SECTION 05 05 19 - POST-INSTALLED CONCRETE ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical anchors installed in hardened concrete.
2. Adhesive anchors installed in hardened concrete.

B. Related Sections:

1. Division 03 Section “Cast-in-Place Concrete”
2. Division 04 Section “Unit Masonry”
3. Division 05 Section "Miscellaneous Metal Fabrications" for steel lintels and shelf angles not attached to structural steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel.
4. Division 05 Section "Metal Pan Stairs."

1.2 REFERENCES

A. Definitions:

1. Structural Drawings: "S" series drawings of the Contract Documents.
2. Exposed to View: Readily apparent to the public in normal use of the structure. A view distance of 20 feet is consistent with the intent of this definition.

B. Reference Standards: Comply with requirements of the following as modified by the Contract Documents.

1. ACI 355.2, "Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary," 2007.
2. ACI 355.4, "Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary," 2011.
3. ICC-ES AC193, "Acceptance Criteria for Mechanical Anchors in Concrete Elements," 2012.
4. ICC-ES AC308, "Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements," 2012.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the Work of this Section with the Work of other Sections.

B. Pre-installation Meeting:

1. Conduct meeting at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
2. Require representatives of each entity directly concerned with structural steel framing to attend, including the following:

a. Contractor's superintendent.
b. Erector.
c. Owner's Testing and Inspecting Agency.

3. Review methods and procedures including, but not limited to, the following:

a. Galvanizing.
b. Field erection.
c. Tolerances.
d. Bolting.
e. Field painting.
f. Special inspection and testing and inspecting agency procedures for shop and field quality control.

1.4 SUBMITTALS, GENERAL

A. Submittals for Work of this Section shall be prepared and submitted separately from Submittals for Work of other Sections. Submittals combining Work of this Section with that of other Sections will be returned without review.

B. Submittals and accompanying correspondence from the Contractor shall not contain clauses defining the meaning or implication of the action taken by those reviewing the Submittal. Submittals not in compliance will be returned without review.

C. After review of the first re-submittal, review of re-submittals is at Contractor's expense.

D. Format:

1. All Submittals, except Samples, shall be submitted in PDF format with each file being uniquely named.
2. All Submittals, except Samples, will be returned in PDF format with each file being uniquely named.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include:

1. Product specifications with recommended design values and physical characteristics for epoxy dowels and expansion anchors.
2. Quality Assurance Submittals:

a. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
b. Certificates: ICC ES Evaluation Reports

B. Shop Drawings, General

1. Drawings shall be no larger than 24 inches by 36 inches.
2. Reproduction of Contract Documents is unacceptable. Do not use the same sheet numbers nor section labels as used on Contract Documents. References to Contract Documents shall not be substituted for complete Shop Drawings.
3. Cloud the following on each Shop Drawing.Adequacy of unclouded deviations or revisions is Contractor's r

a. Questions concerning interpretation of Contract Documents.
b. Deviations from Contract Documents.
c. Revisions incorporated into re-submittals.

1.6 INFORMATIONAL SUBMITTALS

A. Installer Qualifications and Procedures: Submit installer qualifications as stated below. Submit a letter of procedure stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date, and a list of the personnel to be trained on anchor installation.

B. Manufacturer's installation instructions.

C. Samples: Representative length and diameters of each type anchor shown on the Drawings.

D. Qualification Data: For each of the following:

1. Installer.

E. Field Quality Control:

1. Minutes of Pre-installation Meeting.
2. Field quality-control test and inspection reports.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications:

a. Drilled-in anchors shall be installed by an installer with at least three years of experience performing similar installations.
b. Installer training: Conduct a thorough training with the manufacturer or the manufacturer's representative for the installer on the project. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not limited to the following:

1) Hole drilling procedure
2) Hole preparation and cleaning technique
3) Adhesive injection technique and dispenser training and maintenance
4) Rebar dowel preparation and installation
5) Proof loading/torquing

2. Certifications: Unless otherwise authorized by the Engineer, anchors shall have one of the following certifications:

a. ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria

1.8 DELIVERY AND ACCEPTANCE REQUIREMENTS

A. Deliver materials to Project in such quantities and at such times to ensure continuity of installation.

1.9 STORAGE AND HANDLING REQUIREMENTS

A. Store fasteners in accordance with manufacturer's recommendations.

1.10 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 GENERAL

A. Availability: Confirm availability of all products and notify Architect of any that cannot be provided.

B. Metal Surfaces: For work that will be exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding or by welding and grinding prior to cleaning, treating, and application of surface finishes.

