
SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

Disciplines: Structural

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Division of the State Architect (DSA) documents referenced within this publication are available on the [DSA Forms](#) or [DSA Publications](#) webpages.

PURPOSE

This Interpretation of Regulations (IR) provides guidelines for the design and installation of metal suspension systems for lay-in ceilings on projects under DSA jurisdiction. This IR does not preclude the use of other systems, including proprietary systems as discussed in Section 4 below or custom designed systems, when approved by DSA.

SCOPE

This IR is applicable to the design, material requirements, gravity load support, seismic load resistance, and interface with mechanical and electrical appurtenances of metal suspension ceilings with lay-in panels. It covers ceiling systems whose total weight, including luminaires, services, and other devices, does not exceed 4 pounds per square foot (PSF). Heavier systems, faceted systems, ceilings that support lateral loads from partitions, and free-floating ceilings supported by chains or cables are beyond the scope of this IR and require project-specific design and details.

Appendix A below provides a library of details illustrating the requirements of this IR. The detail library is available in REVIT format for download via the link in Section 5.9.4 below. The project's design professional (DP) is responsible to select only the appropriate details that are applicable to the project-specific scope defined on the construction drawings. The design professional is also responsible to revise the library details to provide the project-specific information where required as noted in brackets with bold and italicized text, such as “[***DP TO SPECIFY...***]”. It is not permitted to reproduce the body of this IR on the construction documents, except as described in Sections 5.9, 5.10, and Appendix A below.

The primary focus of this IR is typical flat/level ceilings with mineral or glass fiber tiles, troffer light fixtures, and mechanical registers that fit into the ceiling grid. Other types of installations are also addressed but require additional design and detailing by the design professional to produce a set of code compliant details that will be reviewed and approved by DSA. General guidance is provided for sloped ceilings (see Section 2.7 below) and linear luminaires (see Appendix B below).

BACKGROUND

Metal suspension ceiling systems with lay-in tiles are a common type of ceiling construction. Providing guidelines to clarify the design and construction of these systems in compliance with code prescribed requirements promotes consistency in detailing and construction documents, efficiency of plan review, and quality field installation.

California Building Code (CBC) Section 1617A.1.21 modifies American Society of Civil Engineers Standard 7 (ASCE 7), Section 13.5.6.2 by adding an exception to the end of Section 13.5.6.2.2 and adding Section 13.5.6.2.3. ASCE 7 Section 13.5.6.2.2 requires the design and installation to comply with American Society for Testing and Materials (ASTM) standard specifications C635, C636, and E580.

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1. DESIGN AND INSTALLATION REQUIREMENTS**1.1 Ceiling System Components**

Components shall comply with ASTM C635 and ASTM E580 Section 5.1.

1.1.1 The ceiling grid system shall be rated heavy duty per ASTM E580 Section 5.1.1 as defined by ASTM C635. Cross runners shall have a minimum load carrying capability of 16 pounds per linear foot per ASTM E580 Section 5.3.3.

1.1.2 Main runners, cross runners, splices, expansion devices, and intersection connectors shall be designed to carry a mean ultimate test load of not less than 180 pounds in compression and tension per ASTM E580 Section 5.1.2.

1.1.3 Hanger and brace wires shall conform to ASTM A641 and the material properties required by *IR 25-1: Maximum Allowable Load for Ceiling Wires*. Hanger and brace wires shall be #12-gauge (0.106-inch diameter) or larger.

1.2 Suspension System Installation

Installation of the suspension system shall comply with ASTM C636 and ASTM E580 Section 5.2.

1.2.1 Hanger wires shall be provided on a 4-foot by 4-foot grid spacing and shall be attached to main runners. Refer to Appendix A Detail 2.35 below for a graphical illustration. Splices in hanger wires shall develop 50 percent of the wire allowable load. Only one splice is permitted in the entire length of a hanger wire. Refer to Appendix A Detail 6.10 below for a graphical illustration.

1.2.2 Hanger wires shall be provided at the ends of all main and cross runners within 8-inches of the ceiling perimeter or within one-fourth of the length of the end runner, whichever is least. Perimeter hanger wires are not required when the length of the end runner is 8-inches or less. Refer to Appendix A Detail 2.60 below for a graphical illustration.

1.2.3 Ceiling grid members shall be attached to two adjacent walls (attached condition) per ASTM E580 Section 5.2.3 and Figure 4. Ceiling grid members shall be at least 3/4-inch clear of perimeter wall angles on the other walls (free condition) per ASTM E580 Section 5.2.3 and Figure 5. Refer to Appendix A Detail 2.60 below for a graphical illustration.

1.2.4 If a wall or multiple walls are specified in a plan configuration that is not orthogonal to the ceiling grid system, the runner to wall connections shall be as follows. If the following provisions cannot be met, then a project-specific layout of main and cross runners and their connections shall be designed and specified on the construction drawings.

1.2.4.1 At least two adjacent perimeter walls shall be connected to the ceiling grid as attached.

1.2.4.2 Main runners shall be oriented in the direction that facilitates at least one end being connected to a “attached” wall condition.

1.2.4.3 One end of each main runner should be free and clear of the wall as required by Section 1.2.3 above.

1.2.4.4 Opposite ends of some cross runner lines may have the same wall connection type (i.e., attached-attached or free-free). This is permitted with non-orthogonal configurations, but the number of cross runner lines with like connections at each end should be minimized.

1.2.5 The width of the perimeter supporting closure angle shall not be less than 2-inches except as allowed by Section 1.2.6 below. Closure angle shall be screwed or otherwise positively attached to the wall studs or other supporting structure (e.g., blocking).

1.2.6 The use of angles with widths less than 2-inches in conjunction with qualified proprietary

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perimeter clips may be acceptable.

1.2.6.1 Proprietary perimeter clips shall be attached to the supporting closure angle with a minimum of two screws per clip.

1.2.6.2 Proprietary perimeter clips shall be installed around the entire ceiling perimeter except that a steel pop rivet may be used at the attached sides in lieu of clips when permitted by the evaluation report.

