

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)

932 NONMETALLIC ACCESSORY MATERIALS FOR CONCRETE PAVEMENT AND CONCRETE STRUCTURES.

(REV 5-3-23) (FA 11-30-23) (FY 2024-25)

SECTION 932 is deleted and the following substituted:

932-1 Joint Materials.

932-1.1 Preformed Joint Filler for Pavement and Structures: Preformed joint filler shall meet the requirements of AASHTO M 153, ASTM D8139, AASHTO M 213, or cellulose fiber types meeting all the requirements of AASHTO M 213 (except for the asphalt content) is acceptable provided they contain minimums of 0.2% zinc borate as a preservative and 1.5% waterproofing wax. For AASHTO M 153, unless a particular type is specified, either Type I, Type II or Type III may be used.

Preformed joint fillers shall have a thickness equal to the width of the joint required, and shall be furnished in lengths equal to the widths of the slabs in which they are to be installed, except strips which are of a length not less than the distance between longitudinal joints, or between longitudinal joint and edge, may be used if laced or clipped together in a manner approved by the Engineer. The depth and shape of the joint filler shall conform to the dimensions shown in the Plans. For doweled joints, proper provision shall be made for the installation of the dowels.

932-1.1.1 Certification: The Contractor shall submit to the Engineer a certification confirming that the preformed joint filler meets the requirements of this Section. The certification shall conform to the requirements of Section 6.

932-1.2 Joint Sealer for Pavement and Structures:

932-1.2.1 General: This Specification covers joint sealer intended for use in sealing joints in asphaltic concrete pavement and portland cement concrete pavement. These materials may also be used to seal joints in portland cement concrete bridges and other structures.

932-1.2.2 Material: The joint sealant shall be composed of a mixture of materials, typically but not limited to bituminous based, that will melt when heated for application and then solidify to form a resilient and adhesive compound capable of sealing joints in portland cement concrete and asphaltic concrete against the infiltration of moisture and foreign materials throughout normal pavement conditions and at ambient temperatures. The manufacturer shall have the option of formulating the material according to their Specifications. However, the requirements delineated in this Specification shall apply regardless of the type of formulation used. The material shall cure sufficiently to not flow from the joint or be picked up by vehicle tires after 3 hours at 77°F. The material shall be capable of a uniform application consistency suitable for filling joints without the inclusion of large air holes or discontinuities and without damage to the material.

Materials for pavement joints shall be tested according to
ASTM D5329.

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)



932-1.2.2.1 Physical Requirements of Joint Sealants for Portland Cement Concrete Only:

Table 932-1	
Parameter	Limits
Pour Point	At least 20°F lower than the safe heating temperature as stated by the manufacturer.
Cone-Penetration, Non-immersed at 77°F, 150 g, 5 s	Less than or equal to 90 mm
Flow at 140°F, 5 h	Less than or equal to 5.0 mm
Bond, Non-immersed, 0°F for 5 cycles*	No cracking, separation, or opening that at any point is over 1/4 inch deep, in the sealant or between the sealant and the substrate.
*The depth of a crack, separation or opening shall be measured perpendicular to the side of the sealant showing the defect. At least two test samples in a group of three representing a given sample of sealant shall meet this requirement.	

932-1.2.2.2 Physical Requirements of Joint Sealants for Portland Cement Concrete and/or Asphaltic Concrete:

Table 932-2	
Parameters	Limits
Pour Point	At least 20° lower than the safe heating temperature as stated by the manufacturer.
Cone-Penetration, Non-immersed at 77°F, 150 g, 5 s	Less than or equal to 90 mm
Flow at 140°F, 5 h	Less than or equal to 3.0 mm
Bond, Non-immersed, -20°F for 3 cycles, 50% extension*	No cracking, separation, or opening that at any point is over 1/4 inch deep, in the sealant or between the sealant and the substrate.
Resilience at 77°F	Recovery greater than or equal to 60%
Asphaltic Concrete Compatibility at 140°F	No failure in adhesion, formation of an oily exudates at the interface between the sealant and the asphaltic concrete, or softening or other deleterious effects on the asphaltic concrete or sealant.
*The depth of a crack, separation or opening shall be measured perpendicular to the side of the sealant showing the defect. At least two test samples in a group of three representing a given sample of sealant shall meet this requirement.	

