1. GENERAL

1.1. Scope

1.1.1. All engineering design and related detailing of the bridge(s) shall be provided by the supplier. The design and detailing shall conform to the Applicable Codes and Standards listed in the section 2 of this document and shall comply with structural drawings/plans prepared by 0 and this document.

1.1.2. Bridge(s) and its attachments shall be fully fabricated by a qualified supplier as outlined in this document.

1.1.3. Supplier shall be responsible for the delivery of all bridge materials.

1.1.4. These specifications are for fully engineered clear span bridge(s) of aluminum construction and shall be regarded as minimum standards for design and construction.

1.2. Qualified Suppliers

Each bidder is required to identify their intended bridge supplier as part of the bid submittal. Qualified suppliers must have at least 5 years of experience fabricating aluminum bridge type structures.
The bridge supplier should have in-house capability to provide design, engineering and fabrication thus providing an integrated approach that delivers design and fabrication services with a single point of responsibility. Brokering is NOT allowed
Pre-approved Manufacturers:

Gator Dock and Marine, LLC
2880 Mellonville Avenue
Sanford, Florida 32773

Suppliers other than those listed above may be used provided they meet all the criteria of this specification and are approved, in writing, no later than two weeks prior to bid exclusively by:

Documentation to ensure proposed substitution shall be in compliance with these specifications must be provided and shall include the following minimum criteria to be considered:

- Representative Design Calculations
- Representative Drawings & Details
- Anticipated Reaction Forces
- Splicing and Erection Procedures
- Warranty Information
- Inspection and Maintenance Procedures
- Welder Qualifications
- Certified Weld Inspector Qualifications

2. APPLICABLE CODES AND STANDARDS

2.1. Governing Codes and Standards

Bridge(s) shall be designed in accordance with the AASHTO, LRFD Guide Specification for Design of Pedestrian Bridges, latest edition, where applicable and unless otherwise stated in section 3 & 4 of this document.

2.2. Reference Codes and Standards

- LRFD AASHTO, Guide Specification for Design of Pedestrian Bridges, latest edition
- The Aluminum Association, Specifications and Guidelines for Aluminum Structures, latest edition
- AASHTO LRFD Bridge Design Specifications, latest edition
- AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic, latest edition
- AASHTO Standard Specifications for Highway Bridges, latest edition
- ASCE 7-10, latest edition
- Aluminum Structures, A Guide to Their Specification and Design, latest edition
- American Welding Society, Structural Welding Code, D1.2, latest edition
- National Design Specification for Wood Construction, ANSI NDS, latest edition
- American Wood Preservers Association Standards, latest edition.

3. GENERAL FEATURES OF DESIGN

3.1. Span

Bridge span(s) shall be:

70 ft

measured in feet from outside of end post to outside of end post.

3.2. Width

Interior clear width of the bridge(s) shall be 6 ft measured from innermost point of rail to innermost point of rail.

3.3. Style

3.3.1. Bridge(s) shall be a Cascade style aluminum truss bridge, as defined in the structural drawings and this specification, or similar in look and function. Style must be approved in accordance with section 1.1 of this specification.

3.3.2. Bridge(s) shall be fabricated and delivered as continuous and pre-assembled structures unless mid-span splices are required and noted in Section 6.3.

3.3.3. Bridge(s) shall incorporate an Enclosed Floor System to hide horizontal bracing, floor beams and stringers from view.

3.3.4. Bridge(s) shall be designed utilizing an H-section configuration, where the floor support system intersects the truss verticals above the bottom chord to increase buckling stability.

3.3.5. The top of the top chord shall not be less than 54" above the finished deck at bridge center in accordance with the structural plans.

3.3.5. The top of the top chord shall not be less than 54" above the finished deck at bridge ends in accordance with the structural plans.

3.4. Camber

Bridge(s) shall be cambered to Offset Dead Load .

3.5. Incline & Skew

3.5.1 Bridge(s) shall be designed for abutments and/or pier bearing surfaces constructed at constant elevations.

3.5.2 Bridge deck(s) shall be constructed at right angles in the horizontal plane

3.6. Deck

Bridge(s) Decking shall be Prepared for 3.5" concrete deck to be poured on-site in accordance with section 5.2 of this document

3.7. Bearing Pads

Bridge(s) shall include bearing pads, which shall allow the bridge to expand and contract as needed without binding, in accordance with section 5.3 of this document

3.8. Guards, Railing, and Infill

Bridge(s) shall include the following in accordance with section 5 of this specification and the structural plans.