1.2.6.3 The proprietary perimeter clip shall be qualified by approved test criteria of ASCE Section 13.5.6.2.2.a. The qualified proprietary perimeter clip shall be in accordance with Section 4 below.

1.2.7 At the unattached walls (free condition) of the ceiling perimeter an interconnection between the runners to prevent lateral spreading per ASTM E580 Section 5.2.4 shall be provided. A metal stabilizer or a #16-gauge wire with a positive mechanical connection to the runner may be used and placed within 8-inches of the wall. Where the perpendicular distance from the wall to the first parallel runner is 8-inches or less, the stabilizer or #16-gauge wire is not required. Refer to Appendix A Detail 2.60 below for a graphical illustration. The use of proprietary perimeter clips to eliminate the need for stabilization is acceptable in accordance with Section 4 below.

1.3 Lateral Force Bracing Assembly Installation

Lateral force bracing assemblies consisting of a compression strut and four #12-gauge splayed bracing wires oriented 90 degrees (in plan) from each other are required for all ceiling areas. Refer to Appendix A Detail 2.35 below for a graphical illustration.

Exception: Lateral force bracing may be omitted for suspended ceiling systems with an area of 144 square feet or less when lateral restraint is provided at all perimeter walls in accordance with CBC Section 1617A.1.21, Item #4 and ASCE 7 Section 13.5.6, Exception 1.

1.3.1 Lateral force bracing assemblies shall be spaced per Table 1 below for all values of the component importance factor (I_p) of the ceiling. Refer to Appendix A Details 2.10, 2.11, and 2.12 below for graphical illustrations. In cases where the brace assembly spacing changes over the height of the building, each level of the reflected ceiling plan shall indicate the required spacing.

TABLE 1: LATERAL FORCE BRACE ASSEMBLY SPACING		
Design Spectral Acceleration Parameter, (S_{DS})	Brace Assembly Spacing	
	$z/h \leq 0.5^a$	$z/h > 0.5^{a,b}$
$S_{DS} \leq 1.15$	12'-0" x 12'-0"	12'-0" x 12'-0"
$1.15 < S_{DS} \leq 1.73$	12'-0" x 12'-0"	8'-0" x 12'-0"
$S_{DS} > 1.73$	8'-0" x 12'-0"	8'-0" x 8'-0"
Footnotes: a. Where, as defined in ASCE 7 Section 13.3.1: z = height in structure of point of attachment of ceiling with respect to the base. h = average roof height of the structure with respect to the base. b. It shall be permitted to use the brace assembly spacing for " $z/h > 0.5$ " for the full building height.		

1.3.2 There shall be a brace assembly located at a distance of not more than one-half of the spacing required by Table 1 above from each surrounding wall, expansion joint, and ceiling edge at any vertical offset. For example, where the brace spacing is 8-feet by 12-feet, the edge distance shall be 4-feet in the direction of the 8-foot spacing and 6-feet in the direction of the 12-foot spacing.

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1.3.3 The slope of bracing wires shall not exceed 45 degrees from the horizontal plane and wires shall be taut. Splices in bracing wires shall develop the wire allowable load. Only one splice is permitted in the entire length of a single brace wire. Refer to Appendix A Detail 6.10 below for a graphical illustration.

1.3.4 Compression struts shall meet the following requirements:

1.3.4.1 The strut shall be sized to adequately resist the vertical component of the ceiling brace force in combination with the vertical seismic force prescribed by ASCE 7 Section 13.3.1.2 and have a maximum slenderness ratio (kl/r) not to exceed 300. The strut sizes and maximum lengths listed in Appendix A Detail 3.21 below are acceptable for ceilings complying with the requirements of this IR.

1.3.4.2 Struts shall not be more than one (horizontal) in six (vertical) out of plumb.

1.3.4.3 Struts shall be separated at least 6-inches from all unbraced ducts, pipes, conduit, etc.

1.3.5 Ceiling sections in different planes or at different elevations shall have independent positive bracing systems to resist lateral movement and seismic loads per ASTM E580 Section 5.2.8.6.

1.3.6 Proprietary lateral force bracing assemblies may be acceptable in accordance with Section 4 below. The manufacturer, model number, and evaluation report number of the proprietary lateral force bracing assemblies shall be specified. Details of the attachment of the proprietary assembly to ceiling grid members and floor/roof structure in accordance with the evaluation report shall be provided on the construction documents.

1.4 Attachment of Hanger and Bracing Wires

The construction documents shall require hanger and bracing wires to be installed in accordance with this section.

1.4.1 Hanger wires shall be fastened with not less than three tight turns in 3-inches per ASTM E580 Section 5.2.7.2. Hanger wire loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops. Refer to Appendix A Detail 4.10 below for a graphical illustration.

1.4.2 Bracing wires shall be fastened with not less than four tight turns in 1-1/2-inches per ASCE Section 13.5.6.2.3, Item #4 as added by CBC Section 1617A.1.21. Bracing wire loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops. Refer to Appendix A Detail 4.10 below for a graphical illustration.

1.4.3 Hanger and bracing wire anchorage to the structure shall be installed in such a manner that the axis of the anchor and clip aligns closely with the direction of the wire. For example, bracing wire ceiling clips shall be bent as shown in the details in Appendix A below and rotated as required to align closely with the direction of the wire; lag screws or wood screws shall be installed so they align closely with the direction of the wire, etc.

1.4.4 Ceiling hanger and bracing wires shall be separated at least 6-inches from all unbraced ducts, pipes, conduit, etc. per ASCE 7 Section 13.5.6.2.3, Item #5 as added by CBC Section 1617A.1.21.

1.4.5 Hanger and bracing wires shall not attach to or bend around obstructions including but not limited to piping, ductwork, conduit, and equipment. Provide trapeze or other supplementary support members at obstructions to facilitate compliance with hanger spacing requirements. Brace assemblies must be configured or located to avoid obstructions while maintaining compliance with the maximum brace assembly spacing requirements.

