

ITEM 01557.50 M - FIBER REINFORCED POLYMER COMPOSITE BRIDGE DECK

DESCRIPTION

This work shall consist of furnishing and installing a fiber reinforced polymer (FRP) composite bridge deck with a polymer concrete wearing surface, any necessary haunches and a FRP curb.

MATERIALS

All materials shall meet the design requirements provided by the deck manufacturer. All steel hardware shall be of the type and strength specified by the manufacturer and either stainless steel or galvanized steel.

Deck Manufacturers:

The deck panels meeting these specifications may be available from one of the following manufacturers:

1. Creative Pultrusions, Inc., PO Box 6, Alum Bank, PA 15521-0006; (814)839-4186
2. Hardcore Composites, 618 Lambsons Lane, New Castle, DE 19720; (302)442-5900
3. Martin Marietta Composites, PO Box 30013, Raleigh, NC 27622; (919)783-4679

or a source specifically approved for this project by the Deputy Chief Engineer for Structures (DCES). The bidder should be aware that some of these systems may contain patented components, certain materials necessary for the installation may only be available on a limited basis, and certain tasks necessary for the satisfaction of this specification may need to be performed by, or in the presence of, representatives of the manufacturer.

Deck design:

- The design of the deck shall be in accordance with the New York State Standard Specifications for Highway Bridges. Where a conflict exists, this specification will supersede. Dimensions and skew are shown on the plans, but field verification shall be required and is the sole responsibility of the manufacturer.
- The structural support members for the deck system will be as designated on the plans.
- The design load shall include dead load plus MS23 live load with an additional 30% of the live load to account for impact loading. A future course of asphalt wearing surface is to be assumed in the design and load rating (1.2 kPa).
- Deck weight, including the original wearing surface, shall not exceed 1.2 kPa.
- Deflection shall be limited to $L/800$, where L is defined as the span between steel support members. When supported on four sides, the shorter dimension is considered the span.
- The deck shall be designed for a service life of 60 years. The original design shall include knockdown factors to account for any loss of strength or stiffness over the life of the deck.
- The design shall insure that actual stresses in the FRP composite materials under full dead and live load (i.e., allowable stresses) do not exceed 20% of the minimum guaranteed failure stresses (i.e., ultimate strength). The minimum guaranteed failure stresses shall be verifiable by experimental tests. Test results shall be available to DCES upon request.
- Construction joints between deck panels shall be designed to be fully structural (i.e., capable of transferring design shear and moment) and water-tight. The top surface of construction joints shall be flush within a 3 mm tolerance after application of any splice plates.
- The beginning and end of the FRP deck shall be provided with adequate armor to protect it from impact damage and abrasion from traffic and snow plows. A concrete approach slab may be proposed by the manufacturer as an alternate means of protecting the FRP deck if acceptable to the DCES. The cost of the armor angle or approach slab shall be born by the manufacturer and included in the cost bid for the deck system.
- All exposed surfaces shall be protected from abrasion and ultraviolet light using a protective coat according to the manufacturer's recommendation. The color shall be concrete gray as approved by DCES.

Connection design:

- Connections between the deck and the steel supporting members shall be designed for full composite bending action.

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- Connections between the deck and the supports shall be designed for a minimum of 2 000 000 load cycles.

Wearing surface:

- The wearing surface shall be a shop applied 10 mm polymer concrete permanently bonded to the deck. The wearing surface shall provide a wet skid resistance of 60 BPN according to the British Portable Pendulum Test (ASTM E303). The material shall be one of the following: Transpo T48, Tamms flexolith, Kwikbond, PolyCarb, Italgrip, or from a source specifically approved for this project by the DCES. Application shall be done in the presence of the material supplier's representative and according to the manufacturer's recommendations. Application of the wearing surface shall commence only after the DCES approves the method and materials. Materials shall be provided for necessary touch up in the field in the areas of construction joints, bearings, etc.

Adhesives:

- Adhesives shall be as approved by the deck manufacturer's design engineer.

FRP Curb:

- The curb shall be FRP material of the dimensions and location shown on the plans. Materials shall meet the specifications of Pultex Standard Structural FRP Profiles from Creative Pultrusions Inc. or be specifically approved for this project by DCES. Curb shall be securely connected to the bridge deck using a detail approved by the DCES. Curb protruding beyond the face of bridge rail is structural and shall be designed to withstand the impact of snow plows and traffic.

Bridge railing anchorage:

- The FRP deck shall incorporate an anchorage for bridge railing as shown on the plans. If an embedded plate is used, the anchorage must develop the full tensile strength of the anchor bolts. The manufacturer shall provide data from an independent testing agency that verifies that the pull-out strength complies with AASHTO's Guide Specifications for Bridge Railing.