3.8.1. Guard Rail and Infill - Bridge shall incorporate a Combination Rail system consisting of vertical pickets, a graspable top rail, and curb bottom rail, which shall minimize climbing hazards and serve the function of guard, hand, and toe rail. The Combination Rail system shall meet all the dimensional requirements of FDOT Aluminum Pedestrian/Bicycle Picket Railing – Index No. 860 or pre-approved equal.

3.8.1.1. Top of top rail shall not be less than 42" above the finished deck.

3.8.1.2. Solid toe or curb rail shall prevent the passage of a 2" diameter sphere up to a minimum height of 4" from finished deck.

3.8.1.3. Clear opening between pickets, infill, or rail shall reject the passage of a 4" diameter sphere up to the height specified in 3.8.1.1 of this document.

3.8.1.4. Clear opening between bottom rail and finished deck shall reject the passage of a 2” diameter sphere.

3.8.1.5. Any graspable elements shall be round with a 1 ¼” to 2” OD or equivalent gripping surface.

3.8.1.6. Horizontal elements shall be finished or returned smoothly to floor or posts.

3.8.1.7. Any graspable elements must maintain a 1.5” clear distance between wall and rail must be maintained.

3.8.1.8. All geometry is to be smooth with no sharp corners

3.8.2. Grab rail - No ADA grab rail is required

3.8.3. Toe rail - No Additional Toe Railing is Required

3.8.3. Rub rail - No Additional Rub Railing is Required

3.9. Architectural Elements

3.9.1 Color & Texture - All exposed metal surfaces to be Mill Finish Aluminum

3.9.2 Cladding - No additional cladding is required

3.9.3 Accent Lighting - No Accent Lighting is Required

3.10. Maximum Weight

Bridge(s) shall be designed to such that the maximum weight of each assembled span does not exceed 8400 lbs to ensure the most cost effective support structure design and installation.

4. ENGINEERING

4.1. Design Loads

4.1.1. Dead Loads (DC & DW)

The bridge shall be designed considering its own dead load including structure (DC), originally designed decking (DW), and originally designed utilities only (DW). No additional loads shall be considered. Dead loads shall be designed in

4.1.2. Pedestrian Live Load (PLu)

Main supporting members, including trusses, primary beams, arches, deck and supporting floor system shall be designed for a uniformly distributed load of 90 pounds per square foot in combination(s) per section 4.3.1.

4.1.3. Vehicle Live Loads (LL)

The bridge shall be designed for an occasional 0 lb vehicle loading. All floor beams and main supporting members shall be designed to support the vehicle load, uniformly distributed across their width at a maximum wheel base of 6 feet and in

0% of the load shall be considered to act on the rear axle.

0% shall be considered to act on the front axle.

All deck members and stringers shall be designed for a concentrated load of 0% of the vehicle load, positioned to produce the maximum load effect over a 10"x10" area.

The loading outlined in this section shall supersede AASHTO suggested loading requirements. No vehicle impact or dynamic loading requirements are required.

4.1.4. Wind Loads (WS)

4.1.4.1. Horizontal Wind Load (WSp & WSf)

The Bridge shall be designed per AASHTO LRFD for a horizontal peak (Strength III) and normal (Fatigue I) wind speeds based on the criteria below, at right angles to the longitudinal axis of the structure. Wind loads shall be proportionally distributed across all exposed primary member surfaces including chords, vertical posts, and truss diagonals on the windward side in combination(s) per section 4.3.1.

- ASCE 7-05 Wind Speed (3-sec peak gust) - 91 mph
- Wind Importance Factor - 1.15
- Gust Effect Factor - 1.14
- Bridge Height Above Ground - 15 ft
- Height and Exposure Factor - 0.849
- Wind Drag Coefficient - 2
- **Resultant Peak Wind Pressure (WSp) - 47.192 psf**
- Fatigue Importance Factor - 1
- **Resultant Normal Wind Pressure (WSf) - 10.4 psf**
- Fatigue resistance shall be calculated for Infinite cycles
- Truck induced fatigue loading is not required.

4.1.4.2. Overturning Wind Load (WSo)

The effect of forces tending to overturn the structure shall be calculated assuming that the wind direction is at right angles to the longitudinal axis of the structure. In addition, an upward force shall be applied at the windward quarter point of the transverse superstructure width. This force shall be 20 pounds per square foot of deck influence area in combination(s) per section 4.3.1..

