READ THIS FIRST

Notice to the Design Engineer; please refer to the Port of Seattle, Facilities and Infrastructure standards for reference before editing this specification.

This Project Spec Document may need additional modifications to suit your project. It is recommended that you proofread each section, paying attention to any “Notes” boxes such as this one--you should remove these “Notes” sections as you go. Also, do a search for all bracket characters “ [ ] “ as they are used to show you areas containing options or project specific details (you can use Microsoft Word’s Find feature {Ctrl-F} to jump to an open bracket “ [ “ character quickly). Again, these bracket characters should be removed.

It is important that every paragraph be numbered to allow for easy referencing. If you use the document’s built in styles and formatting your outline should be fine (turn on the formatting toolbar by going to View > Toolbars > Formatting). Most paragraphs will use the style “Numbered Material” and can be promoted (Shift) or demoted (Shift-Tab).

You should not have to manually enter extra spaces, carriage returns or outline characters such as A, B, C, or 1.01, 1.02; the formatting will do this for you. The entire document is 11 pt. Arial. If you paste items in, you may need to reapply the “Numbered Material” format.

1. GENERAL
   1. SUMMARY OF WORK
      1. The extent and location of “Seismic Controls for Electrical and Communication Systems” Work is shown in the Contract Documents. This section includes seismic and structural load restraints and other loading-damage-reduction measures for electrical components.
      2. Definitions
         1. Load Restraint: A fixed device such as a seismic brace, an anchor bolt or stud, or a fastening assembly used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component from external loading.
         2. Mobile Structural Element: A part of the building structure such as a slab, floor structure, roof structure, or wall that may move independent of other mobile structural elements during an earthquake.
   2. GOVERNING CODES, STANDARDS, AND REFERENCES
      1. ACI 318 (American Concrete Institute) - Building Code Requirements for Structural Concrete.
      2. ASCE 7 (American Society for Testing of Civil Engineers) - Minimum Design Loads for Buildings and Other Structures.
      3. ASTM - American Society for Testing and Materials.
      4. ICBO - International Conference of Building Officials.
      5. IBC - International Building Code as adopted by the [City of Seattle as the Seattle Building Code] [Seattle-Tacoma International Airport Building Department] [Authority Having Jurisdiction] [other].
      6. NFPA 70 (National Fire Protection Association) - National Electrical Code.
   3. SUBMITTALS
      1. Submit materials data in accordance with Section 01 33 00 - Submittals. Furnish manufacturers’ technical literature, standard details, product specifications, and installation instructions for all products.

Structural Engineer should review all submittals listed under this section.

* + 1. Submittals shall include the following:
       1. Plan: Provide layout and details of seismic bracing assemblies, including relevant information about supporting structure and supported electrical system. Show attachment locations, methods, and spacings, and identifying components.
       2. Calculations: Provide structural calculations for all load restraint assemblies, including calculation of loads for assembly design and reactions applied to supporting structure.
          1. Calculations shall include sufficiency and arrangement of supports as needed.
          2. Coordinate design calculations for seismic, wind, or flood load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
       3. Product Data: For each component used, provide the following:
          1. Illustration of component and its place in the associated assembly
          2. Type and style, including model number if applicable.
          3. Size.
          4. Material.
          5. Strength, including maximum working or ultimate loads in all applicable directions.
          6. Fastening provisions.
          7. Finish.
          8. Limits of use as applicable, indicating suitability for specified application.
          9. Additional Information for Cast-in-Place Anchor Bolts, Post-Installed Concrete Anchors, Studs, and other Anchors: In addition to characteristics listed above, provide the International Code Council Evaluation Services (ICC-ES) report. All anchors shall be certified for use in seismic systems.

Coordinate with Drawings. Where installed outdoor and wind is a factor, include requirements for wind restraints.

* + - 1. Shop Drawings: For anchorage and bracing not defined by details and charts on Drawings. Indicate materials, and show designs and calculations signed and sealed by a Professional Engineer licensed in the State of Washington.
      2. Details: Detail fabrication and arrangement. Detail attachment of restraints to both structural and restrained items. Show attachment locations, methods, and spacings, identifying components and listing their strengths. Indicate direction and magnitude of all forces and moments transmitted to the structure during seismic events.
         1. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
      3. Pre-approval and Evaluation Documentation: By the ICC-ES, showing maximum ratings of restraints and the basis for approval (tests or calculations).

Include paragraph below if seismic bracing of conduit banks, cable trays, and other similar components will be installed in congested areas and if construction budget includes cost of Coordination Drawings.

