**EPOXY OVERLAY FOR SEALING AND HIGH FRICTION SURFACE TREATMENT ON CONCRETE BRIDGE DECKS.**
**(REV 9-17-18)**

The following new Section is added after Section 400.

## EPOXY OVERLAY FOR SEALING AND HIGH FRICTION SURFACE TREATMENT ON CONCRETE BRIDGE DECKS

**403-1 Description.**

**403-1.1 General:** Provide and apply an epoxy as an overlay system over concrete bridge decks in accordance with this specification and in conformity with the lines and details shown on the plans. The overlay shall be uniform in texture and color and shall not change the existing deck slopes.

The work also includes pre-treatment of the concrete surface and the sealing of existing concrete cracks using a crack sealing material proven compatible with the overlay.

**403-1.2 Manufacturer Representative:** Secure the services of a manufacturer representative to visit the construction site to train inspection and contractor personnel in the application and testing of the overlay system prior to application. The representative shall also observe initial application and testing to confirm that application is performed in accordance with the manufacturer's instructions and this Specification. As a minimum, the manufacturer's representative must be available to the Contractor and the Engineer for technical advice and inspection of the application during the duration of the overlay work. Upon completion of the project, the manufacturer must provide a notarized statement indicating that the material has been applied as per the manufacturer's requirements.

**403-1.3 Manufacturer Warranty:** Provide a performance bond warranty for the overlay system that would cover a minimum period of five years. Include materials, labor, MOT, testing, and all required incidentals in the warranty.

**403-1.4 Contractor Qualifications:** The overlay contractor or subcontractor must have the following qualifications and must provide the following information for review by the Department:

1. A record showing a minimum of three successful previous bridge epoxy overlay applications with a minimum requirement of five years of service life applied by the Contractor/Subcontractor within the last three years.
2. List of names and telephone numbers of the overlay owner's contact personnel for previous projects.
3. Brand names of epoxy compounds used for these previous applications along with the surface treatment and application process.

In addition to the above qualifications, the Contractor must demonstrate that the proposed methods and procedures will satisfactorily provide the specified final product by installing the overlay on two designated test sections of the bridge prior to commencing production work. Each test section must be no less than 200 square feet and no larger than 400 square feet.

**403-2 Materials.**

**403-2.1 Pre-Treatment Material:** Use a pre-treatment material that is of ultra-low viscosity consistency (as described in Table 1) capable of penetrating and sealing cracks 4 mils wide and larger, and that is certified by the manufacturer to be compatible with the epoxy overlay.

The mixed pre-treatment and crack sealer material must meet the following requirements as a minimum and be maintained at 73 - 75° F for a minimum of 24 hours prior to mixing and testing:

| Table 1: Properties of Pre-Treatment Epoxy | | |
|---|---|---|
| Property | Requirement | Test Method |
| Viscosity | 100 cP (max) | ASTM D2393 , ISO 2555 (Brookfield) |
| Tack free time | 3 hours (max) | At 70 o F & 50% ± 5% Relative Humidity |
| Compressive strength | 5000 psi (min) 24 hour | ASTM D 695 |
| Shear strength | 250 psi (min) | ASTM C 882 |
| Tensile elongation | 30 % (min) | ASTM D 638 (Type 1) |
| Properties may be slightly adjusted as manufacturer warranties include proper penetration of cracks and is included in bond warranty. | | |

**403-2.2 Overlay Epoxy Binder:** Use two component epoxy or epoxy-urethane overlay binder materials that are compatible with the pre-treatment material. The mixed overlay epoxy must conform to the following characteristics:

| Table 2: Properties of Overlay Epoxy Binder | | |
|---|---|---|
| Property | Requirement | Test Method |
| Pot life | 15 to 45 minutes at 75°F | ASTM C 881 (50 ml sample in paper cup) |
| Tensile strength | 2,000 psi min at 7 days | ASTM D 638 |
| Tensile elongation | 25 % to 70 % | ASTM D 638 |
| Viscosity | 50 to 1500 cP * | ASTM D 2393, ISO 2555 (Brookfield) |
| Compressive strength at 3 hrs | 1,000 psi min. at 75°F | ASTM D 695 |
| Compressive strength at 24 hrs | 5,000 psi min.at 75°F | ASTM D 695 |
| Adhesion strength at 24 hrs | 250 psi min. at 75°F | ASTM C 1583/ ACI 503R |
| Flash point | >200$^{o}$ F | ASTM D 3278 |
| Thermal compatibility | No delamination of overlay | ASTM C 884 |
| *Or as per manufacturer overlay system design. Provide equivalent Zahn Cup viscosity in centistokes (cSt) for the overlay resins. | | |

**403-2.2.1 Packaging:** Furnish the two components of the epoxy resin systems in separate containers that are non-reactive with the materials. The size of the containers will be such that the recommended proportions of the final mixture will be obtained by combining a container of Component A with a container of Component B. Provide containers that do not exceed 10 gallons unless otherwise approved by the Engineer based on type of manufacturer delivery system. When less than one complete unit is used, each component will be measured

within plus or minus two percent of the volume required. Batches of less than 6 fluid ounces will be measured within plus or minus one percent. Do not use materials from opened containers that have been exposed to air for more than 48 hours and obtain manufacturer approval for mixing materials from previously opened containers.