932-1.2.3 Approved Product List (APL): The joint sealant materials used shall be one of the products listed on the Department’s APL. Manufacturers seeking evaluation of their products shall submit product datasheets, performance test reports from an independent laboratory showing the product meets the requirements of this

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)

section, and an APL application in accordance with Section 6. Information on the APL application must identify the sealant type.

932-1.2.4 Shipment: The material shall be delivered in containers plainly marked with the manufacturer's name or trademark product name, LOT number and date of expiration.

932-1.2.5 Bond Breaker Rod: The bond breaker rod shall be a closed cell, expanded polyethylene foam rod of the size and dimensions shown in the Plans. It shall be compatible with the joint sealant and no bond or reaction shall occur between the rod and the sealant.

All bond breaker rods installed shall be covered by a sealant at the end of each workday.

Bond breaker tape approved by the sealant manufacturer may be used in lieu of bond breaker rod when sealing random cracks.

932-1.3 Low Modulus Silicone Sealant Materials:

932-1.3.1 Low Modulus Silicone Sealants: Silicone sealant shall be furnished in a one part or pre-measured two-part formulation meeting the requirements specified herein.

Acetic acid cure sealants are not acceptable. A primer as specified in 932-1.4 for bonding sealant to concrete shall be used if required by the manufacturer. When a manufacturer's product is tested and approved by the Department using a primer, primer will be required for project installation.

Do not use Low Modulus Silicone Sealants Types A, B or C for bridge expansion joints.

Silicones shall be identified in the following manner:

Type A - A low modulus, non-sag (non-self-leveling) silicone formulation, used in sealing horizontal and vertical joints in cement concrete pavements and bridges (i.e., concrete-concrete joints). Tooling is required.

Type B - A very low modulus, self-leveling silicone formulation, used in sealing horizontal joints (including joints on moderate slopes) in cement concrete pavements and bridges (i.e., concrete-concrete joints). Tooling is not normally required.

Type C - An ultra-low modulus, self-leveling silicone formulation, used in sealing horizontal joints (including joints on moderate slopes) in cement concrete pavements and bridges (i.e., concrete-concrete joints). It can also be used to seal the joints between cement concrete pavements and asphalt concrete shoulders (including asphalt-asphalt joints). Tooling is not normally required.

Type D - An ultra-low modulus, self-leveling silicone formulation, cold-applied, rapid-cure, used to seal expansion joints that experience both thermal and/or vertical movements. The material must cure by chemical reaction and not by evaporation of solvent or fluxing of harder particles. Tooling shall not be required. Use in accordance with Standard Plans, Index 458-110 for bridge deck expansion joints with backer rods or as shown in the Plans for other joints with or without backer rods.

932-1.3.2 Physical Requirements:

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)