4.1.5. Guards & Railing Live Loads (PLr)

Guard & railing loads shall be analyzed as Live loads in combination(s) per section 4.3.1.

4.1.5.1. Top Rail Load

The top rail and top chord if <54" from the top of deck shall be designed for a simultaneous vertical AND horizontal load of 50 pounds per linear foot AND a 200 pound point load, positioned to produce the maximum load effect.

4.1.5.2 Post Rail Load

The vertical posts shall be designed for a horizontal load of 50 pounds per linear foot AND a 200 pound point load positioned at the top rail height.

4.1.5.3 Infill

The picket, intermediate railing, toe railing, or infill system shall be designed for a 200 pound point load, applied transversely over an area of 1 square feet and positioned to produce the maximum load effect.

4.1.6. Seismic Extreme Event Loads (EQ) - No seismic analysis is required

4.1.7. Additional Snow Loads (IC) - Based on the ASCE 7 snow maps and capacity already accounted for in strength I and section 4.3.1., no additional snow analysis is required

4.1.8. Flood Extreme Event Loads (WA) - Based on the wind capacity already accounted for in strength III and section 4.3.1., no additional flood analysis is required

4.2. Design Limitations

4.2.1. Resistance & Allowable Stresses

4.2.2.1. All resistance stresses for aluminum shall be determined in accordance with the most current version of the AASHTO LRFD Bridge Design Specifications - Section 7, supplemented by the Aluminum Association, Specifications and Guidelines for Aluminum Structures, and by Aluminum Structures, A Guide to Their Specification and Design where applicable. Resistance stresses shall be appropriately reduced due to welding and/or fatigue where applicable.

4.2.2.2. All allowable or resistance stresses for pressure treated pine shall be determined in accordance with NDS, Design values for wood construction.

4.2.2.3. All allowable or resistance stresses for other materials shall be in accordance with the most relevant standard, manufacturers specifications, or sound engineering judgement.

4.2.2. Deflection

The vertical deflection of the main truss due to unfactored DC, DW, LL, and PL loads in the Service I load combination shall not exceed L/360, where L is the length of the unsupported span.

The horizontal deflection of the floor system due to unfactored, horizontal, WS and WA loads shall not exceed L/360, where L is the length of the unsupported span.

4.2.3. Buckling & Frame Stability

For half-through trusses, the bridge shall be analyzed per 4.3.1. and Strength I as a lateral U-frame as defined in AASHTO LRFD Guide Specification for Design of Pedestrian Bridges, Section 7 - Stability to carry additional lateral forces induced by secondary or buckling bending forces. For more complex or other structure types, buckling analysis must be conducted using Finite Element Analysis with and a maximum allowable buckling load factor of 4 for any combination of applied loads, to ensure adequate overall stability and stiffness.

4.2.4. Vibration

The 1st mode fundamental frequency of the unloaded pedestrian bridge shall be no less than 3 Hz to avoid the first harmonic.

4.3. Analysis

Full structural analyses for the primary bridge structure shall be completed using a 3-D finite element analysis. All member end conditions are to be considered fixed. Other analysis methods may be used for secondary members. All analysis and results necessary to determine the structural adequacy per section 4.2 of the bridge shall be reported. The following analyses are required:

4.3.1. Load Applications

4.3.1.1. Resistance & Allowable Stresses

Analysis shall be completed to determine that all bridge members, critical connections, and bridge configurations are sufficiently sized to adequately resist the following loads from these combinations per AASHTO LRFD and in accordance with section 4 of this specification:

· Strength I – DC, DW, Plu
· Strength I – DC, DW, LL
· Strength I – DC, DW, PLr
· Strength III – DC, DW, WSp, Wso
· Service I – DC, DW, PL, WSp, Wso
· Fatigue I – WSn

4.3.1.2. Deflection

Analysis shall be completed to determine that bridge stiffness is sufficient to limit deflections to the maximum allowable per section 4.2.2.