Identify the containers as “Component A – Contains Epoxy Resin” and “Component B – Contains Hardener” and show the type, class, and mixing directions. Mark each container with the name of the manufacturer; class, batch, or lot number; date of packaging; date of shelf life expiration; pigmentation, if any; and the quantity contained in pounds and gallons.

**403-2.3 Pre-Qualification of Materials:** Submit all overlay systems and materials along with manufacturer’s materials warranty for approval by the Engineer prior to delivery to the site.

Submit the following documentation for approval:

1. Independent laboratory test results documenting that the proposed epoxy materials meet all of the properties as required by this Specification. The independent laboratory shall be ISO 9001 certified.

2. Manufacturer approved method(s) for mobile and localized application.

**403-2.4 Aggregate:** Use basalt, bauxite, or flint aggregate unless otherwise noted in the contract documents for the project. Use aggregates that are thoroughly cleaned and having less than 0.2% moisture. The aggregates must be free of dirt, clay, asphalt and other foreign or organic materials. Only use calcined bauxite aggregate with a 76% minimum alumina content when the overlay is also intended as a high friction surface treatment.

Use aggregates that have a Mohs' scale hardness of 6.5 minimum or a maximum LA Abrasion (AASHTO T 96) of 30%. The aggregate must be 100% fractured in at least one face. Fractured condition will apply to all material retained in the No. 8 sieve. Unless otherwise approved, aggregate must conform to the following gradation:

| Table 3: Percent by Weight of Material Passing | | | |
|---|---|---|---|
| No. 4 | No.8 | No. 16 | No. 30 |
| US Sieve Size | US Sieve Size | US Sieve Size | US Sieve Size |
| 100 | 30-75% | Max. 5% | Max. 1% |

**403-2.5 Resin Binder:** Provide a minimum of one retainer random test sample of each component from each batch or lot number for each shipment of material greater than 15 gallons. Provide one quart of Component A and the quantity of Component B necessary to react with the quart of Component A to the State Materials Office (SMO) Components will be furnished in as few different batches or lots as possible.

Shipments of less than 15 gallons may be accepted upon certification. Submit a certification from the manufacturer stating that Components A and B conform to these specifications. The certification will consist of a statement by the manufacturer indicating that Components A and B have been sampled and tested.

**403-2.6 Storage of Materials:** Provide all SDS and other information pertaining to the safe practices for the storage, handling and disposal of the materials, and to their hazards. Obtain the SDS from the manufacturers and post a copy at the Engineer designated area(s). Provide an additional copy of such information to the Engineer.

Store the materials in a dry area that would prevent these from getting wet and that will maintain a temperature between 50 and 90°F. Store the polymer based primers, binders and top coat away from open flames or other ignition sources.

**403-3 Construction Methods.**

**403-3.1 Mixing Epoxy Binder:** Furnish and mix epoxy resin in two components for combining in accordance with the manufacturer's instructions immediately prior to use. Component A will contain the epoxy polymer resin. Component B will contain one or more hardening agents that will cause the system to polymerize and harden when mixed with Component A. Thixotropic agents used to control viscosity will be permitted only when utilized in strict accordance with the manufacturer's recommendations.

Thoroughly stir the contents of the separate packages containing Components A and B prior to use. Do not use the same mixing device to stir both components. Clean or replace mixing devices used for mixing components A and B after mixing each batch. Dispose of solvents used for cleaning in accordance with all applicable Local, State and Federal policies and regulations. Store Components A and B between 65°F and 80°F for at least 2 hours prior to use. Epoxy components may be heated in hot water or by indirect heat prior to mixing to bring them to the required temperature and viscosity. Do not use solvents and thinners except for cleaning equipment.

**403-3.2 Spall Repairs:** Repair all spalls present on the bridge deck and within the areas to receive the overlay. Use an epoxy mortar or polymer modified concrete material that is free of magnesium phosphate with a minimum compressive strength of 5,000 psi (ASTM C39) after extending, if extension is necessary. Saw cut the perimeter of the spall and excavate behind all exposed bars to provide a good mechanical bond between the deck and the patch material. Allow the patch material to cure for a minimum of 24 hours for epoxy concretes and twenty eight days for cementitious based concretes prior to placement of the overlay unless otherwise approved by the Engineer and the overlay manufacturer.

**403-3.3 Surface Preparation:** Determine the level of bridge deck cleaning and the preparation methods necessary to provide a minimum of 250 psi bond strength on two pre-selected test sections. Use ASTM C 1583 or ACI 503R bond tests to determine the size of shot, flow of shot, forward speed of shot-blast machine, and number of passes necessary to provide a tensile bond strength greater than or equal to 250 psi (using a 2 inch dolly) prior to commencing production work. Alternatively, the surface preparation must provide a failure area, at a depth of 1/4 inch or more into the base concrete that shows on 50% or more of the test dolly. A test result will be the average of three pull tests with no one pull less than 175 psi on a test section of 1.5 feet x 3 feet consisting of two courses. Repair all tested areas.

Install the test sections with the same materials, equipment, personnel, timing, sequence of operations, and curing period prior to opening to traffic that will be used for the installation of the production overlay. The cleaning method, materials, and installation procedure will be approved if passing test results are obtained from each test area. Remove and reinstall test sections if satisfactory results are not obtained.