Table 932-3					
Silicone Sealant Type	Test Method	Type A	Type B	Type C	Type D
Flow	ASTM D5893	No Flow			
Slump (maximum)	ASTM D2202	0.3 inches			
Extrusion rate (minimum)	ASTM C1183, Procedure A	20 ml/min	20 ml/min	20 ml/min	20 ml/min
Tack-free time at 77 ± 3°F and 45 to 55% Relative Humidity	ASTM C679	90 minutes maximum	180 minutes maximum	180 minutes maximum	20 – 60 minutes
Specific gravity	ASTM D792, Method A	1.1 to 1.515	1.10 to 1.40	1.1 to 1.5	1.26 to 1.34
Durometer hardness, Shore A (Cured seven days at 77 ± 3°F and 50 ± 5% Relative Humidity)	ASTM D2240	10-25			
Durometer hardness, Shore 00 (Cured 21 days at 77 ± 3°F and 50 ± 5% Relative Humidity)	ASTM D2240		40-80	20-80	
Tensile stress (maximum) at 150% elongation	ASTM D412 (Die C)	45 psi	40 psi	15 psi	
Elongation (Cured seven days at 77 ± 3°F and 50 ± 5% Relative Humidity)	ASTM D412 (Die C)	800% minimum			600% minimum
Elongation (Cured 21 days at 77 ± 3°F and 50 ± 5% Relative Humidity)	ASTM D412 (Die C)		800% minimum	800% minimum	
Ozone and Ultraviolet Resistance	ASTM C793	No chalking, cracking or bond loss after 5,000 hours, minimum.			
Bond to cement mortar briquets (primed if required) (Cured seven days at 77 ± 3°F and 50 ± 5% Relative Humidity)	AASHTO T 132	50 psi minimum			
Bond to cement mortar briquets (Cured 21 days at 77 ± 3°F and 50 ± 5% Relative Humidity)	AASHTO T 132		40 psi minimum	35 psi minimum	

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)



Table 932-3					
Silicone Sealant Type	Test Method	Type A	Type B	Type C	Type D
Movement Capability	ASTM C719	No adhesive or cohesive failure and adhesion, 10 cycles at -50 to +100%			No adhesive or cohesive failure and adhesion, 10 cycles at +100/-50 %

Portland Cement Mortar: Briquets shall be molded and cured 28 days minimum in accordance with AASHTO T 132. Saw cut cured briquets in half, clean, and dry at 230°, plus or minus 5°F. Bond the two halves together with a thin section of sealant. After cure of sealant, briquets shall be tested in accordance with AASHTO T 132.

932-1.3.3 Field Cure: Six-inch samples of the sealant shall be taken by the Engineer from the joint at the end of a two-week curing period and tested for durometer hardness (by FM ANSI/ASTM D2240), except that the requirements of a 1-inch sample width shall not apply. A minimum hardness of 7.0 is required as evidence of adequate cure.

932-1.3.4 Approved Product List: The low modulus silicone sealant used shall be one of the products listed on the APL. Manufacturers seeking evaluation of their products shall submit product datasheets, performance test reports from an independent laboratory showing the product meets the requirements of this Section, an infrared identification curve (2.5 to 15 μm) and an APL application in accordance with Section 6. Information on the APL application must identify the sealant type.

932-1.3.5 Shipment: The material shall be delivered in containers plainly marked with the manufacturer’s name or trademark product name, LOT number and date of expiration.

932-1.3.6 Primer: When required by the manufacturer’s product, a primer shall be used.

The manufacturer shall perform quality control tests on each LOT of sealant primer material furnished to each project and submit a certified report that each LOT of primer material furnished to a project meets the company’s specifications for that product and the primer is suitable for its intended use.

Sealant primer material shall be delivered in containers plainly marked with the manufacturer’s name or trademark and product name, LOT number and date of expiration.

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)



932-1.3.7 Backer Rod and Tape Bond Breakers: Backer rods and tape shall be compatible with the joint sealant and approved by the sealant manufacturer. No bond or reaction shall occur between the rod and the sealant.

932-1.3.8 Installation: Installation, material selection, joint dimensions, bond breaker suitability (by type and project) shall be in agreement with the requirements of Standard Plans, Indexes 350-001 and 458-110. Any modifications or exceptions to these requirements shall be shown in the Plans.

For new construction projects or general use where the joints to be sealed have uniform width, a closed cell, expanded polyethylene foam backer rod bond breaker shall be required. For rehabilitation projects and similar joint seals where the joints to be sealed have irregular width, an open cell, expanded polyethylene foam backer rod bond breaker with an impervious skin shall be required.

The backer rod shall be compatible with the joint sealant. No bond or reaction shall occur between the rod and the sealant.

Tape bond breaker approved by the sealant manufacturer may be used in lieu of backer rod bond breaker when sealing joints and/or random cracks, as required.