* + - 1. Coordination Drawings: Plans and sections drawn to scale and coordinating seismic bracing for electrical components with other systems and equipment, including other load restraints, in the vicinity.
      2. Product Certificates: For each type of load restraint system, provide a product certificate signed by manufacturer certifying that products furnished comply with requirements.
      3. Qualification Data: Provide evidence of current licensure for firms and persons specified in “Quality Assurance” section.
  1. QUALITY ASSURANCE
     1. Comply with the International Building Code and ASCE 7 unless requirements in this section are more stringent.
     2. Professional Engineer Qualifications:
        1. All required calculations shall be provided by a Professional Engineer who is licensed in the State of Washington and who is experienced in providing seismic engineering services.
        2. Certification by a Professional Engineer licensed in a state other than Washington, if requested, may be approved by the Engineer.
  2. PROJECT CONDITIONS
     1. In accordance with Section 1605, “Load Combinations” of the International Building Code, shall be used for design.
     2. In accordance with Section 1604.5, “Risk Category” of the International Building Code; the Risk Category of the Work Area is “II”.
     3. The Importance Factor, Ip (Seismic), IW (Wind) shall be selected for each restraint assembly based on the system’s purpose in accordance with applicable section for the design of nonstructural components per ASCE 7.
     4. In accordance with Section 1613, “Earthquake Loads” of the International Building Code the following design values shall be used:

Use the conservative values below for Airport locations. For all other locations or for a potential improvement at Airport locations, talk to the Structural Engineer.

|  |  |
| --- | --- |
| WORK AREA | SEATAC AIRPORT |
| Site Class | D |
| SS | 1.45g |
| S1 | 0.498g |
| SDS | 0.967g |
| SD1 | N/A |

* + 1. In accordance with Section 1609, “Wind Loads” of the International Building Code the following design values shall be used:

|  |  |
| --- | --- |
| WORK AREA | Pier 69 |
| Basic Design Wind Speed | 98-mph |
| Wind Exposure | D |
| Topographical Factor KZT | 1.0 |

* + 1. In accordance with Section 1612, “Flood Loads” of the International Building Code the following design values shall be used:

|  |  |
| --- | --- |
| WORK AREA | Pier 69 |
| Flood Design Class | 2 |

* + 1. Any alternative designs to be considered for substitution shall be per the IBC and ASCE 7 provisions and will be subject to the approval of the Engineer.
  1. COORDINATION
     1. Coordinate layout and installation of seismic bracing with building structural system and architectural features, and with mechanical, fire-protection, electrical, communication, and other building features in the vicinity.
     2. Coordinate concrete bases with building structural system.

1. PRODUCTS

A. If only one product is acceptable (single or sole source product), obtain an approved Competition Waiver and submit to the CPO Construction, Contract Administrator. The language shall read as: “Manufacturer Name, Product # XXXXX, No Equal.” Refer to CPO-6 Competition Waiver Policy for more information.

B. If a Competition Waiver is not approved or more than one product is acceptable, this section must list a minimum of 2 products plus the language “Or Approved Equal,” along with salient characteristics. Refer to CPO Construction’s Salient Characteristics Guidelines for more information.

* 1. MANUFACTURERS
     1. Bracing and attachment: Subject to compliance with requirements, provide bracing and attachment products by one of the following, or other manufacturer with at least 5 years of experience in seismic-specific bracing systems:
        1. Cooper B-Line; Division of Eaton.
        2. Erico
        3. GS Metals; Division of Cooper
        4. Hilti
        5. Thomas & Betts; Division of ABB
        6. Unistrut
        7. Or Approved Equal.
     2. Anchorage: Subject to compliance with requirements, provide anchorage products by one of the following, or other manufacturer with at least 5 years of experience in seismic-specific anchorage:
        1. Hilti
        2. DeWalt
        3. Red Head
        4. Simpson Strong-Tie
        5. Or Approved Equal.
  2. MATERIALS
     1. Use the following materials for restraints:
        1. Indoor Dry Locations: Steel, zinc plated.
        2. Outdoors and Damp Locations: Galvanized steel.
        3. Corrosive Locations: Stainless steel.
     2. Unless otherwise noted, steel materials shall be per Section 05 12 00 – Structural Steel.
  3. ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

Coordinate paragraphs below with Structural Engineer and with Drawings. Seismic calculations will likely be required by the Building Department.