1.4.6 Additional hangers, struts, and brace assemblies shall be provided as required at all

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ceiling breaks, soffits, or discontinuous areas.

1.4.7 Hanger wires that are out of plumb more than one (horizontal) in six (vertical) shall have counter-sloping wires. See ASTM C636 Figure 1 and Appendix A Detail 4.40 below for acceptable counter-sloping methods.

1.4.8 Hanger wire connection to the structure above shall be capable of carrying not less than a 90-pound allowable load per ASTM E580 Section 5.2.7.2.

1.4.9 Attachment of the bracing wires to the structure above and to the main runners shall be adequate for the load imposed. The ceiling weight (W_p) shall not be taken as less than 4 PSF for calculating seismic forces (F_p).

1.4.10 Post-installed anchors (e.g., expansion anchors, screw anchors, power-actuated fasteners, etc.) shall have a current evaluation report in accordance with *IR A-5: Acceptance of Products, Materials and Evaluation Reports*. The specified embedment of post-installed anchors is permitted to be less than the minimum embedment noted in the Appendix A details below, provided it complies with the evaluation report and the design professional specifies the anchor and demonstrates its structural adequacy.

1.4.11 Power-actuated fasteners in concrete are not permitted for bracing wires.

1.4.12 The DSA-approved construction documents shall address the protection of prestressing tendons when post-installed anchors are specified in prestressed concrete. The construction documents shall require field verification of the existing prestressing tendon or strand locations and include the following:

1.4.12.1 Notes on plans and details indicating where nondestructive scanning is required, and that extreme caution should be exercised while drilling.

1.4.12.2 Minimum clearance dimensions between post-installed anchors and prestressing steel.

1.4.12.3 Notes giving direction in the event of damage to existing prestressing steel, including work stoppage and immediate notification of the design professional.

1.5 Expansion Joint and Seismic Separation Joints

The construction documents shall specify joints in the ceiling system in accordance with this section.

1.5.1 Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors and lobbies or other similar areas. Refer to Appendix A Details 2.30 and 2.40 below for graphical illustrations.

1.5.2 For ceiling areas exceeding 2,500 square feet, a seismic separation joint shall be provided to divide the ceiling into areas not exceeding 2,500 square feet in accordance with ASTM E580 Section 5.2.9. Refer to Appendix A Detail 2.45 below for a graphical illustration.

1.6 Luminaires, Services, and Other Devices

All luminaires, services, and other devices shall be mounted in a manner that will not compromise ceiling performance in accordance with ASTM E580 Sections 5.3 and 5.4.

1.6.1 Ceiling panels shall not support any luminaires, services, or other devices.

1.6.2 Penetrations through the ceiling for sprinkler heads and other similar devices that are not integrally tied to the ceiling system in both horizontal directions shall provide one of the following per ASTM E580 Section 5.2.8.5:

1.6.2.1 2-inch oversized ring, sleeve, or adapter through the ceiling tile to allow free movement

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of 1-inch in all horizontal directions.

1.6.2.2 Flexible sprinkler hose fitting that can accommodate 1-inch of ceiling movement.

1.6.3 Slack safety wires shall be considered hanger wires for installation and testing requirements.

1.6.4 Where Section 1.7.5 or 1.8.4 below require independent vertical support, the following provisions apply:

1.6.4.1 The specified design (including attachment to the structure above) shall be capable of supporting four times the weight of the luminaire or service.

1.6.4.2 Additional slack safety wires are not required.

1.7 Luminaires

All luminaires shall be positively attached to the ceiling suspension systems by mechanical means per California Electrical Code (CEC) Article 410.36 and this section.

1.7.1 A minimum of two screws or approved fasteners capable of resisting a horizontal force equal to the weight of the fixture are required at each light fixture per ASTM E580 Section 5.3.1. See Section 2.1.1 below for pendant luminaires.

1.7.2 Surface-mounted luminaires shall be attached to the main runner with at least two positive clamping devices on each fixture. The clamping device shall completely surround the supporting ceiling runner and be made of steel with a minimum thickness of #14-gauge. Rotational spring catches are not permitted. A #12-gauge slack safety wire shall be connected from each clamping device to the structure above. Provide additional supports when luminaires measure 8-feet or longer or exceed 56 pounds. Maximum spacing between supports shall not exceed 8-feet.

1.7.3 Luminaires weighing less than or equal to 10 pounds may be supported directly on the ceiling runners, but they shall have a minimum of one #12-gauge slack safety wire connected from the luminaire housing to the structure above.

1.7.4 Luminaires weighing greater than 10 pounds but less than or equal to 56 pounds may be supported directly on the ceiling runners, but they shall have a minimum of two #12-gauge slack safety wires connected from the luminaire housing at diagonal corners to the structure above.

Exception: All luminaires greater than 2-feet wide by 4-feet long and no more than 8-feet long weighing less than 56 pounds shall have a #12-gauge slack safety wire at each corner.

1.7.5 All luminaires weighing greater than 56 pounds shall be independently supported by no less than four taut #12-gauge hanger wires (one at each corner) attached from the luminaire housing to the structure above or other approved hangers.

1.8 Services within the Ceiling

All flexible sprinkler hose fitting mounting brackets, ceiling-mounted air terminals, solar daylight tubes, or other services shall be positively attached to the ceiling suspension systems by mechanical means to resist a horizontal force equal to the weight of the component.

1.8.1 Screws or approved fasteners are required. A minimum of two attachments are required at each component.

1.8.2 Flexible sprinkler hose fittings, ceiling-mounted air terminals, and other services weighing less than or equal to 20 pounds shall have one #12-gauge slack safety wire attached from the terminal or service to the structure above.

1.8.3 Flexible sprinkler hose fittings, ceiling-mounted air terminals, and other services weighing

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more than 20 pounds but less than or equal to 56 pounds shall have two #12-gauge slack safety wires (at diagonal corners) connected from the terminal or service to the structure above.