Type D Silicone sealant shall be placed when the ambient temperature is rising and is between 55°F and 85°F and the temperature is expected to rise for the next three hours minimum to provide to adequate joint opening and compression of the sealant during curing.

All installed bond breakers shall be covered by sealant at the end of each workday.

A tolerance in cross-sectional height at midpoint of minus 1/16 inches to plus 3/16 inches will be allowed to the nominal values shown for each joint width on the plan sheet. The Engineer shall check one joint for each 1,000 feet of roadway by cutting out specimens. If the cross section of the cut specimen is out of the allowable range, additional specimens shall be taken as follows:

One joint every 100 feet of pavement, not to exceed 500 feet.

If the average of the specimens is out of tolerance, the Contractor shall remove and replace the entire 500-foot section at no additional expense to the Department.

Installation tolerance shall be verified at 1,000-foot intervals.

932-1.4 Pre-cured Silicone Sealant:

932-1.4.1 General: Pre-cured silicone sealants are intended for sealing vertical joints on concrete surfaces. Type V1 sealant is intended for contraction joints or joints with movements less than 1/4 inches. Type V2 sealant is intended for expansion joints not exceeding 200% of the nominal joint opening. Type V2 sealant may be substituted for Type V1 sealant. The joint sealant must be listed on the APL.

932-1.4.2 Physical Requirements: Sealant material shall be a nominal 1/16 inches thick, available in standard widths from 1 inch to 6 inches, colored to match the finish surface coating of the concrete, and meet the following minimum testing requirements:

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)



Table 932-4			
Test Property Description	Test Method	Type V1	Type V2
Minimum Movement, Cohesion/Adhesion	ASTM C1523	100%	200%
Dry/Room Temperature Loss of Adhesion/Cohesion	ASTM C1523	None	None
Water Immersion Loss of Adhesion/Cohesion	ASTM C1523	None	None
Frozen Loss of Adhesion/Cohesion	ASTM C1523	None	None
Heat Loss of Adhesion/Cohesion	ASTM C1523	None	None
Artificial Weathering Loss of Adhesion/Cohesion	ASTM C1523	None	None
Tear Propagation	ASTM C1523	NT or PT (No Tear or Partial/Knotty Tear)	NT or PT (No Tear or Partial/Knotty Tear)
Ultimate Elongation	ASTM D412	250%	500%

932-1.4.3 Approved Product List: The pre-cured silicone sealant used shall be one of the products listed on the APL. Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6. Applications must include test results, an infrared identification curve (2.5 to 15 μ m), and a product data sheet with the recommended adhesive and installation requirements.

932-1.5 Compression Seals and Adhesive Lubricant

932-1.5.1 Preformed Elastomeric Compression Seals: Preformed Elastomeric Compression Seals shall meet the requirements of ASTM D2628 except that immersion oil IRM 903 may be substituted for Oil No. 3 in the Oil Swell test procedure.

932-1.5.2 Compression Seal Adhesive Lubricant: Compression seal adhesive lubricant shall meet the requirements of ASTM D4070. The material shall be fluid from 5°F to 120°F (-15°C to 49°C).

932-1.5.3 Certification: The manufacturer shall submit a certified test report for each LOT of material furnished to each project along with a statement certifying that the material conforms to this specification and identifying the project number and manufacturer's LOT number.

932-1.5.4 Verification Samples: Provide verification samples in accordance with Section 6.

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)

932-2 Structural Bearing Pads.

932-2.1 General: Provide bearing pads from producers who have a “Compliant” audit status with the National Transportation Product Evaluation Program (NTPEP) for “Elastomeric Bridge Bearing Pads”. Furnish elastomeric structural bearing pads as shown in the Contract Documents. Elastomeric bearing pads as defined herein shall include plain pads (elastomer only) and laminated bearing pads (elastomer with steel laminate inserts). Perform marking, sampling, testing and certification per this Section.

