

# E.T. Techtonics

## PRE-FABRICATED BRIDGE SPECIFICATIONS

### 1.0 GENERAL

#### 1.1 Scope

These specifications are for a fully engineered clear span bridge of Fiber Reinforced Polymer (FRP) composite construction and shall be regarded as minimum standards for design and construction as manufactured by E.T. Techtonics, Inc., P.O Box 40060, Philadelphia, PA 19106, phone 215-592-7620 or approved equal.

#### 1.2 Qualified Suppliers

The bridge manufacturer shall have been in the business of design and fabrication of bridges for a minimum of five years and provide a list of five successful bridge projects, of similar construction, each of which has been in service at least three years. List the location, bridge size, owner and contact reference for each bridge.

### 2.0 GENERAL FEATURES OF DESIGN

#### 2.1 Span

Bridge span will be xxx' xx" (straight line dimension) and shall be measured from each end of the bridge structure.

#### 2.2 Width

Bridge width shall be xx' xx" and shall be measured from the inside face of structural elements at deck level.

#### 2.3 Bridge System Type

Bridges must be designed as a FRP Composite Truss Span or FRP Composite Cable Span

#### 2.4 Member Components

All members shall be fabricated from pultruded FRP composite profiles and structural shapes as required.

#### 2.5 Camber

Bridges can be precambered to eliminate initial dead load deflections. Cambers of 1% of the total span length can be provided on request.

### **3.0 ENGINEERING**

Structural design of the bridge structure(s) shall be performed by or under the direct supervision of a Licensed Professional Engineer and done in accordance with recognized engineering practices and principles.

#### **3.1 Uniform Live Load**

Bridges spanning less than 50'-0" will be designed for 85 psf. Bridges spanning greater than 50'-0" will be designed for 60 psf unless otherwise specified.

#### **3.2 Vehicle Load** (as required)

A specified vehicle configuration determined by the Operating Agency may be used for the design vehicle. If an Agency design vehicle is not specified, the loads conforming to the AASHTO Standard H-Truck is used. The maintenance vehicle live load shall not be placed in combination with the pedestrian live load. A vehicle impact allowance is not required

#### **3.3 Wind Load**

All bridges shall be designed for a minimum wind load of 25 psf. The wind is calculated on the entire vertical surface of the bridge as if fully enclosed.

#### **3.4 Seismic Load**

Seismic loads shall be determined according to the criteria specified in the standard building codes (IBC, ASCE, or UBC) unless otherwise requested. Response Spectrum Analysis shall be performed in those designs that require complex seismic investigation. All necessary response spectra information will be provided by the client for evaluation.

#### **3.5 Allowable Stress Design Approach**

An Allowable Stress Design (ASD) approach is used for the design of all structural members. Factors of safety used by E.T. Techtonics, Inc. in the design of FRP bridges are as follows unless otherwise specified: (Based on the Ultimate Strength of the FRP material)

Tension	2.5
Compression	2.5
Shear	2.5
Bending	2.5
End Bearing	2.5
Connections	3.0

Above information is based on E.T. Techtonics 5 year test program funded by the National Science

## Foundation

### **3.6 Serviceability Criteria**

Service loads are used for the design of all structural members when addressing deflection and vibration issues. Criteria used by E.T. Techtonics, Inc. in the design of FRP bridges are as follows:

Deflection:

$$\text{Live Load (LL) deflection} = L/240$$

$$\text{Vertical Frequency (fn):} = 5.0 \text{ Hz}$$

The fundamental frequency of the pedestrian bridge (in the vertical direction) without live load should be greater than 5.0 hertz (Hz) to avoid any issues with the first and second harmonics.

$$\text{Horizontal Frequency (fn):} = 3.0 \text{ Hz}$$

The fundamental frequency of the pedestrian bridge (in the horizontal direction) without live load should be greater than 3.0 hertz (Hz) to avoid any issues due to side to side motion involving the first and second harmonics.

### **3.7 Snow Load**

Sustained snow load conditions shall be evaluated for time dependent effects (creep and relaxation) and expected recovery behavior.

## **4.0 MATERIALS**

### **4.1 FRP Composites**

FRP bridges shall be fabricated from high-strength E-glass and isophthalic polyester resin unless otherwise specified.

