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Purpose and Scope These specifications are for a fully engineered clear span bridge of welded steel construction and shall be regarded as minimum standards for design and construction.

Qualified Suppliers

Each bidder is required to identify the intended bridge supplier listed below as part of the bid submittal. Pre-approved Manufacturer:

Bridge Brothers Inc
Atlanta, GA
Phone: 866.258.3401
Email: sales@bridgebrothersinc.com

Suppliers other than those listed above may be used provided the engineer or owner's agent evaluates the proposed supplier and approves the supplier ten (10) days prior to bid. The contractor must provide the following documentation, for any proposed supplier who is not listed above for approval:

* Product Literature
* All documentation to insure the proposed substitution will be in compliance with these specifications. This shall include:
  - Project specific design calculations
  - Project specific shop drawings
  - Splicing and erection procedures
  - Warranty information
  - Inspection and Maintenance procedures

Part 1 - Materials

1.1) Unpainted Weathering Steel Bridges which are not to be painted shall be fabricated from high strength, low alloy, and atmospheric corrosion resistant ASTM A847 cold-formed welded square and rectangular tubing and/or ASTM A588, ASTM A242, or ASTM A606 plate and structural steel shapes. Steel shall have a minimum yield strength of 50ksi. The minimum corrosion index of atmospheric corrosion resistant steel, as determined in accordance with ASTM G101, shall be 6.0.

1.2) Painted Steel Bridges which are to be painted shall be fabricated from ASTM A36 or A572 and tubular sections from ASTM A500 GR B.

1.3) Galvanized Steel Bridges which are to be galvanized shall be fabricated from ASTM A36 or A572 and tubular sections from ASTM A500 GR B.

1.4) Bolts Field splices shall be fully bolted with ASTM A325 high strength bolts in accordance with the AASHTO Specifications for Structural Joints. Type 3 hardware shall be used for weathering steel bridge. Galvanized hardware shall be used for painted or galvanized finishes.

1.5) Deck Decking shall meet one of the following criteria:

- **Pressure Treated Pine** Decking shall be Southern Pine No. 1 Structural (1200# extreme fiber bending) Stress Grade. Wood decking shall have a minimum CCA (Copper Chromium Arsenate) content equal to .40 pounds per cubic foot. Equivalent pressure treating methods are acceptable. All wood shall comply with American Softwood Lumber Standard PS 20-70. Each piece of lumber shall be identified by the grade and treatment mark of recognized organization or independent agency certified by the American Lumber Standards Committee, Washington, DC to grade the species. All lumber specified for treatment shall be treated to the requirements of American Wood Preservers Bureau AWPB LP-22.

- **Tropical Hardwood** Hardwood decking shall be IPE hardwood decking meeting or exceeding mechanical properties as defined by US Forest Products Laboratories testing methods. All decking material is to be produced from an IBAMA (Brazilian Institute for the Environment and the Renewal of Natural Resources) registered mill and produced from legally harvested logs as defined under Brazilian Forest Code Law 4771 as regulated by IBAMA and the ITTO (International Timber Trade Organization).

- **ADA Floor Grating** The bridge shall be supplied with a steel bar grating floor meeting ADA requirements with a maximum opening of ½". The grating shall be attached to the bridge in accordance with the grating manufacturer's requirements. Grating main bars shall span transverse to the primary direction of roadway travel.

- **Concrete** The bridge shall be furnished with a stay-in place galvanized steel form deck suitable for pouring a reinforced concrete slab. The form deck shall be designed to carry the dead load of the wet concrete, weight of form

decking, plus a construction load of 20 psf or a 150 pound concentrated load on a 1'-0" wide section of deck. When edge supports are used, deflection is limited to 1/180 of the span or." whichever is less. Without edge supports, deflection shall be limited to 1/180 of the span or 3/8". Whichever is less.