932-2.2 Materials and Sampling: Provide materials for plain and laminated bearing pads in accordance with this Table 932-5 and this Section. Provide steel that is melted and manufactured in the USA. Reclaimed material is not allowed in the finished product. External load bearing plates shall be finished or machined flat to within 0.01 inches. The bottom surfaces of external load plates (masonry plates) designed to rest on bearing pads shall not exceed an out of flatness value of 0.0625 inches. External load bearing plates (e.g., galvanized, or metalized) shall be protected from rust until all exposed surfaces can be welded. Any rust inhibitor shall be removed from all surfaces prior to welding.

Bearings with steel laminates shall be cast as a unit in a mold and bonded and vulcanized under heat and pressure. Bearings with steel laminates which are designed to act as a single unit with a given shape factor must be manufactured as a single unit. The mold shall have a standard shop practice mold finish. The internal steel laminates shall be blast cleaned to a cleanliness that conforms to SSPC-SP6 at the time of bonding. Plates shall be free of sharp edges and burrs and shall have a minimum edge cover of 0.25 inches. External load plates (sole plates) shall be hot bonded to the bearing during vulcanization.

Edges of the embedded steel laminates, including the laminate restraining devices and around holes and slots shall be covered with not less than 0.25 inches of elastomer or the minimum edge cover specified in the Plans. All exposed laminations or imperfections that result in less than the specified elastomer cover of any surface of the steel laminations shall be repaired by the manufacturer at the point of manufacture. The repair shall consist of sealing the imperfections flush on the finished pads with a bonded vulcanized patch material compatible with the elastomeric bearing pad. Repairs employing caulking type material or repairing the bearings in the field will not be permitted.

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)



Table 932-5 Material Requirements for Structural Bearing Pads					
Product	Process	Material	Standard	Grade	Reportable Properties
Plain Pad	Molded Vulcanization or Extruded Vulcanization	Elastomer 100% virgin polychloroprene (neoprene)	AASHTO M251 ARPM MO-1 F3-T.063 (Molded), F2-T (Extruded)	2, 3, 4, 5	Finish, Dimensions, Shear Strength, Tensile Strength, Shear Modulus, Elongation
Laminated Pad (Steel inserts)					
Laminated Pad (Steel inserts)	Hot Rolled	10 gage Steel (Laminates)	ASTM A36	Any	Designation Grade
			ASTM A1011	Min. SS Gr. 36 Type 1	Yield, Tensile, Elongation, Killed

932-2.3 Dimensional Tolerances: Fabricate elastomeric bearings within the dimensional tolerances specified in AASHTO M251, as modified below or as designated in the Plans. If any of the dimensions are outside the limits specified, the bearing pad shall be rejected.

Table 932-6 Dimensional Tolerances for Bearing Pads		
Measurement		Tolerance (inches)
Overall vertical dimensions	Design thickness ≤ 1.25 inches	-0, +0.125
	Design thickness > 1.25 inches	-0, +0.25
Overall horizontal dimensions	measurements ≤ 36 inches	-0, +0.25
	measurements > 36 inches	-0, +0.50
Thickness of individual layers of elastomer (laminated bearings only) at any point within the bearing		± 0.125
Variation from a plane parallel to the theoretical surface (as determined by measurements at the edge of the bearings)	Top (slope relative to bottom)	≤ 0.005 radians
	Sides	0.25
Position of exposed connection members		± 0.125
Edge cover of embedded laminates of connection members		-0, +0.125

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)



Table 932-6 Dimensional Tolerances for Bearing Pads	
Measurement	Tolerance (inches)
Position and size of holes, slots, or inserts	±0.125

932-2.4 Marking: Each elastomeric bearing pad shall be permanently marked in indelible ink or flexible paint. The marking shall consist of the order number, LOT number, pad identification number, elastomer type, and shear modulus or hardness (when shear modulus is not specified). Where possible, the marking shall be on a face of the bridge bearing pad that will be visible after erection of the structure.

