LONGSPAN ALUMINUM STADIA SYSTEM —

SECTION 13 34 16

PART 1 — GENERAL

1.1 General

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 — Specification sections, apply to work of this section.

1.2 Scope

A. These Specifications cover the requirements for the design, fabrication, delivery and installation of an engineered metal seating bowl system, including the following:

1. Longspan Aluminum tread and riser seating units
2. Wall panels and metal closure panels
3. Stair units and infill steps
4. Vomitories
5. Other members and materials necessary to complete the seating bowl and other related items such as anchorage and bearing pads
6. Railing system attached to stadia system

1.3 Related Sections and Documents

A. Structural Steel — Division 5

B. Railings and Seating Bowl Railings — Division 5

C. Stadium Seating — Division 12

1.4 Codes and Standards

A. Perform all work in accordance with the latest editions and revisions of the following standards, which hereby become part of this section.

1. International Building Code, Edition 2018 **[2015, 2012]**
2. Local Building Code Amendments **[LIST STATE]**
3. AWS D1.1 — Structural Welding Code — Steel
4. AWS D1.2 — Structural Welding Code — Aluminum
5. AISC 360 — Specification for Structural Steel Buildings
6. Aluminum Design Manual (ADM), 2015
7. ACI 318 — Building Code Requirements for Structural Concrete
8. The Institute of Structural Engineers (IStructE), Dynamic Performance Requirements for Permanent Grandstands Subject to Crowd Action, 2008.

1.5 Longspan Aluminum Stadia System Contractor Qualifications

A. Manufacturer/Fabricator Qualifications:

1. Experience: Manufacturer/fabricator with not less than 10 years experience with successful production of products and systems to the specified scope of Work, with a record of successful in-service performance and completion of similar projects for a period of not less than 10 years, and with sufficient production capability, facilities, and personnel to produce required Work.
2. Approved design-build manufacturer:
   a) Dant Clayton Corporation — Louisville, KY, Longspan Aluminum Stadia System.
3. Supervision: Provide an on-site supervisor, who is experienced in fabricating/installing systems of the type and scope of Work specified, at the Project during times the specified Work is in progress.

B. Erector Qualifications:

1. Experience: Erector with not less than 5 years experience in performing specified scope of Work, with a record of successful in-service performance and completion of projects for a period of not less than 2 years, and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Provide a full-time on-site supervisor, who is experienced in installing systems of the type and scope specified, at the Project during times the specified Work is in progress.
3. Manufacturer/Fabricator Acceptance: Erector shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.

C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installations similar to this Project, and that has a record of successful in-service performance.

D. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installations similar to this Project, and that has a record of successful in-service performance.

1. Preparation of structural analysis data including engineering calculations, shop drawings, and other submittals signed and sealed by the qualified professional engineer responsible for their preparation.
2. Comprehensive engineering analysis indicating governing unit types, connections, unit thicknesses and including any special details or conditions.
3. Location, type, magnitude, and direction of loads imposed on the building structural frame from units.

1.6 Submittals

A. Product Data: Manufacturer/fabricator's technical literature for each product and system indicated.

1. Include manufacturer/fabricator's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Approval Drawings: Submit for review by the Architect/Engineer detailed approval drawings as follows:

1. Drawings

   a) Dimensioned seating unit plans, elevations, and sections drawn to scale and showing identification of each seating unit.

   b) Connection details showing size, type, and grade of all plates, bearings, inserts and anchors. Show proper welding symbols in accordance with AWS D1.1 and AWS D1.2.

   c) Description of all loose and installed hardware, plates, inserts, etc.

   d) Handling requirements.

   e) All dead, live and other applicable loads used in the design.

   f) Member elevations and sections showing all dimensions.

   g) Finishes.

   h) Joint covers.

   i) Size, type and location of all drain holes, sleeves and other openings.

   j) Size, type and location of all installed plates, inserts and other hardware.

2. Field Installed Seating Unit Attachment Drawings: Submit a drawing showing the method and proposed location for attaching all stadium seats to the seating units, as required.

3. Equipment Hung From Seating Units: No pipe, ducts or other equipment shall be hung from the seating units without written approval of the Delegated Design Engineer. Coordinate all attachment methods and fastener types with the Delegated Design Engineer to ensure they are suitable for the selected system.
4. All approval drawings submitted shall be sealed by a professional engineer who is licensed in the state where the project is located.