The form deck shall be either smooth or composite. Composite decking shall not be used as reinforcing when designing for concentrated loads (wheel loads). The decking shall be galvanized in accordance with ASTM A525 (G60) Concrete deck design shall be performed by the Bridge manufacturer.

Concrete decks shall be designed for concentrated load as specified in Section 4.1.3. The wheel loads used for deck design shall be distributed per the Structural Engineering Handbook by Gaylord and Gaylord. The load distribution width is equal to the tire width plus 0.6 times the slab span but in no case will it be greater than the smallest of the following values:

- ½ the deck width
- 75% of the wheel track spacing, or
- 4' + 0.06S, per AASHTO, where S = slab span in feet

Part 2 - Applicable Codes and Standards

2.1) Governing Codes and Standards Bridges shall be designed in accordance with the AASHTO Guide Specification for the Design of Pedestrian Bridges, 2009 edition, where applicable and unless otherwise stated in the document.

2.2) Reference Codes and Standards

- AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges, 2009
- AASHTO LRFD Bridge Design Specifications, latest edition
- Galambos – Guide to Stability Design Criteria for Metal Structures, 1998
- AWS D1.1 Structural Welding Code – Steel, latest edition
- AASHTO M 133 Standard Specification for Preservatives and Pressure Treatment Processes for Timber, latest edition
- National Design Specification for Wood Construction, ANSI NDS, latest edition
- American Wood Preservers Association Standards, latest edition

Part 3 - General Design Features

3.1) Span The bridge span shall be _____. The span shall be a straight line dimension measured from each end of the bridge structure.

3.2) Width The bridge width shall be _____. The width shall be the clear width to structural members or accoutrements to the structure as measured at deck level.

3.3) Truss Style The bridge shall be designed as a half-through Pratt truss with one (1) diagonal per panel and square ended vertical members. All end vertical members, unless specified otherwise, shall be plumb. Interior vertical members shall be perpendicular to chord faces.

3.3.1) Bridges may be designed utilized an H-Section configuration where the floor beams are placed up inside the trusses.

3.3.2) The distance from the top of the deck to the top and bottom truss members shall be determined by the bridge fabricator based upon structural and/or shipping requirements. When the bridge is in the floodplain, the overall height of the truss and distance from the deck to the bottom chord shall be minimized as much as possible.

3.3.3) The top of the top chord shall not be less than fifty-four inches (54”) above the deck (measured from the high point of the riding surfaces).

3.4) Maximum Weight The bridge shall be designed to such that the maximum shipped weight does not exceed _____ lbs to ensure the most cost effective support structure and installation.

3.5) Member Components All members of the vertical trusses (top and bottom chords, verticals, and diagonals) shall be fabricated from square and/or rectangular structural steel tubing. Other structural members and bracing shall be fabricated from structural steel shapes or square and rectangular structural steel tubing.

3.6) Deck Decking shall be _____, in accordance with section 1.3 of this document.

3.7) Attachments

3.7.1) Safety Rails Horizontal safety rails shall be placed on the structure up to a minimum height of fifty-four inches (54") above the deck surfaces. Safety rails shall be placed so as to prevent a four inch (4") sphere from passing through the truss. Safety rails shall be welded to the outside of the structure. Safety rails shall have their ends sealed and ground smooth so as to produce no sharp edges.

3.7.2) Toe plate The bridge shall be supplied with a toe plate mounted to the inside face of both trusses. The toe plate shall be welded to the truss members at a height adequate to provide no more than a two inch (2") gap between the bottom of the plate and the top of the deck or the top of the bottom chord, whichever is higher.

3.7.3) Rubrails The bridge shall be supplied with nominal two by six (2x6) pressure treated lumber. Rubrails shall be attached flush to the inside face of the bridge truss verticals and fastened at each support location. The top of the rubrail shall be two feet 10 inches (2'-10") above the top of the deck (measured at the outside edge of the deck).