932-2.5 Sampling: A sampling LOT shall consist of a maximum of 100 bearing pads of a single type of bearing (plain or steel laminated), of the same design, materials, thickness, and manufacturer, referred to here as “like pads”, delivered to the project site or to an offsite storage facility within the State of Florida in reasonable proximity to the project site as determined by the Engineer. Organize stockpiled pads into groups of like pads by LOT so that they can be readily identified and sampled by the Engineer.

When the total number of like pads, as defined in 932-2, consists of a LOT of 10 or less, sampling is not required, and acceptance is by certification, as stated in 932-2.7.

For LOT sizes of like pads that exceed 10, two bearing pads per LOT will be selected by the Engineer, one for testing and one for verification in the event of a failing test result. LOT's will be sampled only after all like pads in the LOT are at the project site or in an offsite storage facility. Samples shall consist of complete pads as detailed in the Plans. Furnish additional complete bearing pads to replace those selected for testing. Bearing pads shall be available for sampling a minimum of three weeks prior to their installation. Submit the sample bearing pads to a Department approved independent laboratory for testing. Shipping and testing will be at the Contractor's expense.

932-2.6 Testing: Test bearing pads in accordance with Florida Method FM 5-598. Laminated bearings must meet a minimum compressive strength of 2,400 psi and non-laminated (plain) pads must meet a minimum compressive strength of 1,200 psi. The shear modulus of the elastomer shall be minimum 80 psi unless otherwise noted in the Contract Plans. If any properties are identified as noncompliant with the criteria specified, the bearing shall be rejected, and the verification sample tested. If the verification sample test results are also noncompliant, the LOT shall be rejected. A list of approved testing laboratories can be found on the Department's website. The URL for obtaining this information, if available, is: <https://mac.fdot.gov/reports>.

932-2.7 Certification: For Lot sizes ≤ 10 , the Contractor shall submit to the Engineer a certification statement from the manufacturer that materials provided conform to the requirements of Section 6 and this Section, and the bearings in the LOT were manufactured in a reasonably continuous manner from the same batch of elastomer and cured under the same conditions. The certification shall identify the production facility,

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)

material, quantity, grade, and reportable properties as defined in Table 932-5 for each LOT.

For Lot sizes > 10, the Contractor shall submit to the Engineer a certification statement from the manufacturer that materials provided conform to the requirements of Section 6 and this Section, and the bearings in the LOT were manufactured in a reasonably continuous manner from the same batch of elastomer and cured under the same conditions. The certification shall identify the production facility. Additionally, the Contractor shall submit to the Engineer complete certified test results as required in FM5-598, from an independent laboratory.

932-3 Ancillary Bearing Pads.

932-3.1 General: Provide bearing pads from producers who have a “Compliant” audit status with the National Transportation Product Evaluation Program (NTPEP) for “Elastomeric Bridge Bearing Pads”. Structural bearing pads certified to meet 932-2 may be substituted for ancillary pads. Provide materials for ancillary plain plain pads in accordance with this section and Table 932-7. Perform testing and certification per this Section.

932-3.2 Plain Pads: Cutting shall not heat the material and shall produce a smooth finish with a maximum roughness average (Ra) of 6.3 μm (0.248 mils) measured in accordance with ASME B46.1. Plying pads of lesser thickness together shall not be permitted. External load plates (e.g., galvanized, or metalized), when used, shall be protected from rusting and shall be hot bonded by vulcanization during the primary molding process.

Table 932-7 Requirements for Ancillary Pad Material					
Product	Manufacturing	Material	Standard	Grade	Properties
Plain Pad	Molded Vulcanization or Extruded Vulcanization	Elastomer 100% virgin polychloroprene (neoprene)	AASHTO M251 ARPM MO-1 F3-T.063 (Molded), F2-T (Extruded)	2, 3, 4, 5	Compressive Strength 1,200 PSI per FM 5-598

932-3.3 Testing and Certification: The Contractor shall provide a certification to the Engineer for all ancillary pads used outside of a railing application, confirming that each LOT of material meets the requirements of Section 6 and this Section and that the bearings were produced in a continuous manner from the same batch of elastomer and cured under the same conditions. The certification shall also the production facility, material, grade, and compressive strength for each LOT.