1.8.4 Flexible sprinkler hose fittings, ceiling-mounted air terminals, and other services weighing more than 56 pounds shall be independently supported directly from the structure above by no less than four taut #12-gauge hanger wires attached from the terminal or service to the structure above or other approved hangers.

1.9 Other Devices within the Ceiling

Miscellaneous lightweight devices weighing 20 pounds or less, such as strobe lights, occupancy sensors, speakers, exit signs, etc., shall be attached to the ceiling grid per Section 1.8.1 above. In addition, devices weighing more than 10 pounds shall have one #12-gauge slack safety wire anchored to the structure above per Section 1.8.2 above.

2. ADDITIONAL REQUIREMENTS**2.1 Alternate Luminaire Types**

2.1.1 Where pendant luminaires are specified in areas with a suspended ceiling, the construction documents shall include complete support details complying with *IR 16-9: Pendant Luminaires*.

2.1.2 Where recessed linear luminaires are specified in areas with a suspended ceiling, refer to Appendix B below for design and construction guidelines.

2.2 Fire-Resistance-Rated Ceilings

The construction documents shall include a manufacturer's installation detail and specify a tested assembly number for fire-resistance-rated ceiling assemblies from a nationally recognized testing laboratory.

2.2.1 The components and installation details shall conform in every respect with the listed detail and number. Details shall clearly depict all components, including insulation materials, framing, and attachment of the design so that the assembly can be constructed and inspected accordingly.

2.2.2 Pop rivets, screws or other attachments are not acceptable unless specifically detailed in the listed construction detail(s), or an approved listing by a State Fire Marshal recognized laboratory.

2.3 Acoustical Ceiling Tile Panel Clearance

For ceiling installations utilizing acoustical tile panels of mineral or glass fiber, it is not mandatory to provide 3/4-inch clearance between the acoustical tile panels and the wall on the sides of the ceiling which are free to slip. See Section 2.4 below for other panel types. Clearance between the ceiling grid members and the walls as required by Section 1.2.3 above is required regardless of the ceiling tile material.

2.4 Other Panel Types

Panels other than mineral fiber and glass fiber acoustical tile shall weigh no more than 0.5 PSF and be positively attached to the ceiling runners by mechanical means, such as bolts, cables, carabiners, d-shaped rings, screws, or rivets. Each attachment shall have an allowable design strength to support the weight of the panel acting in any direction. A minimum of two attachments are required for each panel. For ceiling installations utilizing panels other than mineral or glass fiber, 3/4-inch clearance shall be provided between the ceiling panel and the wall on the sides of the ceiling area which are free to slip.

2.4.1 Other types of attachment, such as clips, snap-in devices, perforated lips, clamping

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devices, or spring-loaded devices or hooks, can be accepted when qualified by an evaluation report per IR A-5. The attachment device shall be seismically qualified in accordance with ASCE 7 Section 13.2.5 or 13.2.6.

2.4.2 An alternate means of compliance per California Administrative Code (CAC) Section 4-304 may be used to achieve approval on a project-by-project basis of other means of attachment without an evaluation report per IR A-5. See *Procedure (PR) 18-01: Request for Alternate Design, Materials and Methods of Construction*. The alternate means of attachment shall have an allowable design strength to support the weight of the panel acting in any direction and shall be capable of maintaining that strength if the ceiling grid is distorted or out of level.

2.4.3 In lieu of direct restraint attachments, it is permitted to provide a secondary means of supporting the panel in case of panel dropout or dislodgement due to ceiling grid distortion or the ceiling grid becoming out-of-level. The secondary attachment shall have an allowable design strength to support two times the weight of the panel acting in any direction. A slack wire or cable connecting each panel to the ceiling grid or structure above are examples of secondary means of support.

2.4.4 Special attachment details complying with one of the methods outlined above shall be provided for the ceiling perimeter condition, where panels are cut or altered and where nonstandard panel sizes or edge conditions occur.

2.5 Exits

Ceilings over exit paths shall be installed in accordance with ASCE 7 Section 13.5.6.2.3, Item 1 as added by CBC Section 1617A.1.21. A main or cross runner shall be installed on all sides of each ceiling panel, luminaire, and service device. Splices or intersection of such runners shall be attached with through connectors such as pop rivets, screws, pins, plates with end tabs, or other approved connectors.

2.6 Free-Floating Ceilings

Free-floating ceilings (i.e., ceilings not attached to any walls) supported by wires in accordance with this IR shall be braced in accordance with Section 1.3 above, regardless of the ceiling area, unless it can be demonstrated the anticipated ceiling movement will not cause failure of the ceiling components or failure of mechanical, electrical, plumbing, or fire and life safety components and systems within the area of anticipated movement. The anticipated movement can be assumed as the hanger supports swinging to a 45-degree angle from vertical in any plan direction.

The perimeter of free-floating ceilings shall be supported by a continuous runner which is spliced in accordance with ASTM E580 Section 5.1.2.

2.7 Sloped Ceilings

Sloped ceilings with acoustical mineral or glass fiber tiles, surrounded on all sides by partition walls are permitted in accordance with the requirements of this section. Sloped ceilings not meeting the requirements of this section shall be custom designed and detailed.

2.7.1 The slope of the ceiling shall not exceed the manufacturer's published maximum slope recommendation nor 25 degrees from horizontal, whichever is less. The ceiling shall be square or rectangular in plan. The structure above the sloped ceiling may be flat or sloped in a different direction.

2.7.2 The slope shall occur across a single plane. The slope of the ceiling is to be uniform from the intersection of the wall at the lowest end of the ceiling to the intersection of the wall at the uppermost end of the ceiling. A gable or multifaceted ceiling profile can be accomplished within the parameters of these provisions by replacing a full height wall with a soffit at the ridge or

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each slope transition line. The design must demonstrate the soffit construction provides strength and stiffness in the plane of the ceiling equivalent to a full height wall.