3.8) Camber The bridge shall have a vertical camber dimension at midspan equal to one hundred percent (100%) of the full dead load deflection.

3.9) Elevation Difference The bridge abutments shall be constructed at the same elevation on both ends of the bridge.

Part 4 - Engineering Structural design of the bridge shall be performed by or under the direct supervision of a professional engineer licensed within the project state, and in accordance with recognized engineering practices and principles.

4.1) Design Loads In considering design and fabrication issues, this structure shall be assumed to be statically loaded. No dynamic analysis shall be required nor shall fabrication issues typically considered for dynamically loaded structures be considered for this bridge.

4.1.1) Dead Loads The bridge structure shall be designed considering its own dead load (superstructure and original decking) only. No additional dead loading shall be considered.

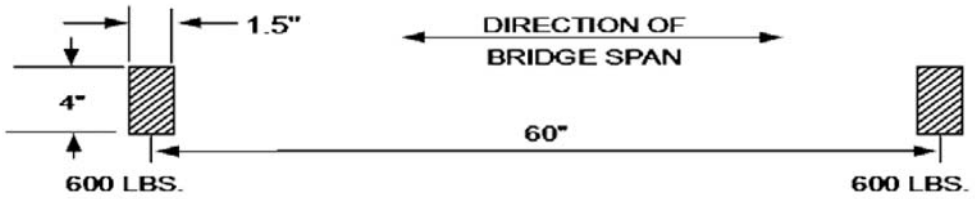
4.1.2) Pedestrian Live Load

i. Main supporting members, including girders, trusses and arches shall be designed for a pedestrian live load of ninety pounds (90lbs) per square foot of bridge walkway area. The pedestrian live load shall be applied to those areas of the walkway so as to produce maximum stress in the member being designed. Pedestrian live loads shall NOT be reduced.

ii. Secondary members such as bridge decks and supporting floor systems, including secondary stringers, floor beams, and their connections to main supporting members shall be designed for a live load of ninety pounds (90lbs) per square foot, with no reduction allowed.

4.1.3) Vehicle Load The bridge superstructure, floor system, and decking shall be designed for the following point load conditions:

i. An occasional twelve hundred pound (1,200 lb) two wheeled vehicle with a wheelbase and tire print area as shown in the following diagram:



ii. An occasional six thousand pound (6,000 lb) four wheeled vehicle where 80% of the load is considered to act on the rear axle and 20% on the front. All deck members and stringers shall be designed for a concentrated load of 30% of the vehicle load.

All of the concentrated or wheel loads shall be placed so as to produce the maximum stress in each member being analyzed. Critical stresses shall be calculated assuming there is only one (1) vehicle on the bridge at any given time. Assumptions that vehicles only travel down the center of the bridge or that the vehicle load is a uniform line load shall not be allowed.

A vehicle impact allowance shall not be required.

4.1.4) Wind Load

i. **Horizontal Forces** The bridge shall be designed for a wind load as specified by AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges, latest edition. The wind load shall be applied horizontally at right angles to the longitudinal axis of the structure.

The wind load shall be considered both in the design of the lateral load bracing system and in the design of the truss vertical members, floor beams, and their connections.

ii. **Overturning Forces** The effect of forces tending to overturn structures 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 twenty pounds (20lbs) per square foot of deck.

4.1.5) Top Chord Railing Loads The top chord, truss verticals, and floor beams shall be designed for lateral wind loads, per Engineering – Horizontal Forces, herein and for any loads required to provide top chord stability as outlined in Engineering – Top Chord Stability herein. In no case shall the load be less than fifty pounds (50lbs) per lineal foot or a two hundred pound (200lb) point load, whichever produces greater stresses, applied in any direction at any point along the top chord, or at the top of the safety system (42" or 54" above the deck level) if higher than the top chord.

4.1.6) Safety Rails The safety rail system shall be designed for all infill loading of two hundred pounds (200 lbs) applied horizontally at right angles, to a one (1) square foot area at any point in the system.

