SECTION 02310 – PRECAST CONCRETE BOARDWALK SYSTEM

PART 1-GENERAL

* 1. SUMMARY
1. These specifications are for a precast concrete boardwalk and shall be regarded as minimum standards for this project. These specifications are based upon products designed and supplied by:

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This item shall also include the design, specification, and construction of a railing and foundation system that is attached to the proposed boardwalk system.

1.2 ALTERNATE REQUIREMENTS: Alternates are allowed provided that the following

minimum standards and these “Precast Concrete Boardwalk System” specifications are met.

1. “Minimum Standards” as outlined in section 1.3 below must be met.
2. A drawing of the precast boardwalk system (including tread layout, structural details designed for the design loads shown on the contract documents, foundation design and layout) must be submitted 2 weeks before the bid date and signed and sealed by a Professional Engineer.
3. Submittal must meet the requirements set forth in section 1.6a.

1.3 MINIMUM STANDARDS: The selected boardwalk shall have the following minimum characteristics:

1. Boardwalk system (beams, treads, and curbs if applicable) must be precast concrete. A material change, including cast-in-place concrete, is not considered an equal to the design shown on the bid documents.
2. Walking surface (treads) shall be made of precast concrete, and supported by precast concrete beams. Where applicable, edges of treads will receive precast concrete curbs.
3. Walking surface (finish) of top surface of treads shall have a formliner finish with one of PermaTrak’s standard textures (sandblast, broom or timber). Texture must be integral with the concrete and shall not be an applied post pour wearing surface.
4. Precast concrete treads shall be structural load bearing elements and shall interlock with one another via a “tongue and groove” connection.
5. All precast shall consist of integrally colored concrete in a color selected by the owner from one of PermaTrak’s “standard colors”.
6. DESIGN LOADS: Designed for the following live loads:
7. Pedestrian live load of 90 psf.
8. 5000 lb. Maintenance Vehicle with two axles spaced 96 inches apart and equally distributed.
9. H5 Design Truck – 10,000 lbs. total vehicular load (Applicable for boardwalk clearances exceeding 7 ft. but equal to or less than 10 ft.)
10. H10 Design Truck – 20,000 lbs. (Applicable for boardwalk clearance exceeding 10 ft.)
11. Treads shall maintain a “boardwalk appearance”, specifically meaning each tread shall have a width: length ratio ranging from a minimum of 3:1 to a maximum of 14:1. Width is defined as the tread dimension perpendicular to the normal direction of travel. Length is defined as the tread dimension measured in the direction of travel.
12. Tread width shall be as noted on the contract drawings. Alignment should follow the horizontal and vertical alignment shown on the contract plans.
13. Connectors for curbs (if applicable) to treads shall not be visible to boardwalk users while viewed from the top of the walkway.
14. All boardwalk connectors shall be non-corrosive, and hidden from view. Metallic connectors are not acceptable for this project.
15. Boardwalk supplier shall provide a field representative on site for a minimum of 1 day. Field representative shall be knowledgeable in the installation of precast concrete boardwalks.
	1. QUALITY ASSURANCE

A. The contractor performing the installation of the pile foundations shall have installed piles of size and length similar to those shown on the plans for a minimum of three (3) years prior to the bid date for this project. The contractor shall submit a list containing at least three (3) projects completed in the last three (3) years on which the contractor has installed piles of a size and length similar to those shown on the plans. The list of projects shall contain names and phone numbers of owner’s representatives who can verify the Contractor’s participation on those projects.