C. Delegated Design Engineering Calculations: Calculations submittal for products indicated to demonstrate conformance with specified design loads, element stiffness and performance requirements including structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation licensed in the state where the project is located.

1. Seating Unit and Bowl Design:
   a) Provide for review by the Architect/Engineer design calculations for dead load, live load, wind load, seismic load including deflections, and vibration control. Refer to “Performance Requirements” for explicit requirements.
   b) Calculations shall show design for connections at the member ends and to each adjoining member.
2. Railings and guardrail inserts and connections: Shall be designed to resist design load reactions for all railings and guardrails. See related specification sections for design loads. Where not shown, loads shall be per code.

D. Qualification Data: For firms and persons specified in “Quality Assurance” to demonstrate their capabilities, experience and qualifications. Submit for record lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

1. Manufacturer qualifications
2. Professional Engineer qualifications

E. Warranty: Sample of standard warranty.

F. **<REMOVE SECTION IN FULL IF NOT REQUIRED> Pre-Production Sample Units: Provide a finish sample unit as required to verify selections made demonstrate aesthetic effects and qualities of materials and execution. Use materials and installation methods indicated for the completed Work.**

1. Small samples: Submit two 24"x24" samples of each finish indicated for Architect's review and approval. Samples to indicate color, texture, and finish with a color range approved by the Architect.
2. Full size samples: After Architects review of small samples, produce two full-size samples of a seating bay unit for Architect's inspection at production plant prior to start of fabrication or installation work.
   a) One approved full-size unit shall be retained at the production plant for the fabricator as a standard to judge completed pieces prior to shipment. The full-size unit retained at the production plant may be the last panel incorporated into the project.
   b) One approved full-sized panel shall be identified and installed in the project for the purpose of judging the installed units.
3. Submit samples of anchors, dowels, and bearing pads and all other materials requested by the Architect.

G. <REMOVE SECTION IN FULL IF NOT REQUIRED> Mock-ups: Prior to installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
   a) Show typical components, attachments to structure, and requirements of installation including but not limited to:
      i. Aisle steps
      ii. Aisle handrails
      iii. Vomitory walls and closures
      iv. Accelerated stairs
      v. Nosings
      vi. Front guardrails as noted by architect for mock-up
2. Clean exposed faces of mock-up.
3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.

4. **Protect accepted approved mock-up from the elements with weatherresistant membrane.**
5. **Obtain Architect's approval of mock-ups before starting fabrication.**

1.7 Delivery, Storage and Handling

A. Delivery: Deliver units in such quantities and at such times to limit unloading units temporarily on ground and to assure continuity of installation. Support units during shipment on non-staining shock-absorbing material.

B. Storage: Store units with adequate dunnage.

1. Identification
   a) Provide permanent markings to identify part numbers, orientation in the structure complying with markings indicated on final shop drawings. Markings on each unit on shall be on a surface which will not show in finished structure.
   b) Provide additional marking as required by local building codes or ordinances.

C. Handling: Handle and transport units in a position consistent with their shape and design to avoid excessive stresses which would cause damage. Lift and support units only at designated points shown on Shop Drawings.

1.8 Pre-Fabrication Conference

A. Pre-Fabrication Conference: Before fabrication begins, conduct conference at production plant to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:
   a) Owner or Owner's Representative
   b) Architect.
   c) Contractor, including superintendent.
   d) Manufacturer/fabricator's qualified technical representative and Quality Control Manager.
2. Conference Agenda: Fabricator shall demonstrate understanding of the Work required by presenting the pre-production full size sample units to the attendees. Discussions should include, but not be limited to, the following:

a) Review and acceptance of unit color, texture, and finishes.

b) Discussion of unit and component fabrication process.

c) Discussion of Fabricator's proposed repair procedures including, but not limited to, repair methods, scope, and applicability.

d) Review Work requirements (Drawings, Specifications, and other Contract Documents).

e) Review required submittals, both completed and yet to be completed.

f) Review required inspection, testing, certifying, and material usage accounting procedures.

g) Resolve deviations or differences between Contract Documents and the manufacturer/fabricator's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.9 Pre-Installation Conference

A. Pre-Installation Conference: Before Installation begins, conduct conference to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

a) Owner or Owner's Representative

b) Architect.

c) Contractor

d) Erector

e) Manufacturer/fabricator's qualified technical representative

f) Erectors of other construction interfaced with Work

g) Owner's testing agency

2. Conference Agenda: Erector shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a) Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.

b) Review Work requirements (Drawings, Specifications, and other Contract Documents).

c) Review required submittals, both completed and yet to be completed.

d) Review and finalize construction schedule related to Work and verify availability of materials, Erector's personnel, equipment, and facilities needed to make progress and avoid delays.

e) Review required inspection, testing, certifying, and material usage accounting procedures.

f) Review environmental conditions and procedures for coping with unfavorable conditions.

g) Resolve deviations or differences between Contract Documents and the manufacturer/fabricator's specifications.