· Service I (Vert. Def.) – DC, DW, PLu
· Service I (Vert. Def.) – DC, DW, LL
· Unfactored (Horiz. Def.) – WSp

4.3.1.3. Frequency

Frequency analysis shall be completed to determine that the bridge frame is sufficient to avoid resonance due to frequencies likely encountered under normal use for the following load combinations and in accordance with section 4.2 of this
· Unfactored – DC, DW

Load Combinations and Load Factors:

Limit State:	DC + DW	PL_u/LL/PL_r	WS_h/WS_f	Ws_o	WA	EQ	IC
Strength I	1.25	1.75	---	---		---	---
Strength III	1.25	---	1.40	1.40		---	---
Extreme Event I	1.25	0.50	---	---		1.00	---
Extreme Event II	1.25	0.50	---	---	1.00	---	1.00
Service I	1.00	1.00	0.30	0.30	1.00	---	---
Fatigue I	---	---	1.00	---	---	---	---
Unfactored	1.00	1.00	1.00	1.00	1.00	1.00	1.00

DC	Structural Component Load
DW	Wearing Surface & Utility Load
PL_u	Pedestrian Live Load - Uniform
PL_r	Pedestrian Live Load - Rail
LL	Vehicular Live Load
WS_h	Wind Load - Peak Horizontal
WS_f	Wind Load - Normal Fatigue
Ws_o	Wind Load - Overturning
WA	Flood Load
EQ	Earthquake Load
IC	Snow Load

5. MATERIALS

5.1. Structural Members

All aluminum primary structural members are to be 6061-T6 alloy for its high strength and corrosion resistance. Secondary aluminum members are to be 6000 series aluminum for corrosion resistance.

5.2. Deck

Manufacturer to supply aluminum alloy 6061-T6 stay-in-place formwork designed for a 3.5" concrete deck which will be sourced and poured on-site by contractor. Form work shall be designed to resist bending loads per section 4 of this document. Concrete used shall not exceed a density of 115 lb/ft3 and must have a minimum 28 day compressive strength of 3,000 psi. Contractor is responsible for the supply and installation of all concrete and concrete reinforcement as well as the design if not adequately addressed in these specifications or structural plans.

5.3. Bearing Pads

All bearing pads shall be 1” thick UHMW adequately dimensioned to provide support to the structure over the full travel resulting from expansion and contraction and supplied by bridge manufacturer.

5.4. Fasteners

Any and all fasteners required for assembly shall be stainless steel type 304 and supplied by bridge manufacturer. Insulating washers shall be provided where stainless steel and aluminum contact is anticipated to minimize the potential for galvanic action.

5.5. Rub Railing

No Additional Rub Railing is Required

5.5. Cladding

No additional cladding is required

5.5. Accent Lighting

No Accent Lighting is Required

6. FABRICATION & ASSEMBLY

6.1. Welding

All aluminum members shall be welded using 5356 aluminum filler wire in accordance with AWS D1.2

6.2. Expansion Slots

Slots shall be cut into bridge bearing area to allow for proper expansion and contraction of the bridge.

6.3. Delivered Sections

Bridge shall be shipped in pieces if required to ensure that no individual unit exceeds:
Maximum Weight of 8400 lbs
Maximum length of 70 ft

6.4. Mid-Span Splices

When required to accommodate contractor requirements or those of this specification, mid span splices shall be incorporated and be adequately designed to meet all criteria specified in section 4 of this document. Mid-span splices shall be designed and fabricated in accordance with the Aluminum Association, Specifications and Guidelines for Aluminum Structures,

7. SUBMITTALS

7.1. Fabrication drawings

Fabrication drawings and calculations shall be prepared and submitted for review after receipt of the order. Submittal drawings shall be unique drawings to this project, prepared to illustrate the specific portion of the bridge(s) being fabricated. All relative design information such as member size, material specification, dimensions, and required critical welds shall be clearly shown on the drawings. Drawings shall have cross referenced details and sheet numbers. All drawings shall be

The following minimum criteria must be included for approval:

· All Relevant Bridge Dimensions
· Bridge Cross sections
· Sufficient Detailing
· Member Cross sections
· General Notes indicating material specifications
· Weld Details
· Detail of Bolted Splices (if applicable)
· Signature and Seal of PE licensed in accordance with this specification
· Camber Details

7.2. Calculations & Results

Structural analysis results and calculations shall be prepared and submitted for review after receipt of the order. All analysis and results necessary to determine the structural adequacy of the bridge shall be shown. A stamped electronic soft copy shall

The following minimum criteria must be included for approval:

· Bridge Reactions for all unfactored loads
· Expansion and Contraction Requirements and/or induced loads
· Critical weld analysis results
· Bolted Splice Calculations (if applicable)
· Detailed Description of Applied Loads and Conditions for all load combinations
· Member maximum allowables for all load and design conditions
· FEA boundary conditions
· FEA Data Input
· FEA results and supplementary calculations for all Resistance & Deflection Analyses
· FEA results for frame stability analysis (if required)
· FEA results for frequency analysis