4.2) Design Limitations

4.2.1) Deflection

i. **Vertical Deflection** The vertical deflection of the main trusses due to service pedestrian Live Load shall not exceed one three-sixtieth (1/360) of the span.

The vertical deflection of cantilever spans of the structure due to service pedestrian Live Load shall not exceed one three-sixtieth (1/360) of the cantilever arm length.

The deflection of the floor beams due to service pedestrian Live Load shall not exceed one three-sixtieth (1/360) of its span.

The deflection of the deck and stringers due to service pedestrian Live Load or Vehicle Load shall not exceed one thousandth (1/1000) of their respective spans.

The service pedestrian Live Load shall NOT be reduced for deflection checks.

ii. **Horizontal Deflection** The horizontal deflection of the structure due to lateral wind loads shall not exceed one three-sixtieth (1/360) of the span.

4.2.2) Vibration The fundamental frequency of the unloaded pedestrian bridge shall be no less than 3.0 Hz to avoid the first harmonic.

4.2.3) Minimum Thickness of Metal The minimum thickness of all structural steel members shall be three-sixteenths of an inch (3/16") nominal and be in accordance with the AISC Manual of Steel Constructions "Standard Mill Practice Guidelines". For ASTM A500 and ASTM A847 tubing, the section properties used for design shall be per the Steel Tube Institute of North America, Hollow Structural Sections, "Dimensions and Section Properties".

4.3) Analysis

4.3.1) Load Combinations The loads listed herein shall be considered to act in the following combinations, whichever produce the most unfavorable effects on the bridge superstructure or structural member concerned. [DL = Dead Load, LL = Live Load, WL = Wind Load, VL = Vehicle Load]

- Strength I
  - 1.25*DL+1.75*LL
  - 1.25*DL+1.75*VL
- Strength III
  - 1.25*DL+1.40*WL+1.40*OW
- Service I
  - DL+LL+0.3*WL+0.3*OW
- Fatigue I
  - Fatigue WL Only

The foundation engineer will determine any additional loads (i.e. earth pressure, stream force on abutments, wind loads other than those applied perpendicular to the long axis of the bridge, etc.) and load combinations required for design of the abutments.

4.3.2) 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

4.3.3) Top Chord Stability The top chord of a half-through truss shall be considered as a column with elastic lateral supports at the panel points

4.3.4) Welded Tubular Connections All welded tubular connections shall be checked, when within applicable limits, for the limiting failure modes outlined in the ANSI/AWS D1.1 Structural Welding Code.

When outside the "validity range" defined in these design guidelines, the following limit states or failure modes shall be checked:

- Chord Wall Plastification
- Shear Yielding (Punching)
- Local Yielding of Chord Sidewalls
- Local Crippling of Chord Sidewalls
- Local Yielding of Branch Due to Uneven Load Distribution

All tubular joints shall be plain unstiffened joints and fabricated without the use of reinforcing plates, except as follows:

Floor beams hung beneath the lower chord of the structure may be constructed with or without stiffener (or gusset) plates, as required by design.

Floor beams which frame directly into the truss verticals (H-Section bridges) may be designed with or without end stiffening plates as required by design.

Where chords, end floor beams and in high profiles the top end struts weld to the end verticals, the end verticals (or connections) may require stiffening to transfer the forces from these members into the end vertical.

Truss vertical to chord connections.

4.3.5) Bolted Splices Bolted splice design shall be in accordance with Section J3 of the "Manual of Steel Construction: Allowable Stress Design" and in accordance with section 1.2 of this document. Splices shall be designed for the actual load in the member but in no case for less than 50% of the effective strength of the member. Bolted field splices shall be located on the bridge so as to produce a structure which can be economically shipped and erected. Splices across the width of the bridge (in floor beams and wind braces) may be used, when necessary, to keep the overall structure width within reasonable limits for shipping.