2.2 MANUFACTURERS

A. In other Part 2 Articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products:Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products:Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.3 STRUCTURAL STEEL MATERIALS

A. Fasteners and Anchors:

1. Carbon and Alloy Steel Nuts: ASTM A563.
2. Carbon Steel Washers: ASTM F436.
3. Carbon Steel Threaded Rod: ASTM A36; or ASTM A193 Grade B7; or ISO 898 Class 5.8.
4. Wedge Anchors: ASTM A510; or ASTM A108.
5. Stainless Steel Nuts: ASTM F594.
6. Zinc Plating: ASTM B633.
7. Hot-Dip Galvanizing: ASTM A153.
8. Reinforcing Dowels: ASTM A615

2.4 POST-INSTALLED ANCHORS

A. Adhesive Anchors:

1. Adhesive anchors shall have a current ICC-ES report that demonstrates compliance with ACI 355.4 (which as supplemented by ICC-ES AC308) for use in cracked concrete.
2. For structural or safety related attachments in structures assigned to Seismic Design Category C, D, E, or F, adhesive anchors shall have a current ICC-ES report that demonstrates compliance with ACI 355.4 for use in cracked concrete and shall have passed the simulated seismic tests in accordance with ACI 355.4.
3. Threaded steel rod inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Type and size as indicated on Drawings.
4. Finish:
    a. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel threaded rods conforming to ASTM A36, ASTM A193 Type B7 or ISO 898 Class 5.8 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
    b. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
5. Adhesive anchors shall be as follows:
    a. Into solid, normal weight concrete: Hilti HIT-HY 200 (ECC-ES ESR 3187), Simpson Set-XP (ICC-ES ESR 2508), or approved equal.
    b. Into grout-filled CMU: Hilti HIT-HY 70 (ICC-ES ESR 2682), Simpson SET (ICC-ES ESR 1772), or approved equal.
    c. Into hollow CMU, with screen tube: Hilti HIT-HY 70 (ICC-ES ESR 2682), Simpson SET (ICC-ES ESR 1772), or approved equal.
    d. Hilti HAS threaded rods with HIT-HY 200 Safe Set System using Hilti Hollow Drill Bit System for anchorage to concrete, ICC ESR-3187.
    e. Hilti HIT-Z anchor rods with HIT-HY 200 Safe Set System for anchorage to concrete, ICC ESR-3187.

B. Mechanical Anchors:

1. Mechanical anchors shall have a current ICC-ES report that demonstrates compliance with ACI 355.2 (which is supplemented by ICC-ES AC193) for use in cracked concrete.
2. For structural and safety related attachments in structures assigned to Seismic Design Category C, D, E, or F, mechanical anchors shall have a current ICC-ES report that demonstrates compliance with ACI 355.2 for use in cracked concrete and shall have passed the simulated seismic tests in accordance with ACI 355.2.
3. Wedge Anchors: Wedge type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length identification markings conforming to ICC ES AC01 or ICC ES AC193. Type and size as indicated on Drawings.
    a. Finish:
        1) Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).

2) Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. Stainless steel nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

b. Wedge (expansion) Anchors shall be as follows:

1) Into solid normal weight or lightweight concrete, including normal weight concrete over metal deck: Hilti Kwik Bolt TZ (ICC – ES ESR 1917), Simpson Strong-Bolt 2 (ICC-ES ERS 3037) or approved equal.
2) Into solid grout-filled CMU: Hilti Kwik Bolt 3 (ICC-ES ESR1385), Simpson Wedge-All (ECC-ES ESR 1396) or approved equal

4. Screw Anchors: screw type. Pre-drilling of the hole requires a standard ANSI drill bit with the same diameter as the anchor and installing the anchor will be done with an impact wrench. Provide anchors with a diameter and anchor length marking on the head. Type and size as indicated on Drawings.

a. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating equivalent to DIN EN ISO 4042 (8□m min.).
b. Screw Anchors shall be as follows:

1) Hilti Kwik-HUS-EZ, ICC-ESR 3027
2) Hilti Kwik-HUS EZ-I, ICC-ESR 3027.
3) Simpson Strong-Tie Titen HD, ICC-ESR 1056
4) Simpson Strong Tie Titen HD, ICC ESR 2713

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 FIELD CONNECTIONS

A. Post-Installed Concrete Anchors: Install anchors in accordance with approved ICC-ES report. Where conflicts exist between the approved ICC-ES report and the requirements of this section, the requirements of the ICC-ES report shall control.

3.4 INSTALLATION

A. Drilled-In Anchors: All installation shall be in accordance with manufacturer's installation requirements, along with the following considerations:

1. Drill holes with rotary impact hammer drills using carbide-tipped bits or hollow drill bit system. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
    a. Cored Holes: Where anchors are permitted to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Properly clean cored hole per manufacturer's instructions.
    b. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
    c. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
2. Perform anchor installation in accordance with manufacturer instructions.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.
4. Cartridge Injection Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
5. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.

3.5 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Correct deficiencies in the Work, at Contractor's expense, that test reports and inspections indicate does not comply with the Contract Documents. Re-inspection and re-testing shall be at Contractor's expense.

C. Special Inspections:

1. Testing: 10% of each type and size of drilled-in anchor shall be proof loaded by the independent testing laboratory. Adhesive anchors and capsule anchors shall not be torque tested unless otherwise directed by the Engineer. If any of the tested anchors fail to achieve the specified torque or proof load within the limits as defined on the Drawings, all anchors of the same diameter and type as the failed anchor shall be tested, unless otherwise instructed by the Engineer.

   a. Tension testing should be performed in accordance with ASTM E488.
   b. Torque shall be applied with a calibrated torque wrench.
   c. Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive and capsule anchors at proof load shall not exceed D/10, where D is the nominal anchor diameter.

2. Minimum anchor embedments, proof loads, and torques shall be as shown on the Drawings.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

END OF SECTION