1. Manufacturer Qualifications: Not less than 10 years experience in the actual production of precast products as described below.
2. Components shall be factory fabricated and engineered by single entity.
3. Boardwalk supplier (Precaster) for the boardwalk shall have in-house color mixing facilities for color pigmentation.
4. Boardwalk supplier (Precaster) shall have either a minimum experience of 5 years or 50 boardwalk projects in design, production, and field consultation.
5. Boardwalk supplier (Precaster) must be certified by PCI or NPCA.
6. Precast components must be manufactured with the use of hot rolled steel skin in reinforced steel forms. Temporary single use forms are unacceptable.
7. Acceptability Criteria for Treads and Curbs (if applicable): The finished visible (in the final installed position) surface shall have no obvious imperfections other than minimal color or texture variations from the approved samples or evidence of repairs when viewed in good typical daylight illumination with the unaided naked eye at a 20 ft. viewing distance. Appearance of the surface shall not be evaluated when light is illuminating the surface from an extreme angle as it tends to accentuate the minor surface irregularities. The following is a list of finish defects that shall be properly repaired, if obvious when viewed at a 20 ft. distance. Patching (by a trained skilled concrete repair person) is an acceptable repair method.
8. Ragged or irregular surfaces.
9. Excessive air voids (commonly called bug holes) larger than ¼ in. evident on the top surface of the tread or curbs (if applicable).
10. Adjacent flat and return surfaces with greater texture and/or color differences than the approved samples or mockups.
11. Casting and/or aggregate segregation lines evident from different concrete placement lifts and consolidation.
12. Visible mold joints or irregular surfaces.
13. Rust stains on exposed surfaces.
14. Units with excessive variation in texture and/or color from the approved samples, within the unit or compared with adjacent units.
15. Blocking stains evident on exposed surfaces.
16. Areas of backup concrete bleeding through the facing concrete.
17. Foreign material embedded in the surface.
18. Visible repairs at a 20 ft. viewing distance.
19. Reinforcement shadow lines.
20. Cracks visible at a 20 ft. viewings distance.
21. Installer Qualifications: Firm with 3 years experience in installation of systems similar in complexity to those required for this Project.
22. Mock-Up: Provide, if required by Architect/ Engineer, a mock-up for evaluation of the boardwalk showing the surface preparation techniques and application workmanship.

Finish areas designated by Architect / Engineer.

Do not proceed with remaining work until mock-up is accepted by Architect / Engineer.

Refinish mock-up area as required to produce acceptable work.

* 1. DESIGN
1. The designer of the boardwalk, foundation and railing system shall be a qualified registered Professional Engineer licensed in the State of Ohio and experienced in the design of concrete structures, foundation and railing systems.
2. The foundation design shown on the boardwalk drawings are based recommendations found in the geotechnical reports by Terratech.

1. DESIGN CRITERIA: The design of the boardwalk and railing system shall comply with the following guidelines:
2. AASHTO LRFD Guide Specifications for The Design of Pedestrian Bridges, 2nd Edition
3. AASHTO LRFD Bridge Design Specifications for Highway Bridges, 5th Edition.
4. American Concrete Institute 2005 – Building Code and Commentary.
5. In addition to the dead loads of the system, the structure shall be designed for the live loads defined in Section 1.3.E above.
6. Railings structural requirements:
7. Handrail and railing assemblies and attachments shall resist a minimum concentrated load of 200 pounds (91 kg) applied in any direction at any point on the top rail and a vertical and horizontal thrust of 50 lb./lf (0.73 kN/m) applied to the top railing without permanent set or damage. The two loads are not cumulative.
8. Infill area of railing system capable of resisting a horizontal concentrated load of 200 pounds applied to one square foot (8165 g/sq. m) at any point in the system. This loading shall not be applied simultaneously with other loading conditions.
9. Handrail assemblies and guards shall be designed to resist a load of 50 pounds per linear foot (0.73 kN/m) applied in any direction at the top and to transfer this load through the supports to the structure.
10. Railings shall be suitable for pedestrian traffic and shall be a minimum of 42-inches above the tread / deck surface.
	1. SUBMISSIONS: Prior to the start of fabrication or construction, the Contractor shall submit to the Engineer a design package, which shall include, but is not limited to, the following:
11. PRELIMINARY SUBMISSIONS: Prior to the start of fabrication or construction, the Contractor shall submit to the Engineer a design package, which shall include but not limited to the following:
12. DETAILED PLANS:
	1. REGISTRATION / SEAL: Sealed by a licensed Professional Engineer (Ohio).
	2. PLAN VIEW: Full plan view of the boardwalk, foundation and railing system drawn to scale. The plan view must reflect the proposed horizontal alignment as shown on the design plans.
	3. ELEVATION VIEW: Full elevation view of the boardwalk, railing and foundation system drawn to scale which reflect the actual vertical alignment. Elevation views shall indicate the elevation at the top and bottom of the boardwalk and foundation system components, horizontal and vertical break points, and location of the finished grade.
	4. DETAILS: Details of all boardwalk and railing system components and their connections such as the length, size and where changes occur; connections; etc.
	5. CODE REFERENCE: Design parameters used along with AASHTO references.
13. DESIGN COMPUTATIONS: computations shall:
	1. Be stamped by a licensed Professional Engineer in the state of Ohio.
	2. Computations shall clearly refer to the applicable AASHTO provisions
	3. Documentation of computer programs including all design parameters.
14. CONSTRUCTION SPECIFICATIONS:
	1. Construction methods specific to the boardwalk vendor chosen. Submittal requirements such as certification, quality and acceptance/rejection criteria shall be included. Details on connection of boardwalk units and foundation system such that assurance of uniform load transfer shall be checked.
15. FINAL SUBMISSION: Once a boardwalk, foundation and railing system design has been reviewed and accepted by the Owner, the Contractor shall submit the final plans. The designer of the boardwalk, foundation and railing system is responsible for the review of any drawings prepared for fabrication. One set of all approved shop drawings shall be submitted to the Engineer’s permanent records.
16. SUBMITTALS: Product Data: Submit Manufacturer’s technical product data for railing components and accessories.