For bearing pads to be used under metal railings, submit a certification indicating the production facility and compliance with either of the following standards:

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)

1. A certification stating that each LOT of material was reviewed, sampled, tested, and meets the requirements of Section 6 and this Section, and the bearings in the LOT were manufactured in a reasonably continuous manner from the same batch of elastomer and cured under the same conditions.

2. A certification stating that the pads were tested and meet ASTM D2000 M1 BC (suffix grade 1 - basic requirements, type B, class C).

932-4 Fiber Reinforced Polymer (FRP) Reinforcing Bars.

932-4.1 General: Obtain FRP reinforcing bars from producers currently on the Department’s Production Facility Listing. Producers seeking inclusion on the list shall meet the requirements of Section 105.

Use only solid, round, thermoset basalt fiber reinforced polymer (BFRP), glass fiber reinforced polymer (GFRP) or carbon fiber reinforced polymer (CFRP) reinforcing bars. Single or multi-wire CFRP strands are permitted as spirals for reinforcing in concrete piling where specified in the Contract Documents. Bars shall be manufactured using pultrusion, variations of pultrusion, or other suitable processes noted in the producer’s Quality Control Plan, subject to the approval of the State Materials Office (SMO). For BFRP and CFRP bars only vinyl ester or epoxy resin systems are permitted. For GFRP, use only bars manufactured using vinyl ester resin systems and glass fibers classified as E-CR or R that meet the requirements of ASTM D578.

932-4.2 Bar Sizes and Loads: The sizes and loads of FRP reinforcing bars shall meet the requirements in Table 932-8. The measured cross-sectional area, including any bond enhancing surface treatments, shall be determined according to Materials Manual Section 12.1 Volume II.

Table 932-8 Sizes and Tensile Loads of FRP Reinforcing Bars								
Bar Size Designation	Nominal Bar Diameter (in)	Nominal Cross Sectional Area (in ²)	Measured Cross-Sectional Area (in ²)		Minimum Guaranteed Tensile Load (kips)			
			Minimum	Maximum	BFRP & GFRP Bars (Type 0)	BFRP & GFRP Bars (Type III)	CFRP (Type II) Single & 7-Wire Strands	CFRP (Type I) Bars
2.1-CFRP	0.21	0.028	0.026	0.042	-	-	7.1	-
2	0.250	0.049	0.046	0.085	6.1	7.4	-	10.3
2.8-CFRP	0.280	0.051	0.048	0.085	-	-	13.1	-
3	0.375	0.11	0.104	0.161	13.2	16.0	-	20.9

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)



Table 932-8 Sizes and Tensile Loads of FRP Reinforcing Bars								
3.8-CFRP	0.380	0.09	0.087	0.134	-	-	23.7	-
4	0.500	0.20	0.185	0.263	21.6	27.9	-	33.3
5	0.625	0.31	0.288	0.388	29.1	40.8	-	49.1
6	0.750	0.44	0.415	0.539	40.9	57.3	-	70.7
6.3-CFRP	0.630	0.19	0.184	0.242	-	-	49.8	-
7	0.875	0.60	0.565	0.713	54.1	75.8	-	-
7.7-CFRP	0.770	0.29	0.274	0.355	-	-	74.8	-
8	1.000	0.79	0.738	0.913	66.8	94.9	-	-
9	1.128	1.00	0.934	1.159	82.0	115.0	-	-
10	1.270	1.27	1.154	1.473	98.2	138.7	-	-
11	1.410	1.56	1.500	1.700	105.8	160.0	-	-

932-4.3 Material Acceptance: Submit to the Engineer a certificate of analysis for each production LOT from the producer of the FRP reinforcing bars, confirming compliance with the requirements of this Section.