SUBMITTALS

- Working (shop) drawings and design calculations for the entire FRP bridge deck system shall be certified and signed by a professional engineer licensed to practice in New York State and provided to the DCES prior to fabrication of any components. The submission shall include the material properties and design assumptions upon which the deck and connection design is based. Acceptance or rejection of the deck system and installation procedure will be provided within two weeks of submission to the DCES in Albany.
- Certified test data supporting the material property values used in the design shall be provided to the DCES upon request.
- Lot numbers for all fiber, resin, or adhesive used in the deck system shall be recorded and provided to the DCES upon request.
- Data sheets and manufacturer's quality control sheets for all materials and methods used in the fabrication and installation of the deck shall be provided to the DCES upon request.
- Material Safety Data Sheets (MSDS) shall accompany any materials delivered to the site. A copy shall also be provided to the DCES upon request.
- Deliverables shall include detailed instructions for properly mixing on-site materials, preventing spills, cleaning up and disposing of excess material.

BASIS OF ACCEPTANCE

- **Warranty** - The product shall be warrantied to the bridge owner against manufacturing defect for a period of thirty years. The definition of defect shall include: deflections in excess of those specified in the design parameters, delamination caused by overstress or the manufacturing process, and premature failure of the

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coating system. The definition shall also include any other flaw that could reasonably be considered the result of faulty workmanship or failure to meet the design specifications. In case of defect, the manufacturer's warranty shall contain provisions for repair, strengthening, or replacement of the faulty component within 30 days of notification by the DCES that there is a defect. The warranty shall be transferrable to the new owner should there be a transfer of ownership during the warranty period.

- **Certification** - Upon delivery of the approved deck system, the manufacturer shall provide three sets of the working drawings that have been approved by the DCES and certified by a professional engineer licensed to practice in New York State. The signed documentation shall certify compliance with NYSDOT's Standard Specifications for Highway Bridges. The plans shall include a load rating summary table prepared in accordance with AASHTO's Manual for Condition Evaluation of Bridges and New York's Uniform Code of Bridge Inspection.
- **Level 1 load rating** - Upon delivery of the approved deck system, the manufacturer shall provide load rating calculations for the deck system and a summary table according to the New York's Uniform Code of Bridge Inspection. The analysis shall be certified by a professional engineer licensed to practice in New York State. A digital copy of the design engineer's analysis and raw data shall also be provided. File format shall be STAAD or equivalent as approved by the DCES.
- **Material Tests** - The Supplier shall engage an independent testing laboratory satisfactory to the DCES to conduct material testing and provide results directly to the DCES. At the time of deck fabrication, a sufficient number of companion FRP laminate samples (i.e., the same materials and fiber content and orientation used in the product) shall be made for testing according to standard ASTM methods. Companion samples shall also be provided to the Materials Bureau, Albany for comparison testing. The test results shall verify the material properties upon which the deck design has been based. As a minimum, tests shall be conducted for tension, compression, shear strength, fiber content and resin content. Failure to obtain verification of the design property assumptions shall be cause for rejection of the deck. Selection of the laboratory shall be based on experience in testing FRP and is subject to the approval of the DCES. Two witness coupons (500 mm x 500 mm) shall be manufactured from the same materials and lots used in the deck laminates. This is to be provided to the DCES upon delivery of the deck.

CONSTRUCTION DETAILS

- **Dimensions and tolerances** - Actual dimensions and tolerances shall be as detailed on the approved shop drawings. If desired, provisions may be made by the manufacturer to modify the deck thickness, joints and approaches to meet an alternate deck thickness at the manufacturer's expense. Any modifications are subject to the approval of the DCES. A cross slope as shown on the plans shall be provided for.
- **As-Built Drawings** - Within 30 days of installation, as-built drawings shall be provided to DCES that include maintenance and inspection guidelines as well as a load rating summary table for the deck system.
- **Damages prior to acceptance** - The Supplier shall be responsible for any damage incurred prior to acceptance at the job site. If there is damage and in the opinion of the DCES, the damage is repairable with no long term effect on the structure, the Supplier shall repair the damage without compensation. If, in the opinion of the DCES, the material is damaged beyond repair, it shall be removed and replaced by the Supplier at no cost to the NYSDOT.
- **Damages after acceptance** - If the product is damaged by the installer after acceptance, the Supplier shall be available for consultation and guidance on field repairs at no expense to the State.
- **Joints** - All joints in the deck shall be demonstrated to the Engineer to be watertight in accordance with NYSDOT Standard Specifications subsection 567-3.01H Watertight Integrity Test.

METHOD OF MEASUREMENT

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The quantity of work to be paid for under this item will be measured as the actual number of deck systems provided (one each per bridge site).

BASIS OF PAYMENT

The lump sum price bid for this item shall include all costs necessary to provide the product as specified and provide the quality assurance testing of the engineered deck system.

Shipping - The cost of the item shall include all transportation expenses necessary to deliver the deck system to the job site and unload it. This includes the cost of special hauling permits, escort vehicles, and required police escorts.

Installation - The cost of the item shall include the expense of a qualified representative of the deck manufacturer who shall be present to facilitate the installation procedure. Field measurements necessary to fabricate the deck and install it to the limits shown on the plans shall be the manufacturer's responsibility.

DISAPPROVED