SECTION  – precast concrete stairs

1. General
   1. Summary
      1. Complete all precast concrete stairs work including structural steel elements such as bracing and plates to the full intent of the Drawings and as specified herein.
      2. Related Requirements:
         1. Section 03 11 00 – Concrete Formwork.
         2. Section 03 20 00 – Concrete Reinforcing and Accessories.
         3. Section 03 30 00 – Cast-In-Place Concrete.
         4. Section 03 35 00 – Concrete Finishing.
         5. Section 03 45 00 – Architectural Precast Concrete.
         6. Section 04 20 00 – Unit Masonry.
         7. Section 05 12 00 – Structural Steel Framing.
         8. Section 05 31 13 – Steel Floor Deck.
         9. Section 05 50 00 – Metal Fabrications.
         10. Section 05 51 00 – Steel Stairs.
         11. Section 07 92 00 – Joint Sealants.
         12. Section 09 90 00 – Painting.
   2. quality assurance
      1. Concrete Materials: Conforms to CAN/CSA-A23.1-09.
      2. Design of Concrete Structures for Buildings: Conforms to CAN/CSA-A23.3-04.
      3. Precast Concrete Materials and Construction: Conforms to CAN/CSA-A23.4-04.
      4. Certification of Companies for Fusion Welding of Steel Structures: Conforms to CSA W47.1-09.
      5. Precast concrete stair units shall be fabricated and erected by a manufacturing plant certified by the Canadian Standards Association (CSA) in the appropriate category(ies). The precast concrete manufacturer shall be certified in accordance with CSA's certification procedures for precast concrete plants prior to submitting his bid and shall specifically verify as part of his bid that his plant is currently certified in the appropriate category(ies). Only precast concrete stairs fabricated in such certified plants shall be acceptable to the Owner. Precast plant certification shall be maintained for the duration of the fabrication and erection for this project.
      6. Submit references indicating history of successful work of this type and evidence of certification to Consultant for approval within five (5) days of Consultant's request.
   3. design criteria
      1. Design precast concrete stairs to carry handling, expected dead loads and live loads, without detrimental effects.
      2. Retain a structural engineer, registered in place of Work, experienced in the field of precast concrete to ensure the adequacy of the structural aspects of the design, shop drawings, manufacturing, transportation, and installation of all precast concrete stair components.
      3. Design lifting devices for precast concrete stair units to ensure that they shall safely and efficiently handled and not produce distortion, cracking, deflection, strain or adversely affect the units.
      4. Design and fabricate precast concrete stairs to conform the following requirements:
         1. To meet or exceed the specified requirements of CAN/CSA-A23.4.
         2. Adequate provision for thermal movement without thermal fractures.
         3. Adequate provision for live and dead loads without failure, distortion, or fracture.
         4. For differential movement of structural live load deflection.
         5. Adequate support and anchorage of components taking into consideration all loading factors.
         6. Tolerances:
            1. Dimensions of successive steps shall not differ more than 1/16" for risers and 1/8" for treads.
            2. Specified tolerances shall be non-cumulative.
   4. Submittals
      1. Provide required information in accordance with Section 01 33 00 – Submittal Procedures.
      2. Shop Drawings:
         1. Prepare and submit fully detailed shop and erection drawings containing all pertinent information in regard to the fabrication and erection of precast concrete stairs including but not limited to the following:
         2. Details of stairs bearing on different landings to a scale of 1:10 minimum, showing all dimensions, matching landing details indicated on architectural drawings.
         3. Location of each stair unit in the completed structure and identifying marks for each stair unit.
         4. Size and dimensions of each stair and complete details of connections.
         5. Reinforcing details, reinforcement grade, concrete strength, and admixtures.
         6. Locations and details for lifting hooks and handling points.
         7. Sequence of erection and any special instructions that may be required in handling, setting and temporary bracing.
      3. Shop drawings shall bear the seal and signature of a Professional Engineer registered to practise in the place of Work and employed by the precast concrete stairs subcontractor. Shop drawings shall include complete design calculations for the precast concrete stair units, clearly showing that the stair units meet all Code requirements and safely support all superimposed loading.
      4. Quality Control Test Reports:
         1. Submit manufacturer's quality control test reports in accordance with specified standards.
   5. mock-up
      1. Prior to proceeding with full production of the precast concrete stairs, the manufacturer shall produce one (1) stair unit for the approval of the Consultant. When the stair unit has been approved by the Consultant, it shall be the acceptance criteria for all subsequent work of this Section.
