

SECTION 034123 – PLANT PRECAST STRUCTURAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide pre-cast structural concrete RediStair® units.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site or virtually.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for RediStair® stringers and chosen stair nosing products
- B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.
 - 1. Shop drawings shall be prepared and stamped by a qualified engineer licensed in the jurisdiction of the project.
 - 2. Provide preliminary shop drawing indicating elevations, horizontal grid locations, and line loads. Submit for approval prior to production of complete shop drawing.
- C. Samples: Submit 3ea 12"x12"x2" finish sample of each specified surface finish representative of finish, color, and texture.

1.4 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers appropriately licensed to provide RediStair® pre-cast concrete stringers. Use qualified installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Casting: NPCA or PCI certified plant at RediStair® discretion.
- C. Standards: ACI 318 Building Code Requirements for Reinforced Concrete, and CRSI
- D. Testing: CIP concrete independent testing laboratory.
- E. Erection Tolerance Limits: PCI MNL 127.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Carefully transport and handle precast concrete stairs so as to prevent soiling or damage. Store clear of ground in manner to prevent cracking, distortion, warping and to protect from damage and dirt. Soiling or staining of precast units may be cause for rejection of units. Lift and support units only at designated lifting or supporting points as shown on approved shop drawings.

PART 2 - PRODUCTS

2.1 FINISHES

- A. Finish exposed-face surface of precast concrete units to match approved design reference sample and as follows.
 - 1. Treads, risers, landings, side of stair: Smooth form finish.
 - 2. Back of stair: Smooth trowel finish.
- B. Variation in color and texture expected.
- C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 60 percent.
- D. Reinforcement: Reference structural drawings general notes for materials requirements.

2.2 MATERIALS

- A. Plant-precast RediStair® structural concrete stair stringers and associated site concrete.
- B. Surface treatment: Raw unless noted otherwise. Concrete sealant, when applicable, to be applied in-field after installation, concurrent with CIP portions.
- C. RediStair® trade-marked elevator bolt located on side of each stringer.
- D. Williams C2T couplers and #5 R6J threaded end bar shall be used as the primary reinforcing for all stringer end splice conditions. Other coupling devices shall be subject to RediStair® engineering review/approval.

2.3 GENERAL REQUIREMENTS

- A. Governing Code: The design and construction of this project is governed by the "California Building Code (CBC)", 2019 Edition, hereafter referred to as the CBC.
- B. Reference Standards: Refer to Chapter 35 of 2019 CBC. Where other standards are noted in the drawings, use the latest edition of the standard unless a specific date is

indicated. Reference to a specific section in a code does not relieve the contractor from compliance with the entire standard.

- C. Other Drawings: Refer to the architectural, mechanical, electrical, civil and plumbing drawings for additional information including but not limited to: dimensions, elevations, slopes, door and window openings, non-bearing walls, stairs, finishes, drains, waterproofing, railings, curtain walls, elevators, curbs, depressions, mechanical unit locations, and other nonstructural items.
- D. Structural Details: The structural drawings are intended to show the general character and extent of the project and are not intended to show all details of the work.
- E. Structural Responsibilities: The structural engineer (SER/SEOR) is responsible for the strength and stability of the primary structure in its completed form.
- F. Coordination: The Contractor is responsible for coordinating details and accuracy of the work; for confirming and correlating all quantities and dimensions; for selecting fabrication processes; for techniques of assembly; and for performing work in a safe and secure manner.
- G. Means, Methods, and Safety Requirements: The contractor is responsible for the means and methods of construction and all job-related safety standards such as OSHA and DOSH (Department of Occupational Safety and Health).
- H. Bracing/Shoring Design Engineer: The contractor shall at his discretion employ an SSE, a registered professional engineer for the design of any temporary bracing and shoring.
- I. Temporary Shoring and Bracing: The contractor is responsible for the strength and stability of the structure during construction and shall provide temporary shoring, bracing and other elements required to maintain stability until the structure is complete. It is the contractor's responsibility to be familiar with the work required in the construction documents and the requirements for executing it properly. Shoring/reshoring of RediStair® system shall be limited to horizontal planes and at no point may be installed against any non-horizontal RediStair® surfaces (i.e., sloping soffits).
- J. Construction Loads: Loads on the structure during construction shall not exceed the design loads as noted in DESIGN CRITERIA & LOADS below or the capacity of partially completed construction as determined by the Contractor's SSE for Bracing/Shoring.
- K. Changes in Loading: The contractor has the responsibility to notify the SER of any architectural, mechanical, electrical, or plumbing load imposed onto the structure that differs from, or that is not documented on the original Contract Documents (architectural / structural / mechanical / electrical or plumbing drawings). Provide documentation of location, load, size and anchorage of all undocumented loads in excess of 400 pounds. Provide marked-up structural plan indicating locations of any new equipment or loads. Submit plans to the Architect/Engineer for review prior to installation.
- L. Note Priorities: Plan and detail notes and specific loading data provided on individual plans and detail drawings supplements information in the Structural General Notes.