2.7.3 Specific detailing of the sloped ceiling system is required. The requirements for a level ceiling in this IR also apply to sloped ceilings. The library of details in Appendix A below does not include details specific to sloped ceilings, but the details provided for level ceilings can be modified to meet the requirements of this section. The design professional shall review manufacturer technical guides for recommended installation to assist in the development of site-specific details.

2.7.4 DSA may require structural calculations to demonstrate the adequacy of the lateral bracing system.

2.7.5 Sloped ceilings shall comply with the following detailing requirements:

2.7.5.1 Attachment of proprietary perimeter clips to the walls shall comply with Section 1.2.6 above.

2.7.5.2 Main runners are to be installed parallel (up/down) to the direction of the ceiling slope.

2.7.5.3 Runners at the bottom/lower end of the slope shall be installed as the attached side per Section 1.2.3 above.

2.7.5.4 Runners at the top/higher end of the slope shall be installed as the free side per Section 1.2.3 above.

2.7.5.5 Perimeter wall angles at the top and bottom of the slope are to be shimmed or installed with adjustable wall mounting brackets such that the bottom leg of the angle aligns with the plane of the ceiling. This is to ensure the 90-degree angle of the wall trim in relation to the runner is maintained. Bending the leg(s) of the wall angle to match the slope of the ceiling is prohibited.

2.7.5.6 Hanger wires, including slack wires, are to be installed vertical and plumb.

2.7.5.7 Compression struts are to be installed vertical and plumb in compliance with Section 1.3.4.2 above.

2.7.5.8 Brace wires are to be installed a maximum of 45 degrees from the horizontal plane.

2.7.5.9 Shims between the tiles and the grid are required to ensure panels are centered to resist sliding out.

2.7.5.10 Panel edge hold down clips are to be installed along the top of the grid to the ceiling tiles as follows:

2.7.5.10.1 For ceiling slope less than or equal to 15 degrees from horizontal: Clips are to be installed at each main runner and cross runner around the perimeter of the ceiling in the first bay adjacent to the walls. See Appendix A Detail 2.90 below.

2.7.5.10.2 For ceiling slope greater than 15 degrees but less than or equal to 25 degrees from horizontal: Clips are to be installed per the illustration in Appendix A Detail 2.90 below.

2.7.5.11 A minimum 3/4" horizontal clearance of the runners to the wall angle is to be maintained at the free sides.

2.7.5.12 The use of a 7/8-inch wall angle requires proprietary seismic clips. Each seismic clip shall be attached to the wall angle with two screws.

2.7.6 Sloped free floating ceilings are beyond the scope of this IR. The design professional is responsible to provide project-specific design (including supporting calculations) and details.

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When any portion of an existing grid system is cut or altered and any one of the conditions described in the subsections below applies, the entire ceiling in the affected space shall be evaluated and upgraded as required to meet the requirements of the current CBC and this IR. With DSA concurrence, other existing lateral bracing systems may be deemed equivalent to a 4-way brace wire and compression post lateral force bracing system.

3.1.1 The existing ceiling does not have lateral bracing assemblies (i.e., 4-way brace wires and compression post).

3.1.2 The existing ceiling has lateral bracing assemblies (i.e., 4-way brace wires and compression post) with spacing greater than 12-feet on center in either principal axis.

3.1.3 The area cut or altered exceeds 10 percent of the entire ceiling area. The “entire” ceiling in the affected space is defined as the area of ceiling bounded by four walls or a combination of walls and expansion joints or seismic separation joints.

3.2 Existing Grid Not Cut or Altered

Evaluation and associated upgrade to the ceiling grid, suspension system, and lateral force bracing assemblies is not required when the ceiling grid is not cut or altered, and the scope of work is limited to the following:

3.2.1 Replacement of existing ceiling panels with like panels of equal or lesser weight.

3.2.2 Replacement of luminaires or air terminals with like units (i.e., equal size and equal or lesser weight) placed in the same locations.

3.2.3 Replacement of only the internal lighting components (e.g., lens, ballast, or lamps) within existing luminaires and the attachment of the luminaire’s outer enclosure to existing grid is not altered.

3.3 Reuse of Existing Ceiling Wires

Existing ceiling hanger and bracing wires may be reused provided the following requirements are met:

3.3.1 Wire gauge and spacing complies with the current applicable codes and this IR.

3.3.2 DSA-approved construction drawings include a detail specifying the splice between a new and existing wire. Acceptable wire splice details are provided in Appendix A Detail 6.10 below.

3.3.3 Wires are tested in accordance with Section 6.2 below.

4. ACCEPTANCE OF EVALUATION REPORTS

Ceiling grid systems and components with valid evaluation reports issued by qualified evaluation agencies, in accordance with IR A-5 are accepted by DSA, provided the system or component meets the requirements of CBC Section 1617A.1.21, ASTM C635, ASTM C636, and ASTM E580 Section 5. Where a qualified evaluation report is utilized, the installation shall comply with all the requirements specified in the evaluation report (e.g., connections, member sizes, perimeter details, special clips to wall angles, rigid braces, etc.).

In accordance with IR A-5, DSA will accept Department of Health Care Access and Information (HCAi) Preapproved Details (OPD) “2013 CBC Standard Suspended Ceiling Details for Acoustical Tile or Lay-in Panel Ceilings” and HCAi Preapproval of Manufacturer Certification (OPM).



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The construction documents shall clearly specify all suspended ceiling systems, support details, and lateral bracing requirements.

5.1 General Requirements

The items listed in this section shall be specified in the construction documents where applicable to the project scope. This list includes items common to most projects but may not include all information required for all projects. Additional information and details may be required on the construction documents for project-specific specialty conditions, configurations, products, etc.

Except as indicated in Sections 5.9 and 5.10 and Appendix A below, it is not permitted to reproduce this IR on the construction documents as a means of compliance.