   6. quality control
      1. Owner may arrange and pay for out of cash allowance included in Section 01 20 00 – Allowances, for inspection and testing of work of this Section by an independent agency, as directed by Consultant. Cooperate with the inspection company and provide all necessary facilities and information.
      2. Inspection and testing company may inspect the following, but not limited to the following:
         1. In the Plant:
            1. Forms.
            2. Size and location of reinforcing.
            3. Size and location of cast in hardware.
            4. Mill test reports.
            5. Concrete batching methods.
            6. Cement.
            7. Aggregates.
            8. Curing methods.
            9. Cylinder tests.
            10. Slump tests.
            11. Dimensional tolerances of completed units.
            12. Finishes.
         2. On the Job Site:
            1. Erection methods.
            2. Connections in accordance with approved drawings.
            3. Welding of connections.
            4. Joint widths.
            5. Finishes.
   7. DELIVERY, STORAGE, HANDLING and protection
      1. Support precast concrete stair units uniformly while curing. Keep a daily check to discover any development of warpage or other distortion. If required, rearrange supports as required to compensate for warpage or distortion.
      2. Handle, transport, store and protect precast concrete stairs as specified herein.
      3. Precast concrete stair units shall be handled and adequately protected during fabrication, curing, storage and transport by methods that shall prevent damage, warping, cracking, breakage, chipping, staining or other disfigurement. Do not permit precast concrete stair units to contact earth, or to be stored as to be exposed to splashing of earth, mud and the like.
      4. Allow for storage and protection of precast concrete stair units at the plant, at no additional cost to the Owner until such units are required at the job site in accordance with the requirements of the construction schedule. Store precast concrete stair units clear of ground, providing free air movement at all surfaces, protected from inclement weather to prevent entry of water and snow in depressions and holes, and supported to prevent over-stressing, warping and twisting of units.
      5. Deliver precast concrete stair units to the site, clearly identified in acceptable manner as indicated on approved shop drawings, showing final position in the building. Sequence of delivery and timing of delivery to the site shall conform to erection schedule and storage space available for handling operations.
      6. Protect precast concrete stair units delivered to site from inclement weather.
      7. Repair chipped, checked, cracked, blemished or defective precast concrete stair units. Replace units which in the opinion of the Consultant cannot be satisfactorily repaired. Reject all units with in-plant defects.
      8. Provide precast concrete stair units with all exposed surfaces clean and in an unblemished condition. Dirty units will not be accepted and must be cleaned to the Consultant's satisfaction by this Section at no additional cost to the Owner.
   8. warranty
      1. Warrant work of this Section against defects in materials and workmanship in accordance with General Conditions but for a period of two (2) years.
      2. Agree to promptly make good defects which become evident during warranty period without cost to the Owner. Defects shall include but shall not be limited to the following: spalling, cracking, splitting, deformation due to improper materials, or misalignment. The Contractor further agrees to repair to Owner's satisfaction or replace all the work which fails in any of the aforesaid respects, making good all damage to other property and the Owner's property due to replacement.
2. Products
   1. Manufacturers
      1. Precast Concrete Stairs:
         1. Precast concrete stairs shall high quality, reinforced, precast concrete stairs as indicated on Drawings and as specified herein, "Precast Concrete Stairs" by Hy-Grade Precast Concrete, St. Catharines, Ontario (Tel. (905)684-8568), or approved equal, as accepted by the Consultant.
   2. Materials
      1. Cement:
         1. Conforms to applicable requirements of CAN/CSA-A3000 and CAN/CSA-A23.1.
      2. Aggregates:
         1. Conforms to applicable requirements of CAN/CSA-A23.1, having 5/32" to 23/32" aggregate size.
      3. Admixtures:
         1. Conforms to applicable requirements of CAN/CSA-A23.1.
      4. Air Entraining Agent:
         1. "MBVR" by BASF Construction Chemicals, or "DAREX A.E.A." by W.R. Grace & Co. of Canada Ltd., or "N.V.R." by the Sternson Group, or other approved alternate conforming to ASTM C 260 and CAN3-A266.1-M.
      5. Water:
         1. Clean, potable, free of organic and deleterious matter, conforming to CAN/CSA-A23.1.
      6. Curing-Sealing Compound:
         1. Water based, acrylic resin formulation conforming to ASTM C 309-11, Type 1, Class B and compatible with having painted finish by Section 09 90 00.