Manufacturer to supply submittal drawings for approval to include the following:

1. Section-thru details.
2. Mounting methods.
3. Typical Elevations.
4. Key plan layout.
5. Shop Drawings: Shop drawing showing actual field conditions and true elevation and location supplied after field verification.
	1. DELIVERY, STORAGE, AND HANDLING
6. Store products in manufacturer's unopened packaging until ready for installation.
7. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings:
	* + 1. Where field measurements cannot be made without delaying the railing fabrication and delivery, obtain guaranteed dimensions in writing by the Contractor and proceed with fabrication of products so as not to delay fabrication, delivery and installation.
8. Coordinate fabrication and delivery schedule of handrails with construction progress and sequence to avoid delay of railing installation.
	1. WARRANTY:
9. Contractor will be responsible for installation defects associated with the boardwalk and abutment components, foundation system, and railings for a period of 12 calendar months from the date of final acceptance by the Owner.
10. Boardwalk manufacturer shall warranty all precast concrete components against defects in material and workmanship for a period of ten years.
11. Railing manufacturer shall warranty the railing against defects in materials and workmanship for a period of 12 months.
	1. MEASUREMENT AND PAYMENT
12. Precast concrete boardwalk, railings, and foundations shall be paid for at the contract lump sum price as listed in the bid proposal for “Precast Concrete Boardwalk”. This price shall include all materials, equipment, labor and work necessary for and incidental to the design, construction, delivery, unloading, assembly, and placement of the boardwalk and foundation as shown in the contract plans including all railings on the superstructure.

PART 2-MATERIALS & TESTING

* 1. PRECAST CONCRETE: shall conform to the following:
		+ 1. The minimum compressive strength of the concrete shall be 4000 psi measured at 28 days.
			2. All precast concrete components shall be air entrained composed of Portland cement, fine and course aggregates, admixtures and water. The air-entraining feature may be obtained by the use of either an air entraining Portland cement or an air entraining admixture. The entrained air-content shall be not less than four percent or more than seven percent.

PART 3 - EXECUTION

* 1. PRECAST CONCRETE BOARDWALK
1. Installation of the precast concrete boardwalk system and railings, if applicable, shall be performed in accordance to the approved plans and manufacturers installation instructions. Boardwalk manufacturer shall provide a field representative to review installation instructions with the Contractor and Engineer and to certify that the installation has been performed according to the approved drawings and manufacturer’s instructions.

END SECTION