5.2 Ceiling Systems

An acceptable ceiling grid system (or multiple systems) shall be specified on the construction documents. Each system specified must be classified as heavy duty and shall have a valid evaluation report in accordance with IR A-5. The construction documents shall specify the following for each specified grid system:

5.2.1 Manufacturer.

5.2.2 Product name.

5.2.3 Evaluation report number.

5.2.4 Main runner part, model, or catalog number.

5.2.5 Cross runner part, model, or catalog number.

5.2.6 Seismic wall clip (if used).

When manufacturer specific information (e.g., proprietary seismic wall clips, adjustable wall molding brackets, panel hold downs clips, etc.) is stated in the specifications, details on the construction drawings shall be provided and coordinated to reflect the same manufacturer specific information.

5.3 Ceiling Suspension System

The ceiling suspension system and its anchorage to the structure shall be fully detailed. Where proprietary devices, clips, wall angles, brackets, etc. are specified, the details on the construction documents shall clearly specify the installation information necessary to show compliance with all evaluation report requirements.

5.4 Ceiling Lateral Force Bracing

The ceiling lateral force bracing system, including bracing wires, compression struts, and anchorage to the structure shall be fully detailed on the construction documents. The bracing assembly spacing at each floor level shall be clearly specified.

When a proprietary lateral force bracing system with a valid approval per IR A-5 (e.g., HCAI OPM), the manufacturer's system-specific information and details (e.g., ceiling grid clip, bracing members, connectors, etc.) shall be included on the construction documents.

5.5 Expansion Joints and Seismic Separations Joints

Expansion joints and seismic separation joints shall be fully detailed, and their locations shall be shown on the reflected ceiling plans.

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**5.6 Luminaires, Services and Other Devices**

Details specifying required support and bracing of all luminaires, services, and other devices shall be provided as required to comply with this IR. Where pendant luminaires are to be installed in areas with a suspended ceiling, the construction documents shall include complete support details complying with IR 16-9.

5.7 Supplementary Support Members

Details of trapeze or other supplementary support members necessary to maintain typical hanger spacing while avoiding obstructions shall be shown on the construction documents.

5.8 Partition Bracing

Partition bracing shall be shown on the construction documents and be independent of the ceiling system.

5.9 Ceiling Notes and Details in Appendix A

The ceiling notes and details provided in Appendix A below are deemed to meet the general requirements of this IR. These notes and details shall not be used for construction or inspection except when incorporated in DSA-approved construction documents.

5.9.1 Use of the notes and details in Appendix A is not mandated by DSA; they are provided only as a convenience to the design professional for incorporation into the construction documents.

5.9.2 Use of other notes and details created by the design professional is always acceptable provided they comply with the CBC and this IR.

5.9.3 While the Appendix A notes and details do not cover every condition that may occur on every project, they are intended to cover conditions common to most projects with suspended ceilings. It is anticipated their use will facilitate a more efficient design, plan review, and construction process.

5.9.4 An [electronic drawing file](#) of the Appendix A details in Revit LT™ 2024 format is available for download.

5.9.4.1 DSA provides this electronic drawing file to the design professional for convenience only. DSA is not responsible for issues of compatibility with particular computer systems or conversion to other file formats.

5.9.4.2 The requirements of this IR are in no way changed or modified by providing the design professional with this electronic drawing file.

5.9.4.3 The electronic drawing file may not be currently up to date or in conformance with the published IR. The design professional shall verify and coordinate the information with the latest published IR.

5.9.4.4 Information contained in the file may be changed or updated by DSA, and DSA has no responsibility to notify or supply the registered design professional with these changes.

5.10 Ceiling Notes and Details: Conditions of Use

The conditions and requirements for use of the ceiling notes and details in Appendix A below are as follows:

5.10.1 The details give no consideration to suitability for use in a specific application, compatibility with other building systems, appropriate use of materials or design, appearances, etc. The design professionals listed on the form *DSA 1: Application for Approval of Plans and Specifications* shall review all such qualities, features, and properties to ensure code

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

compliance, appropriate integration with other building systems, and proper design for the project-specific conditions.

5.10.2 When the details in Appendix A below are used, they shall be incorporated into the construction drawings submitted for DSA review and approval. Incorporation by reference alone is not permitted. Only the notes and details applicable to the scope of the project shall be incorporated in the construction documents (e.g., do not include wood connection details in the construction drawings for a concrete structure, do not include essential services building details in the construction documents for a school project, etc.).

5.10.3 Provided the content of the details is not changed, it is left to the discretion of the design professional to reconfigure (i.e., renumber, resize, etc.) the details for integration into the construction drawings.

Exception: The design professional (DP) is required to provide additional information on all details where so indicated in brackets with bold and italicized text, such as “[***DP TO SPECIFY...***]”. These brackets and notes to the design professional shall be removed from the details and replaced with the applicable information.

5.10.4 These details submitted as part of the construction documents during the plan review process will be subject to plan review as follows:

5.10.4.1 It is expected no plan review comment will be made on a detail incorporated into the construction documents that is unaltered and found applicable to the project for which it is submitted.

5.10.4.2 Where a detail requires the designer to provide additional information to complete the detail before applying it to the drawings, plan review will be limited to the following:

5.10.4.2.1 A review of the additional information provided.

5.10.4.2.2 A review to determine if the detail, with the additional information, is applicable to the project for which it is submitted.

5.10.4.3 Where a detail incorporated into the construction documents has been altered beyond that described above, it will be subject to a full review for both detail content and applicability to the project for which it is submitted.

5.10.5 Where conditions not covered by the details in Appendix A below occur, project-specific design and details shall be provided by the design professional. This includes, but is not limited to, pendant luminaires, projector supports, projector screens, ceiling fans, free-floating ceilings, etc.

6. TESTING

All field testing shall be performed in the presence of the project inspector or a special inspector. |

6.1 New Installations

Post-installed anchors in concrete used to support new ceiling systems shall be tested in accordance with this section.