Part 5 - Welding

5.1) Welding Welding and weld procedure qualification tests shall conform to the provisions of ANSI/AWS D1.1 "Structural Welding Code", 1996 Edition. Filler metal shall comply with the applicable AWS Filler Metal Specification (i.e. AWS A 5.28 for the GMAW Process). For exposed, bare, unpainted applications of corrosion resistant steels (i.e. ASTM A588 and A847), the filler metal shall comply with AWS D1.1, Section 3.7.3.

5.2) Welders Each welder shall be a properly accredited operator, and shall:

5.2.1) submit certification of satisfactorily passing AWS standard qualification tests for all positions with unlimited thickness of base metal,

5.2.2) have a minimum of six (6) months experience in welding tubular structures and

5.2.3) have demonstrated the ability to make uniform sound welds of the type required.

Part 6 - Submittals

6.1) Submittal Drawings Schematic drawings and diagrams shall be submitted to the customer for their review after receipt of order. Submittal drawings shall be unique drawings, prepared to illustrate the specific portion of the bridge(s) being fabricated. All relative design information such as member size, material specification,

bridge reactions, dimensions, general notes, and required critical welds shall be clearly shown on the drawings. Drawings shall have cross referenced details and sheet numbers. All drawings shall be signed and sealed by a Professional Engineer registered in the state of _____. A stamped electronic soft copy shall be provided. Hard copies may be provided at additional costs.

At minimum the following 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

6.2) Structural Calculations Structural Calculations for the bridge superstructure shall be submitted by the bridge manufacturer. All calculations shall be signed and sealed by a Professional Engineer licensed within the project state. The calculations shall include all design information necessary to determine the structural adequacy of the bridge. A stamped electronic soft copy shall be provided. Hard copies may be provided at additional costs.

At minimum the following criteria must be included for approval:

- Applied loads and conditions for all load combinations
- All resistance checks for axial, bending, and shear in each critical member type (i.e. top chord, bottom chord, vertical, floor beam, etc.)
- Truss and Floor Deflection Checks
- FEA Boundary Conditions
- FEA Data Input
- FEA Results and Supplementary Calculations for all Stress & Deflection Analyses
- FEA Results for Frequency Analysis
- U-Frame Stiffness Checks
- Bolted Splice Connections (if applicable)
- Bearing Plate Analysis
- Critical weld connection check for each truss member type (i.e. vertical, diagonal, floor beam, etc.)

- Welded Tubular Connections (see section 4.3.4 of this document for design check requirements)
- Bridge Reactions
- Expansion and Contraction Requirements and/or Induced Loads

Part 7 - Fabrication

7.1) General Requirements

7.1.1) Drain Holes When the collection of water inside a structural tube is a possibility, either during construction or during service, the tube shall be provided with a drain hole at its lowest point to let water out.

7.1.2) Bolt Holes Cut, drill, or punch standard bolt holes perpendicular to metal surfaces. Do not thermally cut bolt holes or enlarge holes by burning.

7.1.3) Bearing Holes/Slots Cut, drill, mechanically thermal cut, or punch bearing holes/slots perpendicular to steel surfaces.

7.2) Quality Certification

7.2.1) Bridge(s) shall be fabricated by a fabricator who is currently certified by the American Institute of Steel Construction to have the personnel, organization, experience, capability, and commitment to produce fabricated structural steel for the category “Simple Steel Bridges” as set forth in the AISC Certification Program with Fracture Critical Endorsement. Quality control shall be in accordance with procedures outlined for AISC certification.

Part 8 - Finishing

8.1) Blast Cleaning

8.1.1) All Blast Cleaning shall be done in a dedicated OSHA approved indoor facility owned and operated by the bridge fabricator. Blast operations shall use Best Management Practices and exercise environmentally friendly blast media recovery systems.