Clean the deck surface under its specific maintenance of traffic scheme by shot-blasting and other means using the approved cleaning method (examples - diamond grinding, hand grinding) before placement of the epoxy concrete overlay pre-treatment. Remove all asphaltic material, oils, dirt, rubber, curing compounds, paint, carbonation, laitance, weak surface mortar and other potentially detrimental materials, which may interfere with the bonding or curing of the pre-treatment or the overlay (solvents will not be allowed). Mortar which is sound and soundly bonded to the coarse aggregate must have open pores after cleaning to be considered adequate for bond. Otherwise, these shall be removed and replaced with suitable

patch material. Remove areas of asphalt larger than one inch in diameter, or smaller areas spaced less than six inches apart.

Remove all deck striping prior to application. Traffic paint lines will be considered fully removed when the concrete has exposed aggregate showing through the paint stripe. Use a truck with a sweep-vacuum or sweep-compressed air system to remove all dust and other loose material from the area to be treated immediately prior to the pre-treatment application.

Only use cleaning methods and procedures recommended by the manufacturer and that have been approved by the Engineer.

Do not place epoxy overlay on hydraulic cement concrete that is less than 28 days of age. Do not place epoxy concrete overlay on magnesium phosphate cement concretes. Remove and replace with polymer modified concrete any magnesium phosphate patches found on the deck prior to placement of the overlay system. Patching and cleaning operations will be inspected and approved prior to placing each layer of the overlay. Any contamination of the deck or to intermediate courses, after initial cleaning will be mechanically removed to sound concrete extending two feet in all directions from the contaminated area. Do not use any open flame to remove applied epoxy or to dry the surface of the deck under any circumstances. Apply both courses within 24 hours following the final cleaning and prior to opening the area to traffic.

Verify that there is no visible moisture present on the surface of the concrete at the time of application of the epoxy concrete overlay. Conduct moisture test in an area away from traffic as per ASTM D-4263 for a minimum of five hours prior to application. Use clean compressed air to dry the deck surface if necessary.

**403-3.4 Application Equipment:** Provide equipment that meets the following requirements:

**403-3.4.1Mobile Application Equipment:** Equipment for mobile application will conform to the FDOT Standard Specifications, Section 100 and will consist of no less than the epoxy distribution system with spreader bar(s) or dispenser nozzle(s), flow meters, aggregate spreader, application brooms and squeegees, and vacuum-broom trucks. The distribution system or distributor will accurately mix the epoxy resin and hardening agent, and will uniformly and accurately distribute the epoxy at the specified rate to the bridge deck in such a manner as to cover 100% of the work area. Mixing and distribution shall not promote the entrapment of air in the resin. Properly spread the aggregate in such a manner as to uniformly and accurately apply the dry aggregate to cover 100% of the epoxy resin. Use self-propelled vacuum trucks.

**403-3.4.2 Localized Application Equipment:** Equipment for localized applications will consist of calibrated containers, a paddle type mixer, squeegees, rollers and brooms, which are suitable for mixing the epoxy and applying the epoxy and aggregate in accordance with this specification. Rolling mixing stations that are allowed on the bridge must be diapered from leaking fluids including condensate water from air conditioning. Fabricate the work platforms for mixing so as to prevent any spill of the mixed epoxy, the resin, or the hardener. Only use localized application equipment for areas where mobile application equipment cannot be used or for applications no greater than 100 square feet in one work shift. Clean or replace mixing paddles after mixing each batch. Areas larger than 100 square feet shall be treated using the equipment specified for Mobile Application.

**403-3.5 Application**: Perform handling and mixing of the epoxy resin and hardening agent in a safe manner to achieve the desired results in accordance with this specification and with the manufacturer's published product data sheet as approved or directed by the Engineer. Do

not place epoxy pre-treatment or concrete overlay materials if traffic has been on the already prepared section(s) or when weather or surface conditions are such that the material cannot be properly handled, placed and cured within the specified time period.

Verify that concrete, resin, air and equipment temperatures are within the manufacturer's specified limits.

Apply the epoxy overlay ensuring that the original slopes of the bridge are maintained and the deck surface is uniform as to not to allow any accumulation of water. Perform the crack sealing and pre-treatment operation immediately followed by the application of the overlay. Apply the overlay in two separate courses in accordance with the following rate of application, and the total of the two applications will not be less than 7.5 gallons of resin per 100 square feet.

Table 4: Application Rates

| Course | Rate * Gal./100 sq.ft. | Aggregate Lbs./Sq.Yd** |
|---|---|---|
| 1 | No less than 2.5 | 10+ |
| 2 | No less than 5.0 | 14+ |

* Application rates per course may differ as recommended by the overlay system manufacturer for the particular concrete surface.
** Application of aggregate will be of sufficient quantity to completely cover the epoxy. Weight of applied aggregate may vary based on material selected.

Place the epoxy mixture on the surface of the bridge deck after it has been prepared for the epoxy concrete overlay and distribute the epoxy uniformly over the concrete. Periodically clean the epoxy distribution tools. Ensure that the temperature of the bridge deck surface and all epoxy and aggregate components will be 55°F or above at the time of application. Do not apply epoxy if the air temperature is expected to drop below 60°F within 8 hours after application, or the remaining gel time is less than 10 minutes. The dry aggregate shall be applied in such a manner as to cover the epoxy mixture completely within 5 minutes. Provide a two inch wide offset between courses for adjacent lane placement, so as to give an overlap of the joint. The same offset joint will be made at transverse locations where work has ceased.