- M. Discrepancies: In case of discrepancies between the General Notes, Specifications Plan/Details or Reference Standards, the Architect/Engineer shall determine which shall govern. Discrepancies shall be brought to the attention of the Architect/Engineer before proceeding with the work. Should any discrepancies be found in the contract documents, the Contractor shall review and assess such discrepancies for price and/or schedule adjustments to the contract and notify respective parties accordingly.
- N. Site Verification: The contractor shall verify all dimensions and conditions at the site. Conflicts between the drawings and actual site conditions shall be brought to the attention of the Architect/Engineer before proceeding with the work.
- O. Alternates: Alternate products of similar strength, nature and form for specified items may be submitted with adequate technical documentation to the Architect/Engineer for review. Alternate materials that are submitted without adequate technical documentation or that significantly deviate from the design intent of materials specified may be returned without review. Alternates that require substantial effort to review will not be reviewed unless authorized by the Owner.
- P. Design Criteria and Loads
1. Seismic Design:
 - a. Seismic Design Category = D
 - b. $I_p = 1.5$
 - c. $S_{DS} = 1.58 g$
 - d. $a_p = 1.0$
 - e. $R_p = 2.5$
 - f. $\Omega = 2.5$
 2. Design Live Loads:
 - a. Stairs & Landings = 100 PSF or 300 Pounds
- Q. Tests and Inspections of Onsite Construction
1. Inspections: Special Inspections shall be done in accordance the Statement of Special Inspections per 1704 and 1705. Foundations, footings, under slab systems and framing are subject to inspection by the Building Official in accordance with CBC 110.3. Contractor shall coordinate all required inspections with the Building Official
 2. Special Inspectors: Special Inspectors shall be employed by the Contractor to provide Special Inspections for the project. Special Inspectors shall be qualified persons who are registered with an approved agency.
 3. Statement of Special Inspections: Special Inspections and Testing are required by 1704, 1706, 1707 and 1708 for the following:
 - a. Concrete Construction
 - 1) Periodic Inspection required for:
 - a) Size & placement of all reinforcing steel prior to the pour
 - b) Shape, location & dimensions of members formed
 - c) Use of the required design concrete mix

- d) Maintenance of specified curing temperature and techniques
 - e) Verification of in-situ concrete strength prior to removal of shores and forms from stairs, landings, and structural slabs
- 2) Continuous inspection required during the:
- a) Placing of reinforced concrete for proper application techniques
 - b) Placing & size of cast-in-place bolts and embedded fabrications prior to the pour
 - c) Placing of concrete around cast-in-place bolts and embeds
 - d) Sampling of fresh concrete
 - e) Grouting operation of post-installed bolts or rebar dowels
- b. Post Installed Anchors to Concrete and Masonry
- 1) Inspections shall be in accordance with the requirements set forth in the approved ICC Evaluation Report and as indicated by the design requirements specified on the drawings. Refer to the Post Installed Anchors section of these notes for anchors that are the basis of the design. Special inspector shall verify anchors are as specified in the Post Installed Anchors section of these notes or as otherwise specified on the drawings. Substitutions require approval by the SER and require substantiating calculations and current 2019 CBC recognized ICC Evaluation Services (ES) Report. Special Inspector shall document in their Special Inspection Report compliance with each of the elements required within the applicable ICC Evaluation Services (ES) Report.

