ENGINEERING SPECIFICATION

Fiber Reinforced Polymer (FRP) Prefabricated Bridge

FRP Prefabricated Bridge Specifications

PART 1 - GENERAL

1.1 SCOPE

These specifications shall apply to FRP Wide-Flange (WF) beam bridges designed to carry pedestrian, bicycle, equestrian, and/or light vehicle traffic.

1.2 QUALIFIED MANUFACTURERS

A. The FRP WF-beam bridge shall be manufactured by Bedford Reinforced Plastics, 1 Corporate Drive, Suite 106, Bedford, PA 15522 or approved equal.
B. Bridge manufacturer shall be responsible for the design, engineering, fabrication, and shipment of the FRP bridge components. All FRP materials used in the bridge construction must be pultruded by the bridge manufacturer.

1.3 SUBMITTALS

A. Manufacturer shall provide "***Approval Drawings***" and "***Structural Calculations***" in accordance with the design requirements of this Specification. These submittals shall be signed and sealed by a registered Professional Engineer. The manufacturer shall provide these submittals prior to the fabrication of the bridge for the customer review and approval.

B. Manufacturer shall provide "***Assembly and Installation***" instructions of the bridge components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details. These instructions shall provide the customer with a step-by-step process for assembling and installing the bridge.

C. Manufacturer shall provide a "***Lift Analysis***" and a "***Lift Plan***", if required. The "***Lift Plan"*** provides the locations of the steel lifting bars required to safely lift and place the bridge on the foundations using a crane. These submittals shall be signed and sealed by a registered Professional Engineer.

1.4 QUALITY ASSURANCE

A. All items to be provided under this Specification shall be furnished only by manufacturers having a minimum of ten (10) years of experience in the design and manufacture of similar products and systems. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.

B. Manufacturer shall offer a twenty-five (25) year limited warranty on all FRP products against defects in materials and workmanship. The manufacturer shall provide a copy of the warranty to the customer upon request.

1.5 PRODUCT DELIVERY

A. Manufactured bridge parts shall be delivered by truck on pallets and packages to a location nearest the site accessible by roads.

B. The Owner shall be responsible for the unloading of the materials from the truck; and the transportation of the parts to the bridge site or staging area. The manufacturer shall notify the Owner in advance of the delivery to review all shipping requirements.

PART 2 – GENERAL FEATURES OF DESIGN

2.1 DESIGN FEATURES

A. **Span**: Bridge shall be XX'-0" long and shall be measured from each end of the bridge structure.

B. **Width**: Bridge width shall be a minimum of X'-0" and shall be measured from the inside of the curbing or hand-railing posts.

C. **Bridge Structure**: Bridge shall be designed and fabricated with FRP WF-beam main supports that a 12" x 12" x ½" thick. Bridge structure shall also include C8 x 2-3/16" x 3/8" thick c-channel diaphragm brace connectors attached between the main WF-beams for lateral support.

D. **Guardrails**: Bridge shall have either curbing only or hand-railings. Hand-railings will be 42" high from the decking to the top of the railings

E. **Hardware/Fasteners:** Bridge shall be supplied with either A307 hot-dipped galvanized steel or 316 stainless steel hardware. This hardware shall include bolts, nuts, spring washers, and flat washers and screws as required. (*Select material type*).

F. **Color**: Bridge shall be supplied with an Olive Green color.

G. **Decking:** Bridge shall be supplied with either 3x12 pressure-treated Southern Yellow Pine wood decking or an FRP pultruded decking with an anti-skid grit coating in accordance with the design loads.

H. **Safety Mid-Rails**: Bridges with hand-railings shall include 3" C-channel continuous safety mid-rails installed horizontally along the length of the bridge to the inside of the trusses. The mid-rails shall have a maximum separation distance of 4".

I. **Mounting Devices**: Manufacturer shall provide hot-dipped galvanized steel mounting angle clips used to anchor the bridge ends to the foundation anchor bolts. Foundation anchor bolts shall be the responsibility of the customer/contractor.

J. **Foundations:** The Owner shall procure all information about the site and soil conditions including soil tests. The engineering design and construction of the bridge abutments, piers, and/or footings shall be the responsibility of the Owner. The bridge manufacturer Submittals shall provide the bridge reaction loads, anchor bolt locations, and critical dimensions and data pertaining to the installation of the bridge on the foundations.

2.2 DESIGN LOADS

The structural design of the bridge shall be done under the direct supervision of a Licensed Professional Engineer and done in accordance with recognized engineering practices and principles. The manufacturer shall use design standards established by ***ASCE 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.*** The manufacturer shall utilize a RISA 3-D structural analysis program (or approved equal) in order to provide the structural calculations.

A. **Pedestrian Live Load**: The manufacturer shall design the bridge for a 60 PSF pedestrian live load.

B. **Ground Snow Load**: Per ASCE 7-16.

C. **Wind Load**: Per ASCE 7-16.

D. **Seismic Load**: Per ASCE 7-16.

2.3 SERVICEABILITY CRITERIA

A. **Deflection**: Manufacturer shall design the bridge to a maximum allowable deflection of L/180 under Pedestrian Live Load.

2.4 MATERIALS

A. Manufacturer shall pultrude structural shapes with a glass content minimum of 45%, maximum of 55% by weight. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the structural design requirements.

B. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.

C. Resins shall be ISO, non-fire retardant isophthalic Polyester with chemical formulation necessary to provide the corrosion resistance, strength and other physical properties as required.

D. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

E. Pultruded profiles shall be protected from UV attack with integral inhibitors in the resin and a synthetic surfacing veil to produce a resin rich surface.

PART 3 – FABRICATION

3.1 TOLERANCES

A. All pultruded parts shall be in conformance with the latest ASTM D4385 for "***Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products***" and the latest ASTM D 3917 for "***Standard Specification for Dimensional Tolerance of Thermosetting Glass-Reinforced Plastic Pultruded Shapes***." No material deviations beyond industry standards are acceptable.

B. Manufacturer shall fabricate and mark all components for field assembly with appropriate part numbers that cross-reference the Assembly & Installation Instructions. No parts shall require any field cutting, drilling, or other field modification unless specified.

C. The structural shapes shall be free, as commercially possible, from visual defects such as foreign inclusions, delaminations, blisters, resin burns , air bubbles, and pits.