Remove and replace first course applications which do not receive enough aggregate or exceeded the approved thickness prior to gelling of the epoxy. A second course with insufficient aggregate may be left in place, but will require additional epoxy and aggregate applications before opening to traffic and the total thickness of the overlay shall not exceed 0.6 inch. Cure each course of epoxy concrete overlay until vacuuming or brooming can be performed without tearing or damaging the surface. Traffic or equipment will not be permitted on the overlay surface during the curing period. Remove all loose aggregate after the curing period has expired by vacuuming or brooming.

Inspect all the longitudinal centerline joint or multiple longitudinal joints for correct placement prior to final opening to traffic. Make any corrections at no additional cost to the Department.

Plan and execute the work to provide the minimum curing periods as specified in the Plans, or other longer minimum curing periods as prescribed by the manufacturer prior to opening to public or construction traffic, unless otherwise approved by the Engineer. Do not open lanes to traffic over the first course.

Reapply pavement marking materials as directed in the contract documents after the overlay system has been completed and approved by the Engineer. Temporary striping may be necessary as described in the contract documents or as directed by the Engineer

Provide to the Engineer records for each batch of epoxy overlay applied. Records shall include, but not be limited to the following:

1. batch numbers and sizes
2. location of batches as placed on deck, referenced by stations
3. batch mix time
4. batch gel and cure times (measured on 50 ml samples for each batch of localized application or application section using mobile equipment)
5. temperature of the air, deck surface, epoxy components, including aggregates
6. loose aggregate removal time
7. time of curing before opening to traffic

**403-3.6 Limitations:** Mask or otherwise provide the expansions joints and scuppers with a bond breaker prior to the application of the overlay.

Overlap top and bottom lifts at joint areas when application is performed in phases.

Remove the overlay over each deck joint by removal of the bond breakers, by scoring the overlay prior to gelling, or by saw cutting after cure within 12 hours of application and prior to opening to traffic. Featheredge the overlay at expansion joints as to provide a smooth overlay to expansion joint transition.

Remove and replace damaged or deficient areas found on the epoxy concrete overlay by saw-cutting in rectangular sections to the top of the concrete deck surface. Remove and replace the various courses in accordance with this specification at no additional cost to the Department. Do not repair deficient areas by placing a third layer unless specifically approved by the Engineer.

**403-4 Acceptance Testing.**

**403-4.1 Friction Testing:** Measure the friction values of the installed overlay within 30 days of completing the overlay installation. Measure the friction characteristics of the overlay in accordance with AASHTO T242 using the ribbed tire (M 261) option and a trailer type measuring vehicle. The Contractor shall secure the services of an independent enterprise experienced in roadway friction testing with the equipment described. The minimum acceptable friction number (FN40R) for non-high friction applications is 55 and for high friction treatment systems is 65.

**403-4.2 Bond Testing:** Test the tensile bond of the applied overlay after curing. Conduct a minimum of one bond test at every 600 square yards or less if the application is smaller than 600 square yards, or as directed by the Engineer. Inspect the remaining overlay by tapping or chain drag and repair any section discovered debonded or otherwise deficient. Repair test area using the localized application procedure.

Minimum acceptable bond is 200 psi tested as described in 403-3.3. Areas not meeting the bond or friction requirements shall be removed and replaced at no additional cost to the Department.

Provide a copy of the friction and bond test results to SMO for final acceptance.

**403-5 Method of Measurement.**

**403-5.1 Overlay Measurements:** Epoxy concrete overlay system will be measured and paid for in square yards of completed epoxy system (both courses included) installed, tested, and accepted by the Engineer.

**403-5.2 Spall Restoration Measurements:** Restored spall areas will be measured based on the volume in cubic feet of actual spalls restored by the Contractor and accepted by the Engineer as necessary to place the overlay.

**403-6 Basis of Payment.**

All costs to furnish and install the epoxy concrete overlay including but not limited to the following will be included in the cost of Epoxy Concrete Overlay bid item: storage of materials, deck preparation and testing, furnishing and applying the pre-treatment material, furnishing and applying overlay courses, maintaining bridge slopes, protection of deck joints, furnishing and operating testing devices, written test reports.

Cost for restored spall areas will be paid for based on the volume of actual spalls restored by the Contractor. Cost will include all materials and labor associated with identification of spalls, removal of concrete, surface preparation, application of repair material, and curing. Quantities given in the Plans are estimates and may be increased, decreased or deleted beyond the limits allowed by Section 4 of the Specifications as necessary based on actual conditions found on the deck.

Payment will be made under Pay Item:

| | |
|---|---|
| 403- 1- | Epoxy Concrete Overlay for Concrete Bridge Decks – per square yard |
| 403- 2- | Restore Spalled Areas for Concrete Bridge Decks- per cubic foot |

## SECTION 458
## BRIDGE DECK JOINTS

**458-1 Description.**

Furnish and install bridge deck joints of the types and at the locations shown in the Plans. This Section covers the following types of joints:

Poured Joint
Poured Joint with Backer Rod System
Strip Seal Joint System
Modular Joint

**458-2 Materials.**

**458-2.1** General: Transport, store and prepare all joint materials and components for all joint types as per the manufacturer's recommendations.

**458-2.2 Poured Joint:** Furnish a Type D silicone sealant material meeting the requirements of Section 932 that is listed on the Approved Product List (APL).

**458-2.3 Poured Joint with Backer Rod System:** Furnish poured joint with backer rod systems consisting of Type D silicone sealant material, foam backer rods, sidewalk cover plates (as required) and all associated miscellaneous components.