R. Cast-in-Place Concrete

1. Reference Standards

- a. ACI 301-16 "Specifications for Structural Concrete"
- b. CBC Chapter 19-Concrete
- c. ACI 318-14 "Building Code Requirements for Structural Concrete"

2. Field Reference: The contractor shall keep a copy of ACI Field Reference manual, SP-15, "Standard Specifications for Structural Concrete (ACI 301) with Selected ACI and ASTM References."

3. Concrete Mixtures: Conform to ACI 301 Sec. 4 "Concrete Mixtures" and CBC Section 1904.1.

4. Materials: Conform to ACI 301 Sec. 4.2.1 "Materials" for requirements for cementitious materials, aggregates, mixing water and admixtures.

5. Submittals: Provide all submittals required by ACI 301 Sec. 4.1.2. Submit mix designs for each mix in the table below.

6. Mix Design Requirements

a. Stair Stringers:

- 1) Strength = 4000 PSI at 28 days
- 2) Maximum Aggregate Size = $\frac{3}{4}$ "

- b. Intermediate Landings:
 - 1) Strength = 4000 PSI at 28 days
 - 2) Maximum Aggregate Size = $\frac{3}{4}$ "
- c. Pour-backs: Same as structural slab.
- 7. Embedded Items: Position and secure in place expansion joint material, anchors, and other structural and non-structural embedded items before placing concrete. Contractor shall refer to mechanical, electrical, plumbing, and architectural drawings and coordinate other embedded items
- 8. Testing
 - a. Obtain samples and conduct tests in accordance with ACI 301 Sec. 1.6.4.2. Additional samples may be required to obtain concrete strengths at alternate intervals than shown below
 - b. Cure 4 cylinders for 28-day test age. Test 1 cylinder at 7 days, test 2 cylinders at 28 days, and hold 1 cylinder in reserve for use as the Engineer directs. After 56 days, unless notified by the Engineer to the contrary, the reserve cylinder may be discarded without being tested for specimens meeting 28-day strength requirements
- 9. Acceptance: Strength is satisfactory when:
 - a. The averages of all sets of 3 consecutive tests equal or exceed the specified strength.
 - b. No individual test falls below the specified strength by more than 500 psi.
 - c. A "test" for acceptance is the average strength of the two cylinders tested at the specified test age.

S. Concrete Reinforcement

- 1. Reference Standards
 - a. ACI 301-16 "Standard Specifications for Structural Concrete", Section 3 "Reinforcement and Reinforcement Supports."
 - b. ACI SP-66(04) "ACI Detailing Manual" including"
 - c. CRSI MSP-09, 28th Edition, "Manual of Standard Practice."
 - d. ANSI/AWS D1.4 "Structural Welding Code - Reinforcing Steel."
 - e. CBC Chapter 19-Concrete.
 - f. ACI 318-14.
 - g. ACI 117-10
- 2. Lifting Requirements for Precast Stair Stringers: The contractor is responsible for rigging and lifting insert locations and for temporarily bracing the stringers against forces that may occur during construction until connections to the permanent structural system are completed
- 3. Materials
 - a. Reinforcing Bars: ASTM A615, Grade 60, deformed bars.
 - b. Deformed Welded Wire Fabric: ASTM A1064