      7. Curing Sheet:
         1. 2 mils thick polyethylene sheet conforming to CGSB 51-GP-51M or laminated waterproof kraft paper.
      8. Reinforcing Steel:
         1. Conforms to CAN/CSA-G30.18, Grade 400R.
      9. Welded Wire Mesh:
         1. Conforms to CSA W186-M
      10. Steel Anchors, Plates, Connectors and the Like:
          1. Conforms to CAN/CSA-G40.20/G40.21, Grade 300W.
      11. Welding Materials:
          1. Conforms to CSA W59.
      12. Zinc Rich Primer:
          1. Ready mixed, zinc-rich primer
             1. Sealtight Galvafroid Zinc-Rich Coating by W.R. Meadows of Canada Ltd.
             2. Zinc Clad IV Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd.
      13. Bituminous Paint:
          1. Conforms to CAN/CGSB-1.108-M, Type 2.
      14. Shims and Spacers:
          1. Non-corrosive, non-staining neoprene, or plastic type.
      15. Bearing Pads:
          1. Non-corrosive, non-staining neoprene type, having minimum 55,000 Kpa load bearing capacity, and moulded to size or cut from moulded sheet.
      16. Non-Shrink Grout:
          1. Premixed, high strength, maximum bearing, impact resistant, non-shrink metallic aggregate grout having minimum 76 Mpa 28 day compressive strength and conforms to ASTM C 939 and ASTM C 1107.
          2. Basis of Design Products:
             1. Embeco Premixed Grout by BASF Construction Chemicals.
             2. Ferrogrout 939 by Sternson Group.
      17. Patching Material:
          1. Fast setting, one component, polymer modified cement-based repair mortar, "Emaco R310" (horizontal surfaces) and "Emaco R350" (vertical and overhead surfaces) by BASF Construction Chemicals, or "Patchmate Plus" (horizontal surfaces) and "Patchmate OV" (vertical and overhead surfaces) by Sternson Group, or approved equal.
          2. Provide bonding agents as recommended by patching material manufacturer(s).
   3. concrete mixes
      1. Use concrete mix designed to produce minimum 28 MPa compressive cylinder strength at 28 days, with a maximum water/cement ratio of 0.5 in accordance with CAN/CSA A23.1.
      2. Air Entrainment of Concrete Mix:
         1. Conforms to CAN/CSA-A23.4.
      3. Do not use calcium chloride.
   4. fabrication and manufacture
      1. Make through examination of the drawings and details, check interfacing with work of other Sections and other factors which may influence the design and performance of the work of this Section and be fully cognizant of the requirements.
      2. Match details of stair bearings on landings shown on architectural drawings without compromising the structural integrity of the connection.
      3. Design connections and anchorage to transfer loads to structure in conformity with structural and architectural constraints.
      4. Design connections to provide for means of compensating for deviations of the building structure, minimizing widths of joints and gaps to allow for backing and sealing.
      5. Fabricate anchors, connectors and inserts of steel, unless otherwise indicated. Galvanize after fabrication.
      6. Fabricate precast concrete stair units to the requirements of CAN/CSA-A23.4, and to the required tread and dimensions as indicated on drawings.
      7. All formwork for precast concrete stairs shall be steel, accurately constructed, well braced, and stiffened to avoid deformations under pressure of wet concrete and vibrators.
      8. Nosings: Steel forms shall be manufactured to produce CMHC approved, five (5) raised non-slip continuous parallel ridges on treads, near tread nosings.
         1. All nosings shall be rounded and all junctions of treads and risers shall be "coved".
         2. Top and Bottom Stair Landings and Ramps: Cast-in place tactile warning strips, of contrasting colour, 305 mm (12") wide x length of stair, as indicated on the Drawings.
      9. All finished surfaces of precast concrete stair units shall have "smooth" finish as specified herein. Quality of steel forms shall be such that all dimensional tolerances and exposed concrete quality can be consistently maintained. Underside of precast concrete stair units shall have "smooth" finish. "Screed" type finish is not acceptable.
      10. Design reinforcing to permit all necessary drilling of units for installation of metal handrailing posts without any spalling, cracking, or damage to stair unit finish.
      11. Accurately set steel reinforcing and weld at all intersections. Weld all lifting hooks and inserts to reinforcing. Bearing areas shall be reinforced against diagonal tension, splitting, rupture and flexure. Provide extra ties, stirrups and reinforcing bars at support points as required.