3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.10 Quality Control by Contractor

A. For engineered seating bowl members furnished under this Section, quality control inspection and testing shall occur during the manufacture of the components, and the components are subject to the approval of the engineered seating bowl supplier's Quality Control Manager.

B. Plant Quality Control: Provide copies of plant quality control program describing procedures for the following:

1. Overall quality control measures
2. Verifying sizes and critical dimensions of members.
3. Verifying position of plates, inserts, and other embedded items
4. Final inspecting of products prior to shipment.

1.11 Warranty

A. Special Warranty: Manufacturer's standard 1-year warranty is required in which manufacturer agrees to repair finish or replace components that fail in materials or workmanship within specified warranty period.

PART 2 — PRODUCTS

2.1 Longspan Aluminum Stadia System Components

A. Single Source Responsibility: Furnish each type of product from a single manufacturer/fabricator. Provide secondary materials only as recommended by manufacturer/fabricator of primary materials.

B. Longspan Aluminum Stadia Treads and Risers:

1. Stadia treads and risers shall consist of individual aluminum extrusions, connected via continuous welds into a tread panel system engineered to span between the supporting structure.
2. Each individual aluminum extrusion is to be a minimum of 3.5" at all horizontal tread panels and 2.5" at all vertical riser panels to allow for proper joint treatment and coordination with the supporting structure.
3. Extrusions shall be 6063-T6 aluminum alloy with minimum yield strength of 25 ksi.
4. **OPTION, REMOVE IF NOT REQUIRED [Tread cores shall have factory applied integrated sound deadening material made from recycled granular rubber.]**

C. Coordination of Contract Documents and Work:

1. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

D. Bearing:

1. Bear units where directed by contract documents in coordination with the Architect and Structural Engineer.
2. Provide bearing on rear 5"-6" of seating tread. Full length bearing support for longspan stadia unit is not required.
3. Coordinate steel bearing stool details with Div 5 steel fabricator (when required).
4. Separate longspan stadia unit and steel bearing stool with a UHMW plastic bearing pad.

E. Bearing:

1. Joints at member ends abutting walls: ¾"
2. Joint width between ends of adjacent seating units: ¾"
3. At Expansion Joints: Refer to the drawings.

F. Slope on Seating Tread: As indicated on Drawings **[0 OR 1 DEGREE PITCH FORWARD].**

G. Joint Alignment: Align the tread/riser joints with the adjoining units. Do not stagger the joints without explicit approval from the Architect.

H. Performance Requirements

1. General Performance: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated and without permanent deformation or failure of materials.
2. Design Loads: Engineer to withstand design loads including but not limited to gravity, wind, seismic, and erection design loads and shrinkage/thermal movements as established by authorities having jurisdiction, applicable local building codes, and as indicated.

a)	Superimposed Dead Load	10 psf
b)	Live Load	100 psf **[use blended 70 psf for full fixed seating]**
c)	Sway Load	24 plf per row parallel to row
d)	Sway Load	10 plf per row perpendicular to row
e)	Wind Load	Design per local building code
f)	Seismic Load	Design per local building code
g)	Guardrail Loads	Design per local code

3. Stadia Weight: Self-weight of stadia tread and riser system shall not exceed 12 psf to the gross horizontal projection of the stadia footprint for unfilled units and 20 psf to the gross horizontal projection of the stadia footprint for filled units. Prior to submitting shop drawings, notify Architect/Engineer if this will be exceeded.
4. Structural Deflections: Limit live load deflections of seating units and any other flexural members to L/360 of the span. Dead plus live load deflections shall be limited to L/240 of the span.
5. Vibration Control: Proportion seating units including providing stems as required to provide a minimum natural frequency of **[4.5 Hz, 7.5 Hz]** for stiffness and rhythmic activity (sporting event) vibration control. The specified seating unit minimum natural frequency is required in order to

achieve desired minimum natural frequency of the seating bowl framing system, including raker girders. Natural frequency calculations shall be based on using I min on the inclined (principal) axis. Add stems as required to satisfy strength, deflection and vibration criteria. Coordinate any stems with architectural and structural drawings to avoid conflicts.