* + 1. All Post-Installed Concrete Anchors shall meet the requirements in Specification 05 05 20 – Post-Installed Concrete Anchors
    2. Strength:
       1. Strengths used for anchor design shall be as noted in the ICC-ES reports, including use of anchor design criteria specified in ACI 318.
          1. Unless otherwise specifically approved by the Engineer, all anchors located in concrete shall be ICC-approved for and designed using “cracked concrete” criteria.
       2. For each load restraint assembly, either Allowable Strength or Ultimate Strength design shall be used. Methodologies shall not be mixed within a single assembly.
    3. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.
    4. Concrete Inserts: Steel-channel type.
    5. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125 Gr. A325.
    6. Welding Lugs: Comply with MSS SP-69, Type 57.
    7. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
    8. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
    9. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.
  1. LOAD RESTRAINT BRACING COMPONENTS
     1. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches on center in webs, and flange edges turned toward web.
        1. Materials for Channel: ASTM A1011, Grade 33.
        2. Materials for Fittings and Accessories: ASTM A575, ASTM A576, or ASTM A36.
        3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
        4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
     2. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.
     3. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
        1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
        2. Wire Rope Cable: Comply with ASTM A603.
     4. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

1. EXECUTION
   1. APPLICATION
      1. Generator Sets: Comply with Section 20 05 48 - Mechanical Sound, Vibration, and Seismic Control.
   2. INSTALLATION
      1. Install load restraints according to applicable codes and regulations and as approved by authority having jurisdiction, unless more stringent requirements are indicated by manufacturer’s recommendation or this section.
   3. STRUCTURAL ATTACHMENTS

Coordinate attachments with Structural Engineer on these items. Delete requirements below to the extent attachments are detailed on Drawings. Coordinate with Drawings.

* + 1. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to transmit the design loads.
    2. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.
    3. Attachments to Existing Concrete: Use expansion anchors.
    4. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars and comply with anchor manufacturer’s recommendations.
    5. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.
    6. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.
    7. Attachments to Wood Structural Members: Install bolts through members.
    8. Attachments to Steel: Bolt to clamps on flanges of beams and columns, or on upper truss chords of bar joists.
  1. ELECTRICAL AND COMMUNICATION EQUIPMENT ANCHORAGE
     1. Anchor rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.
     2. All floor-mounted equipment shall be secured to the housekeeping bases with ductile steel anchor bolts, preset in the concrete base. Secure vibration mounts, where required, to the concrete bases such that the equipment is free to vibrate but cannot move from the base.
        1. Housekeeping Bases: Provide appropriately sized concrete housekeeping bases for all floor-mounted equipment unless noted otherwise. Size concrete bases so expansion anchors will be a minimum of [10] bolt diameters from the edge of the concrete base, or the minimum required by the anchor manufacturer, whichever is larger. Bases shall be 4" [3 ½”] nominal thickness of concrete with #4 reinforcing bars each way on 12" centers and doweled to floor slab unless noted otherwise. Trowel finish with 1" bevel edge all around.
        2. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.
     3. Wall-Mounted Equipment Fastening: Rigidly secure all flush- or surface-mounted equipment, such as panelboards or cabinets, to the structure. Use expanding type anchors for concrete or masonry construction.
        1. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.
     4. Torque bolts and nuts on studs to values recommended by equipment manufacturer.
        1. Mark lugs after torquing with red paint such that paint will be visibly disturbed if lugs are disturbed.
  2. LOAD RESTRAINT BRACING INSTALLATION
     1. Expansion and Contraction: Install all electrical system components to allow for thermal movement of braced components.
     2. Cable Braces: Install snug tight unless otherwise recommended by the manufacturer. Do not exceed the maximum cable slack as recommended by the cable manufacturer.
     3. Attachment to Structure:
        1. All attachment to the structure shall be per the approved details.
        2. If specific attachment is not indicated for cables, conduit or other lightweight elements, anchor bracing to the structure at flanges of beams and columns, upper truss chords of bar joists, or at concrete members.
        3. If specific attachment is not indicated for panels, chases, racks, and other heavier equipment, submit planned attachment detail to the Engineer for specific approval.
  3. ACCOMMODATION OF DIFFERENTIAL MOTION
     1. Make flexible connections in raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.
        1. Where expansion or control joints are crossed, the flexible connection shall allow for movement in each direction (closing, opening, right, and left) equal to the joint’s total width or greater, unless specified otherwise in the Contract Documents, specified otherwise on the structural drawings for the joint’s construction, or approved by the Engineer.

1. MEASUREMENT AND PAYMENT
   1. GENERAL
      1. No separate measurement or payment will be made for the Work required by this section. The cost for this portion of the Work will be considered incidental to, and included in the payments made for the applicable bid items in the [Schedule of Unit Prices] [Lump Sum price bid for the Project].

End of Section

Revision History:

05/01/2014 Conversion to 2004 CSI Numbering System

10/15/2014 Added Sole Source and Salient Characteristics Note to Part 2 and revisions

09/15/2023 Updating Structural Requirements.

04/30/2024 Updated section title

01/12/2025 Revised 2.03.E Through Bolts