The Type D silicone sealant material used in the system shall be listed on the APL and meet the requirements of Section 932.

**458-2.4 Strip Seal Joint System:** Furnish strip seal joint systems in accordance with ASTM D5973 and Design Standards, Index No. 21100 that are listed on the APL. Manufacturers seeking evaluation of their product for the APL shall submit an application in accordance with Section 6. Design documentation showing the expansion joint system shall include installation details and temporary or sacrificial support brackets, bolts, clamps, etc. that are compatible with decks constructed with or without block-outs. Furnish joint systems consisting of watertight steel edge rails, elastomeric strip seals, sidewalk cover plates (as required) and all associated miscellaneous components. Obtain the elastomeric strip seals from the edge rail manufacturer.

**458-2.5 Sidewalk Cover Plates:** Furnish slip resistant, random hatch matrix or suitable pattern, galvanized steel sidewalk cover plates fabricated from steel meeting the requirements of ASTM A36 or ASTM A709, Grade 36 or 50. Do not use diamond plate or surface applied slip resistant tapes, films, nonmetallic coatings or other similar materials. Fabricate cover plates in accordance with Design Standards, Index Nos. 21100 and 21110. After shop fabrication, hot-dip galvanize cover plates in accordance with Section 962. Galvanized sidewalk cover plates shall have a minimum coefficient of friction on the top surface of 0.8 in dry condition, and 0.65 in a wet condition, as determined by ASTM F1677-05 or ASTM F1679-04. Furnish flat head stainless steel sleeve anchors in accordance with ASTM F593 Group 1 Alloy 304 for attaching sidewalk cover plates. Install sleeve anchors in accordance with the manufacturer's instructions.

**458-2.6 Modular Joint:** Furnish modular joints meeting the requirements of this Section. Submit manufacturer certification that modular joint components meet the following material requirements.

| Table 2-6.1 Component Material Requirements | |
|---|---|
| Solid Separation Beams, Steel Extrusions, Support Bars, and Milled Steel Shapes | ASTM A588 or ASTM A572 |

| Table 2-6.1 Component Material Requirements | |
|---|---|
| Box Seals | ASTM D2628* |
| Adhesive | ASTM D4070 |
| Stud Shear Connectors and Threaded Studs | ASTM A108 |
| Connection Plates – 3/8 inch minimum thickness | ASTM A588 or ASTM A572 |
| Sliding Plates - 3/8 inch minimum thickness | ASTM A240, Type 316 |
| Sliding Plates - 3/8 inch minimum thickness | ASTM D4895-10 |
| Railing and Sidewalk Cover Plates – 1/2 inch minimum thickness | ASTM A36** |
| *Provide seals with hardness Type A durometer equal to 55 (plus or minus 5) by ASTM D2240.<br>**Hot-dip galvanize railing and sidewalk cover plates in accordance with Section 962. | |

Supply test results from the manufacturer verifying the maximum coefficient of friction between mating surfaces. Testing must be performed by an independent testing laboratory according to the manufacturer's stated precompression values for the system to a minimum of two million cycles. Maximum allowed coefficient of friction is 0.10.

Provide PTFE bonded steel sliding plates using a heat cured, high temperature epoxy capable of withstanding temperatures of minus 40°F to plus 250°F.

Use preformed elastomeric joint seals of multiple-web design that comply with ASTM D3542. Use preformed elastomeric joint seals of the strip type that comply with ASTM D5973.

For springs, bearing, and equidistance devices (i.e. control springs), use the same material composition and formulation, manufacturer, fabrication procedure and configuration as those used in the prequalification test.

**458-3 Calculations and Shop Drawings.**

**458-3.1 All Joint Types (with the exception of Poured Joints):** Submit shop drawings in accordance with Section 5 for any applicable joint system supplied. For format and required details, follow the AASHTO/NSBA Steel Bridge Collaboration "Guideline for Shop Detail Drawing Presentation". The following information must be included on the shop drawings:

1. The name and address of the joint system manufacturer, including the physical address where the fabrication is performed.

2. The joint manufacturer's instructions for proper installation, including the proper width settings for a minimum 100°F temperature range. Shop drawings that are submitted without this information will be returned without review.

3. Show all materials including project specific details and dimensions. Include the joint model number and joint movement range.

**458-3.2 Sidewalk Cover Plates:** Submit shop drawings for sidewalk cover plates showing all materials, project specific details and dimensions. The submittal must include a certification from the manufacturer that the sidewalk cover plates meet the minimum coefficient of friction requirements.

**458-3.3 Strip Seals:** Provide the APL number in the shop drawings.

**458-3.4 Modular Joints:** When support boxes are supported by the deck or abutment, detail in the shop drawings a minimum of 2 inches between the bottom surfaces of the joint elements and the deck blockouts to allow easy placement of concrete and allow for proper consolidation of concrete under and around all parts of the joints.

Detail in the shop drawings at least 6 inches of clear space between the support boxes or anchorages on the ends of support boxes and the periphery of the blockout to permit placing of concrete.

Submittal of shop drawings must include a manufacturer's installation manual in accordance with this Section.

Include design calculations, signed and sealed by a Professional Engineer licensed in the State of Florida, confirming that all load bearing components are in conformance with the requirements of this Section.

**458-4 Fabrication and Installation.**

**458-4.1 General:** Install the joint in accordance with the specific requirements of this Section, the plan details, the Design Standards, and the manufacturer's installation instructions for the particular type of expansion joint to be installed.