6.1.1 Anchors for hanger wires shall be tested at a frequency of 10 percent. Power-actuated fasteners in concrete shall be field tested for 200 pounds in tension. Test loads for other post-installed anchors shall be tested in accordance with CBC Section 1910A.5. |

6.1.2 Anchors for bracing wires shall be tested at a frequency of 50 percent in accordance with CBC Section 1910A.5. |

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6.2 Reuse of Existing Ceiling Hanger Wires and Bracing Wires

Existing hanger and bracing wires to be reused in the construction of new ceilings shall be tested in accordance with this section.

6.2.1 All existing ceiling hanger wire assemblies shall be field tested to 200 pounds. If existing hanger wires are spaced no more than 4'-0" on center each way and the first 20 tests pass, the testing frequency can be reduced to 50 percent.

6.2.2 All existing bracing wire assemblies shall be field tested to 440 pounds at a 45-degree angle from horizontal and in the plan direction the wire will be reused. If the first 20 tests pass, the testing frequency can be reduced to 50 percent.

6.2.3 Where a new wire is spliced to an existing wire, each spliced wire shall be field tested to the loads given for existing assemblies above.

6.2.4 The testing frequency reductions given in Section 6.2.1 and 6.2.2 above are not permitted for existing nonconforming buildings subject to rehabilitation in accordance with CAC Section 4-307.

REFERENCES:

2022 California Code of Regulations (CCR) Title 24
Part 2: California Building Code (CBC), Section 1617A.1.21.
Part 3: California Electrical Code (CEC), Article 410.36.

This IR is intended for use by DSA staff and by design professionals to promote statewide consistency for review and approval of plans and specifications as well as construction oversight of projects within the jurisdiction of DSA, which includes State of California public schools (K–12), community colleges and state-owned or state-leased essential services buildings. This IR indicates an acceptable method for achieving compliance with applicable codes and regulations, although other methods proposed by design professionals may be considered by DSA.

This IR is subject to revision at any time. Please check DSA's website for currently effective IRs. Only IRs listed on the webpage at www.dgs.ca.gov/dsa/publications at the time of project application submittal to DSA are considered applicable.

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**APPENDIX A: CONSTRUCTION DOCUMENTS CEILING NOTES AND DETAILS**

See Sections 5.9 and 5.10 above for instruction and guidance on the proper use of these notes and details in the construction documents by the design professional (DP).

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Number	Title	Revision Date
1.00	Ceiling Notes	11/2023
2.10	Typ. Ceiling Plan for 8'-0" by 8'-0" Brace Assembly Spacing	03/2022
2.11	Typ. Ceiling Plan for 8'-0" by 12'-0" Brace Assembly Spacing	03/2022
2.12	Typ. Ceiling Plan for 12'-0" by 12'-0" Brace Assembly Spacing	03/2022
2.30	Corridor Ceiling Plan (School Buildings)	03/2022
2.31	Corridor Ceiling Plan (Essential Service Buildings)	03/2022
2.35	Suspension and Lateral Bracing Assembly	03/2022
2.40	Expansion Joint (School Buildings)	03/2022
2.41	Expansion Joint (Essential Service Buildings)	03/2022
2.45	Seismic Separation Joint	03/2022
2.50	Typ. Section at Exit Corridor (Essential Service Buildings)	03/2022
2.60	Ceiling Perimeter	03/2022
2.80	Luminaire / Air Terminal Support	03/2022
2.90	Panel Hold Down Clips at Sloped Ceiling	03/2022
3.10	Compression Strut - Channel Type	11/2023
3.20	Compression Strut - EMT Type	11/2023
3.21	Compression Strut Table	03/2022
4.10	Hanger and Brace Wire Connections: Typ. Wire Turn	03/2022
4.11	Hanger and Brace Wire Connections Table	11/2023
4.20	Hanger Wire Connection to Metal Deck	03/2022
4.21	Hanger Wire Connection to Concrete Over Metal Deck	11/2023
4.22	Hanger Wire Connection to Concrete Slab, Beam, or Joist	03/2022
4.23	Hanger Wire Connection to Structural Steel	03/2022
4.24	Hanger Wire Connection to Metal Stud Wall	11/2023
4.25	Hanger Wire Connection to Sawn Timber	11/2023

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4.26	Hanger Wire Connection to Wood I-Joist	03/2022
4.27	Hanger Wire Connection to Wood Chord Truss	03/2022
4.28	Hanger Wire Connection to Open Web Steel Joist	03/2022
4.29	Typical Saddle Tie Detail	03/2022
4.30	Not used	
4.31	Brace Wire Connection to Concrete Over Metal Deck	11/2023
4.32	Brace Wire Connection to Concrete Slab, Beam, or Joist	11/2023
4.33	Brace Wire Connection to Structural Steel	03/2022
4.34	Brace Wire Connection to Metal Stud Wall	03/2022
4.35	Brace Wire Connection to Sawn Timber	11/2023
4.36	Brace Wire Connection to Wood I-Joist	03/2022
4.37	Brace Wire Connection to Wood I-Joist	09/2015
4.38	Brace Wire Connection to Wood Chord Truss	03/2022
4.39	Brace Wire Connection to Open Web Steel Joist	03/2022
4.40	Hanger Wire Countersloping Methods (Ref. ASTM C363)	03/2022
5.10	Compression Strut Connection Table	03/2022
5.20	Strut Connection to Bare Metal Deck	11/2023
5.21	Strut Connection to Concrete Over Metal Deck	11/2023
5.30	Strut Connection to Concrete Slab, Beam, or Joist	11/2023
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5.50	Strut Connection to Sawn Timber with Gypsum Board	11/2023
5.51	Strut Connection to Sawn Timber without Gypsum Board	11/2023
5.52	Strut Connection to I-Joist	11/2023
6.10	Ceiling Wire Splices	03/2022

Detail Title: SHEET INDEX	REV: 09/21/2015	Detail No. 0.01
	REV: 03/2022	
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SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**1. CEILING SYSTEM GENERAL NOTES**

- 1.01 Ceiling system components shall comply with ASTM C635 and Section 5.1 of ASTM E580.
- 1.02 The ceiling grid system shall be rated heavy duty as defined by ASTM C635.
- 1.03 Ceiling systems. The following ceiling system(s) is/are part of the scope of this project:
- Manufacturer: **[DP to specify]**
- Product Name: **[DP to specify]**
- Evaluation Report Number: **[DP to specify]**
- Main Runner Part, Model, or Catalog Number: **[DP to specify]**
- Cross Runner Part, Model, or Catalog Number: **[DP to specify]**
- 1.04 Seismic Wall Clip:
- Manufacturer's Model: **[DP to specify if used]**
- 1.05 Ceiling panels shall not support any luminaires, air terminals, or devices.
- 1.06 For acoustical tile panels of any material other than mineral or glass fiber, a 3/4" clearance shall be provided between the panel and the wall on the sides of the ceiling free to slip. Clearance between ceiling grid runners and walls shall comply with the details on these drawings regardless of ceiling tile material.