Weathering and ultraviolet light protection shall be provided by addition of a veil to the laminate construction. Minimum material strengths and properties are as follows:

Tension	33,000 psi
Compression	33,000 psi
Shear	4,500 psi
Bending	33,000 psi
Young's Modulus	2,800,000 psi

The minimum thickness of FRP Composite shapes shall be as follows unless otherwise specified: Square tube members (closed type shape) shall be 0.25 in. Wide-flange beams, channel sections, and angles (open type shapes) shall be a minimum thickness of 0.25 in. Standard plate shall be a minimum thickness of 0.25 in.

#### **4.2 Decking**

Wood decking is No. 2 Southern Yellow Pine treated according to the American Wood Preservers Bureau. The standard 2 in. x 12 in. planks are provided for pedestrian and bicycle type loading conditions. Standard 3 in. x 12 in. planks can be provided for equestrian and light vehicle type loading conditions as required. High strength E-glass/ isophthalic polyester resin planks or recycled plastic deck planks can also be provided as required.

#### **4.3 Hardware**

Bolted connections shall be A307 hot-dipped galvanized steel unless otherwise specified. Mounting devices shall be galvanized or stainless steel.

### **5.0 SUBMITTALS**

#### **5.1 Submittal Drawings**

Schematic drawings and diagrams shall be submitted to the client for their review after receipt of order. As required, all drawings shall be signed and sealed by a licensed Professional Engineer.

#### **5.2 Submittal Calculations**

As required, structural calculations shall be submitted to the client. All calculations will be signed and sealed by a licensed Professional Engineer.

## **6.0 FABRICATION**

### **6.1 Tolerances**

All cutting and drilling fabrication to be done by experienced fiberglass workers using carbide or diamond-tipped tooling to a tolerance of 1/16". No material deviations beyond industry standards are accepted. All cut edges to be cleaned and sealed.

## **7.0 RAILINGS**

**7.1** Railings for pedestrian and bicycle use should be a minimum of 42" above the floor deck and equestrian use should be a minimum of 54" above the floor deck.

### **7.2 Safety Rails**

Continuous horizontal midrails shall be located on the inside of the trusses. Maximum opening between the midrails shall be available as required, but should not be greater than 9". If preferred, vertical pickets can be provided upon request.

### **7.3 Toeplates (optional)**

Park and trail bridge toeplates (if required) are 3" green channels.

## **8.0 FINISHING**

Bridge color shall be determined by the client with green, grey, and as standard options. No painting is required as the color is added during the manufacturing process. Green is recommended for park and trail bridge applications. Custom colors can be provided upon request.

## **9.0 DELIVERY and ERECTION**

Delivery is made by truck to a location nearest the site accessible by roads. E.T. Techtonics, Inc. will notify the client in advance of the expected time of arrival at the site. Bridges are usually shipped to the site in component parts or partially assembled depending on site requirements. The spans can then be completely assembled using standard hand tools. Upon request, bridges can also be shipped totally assembled to the site. Unloading, splicing (if required) and placement of the bridge will be the responsibility of the client.

### **9.1 Erection Direction**

For bridges shipped in component parts or partially assembled, E.T. Techtonics, Inc. shall provide assembly drawings and a recommended assembly procedure for building the bridge. Temporary supports or rigging equipment, if needed, is the responsibility of the client. For bridges shipped assembled, E.T. Techtonics, Inc. shall advise the client of the actual lifting weights, attachment points and all necessary information to install the bridge.

## **9.2 Site Issues and Foundation Design**

The client shall procure all necessary information about the site and soil conditions. Soil tests shall be procured by the client. The engineering design and construction of the bridge abutments, piers and/or footing shall be by the client. E.T. Techtonics, Inc. will provide the necessary information pertaining to the bridge support reactions. The client shall install the anchor bolts in accordance with E.T. Techtonics, Inc's anchor bolt spacing dimensions.

## **10.0 WARRANTY**

E.T. Techtonics, Inc. shall warrant the structural integrity of all FRP materials, design and workmanship for 15 years.

This warranty shall not cover defects in the bridge caused by foundation failures, abuse, misuse, overloading, accident, faulty construction or alteration, or other cause not the result of defective materials or workmanship.

This warranty shall be limited to the repair or replacement of structural defects, and shall not include liability for consequential or incidental damages.