932-4.3.1 Sampling: The Engineer will select a minimum of six straight bars with minimum lengths of 7 feet each and a minimum of five bent bars or spiral bends/revolutions from each shipment, representing a random production LOT, per bar size of FRP reinforcing for testing in accordance with Table 932-9. Testing shall be conducted, at the Contractor's expense, by a Department approved independent laboratory. Each test shall be replicated a minimum of three times per sample. Submit the test results to the Engineer for review and approval prior to installation. Testing will not be required for bars to be used solely as reinforcement for sheet pile bulkheads, but LOT samples will still be selected and retained by the Engineer until final acceptance of the work.

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)



Table 932-9 Testing Requirements for Project Material Acceptance of FRP Reinforcing Bars				
Property	Test Method	Requirement	Test Required for Straight Bar	Test Required for Bent Bar
Fiber Mass Fraction	ASTM D2584 or ASTM D3171	$\geq 70\%$	Yes	Yes – bent portion ^b
Short-Term Moisture Absorption	ASTM D570, Procedure 7.1; 24 hours immersion at 122°F	$\leq 0.25\%$	Yes	Yes – bent portion ^b
Glass Transition Temperature	ASTM D7028 (DMA) or ASTM E1356 (DSC; T_m)/ ASTM D3418 (DSC; T_{mg})	$\geq 230^\circ\text{F}$ $\geq 212^\circ\text{F}$	Yes	Yes – bent portion ^b
Degree of Cure	ASTM E2160	$\geq 95\%$ of Total polymerization enthalpy	Yes	Yes – bent portion ^b
Measured Cross-sectional Area		Within the range listed in Table 932-6	Yes	Yes – straight portion
Guaranteed Tensile Load ^a		\geq Value listed in Table 932-6	Yes	No
Tensile Modulus		ASTM D7205 $\geq 6,500$ ksi for BFRP and GFRP (Type 0) $\geq 8,500$ ksi for BFRP and GFRP (Type III) $\geq 18,000$ ksi for CFRP (Type I) Bars $\geq 22,400$ ksi for CFRP (Type II) Strands	Yes	No

^a – Guaranteed tensile load shall be equal to the average test result from all three LOTs minus three standard deviations.
^b – Bent portion specimens shall be extracted from a central location within a 90° bend.

932-5 FRP Spirals for Concrete Piling.

FRP Spirals for reinforcing in concrete piling shall be CFRP conforming to the requirements of Section 933 or 932-4 for CFRP (Type II).

EXPECTED IMPLEMENTATION JULY 2024 (FY 2024-25)

932-6 Polymer Slurries for Drilled Shafts.

932-6.1 General Requirements: Synthetic polymer slurry are products that can be used to facilitate the construction of drilled shafts. The type of synthetic polymers used in drilling slurry are long chain-like hydrocarbon molecules which interact with each other, with the soil, and with the water to effectively increase the viscosity of the fluid. Commercial polymer products may come in powder, granular or liquid forms and shall be fully mixed with potable water prior to introducing it to the drilled shaft excavation.

932-6.2 Product Acceptance: All materials shall be one of the products listed on the Department's Approved Product List (APL). Manufacturers seeking evaluation of products for inclusion on the APL shall submit an application in accordance with Section 6 and including documentation that meets the requirements of Table 932-10. A separate application must be submitted for each product type to be evaluated, showing that the product meets the applicable requirements.

Table 932-10 Documentation Requirements	
Documentation	Requirements
Installation Instructions	Include mixing and disposal instructions and the Safety Data Sheet (SDS).
Product Photo	Displays the significant features of the product as required in this section. Displays location of Manufacturer name and model number.
Product Label Photo	Displays the Product Name
Technical Data Sheet	Uniquely identifies the product and includes product specifications, storage instructions, and recommended installation materials and equipment as applicable.
Test Reports	Submit test results and reports as required by Materials Manual, Vol 2 Section 2.4