**458-4.2 Poured Joint:** Install the joint at the locations and in accordance with the details shown in the Plans and the manufacturer's recommendations.

**458-4.3 Poured Joint with Backer Rod System:**

**458-4.3.1 Casting Joint Opening:** When casting the bridge deck, approach slab or raised sidewalk adjacent to the expansion joint at temperatures other than 70°F, adjust the joint opening (Dim. A as shown in the Design Standards, Index No. 21110) at 70°F by the amount of the adjustment per 10°F shown in the Structures Plans, Poured Expansion Joint Data Table. For temperatures above 70°F, decrease the opening. For temperatures below 70°F, increase the opening.

**458-4.3.2 Installation of Poured Joint System:** After deck profiling, grinding, and grooving operations are complete, install poured joint with backer rod in accordance with the manufacturer's recommendations, when the joint opening is plus or minus 1/4 inch of the design joint opening (Dim A at 70°F) shown in the Structures Plans, Poured Expansion Joint Data Table. The minimum opening must not be less than 1 inch at the time of installation. Place poured joint material only when the ambient temperature is between 55°F and 85°F and is expected to rise for the next three hours minimum to provide for adequate joint opening and compression of the poured joint material during curing.

**458-4.4 Strip Seal System:**

**458-4.4.1 Elastomeric Seal Fabrication:** Furnish continuous heavy duty bridge deck elastomeric seals sized in accordance with the manufacturer's recommendations, to perform satisfactorily for the opening range shown. Minimum movement classification is 4 inches. Shop vulcanization is restricted to use on horizontal turns on skewed bridges at upturn ends where the horizontal turn angle is greater than 35 degrees. Field vulcanization is not permitted.

**458-4.4.2 Edge Rail Fabrication:**

1. Furnish extruded, hot rolled or machined solid steel edge rails in accordance with ASTM A709, Grade 36, 50 or 50(W). Furnish edge rails with a minimum mass of 19.2 lb/ft excluding studs, a minimum height of 8 inches, a minimum thickness of 1/2 inch and a maximum top surface (riding surface) width of 2 inches. Edge rails manufactured from bent plate or built up pieces are not acceptable.

2. Furnish anchor studs in accordance with ASTM A108, and electric arc end-weld anchor studs with complete fusion. Anchor studs may be piggy backed to achieve required lengths.

3. Perform all shop welding in accordance with the Bridge Welding Code ANSI/AASHTO/AWS D1.5. Do not weld to surfaces in contact with the elastomeric seal or the

top surface (riding surface) except as shown in the shop splice detail. Do not weld inside seal cavity.

4. Fabricate edge rail assemblies in one piece including upturns. Splices in an individual joint are only permitted where a construction joint is specifically required by the Plans, joint segment length exceeds 50 feet, or approved by the Engineer in writing. Shop splice sections of edge rail to obtain the required length by partial penetration double V-groove welds on prepared beveled edges and seal welds as shown in the shop splice detail. Weld all around the joint as far as practical to achieve a watertight seal. Do not use short pieces of edge rail less than 6 feet 0 inches long unless required at curbs, sidewalks or phase construction locations.

5. After shop fabrication, hot-dip galvanize edge rail in accordance with Section 962 and the manufacturer's recommendations.

6. Furnish temporary or sacrificial support brackets, bolts, clamps, etc. that are capable of resisting shipping, handling and construction forces without damage to the edge rail assemblies or galvanized coating and are adjustable to account for variable temperature settings. Do not use temporary or sacrificial support brackets, bolts, clamps, etc. between the faces of the edge rails.

7. Clearly match mark corresponding edge rail assemblies with joint location and direction of stationing.

**458-4.4.3 Installation:**

1. Install the edge rail assemblies at proper grade and alignment before or after deck planing in accordance with the manufacturer's instructions. When installed after deck planing and grinding, install the edge rail assemblies in the block-outs on a profile tangent between the ends of the deck and/or approach slab to within a plus 0 inch and minus 1/4 inch variation. When installed before deck planing, install the edge rail assemblies 3/8 inches, plus or minus 1/16 inch, below the top surface of the deck or approach slab to compensate for concrete removal during planing and grinding.

2. Bolt, weld or clamp edge rail assemblies in position using temporary or sacrificial brackets as required. For phased construction, install edge rail assemblies in a given subsequent phase to align with those installed in an adjacent prior phase after deflection and rotation due to deck casting of adjoining spans has occurred.

3. For installation of edge rail assemblies at temperatures other than 70°F, adjust the opening of the joint (Dim. A as shown in the Design Standards, Index No. 21100) by the amount of the adjustment per 10°F shown in the Structures Plans, Strip Seal Expansion Joint Data Table. For temperatures above 70°F, decrease the opening. For temperatures below 70°F, increase the opening.

4. After galvanizing, do not weld within 2 inches of edge rail surfaces exposed in the completed structure. Do not weld expansion joint components to or electrically ground to reinforcing steel or structural steel. Seal field butt joints and empty shipping and erection holes with caulk before placing deck concrete.

5. Protect galvanized edge rail assemblies during screeding operations per the manufacturer's recommendations. Provide temporary blocking material in the edge rail seal cavities to prevent concrete intrusion during deck pour and finishing.

6. Loosen any temporary or sacrificial support brackets, bolts, clamps, etc. that span across the joint after initial set of concrete, but not more than two hours after conclusion of concrete placement.