6. Thermal Movements: Engineer products and systems to accommodate thermal movements of supporting elements resulting from the maximum change (range) in ambient and surface temperatures without buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.
7. Dimensional Tolerances: Engineer and detail products, systems and connections back to primary structural elements to accommodate fabrication tolerances and dimensional tolerances of framing members and adjacent construction.
8. Miscellaneous Attachments: Design seating units and other seating bowl components for loads arising from miscellaneous attachments such as seats, handrails, signs, banners, guardrails, ribbon boards, hung mechanical, electrical or plumbing equipment or any other item shown in the construction documents.

2.2 Aisle Intermediate Steps

A. Aisle step units are to be provided at all intermediate aisle locations as shown on the architectural drawings and be made from 1¾" aluminum extrusions and plate material.

B. Aisle step units shall be mounted to the stadia system without complete penetration of the tread or riser surface.

C. Provide a finish and feel matching that of the stadia tread and riser system to which they are installed.

D. Provide stair nosings at steps and treads in accordance with the architectural drawings.

E. Shall be designed to resist loads imposed from any step mounted rails.

F. **<REMOVE IF NOT APPLICABLE>Shall be sprayed with Mascoat sound reduction material on the underside of the aluminum steps.**

2.3 Aisle Hand Rails

A. Aluminum aisle hand rails shall be provided in all areas required by building code and as indicated on the architectural drawings at all locations of new aluminum stadia treads and risers.

B. Aisle hand rails shall be $1^{15}/_{16}$" O.D. extruded aluminum pipe. Straight pipe shall be 6061-T6 aluminum alloy with minimum yield strength of 35 ksi. Bent pipe shall be 6061-T4 aluminum alloy with minimum yield strength of 21 ksi.

C. Aisle hand rails shall be two-line and feature internal fittings for both lines of rail. External fittings are not permitted.

D. Aisle hand rails shall be mounted to the aisle steps with connecting bracket or floor flange.

2.4 Connection Materials

A. Steel Plates: ASTM A36 or ASTM A572 Grade 50.

B. Steel Shapes: ASTM A36 or ASTM A992.

C. Anchor Bolts: ASTM F1554 Grade 36. Provide galvanized nuts and galvanized steel washers.

D. Threaded Rods: ASTM A36.

E. Welding Electrodes: Comply with AWS D1.1 and D1.2.

F. UHMW Bearing Pads.

2.5 Seating Anchors

A. Provide attachment methods in the stadia units to fasten both tread and riser mounted seat and bleacher systems to the supporting structure. Coordinate type, location and mounting position with the architectural drawings.

2.6 Electrical, Audio Visual, and Technology Block-Outs, Sleeves, and Openings

A. Refer to architectural details for placement and construction. Refer to electrical and A/V plans for quantity, type, and location.

B. All openings should be coordinated and fabricated in the units at the fabrication shop prior to arriving on site. Delegated Engineering Professional shall account for and make provisions for all openings when designing the units. Field cutting of openings is not allowed without approval from the Architect/Engineer and without approval, details and engineering justification from the Delegated Engineering Professional.

2.7 Joint Cover

A. Seating bowl unit joints shall be concealed with a joint cover specified by the manufacturer.

2.8 Stadia System Finishes

A. Aluminum:

1. Finish of Treads, Steps and Ramps:
   a) All stadia system risers and treads shall exhibit a powder coated slip and stain resistant surface finish that both enhances the slip resistance and prevents oxidation/staining.
   b) The surface finish shall be included on all exposed surfaces, front and back, top and bottom, on both the horizontal and vertical risers.
   c) Slip resistance: The surface treatment shall result in a minimum 0.80 coefficient of friction (COF), as recommended by the ADA Access Board for inclined surfaces, under both wet and dry conditions in all directions of travel, including parallel to any extruded raised “flutes” or “ribs”.
   d) Nosings: Provide stair and tread nosings as indicated in the architectural drawings.
   e) Color: As indicated in the architectural drawings
2. Exposed wall units, risers, non-walking surface panels and planks, etc:
   a) Powder coated finish
   b) Color: As indicated in the architectural drawings
3. Powder coat system provided shall meet or exceed the following test requirements:
   a) Direct Impact Resistance: ASTM D 2794-93, up to 140 in.-lbs
   b) Flexibility: ASTM D 522-93, Method B, 100% Pass
   c) Pencil Hardness: ASTM D 3363-93a, 2H
   d) Crosshatch Adhesion: ASTM D 3359-97, Method B, 5B, 100% Pass
   e) Salt Spray Resistance: ASTM B 117, plus 1,000 hours
   f) Humidity Resistance: ASTM D 2247, plus 1,000 hours

