, holes, etc., but in all cases, any destructively tested areas shall be

repaired by the contractor before final acceptance by the engineer.

**7. MEASUREMENT**

**7.1 Epoxy-Urethane Waterproofing Overlay.** The Department will measure the

overlay application in Square Feet.

**7.2 Shotblasting.** The Department will measure “Blast Cleaning” in Square Yard.

The Department will only measure this quantity once for any area to be shotblast.

Additional blast cleaning to meet the requirements of this note shall be performed

at the Contractor’s expense.

**7.3 Partial Depth Patching.** Partial Depth Patching will not be measured for

payment, but shall be considered incidental to “Epoxy-Urethane Waterproofing

Overlay”.

**7.4 Full Depth Patching.** The Department will measure “Concrete Class M Full

Depth Patching” in Cubic Yard.

**8. PAYMENT**

**8.1 Epoxy-Urethane Waterproofing Overlay.** The Department will pay for the

measured quantities at the Contract unit bid price for “Epoxy-Urethane

Waterproofing”.

**8.2 Shotblasting.** The payment at the contract unit price for the pay item “Blast

Cleaning” shall include all labor, equipment and material needed to complete the

task as described in paragraphs 4.1.4 and 4.1.5.

**8.3 Full Depth Patching.** The payment at the contract unit price shall include all

labor, equipment and material needed to complete this task. The Department will

not measure material removal, forming, blast cleaning, or retying steel

reinforcement in the patches and will consider this work incidental to the pay item

“Concrete Class M Full Depth Patching”.

The Department will make payment under the following:

***Code Pay Item Pay Unit***

23331EC Epoxy-Urethane Waterproofing SQFT

08549 Blast Cleaning SQYD

08526 CONC Class M Full Depth Patch CUYD

END OF SPECIAL NOTE