7. Install elastomeric seal after completion of deck casting. Remove all joint form material and blocking material prior to installing elastomeric seal. Field install elastomeric seal in accordance with manufacturer's recommendations. Thoroughly coat all contact surfaces between the elastomeric seal and the edge rail seal cavities with an adhesive lubricant before setting elastomeric seal in place.

**458-4.5 Modular Joints**

**458-4.5.1 Fabrication:** Perform all steel fabrication in accordance with the requirements of Section 460.

After fabrication, hot-dip galvanize all non-stainless steel metal surfaces in accordance with Section 962.

Joint systems must be designed in accordance with the latest edition of AASHTO LRFD Bridge Design Specifications or as required by the Contract Documents. Supply joint systems for which identical full-size specimens have been subjected to full life-cycle fatigue testing. Obtain all joint system components from the same manufacturer, fabricated at their approved corporate facilities, using subcomponents meeting the testing requirements of this Section.

Provide all load bearing structural steel components with a 1/4 inch minimum thickness in any direction. Construct edge rails consisting of a monolithic steel shape with a machined or extruded retainer cavity. Multiple component welded steel shapes to achieve a final member cross section or seal retainer cavity are not permitted. Attach separation beams to individual support bars with a complete joint penetration weld.

Support each separation beam with a dedicated support bar connected by a complete joint penetration welded connection. Use of bolted connections, yokes, or other means to directly attach separation beams to support bars is not permitted. Maintain equal spacing between separation beams at all stages of movement.

Contain support bars with bearings capable of transferring all imposed loads to the structure and allow the support bar to freely move within the limits of the expansion joint.

Fabricate a full length modular joint system as one piece. Only a minimal number of splices in an individual joint may be permitted where a construction joint is specifically required by the Plans, joint segment length exceeds 50 feet, or approved by the Engineer in writing.

When phased construction is permitted or required by the Contract Documents, fabricate each segment to exactly fit that portion of superstructure, including sidewalks, under construction in each specific phase. Connect segments with a bolted splice to ensure continuity. Fit segments with temporary seals. Lubricant adhesive is not required for temporary seals. Submit watertight seal details for the splice. Shop inspection will be conducted at the discretion of the Engineer in accordance with Article 5-6.

Fabricate final seal assembly as one single, continuous component. Splicing of seals in the field is not permitted.

Provide lifting devices and devices to maintain the preset opening of the joint at a uniform spacing of not greater than 15 feet along the length of the joint. Provide at least three of these preset opening devices per joint segment.

Direct the manufacturer to preset the joint opening in accordance with joint opening as shown in the Plans at 70°F, prior to shipment.

Prior to installation, place the centerbeam/support bar assembly on a flat surface to verify the support bars lay in a single plane, with no part of the bottom of any support bar exceeding 0.25 inches off the surface. The subassembly may be straightened. No more than three attempts may be made to heat-straighten the subassembly.

Polish stainless steel sliding surfaces to an 8 µ-inch mirror finish.

**458-4.5.2 Installation:** Clean any metal surface component exhibiting surface rust and field metalize in accordance with Section 562. Replace any component exhibiting pitting and/or section loss with a new component.

Install the joint system in strict compliance with the manufacturer's instructions in the shop drawings and as directed by the manufacturer's installation technician.

**458-4.5.2.1 Manufacturer's Installation Manual:** Submit the manufacturer's installation manual at least two weeks prior to installation activities, containing complete and detailed installation instructions for the modular expansion joint supplied by the Contractor. The manual must include step-by-step installation instructions and all related manufacturer's recommendations, including bridge deck pouring sequence, restraints, finishing, etc., for successful installation and long term operation and serviceability of the joint.

**458-4.5.2.2 Manufacturer's Installation Technician:** Provide for a manufacturer's installation technician, under the direct employ of the manufacturer, to be on the jobsite prior to the first joint installation and in sufficient time to train the Contractor's joint installation crews using the shop drawings and the manufacturer's installation manual. The manufacturer's installation technician must remain on the jobsite and be present for all modular joint installation activities for a minimum of the first two joints for each of the Contractor's installation crews. The manufacturer's installation technician will submit written certification to the Engineer that the Contractor's installation process follows the requirements outlined in the manufacturer's installation manual.

**458-4.5.2.3 Field Inspection:** The Engineer will inspect the joint system for proper alignment, complete bond between neoprene gland seal and steel, and proper stud placement and effectiveness.

Bends or kinks in the joint system steel are not allowed except as necessary to follow roadway grades. Straightening of any bends or kinks in the steel, whether intentional or inadvertent, is not allowed. Any joint system exhibiting bends or kinks will be rejected, removed from the jobsite, and replaced by a new joint system. Match joint system to the finished roadway profile and grades before final acceptance.

Restore bond of any neoprene gland seal found not fully bonded to steel.

Visually inspect all stud welds. Test a minimum of 10% of the total number of stud welds at the discretion and direction of the Engineer. Any stud found to not have a complete end weld (as evidenced by a ringing sound when struck by a hammer) will require replacement. Any stud located more than one inch in any direction from location shown in the shop drawings will require removal and a new stud placed in the proper location.

**458-4.5.2.4 Width:** For installation at temperatures other than 70°F, adjust opening of the joint as shown in the Contract Documents by amount of adjustment per 10°F shown in the Contract Documents. For temperatures above 70°F, decrease the opening. For temperatures below 70°F, increase the opening. Release all support brackets as the concrete is being placed and no later than when the concrete takes initial set.