8.1.2) To aid in providing a uniformly "weathered" appearance, all exposed surfaces of a weathering steel bridge shall be blast cleaned in accordance with Steel Structures Painting Council Surface Preparation Specifications No. 7 Brush-Off Blast Cleaning, SSPC-SP7 latest edition.

8.1.3) Exposed surfaces of steel shall be defined as those surfaces seen from the deck and from outside of the structures. Stringers, floor beams, lower brace diagonals and the inside face of the truss below deck and bottom face of the bottom chord shall not be blasted.

8.1.4) All finishing shall be completed in manufacturer's shop prior to shipping.

8.2) Painting All exterior surfaces of steel shall be painted utilizing a 3-coat, zinc rich system. All exterior surfaces of steel shall be abrasively blast cleaned in accordance with SSPC-SP6 prior to application of the primer.

8.1.1) Zinc Rich Primer
8.1.2) Epoxy Midcoat
8.1.3) Polyurethane Topcoat

Bridges shall be provided with paint for touch up after erection.

8.3) Galvanizing Proper drainage and venting shall be provided for the galvanization process. All structural steel shall be zinc coat (hot-dip) galvanized per the specifications listed in ASTM A123. Hardware shall be zinc coat (hot-dip) galvanized per the specifications listed in ASTM A153.

Part 9 - Bearing Devices

9.1) Bridge bearings shall consist of a steel setting or slide plate placed on the abutment or grout pad. The bridge bearing plate which is welded to the bridge structure shall bear on this setting plate. One end of the bridge will be fixed by fully tightening the nuts on the anchor bolts at that end. The opposite end will have finger tight only nuts to allow movement under thermal expansion or contraction.

9.2) Bridges in excess of 100 feet in length or bridges with dead load reactions of 15,000 pounds or more (at each bearing location) shall have Teflon on Teflon or stainless steel on Teflon slide bearings placed between the bridge bearing plate and the setting plate. The top slide plate shall be large enough to cover the lower Teflon slide surface at both temperature extremes.

Part 10 - Foundations

10.1) The owner shall procure all necessary information about the site and soil conditions. Soil tests shall be procured by the owner. Unless specified otherwise, the bridge manufacturer shall determine the number, diameter, minimum grade and finish of all anchor bolts. The anchor bolts shall be designed to resist all horizontal and uplift forces to be transferred by the superstructure to the supporting foundations. Engineering design of the bridge supporting foundations (abutment, pier, bracket and/or footings), including design of anchor bolt embedments, shall be the responsibility of the foundation engineer. The contractor shall provide all materials for (including anchor bolts) and construction of the bridge supporting foundations. The contractor shall install the anchor bolts in accordance with the manufacturer's anchor bolt spacing dimensions.

10.2) The bridge bearings shall sit in a recessed pocket on the concrete abutment. Minimum 28-day strength for the abutment concrete shall be 3,000 PSI. The bearing seat shall be a minimum of 16" wide. The step height (from bottom of bearing to top-of-deck) shall be determined by the bridge manufacturer.

10.3) Information as to bridge support reactions and anchor bolt locations will be furnished by the bridge manufacturer after receipt of order and after the bridge design is complete.

Part 11 - Delivery and Erection

11.1) Bridges will be delivered by truck to a location nearest to the site accessible by roads. Hauling permits and freight charges are the responsibility of the manufacturer.

11.2) The manufacturer will notify the customer in advance of the expected arrival. Information regarding delays after the trucks depart the plant such as weather, delays in permits, re-routing by public agencies or other circumstances will be passed on to the customer as soon as possible but the expense of such unavoidable delays will not be accepted by the manufacturer.

11.3) The manufacturer will advise the customer of the actual lifting weights, attachment points and all necessary information to install the bridge. Unloading, splicing, bolting, and proper lifting equipment is the responsibility of others.

11.4) The bridge manufacturer shall provide written inspection and maintenance procedures to be followed by the bridge owner.