- c. Bar Supports: CRSI MSP-09, Chapter 3 "Bar Supports."
 - d. Tie Wire: 16 gage or heavier, black annealed.
- 4. Fabrication: Conform to ACI 301, Sec 3.2.2. "Fabrication", and ACI SP-66 "ACI Detailing Manual."
 - 5. Placing: Conform to ACI 301, Sec. 3.3.2 "Placement." Placing tolerances shall conform to ACI 117
 - 6. Concrete Cover: Conform to ACI 301, Table 3.3.2.3 and Shop Drawings.
 - 7. Field Bending: Conform to ACI 301 Sec. 3.3.2.8. "Field Bending or Straightening." Bar sizes #3 through #5 may be field bent cold the first time. Other bars require preheating. Do not twist bars.
- T. Post Installed Anchors into Concrete and Masonry
- 1. Reference Standards
 - a. CBC Chapter 19 "Concrete"
 - b. ACI 318-14 "Building Code Requirements for Structural Concrete"
 - c. CBC Chapter 21 "Masonry"
 - d. TMS402-16 "Building Code Requirements for Masonry Structures"
 - 2. Post Installed Anchors: Install only where specifically shown in the details or allowed by SER. All post-Installed anchor types and locations shall be approved by the SER and shall have a current ICC-Evaluation Service Report that provides relevant design values necessary to validate the available strength exceeds the required strength. Submit current manufacturer's data and ICC ESR report to SER for approval regardless of whether or not it is a pre-approved anchor. Anchors shall be installed in strict accordance with ICC-ESR and the manufacturer's printed installation instructions (MPII) in conjunction with edge distance, spacing and embedment depth as indicated on the drawings. The contractor shall arrange for a manufacturer's field representative to provide installation training for all products to be used, prior to the commencement of work. Only trained installer shall perform post installed anchor installation. A record of training shall be kept on site and be made available to the SER as requested. Adhesive anchors installed in horizontally or upwardly inclined orientation shall be performed by a certified adhesive anchor installer (AAI) as certified through ACI/CRSI or approved equivalent. Proof of current certification shall be submitted to the engineer for approval prior to commencement of installation. No reinforcing bars shall be damaged during installation of post-installed anchors. Special inspection shall be per the TESTS and INSPECTIONS section. Anchor type, diameter and embedment shall be as indicated on drawings.
 - a. Adhesive Anchors: The following Adhesive-type anchoring systems have been used in the design and shall be used for anchorage to CONCRETE and MASONRY, as applicable and in accordance with corresponding current ICC ESR report. Reference the corresponding ICC ESR report for required minimum age of concrete, concrete temperature range, moisture condition, light weight concrete, and hole drilling and preparation requirements. Drilled-in anchor embedment lengths shall be as shown on drawings, or not less than 7 times the anchor nominal diameter (7D). Adhesive anchors are to be

installed in concrete aged a minimum of 21 days, unless otherwise specified in the ICC ESR report

- 1) HILTI "HIT-HY 200" – ICC ESR-3187 for anchorage to CONCRETE with embedment depth less than or equal to 20 bar diameters
- 2) HILTI "HIT-RE 500 V3" – ICC ESR-3814 for anchorage to CONCRETE with any embedment depth
- 3) HILTI "HIT-HY 270" – ICC ESR-4143 for anchorage to MASONRY Only

b. Expansion Anchors: The following Expansion type anchors are pre-approved for anchorage to CONCRETE or MASONRY in accordance with corresponding current ICC ESR report.

- 1) HILTI "KWIK BOLT TZ" – ICC ESR-1917 for anchorage to CONCRETE Only
- 2) HILTI "KWIK BOLT 3 – ICC ESR-1385 for anchorage to MASONRY Only

U. Structural Steel

1. Reference Standards

- a. CBC Chapter 22 – "Steel"
- b. ANSI/AISC 303-16 – "Code of Standard Practice for Steel Buildings & Bridges"
- c. AISC – "Manual of Steel Construction", Fifteenth Edition (2016)
- d. ANSI/AISC 360-16 – "Specification for Structural Steel Buildings"
- e. AWS D1.1:2015 – "Structural Welding Code – Steel"

2. Submittals: Submit the following documents for review

- a. Submit welder's certificates verifying qualification within past 12 months.

3. Materials

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| a. Channel (C) & Angle (L) Shapes: | ASTM A36, Fy = 36 ksi |
| b. Structural Bars & Plates (PL): | ASTM A36, Fy = 36 ksi |
| c. Hollow Structural Section (HSS): | ASTM A500, Grade C, Fy = 50 ksi |
| d. High-Strength Bolts | ASTM A325/F1852, Type 1, Plain |
| e. Nuts | ASTM A563 |
| f. Washers (flat or beveled) holes | ASTM F436 at slotted & oversize |
| g. Anchor Rods (Anchor Bolts) | ASTM F1554, Gr. 36 |
| h. Welding Electrodes | E70XX |

4. Welding

- a. Welding shall conform to AWS D1. Special Inspections (verification inspections) shall be by a certified Welding Inspector (WI) or Senior Welding Inspector (SWI) per AWS B5.1.