Remove opening devices immediately after the concrete is placed.

**458-4.5.2.5 Permanent Seals:** When phased construction is necessary, remove temporary neoprene seals and replace with full width permanent seals after joint system is completely installed over full width of structure, including sidewalks.

Clean (SSPC-SP6) all metal surfaces which will be in contact with permanent seals to visual standard CSP6 as defined by SSPC Vis 1-89.

**458-4.5.2.6 Final Placement:** After modular joint system has been set to its final line and grade, fill any deck joint blockouts with Class II (Bridge Deck) concrete or as specified in the Plans. Prepare contact surfaces in accordance with the same procedure described in this Section. Finish the uppermost surface of concrete placement in accordance with requirements of 400-15, except that machine finishing is not required. Unless otherwise noted in the Plans, include the cost of the pourback in the unit bid price of superstructure concrete.

Construction loads are not allowed on the modular joint for 72 hours after complete installation unless approved by the Engineer. In the event it is necessary to cross the modular joint before the 72 hour prohibition, bridge over the joint in a manner approved by the Engineer.

**458-4.5.3 Acceptance:** Acceptance of fabricated joint systems will be based on the Engineer's visual inspection at the jobsite and in accordance with requirements of this Section.

Submit certified mill test reports to the Engineer for all steel used to fabricate the joint system.

**458-4.5.3.1 Watertight Integrity Test:** Test full length of joint system for watertight integrity in accordance with this Section, no more than five working days after each joint system installation is completed. In case of phased construction, perform this test after the full length of joint is installed (after all applicable phases). For the first two joints, perform the watertight integrity test and inspection in the presence of the manufacturer's installation technician and the Engineer. For all remaining joints, perform the watertight integrity test and inspection in the presence of the Engineer.

Cover full length of joint with either water ponded to a minimum 1/2 inch depth, or continuously flowing water directly over full plan area of joint for a 15 minute minimum duration. Inspect underdeck surfaces beneath the joint for any evidence of dripping water or moisture for the 15 minute duration of water application and for 45 minutes after water supply is removed. Watertight integrity of joint system is interpreted as absolutely no free dripping water or moisture on underdeck surfaces beneath joint. Document date, time, and location of joint inspections and submit the report to the Engineer.

Repair joint integrity at every location exhibiting free dripping water or moisture identified during the watertight integrity test and subsequently retest, subject to same conditions and consequences as the initial test. Retest and repair until joints pass the watertight integrity test.

**458-5 Method of Measurement.**

The poured joint without backer rod will be incidental to the concrete work and included in the cost of the concrete. Poured joints with backer rod, strip seal joints, and modular expansion joints will be the plan quantity length of each type of joint constructed and accepted.

**458-6 Basis of Payment.**

**458-6.1 Basic Items of Joints.** The Contract unit price per foot for joints will be full compensation for all work and materials necessary for the complete installation. Such price and payment will include, but not be limited to, the following specific incidental work:

1. Any work required to clean and prepare the adjacent bridge deck, deck block out or deck joint gap.
2. Any work to replace any rejected joints.
3. Any repairs to the galvanizing on metallic joint components.
4. Any additional work or materials required for non-standardized or special construction or installation techniques.
5. Any cost of erection and removal of any temporary supports which may be necessary for ensuring proper alignment and positioning of the joint relative to the bridge deck.
6. Any sidewalk cover plates required.
7. All costs associated with the manufacturer's installation technician.
8. All work related to performance of the watertight integrity test and any necessary repairs and retesting.

**458-6.2 Payment Items:** Payment shall be made under:

Item No. 458 - 1- Bridge Deck Expansion Joint - per foot.

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# Typical Sieve Analysis

| | | | |
|---|---|---|---|
| Report For: | LYNNE | TEST # | 10/10/2011 |
| Material Tested: | Vinmar Blend | TEST DATE | 10/10/2011 |
| Identification: | Lynne Mine | SAMPLE DATE | 10/10/2011 |
| Samples By: | DM | | |
| Tested By: | DM | | |

| Sieve Size | Cum.Wgt. Retained | Ind. % Retained | Cum % Retained |
|---|---|---|---|
| 4 | 0.0 | 0.0 | 0.0 |
| 6 | 0.0 | 0.0 | 0.0 |
| 8 | 0.3 | 0.1 | 0.1 |
| 10 | 9.2 | 2.7 | 2.8 |
| 12 | 64.4 | 16.6 | 19.4 |
| 14 | 132.6 | 20.5 | 39.9 |
| 16 | 172.2 | 11.9 | 51.8 |
| 18 | 223.1 | 15.3 | 67.1 |
| 20 | 247.3 | 7.3 | 74.4 |
| 25 | 266.1 | 5.6 | 80.0 |
| 30 | 290.5 | 7.3 | 87.3 |
| 35 | 307.4 | 5.1 | 92.4 |
| 40 | 324.3 | 5.1 | 97.5 |
| 50 | 331.0 | 2.0 | 99.5 |
| 60 | 331.4 | 0.1 | 99.6 |
| 70 | 331.8 | 0.1 | 99.8 |
| 100 | 332.0 | 0.1 | 99.8 |
| Pan | 332.6 | 0.2 | |

Effective Size: 0.55
Uniformity Coef: 2.58

Raw Dry Wgt. 332.6

* - All values shown are averages and do not necessarily reflect a specific sample.

0 31.3 45.4 0 23.3