B. Structural Steel:

1. All structural steel brackets and fasteners shall be galvanized.

PART 3 — EXECUTION

3.1 Fabrication Tolerances

A. General: Fabricate units complying with manufacturing and testing procedures, quality control recommendations.

B. Fabrication Tolerances: Provide fabrication tolerances as follows:

1. Accumulation of tolerances is not acceptable
2. Length: ± 1/4".
3. Width: ± 1/4".
4. Length: ± 1/4".
5. Position of Bearing Plates, Cast-In Plates and inserts: ± 3/8".
6. Bearing Plates, Tipping and Flushness: ± 1/8".

C. Product Variations: In the event of minor differences between products and systems of available manufacturer/fabricators, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner.

D. Allowable Adjustments: Minor dimensional and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect.

3.2 Erection

A. General

1. Comply with manufacturer/fabricator's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors that would result in poor or potentially defective installation or would cause latent defects in Work.
2. General Contractor shall monitor all phases of erection to ensure the work is in conformance with the contract documents and approved shop drawings.
3. Erect members by means of suitable lifting devices at points provided by the manufacturer.
4. Properly align, plumb, and level units. Level out variations between adjacent members by shimming, loading, draw-down connections, or any other feasible method recommended by the manufacturer.

5. Bearing pads shall be located to provide full contact bearing of the stadia units.
6. Provide accurate placement and alignment of anchor bolts, plates or dowels in supporting structural elements.
7. Connections between units and supporting elements shall be completely concealed from view from the bowl side. No exposed bolts/bolt heads permitted.
8. Lifting devices, lifting scars and patches shall be completely concealed from view from the bowl side and from the concourse side where view by public is possible.

B. Erector Acceptance:

1. Examine supporting structure and conditions under which seating bowl is to be erected and provide written notification of conditions detrimental to proper and timely completion of work. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Erector.
2. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Acceptance of Building Structural Frame: Do not install units until supporting structural frame is complete, and cast-in-place concrete structural framing has attained minimum allowable design compressive strength.

C. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

D. Field Welding:

1. Perform welding in compliance with AWS D1.1 and D1.2.
2. Protect units from damage by field welding operations and provide noncombustible shields as required.

3. Remove all lifting accessories and touch-up paint all field welded connections as specified.
4. Repair damaged metal surfaces by cleaning and applying a coat of liquid galvanizing repair compound to galvanized surfaces.

E. Bearing Pads: Install specified bearing pads as units are being erected and maintain in correct position until units are placed.

F. Cleaning: After erection and completion of joint treatment, clean exposed surfaces of units to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to manufacturer/ fabricator's written recommendations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.
3. Remove all metal burrs, sharp edges or other cutting, unsafe conditions.
4. Touch up finishes as recommended by the manufacturer.

3.3 Erection Tolerances

A. Installation Tolerances:

1. Accumulation of tolerances is not acceptable
2. Plan Location: ± 1/4".
3. Tread Elevation at Member Ends: ± 1/4".
4. End Joint Width abutting walls: ± 3/4".
5. Joint Width Between Tread and Riser of Adjacent Units (above and below): ± 1/4".
6. Joint Width Between Adjacent Units: ± 3/4".
7. Differential Top Elevation Between Ends of Adjacent Seating Units: no greater than 3/16".

3.4 Acceptance

A. Field Inspection: Acceptance of erected seating bowl will be made by the Architect/Engineer for general conformance with the plans and specifications.

B. Defective Work: Portions of the seating bowl which do not conform to specified requirements, including strength, tolerances, and finishes, shall be repaired or replaced with ones that meet requirements of this section as directed by the Architect/Engineer. The Contractor shall also be responsible for the cost to any other work affected by or resulting from corrections to the seating bowl.