- b. Welders shall be qualified for the specific prequalified joints required by the design and certified in accordance with WABO and AWS requirements.
 - c. Welding shall be done in accordance with appropriate Weld Procedure Specifications (WPS's). Welders shall be familiar with the applicable WPS's.
 - d. Welding shall be done with AWS Prequalified Welding Processes unless otherwise approved.
 - e. Welder qualifications and WPS's shall be maintained at the site of the work and shall be readily available for inspection upon request, both in the shop and in the field.
 - f. Use E70 or E71T, 70 ksi strength electrodes appropriate for the process selected.
 - g. Prior to the start of work, Special Inspection or, if "AISC Certified" or otherwise "Approved" Shop, a shop Certified Weld Inspector (CWI) certified in accordance with provisions of AWS QC1, shall inspect and document compliance with the following:
 - 1) Confirm welder qualifications prior to the start of work.
 - 2) Review all WPS prior to the start of work.
 - 3) Confirm materials in fabrications conform to the specifications.
 - 4) Periodically observe joint preparation, fit-up and welder techniques.
 - 5) Identify on plans all multi-pass fillet welds, single pass fillet welds greater than 5/16", and Complete- and Partial- Joint Penetration (CJP or PJP) groove welded butt joints that require Continuous (Special) Inspection.
 - 6) Visually inspect all welds per Special Inspection Requirements for Steel and AWS Section 6.5 and Table 6.1.
5. Anchorage to Concrete
- a. Column Anchor Rods and Base Plates: All columns (vertical member assemblies weighing over 300 pounds) shall be provided with a minimum of four 3/4" diameter anchor rods. Column base plates shall be at least 3/4" thick, unless noted otherwise. Cast-in-place anchor rods shall be provided unless otherwise approved by the Engineer. Unless noted otherwise, embedment of cast-in-place anchor rods shall be 12 times the anchor diameter (12D).
 - b. Post-Tension Concrete Anchorage: Anchors installed in post-tensioned slabs after the concrete is cast shall not be installed without verification of tendon location and approval from the SER
6. Erection
- a. Conform to AISC 360 Section M4 "Erection" and AISC 303 Section 7 "Erection".
 - b. Conform to AISC 360 Chapter N "Quality Control and Quality Assurance" and AISC 303 Section 8.
 - 1) The Erector shall maintain detailed erection quality control procedures that ensure that the work is performed in accordance with these requirements and the Contract Documents.
 - c. Steel work shall be carried up true and plumb within the limits defined in AISC 303 Section 7.13.

- d. High strength bolting shall comply with the RCSC requirements including RCSC Section 7.2 "Required Testing", as applicable and AISC 360 Chapter J, Section M2.5 and Section N5.6.
 - e. Welding of HEADED STUD ANCHORS shall be in accordance with AWS D1.1 Chapter 7 "Stud Welding.
 - f. Provide Headed (Shear) Stud Anchors welded through the metal deck to tops of beams denoted in plans.
 - g. The contractor shall provide temporary bracing and safety protection required by AISC 360 Section M4.2 and AISC 303 Section 7.10 and 7.11.
7. Bracing and Safety Protection: The contractor shall provide temporary bracing and safety protection required by AISC 360 Sec. M4.2 and AISC 303 Sec. 7.10 and 7.11.
 8. Protective Coating Requirements:
 9. Steel need not be primed or painted unless noted otherwise on the drawings or in the project specifications. Conform to AISC 360 Sec. M3 and AISC 303 Sec. 6.5 unless a multi-coat system is required per the project specifications.
 10. Architecturally Exposed Structural Steel: Steel identified by the Architect on the architectural drawings as Architecturally Exposed Structural Steel, (AESS) shall conform to AISC 303 Sec. 10

2.4 EXAMINATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117, or stricter if required by the structural drawings or construction sequencing.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

2.5 INSTALLATION

- A. Install RediStair® stringers and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
- B. Provide temporary shoring and bracing as required.
- C. Tolerances: 1/4 inch in 20 feet for plumb and location. Comply with requirements of PCI MNL-127 Recommended Practice for Erection of Precast Concrete.
- D. Restore damaged units and finishes. Clean and protect work from damage.

2.6 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

2.7 PROTECTION

- A. Protect precast concrete stairs from damage due to subsequent building operations.
- B. Immediately prior to final acceptance of project, clean precast concrete stairs.

END OF SECTION 034123