      12. Vibrate all concrete continuously during casting of concrete.
      13. Cast in all lifting devices required for erection of the precast concrete stair units. Ensure that all lifting devices used externally or cast into units are capable of supporting the precast concrete stair units in all positions that the units may be in during manufacture, transportation, and installation. Ultimate capacity of lifting devices shall be sufficient to resist forces obtained by applying load factor of 2.5 to weight of precast concrete stair units.
      14. Cast in all weld plates for anchorage of steel railing posts on the sides of the precast concrete stair units, where indicated on drawings to suit railings design. Co-ordinate locations of weld plates with approved shop drawings of metal railings, of Section 05 50 00. Weld plates shall be minimum 3" x 4" x 3/8" thick, complete with anchors.
      15. Apply one coat of curing/sealing compound to all surfaces of precast concrete stair units. Ensure that curing/sealing compound is compatible with painted floor finish by Section 09 90 00 – Painting. Co-ordinate with Section 09 90 00 – Painting.
      16. Clearly mark each precast concrete stair unit to correspond to identification mark on shop drawings for each location. Clearly mark each precast concrete stair unit with date cast. Markings shall not be exposed in the installed work of this Section.
   5. finishes
      1. Exposed Concrete Surfaces:
         1. "Smooth" finish, free of pin holes, form marks, rough edges or the like.
      2. Concealed Concrete Surfaces:
         1. As cast.
      3. Steel Surfaces:
         1. Two (2) coats zinc rich primer paint after fabrication.
      4. Isolate metals where necessary to prevent corrosion due to contact between dissimilar metals and between metals and concrete or plaster. Use 2 coats of bituminous paint.
3. Execution
   1. Examination and preparation
      1. Prior to start of installation on site, examine locations of the Work to receive precast concrete stair units, verifying that precast concrete stair units shall be located correctly, at the proper levels and in accordance with reviewed precast concrete stairs shop drawings.
      2. Ensure that all bearings for the work of this Section are smooth and level, and provision has been made for proper anchorage of precast concrete stairs units.
      3. Report to Consultant any unsatisfactory conditions as soon as they are discovered. Start of installation shall imply acceptance of surfaces and conditions.
      4. Supply all templates, inserts, information and the like, required for installation of the work of this Section, but are installed under work of other Sections. Assist and/or supervise the work of other Sections in the installation of the above.
   2. installation
      1. Install work of this Section with workers skilled in this trade.
      2. Install precast concrete stairs straight, square, and true, with all treads level.
      3. Shim stair units and adequately secure by means of temporary anchors until welding of permanent anchorage is complete. Secure stair units in place with welded anchorage connections. Thoroughly clean all field welds by power wire brushing and protect with two (2) coats of zinc rich primer paint.
      4. Fill all joints at supports and between precast concrete stair units and adjacent construction completely with non-shrink grout in strict accordance with the manufacturer's written instructions. Provide temporary damming where required. Saturate surfaces of joints with water before grouting.
      5. Do not install chipped, cracked, warped, twisted, stained, blemished or otherwise defective units.
   3. patching
      1. Where precast concrete stair units were damaged at the site, or after installation, repair damaged or defective units only as acceptable to the Consultant. Submit for approval by the Consultant, all repair methods, and materials. Replace entire precast concrete stair unit where repair is not acceptable to the Consultant.
      2. Patch finish shall match colour and texture of adjacent surfaces exactly as approved by the Consultant. Remove and repatch all areas that do not match as directed by the Consultant.
      3. Secure all patches greater than 1/2" in size in any direction, to concrete surfaces using bonding agent in strict accordance with the patching material manufacturer's written instructions.
      4. Cut off all lifting devices minimum 3/4" below precast concrete surfaces and patch recesses with non-shrink grout flush with adjacent precast concrete surfaces.
   4. cleaning
      1. Clean surfaces of the work of this Section after grouting and patching is complete. Use fibre brushes, water, and mild cleaning agents only, as recommended by the manufacturer of the precast concrete stair units. Remove all deposits of foreign materials, dirt, soil, and other stains. Do not use materials and methods which shall damage the finished surfaces. Rinse all precast concrete stair surfaces thoroughly with clean water after cleaning.
      2. Protect adjacent work of other Sections from damage caused by cleaning the work of this Section. This subcontractor shall pay for damage caused by the cleaning the work of this Section to the work of other Sections, without additional cost to the Owner.

END OF SECTION