2. MATERIALS

- 2.01 Ceiling wire shall be Class 1 zinc coated (galvanized) carbon steel conforming to ASTM A641. Wire shall be #12 gauge (0.106" diameter) with soft temper and minimum ultimate tensile strength = 70 ksi.
- 2.02 Galvanized sheet steel (including that used for metal stud compression struts) shall conform to ASTM A653, or other equivalent sheet steel listed in Section A3.1 of the North American Specification for the Design of Cold-Formed Steel Structural Members, (AISI S100). Material 43 mil (18 gauge) thick and lighter shall have minimum yield strength of 33 ksi. Material 54 mil (16 gauge) thick and heavier shall have a minimum yield strength of 50 ksi.
- 2.03 Electrical metallic tube (EMT) shall conform to ANSI C80.3/UL 797 carbon steel with G90 galvanizing. EMT shall have minimum yield strength of 30 ksi and minimum ultimate strength of 48 ksi.

3. ATTACHMENT OF HANGER AND BRACING WIRES

- 3.01 All ceiling hanger and bracing wires shall be separated at least 6 inches from all unbraced ducts, pipes, conduit, etc.
- 3.02 Hanger and bracing wires shall not attach to or bend around obstructions including but not limited to piping, ductwork, conduit, and equipment.
- 3.03 Hanger wires that are more than one (horizontal) in six (vertical) out of plumb shall have counter-sloping wires.

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- 3.04 Slack safety wires shall be considered hanger wires for installation and testing requirements.
- 3.05 Hanger and bracing wire anchorage to the structure shall be installed such that the direction of the anchorage aligns with the direction of the wire. Bracing wire ceiling clips shall be bent as shown in the details and rotated as required to align with the direction of the wire. Screws in wood shall be installed to align with the direction of the wire.

4. FASTENERS AND WELDING

- 4.01 Sheet metal screws shall comply with ASTM C1513 and ASME B18.6.3. Penetration of screws through joined material shall not be less than three exposed threads.
- 4.02 Expansion anchors shall be: **[DP to specify manufacturer, product, evaluation report number, and test load for each size specified per CBC 1910A.5.4.]**
- 4.03 Power-Actuated Fasteners shall be: **[DP to specify manufacturer, product, evaluation report number.]**
- 4.04 If not otherwise specified in the evaluation report, power-actuated fasteners installed in steel shall be installed so the entire pointed end of the fastener is driven through the steel member.
- 4.05 Power-actuated fasteners in concrete or masonry are not permitted for bracing wires.
- 4.06 Concrete reinforcement and prestressing tendons shall be located by non-destructive means prior to installing post-installed anchors.
- 4.07 Welding shall be in accordance with AWS D1.3 using E60XX series electrodes.

5. TESTING

- 5.01 All field testing shall be performed in the presence of the project inspector.
- 5.02 Post-installed anchors in concrete used to support hanger wires shall be tested at a frequency of 10 percent. Power-actuated fasteners in concrete shall be field tested for 200 pounds in tension. All other post-installed anchors in concrete shall be tested in accordance with CBC Section 1910A.5.
- 5.03 Post-installed anchors in concrete used to attach bracing wires shall be tested at a frequency of 50 percent and in accordance with CBC Section 1910A.5.

6. LUMINAIRES

- 6.01 All luminaires shall be positively attached to the ceiling suspension systems by mechanical means to resist a horizontal force equal to the weight of the luminaire. A minimum of two screws or approved fasteners are required at each luminaire per ASTM E580 Section 5.3.1.
- 6.02 Surface-mounted luminaires shall be attached to the main runner with at least two positive clamping devices. The clamping device shall completely surround the supporting ceiling runner and be made of steel with a minimum thickness of #14 gauge. Rotational spring catches are not permitted. A #12 gauge slack safety wire shall be connected from each clamping device to the structure above. Additional supports shall be provided when a luminaire is 8 feet or longer or exceeds 56 pounds. Maximum spacing between supports shall not exceed 8 feet.

Detail Title: CEILING NOTES	REV: 09/21/2015	Detail No. 1.00
	REV: 03/2022	
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SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

6.03 Luminaires weighing less than or equal to 10 pounds supported directly on the ceiling runners shall have a minimum of one #12 gauge slack safety wire connected from the fixture housing to the structure above.

6.04 Luminaires weighing greater than 10 pounds but less than or equal to 56 pounds supported directly on the ceiling runners shall have a minimum of two #12 gauge slack safety wires connected from the fixture housing at diagonal corners to the structure above.

Exception: All luminaires greater than two by four feet weighing less than 56 pounds shall have a #12 gauge slack safety wire at each corner.

6.05 All luminaires weighing greater than 56 pounds shall be independently supported from the structure above. See support details on these drawings for more information.

7. SERVICES WITHIN THE CEILING

7.01 All flexible sprinkler hose fitting mounting brackets, ceiling-mounted air terminals, or other services shall be positively attached to the ceiling suspension systems by mechanical means. Screws or other fasteners specified on the drawings are required. A minimum of two attachments are required at each component.

7.02 Ceiling-mounted services weighing less than or equal to 20 pounds shall have one #12 gauge slack safety wire attached from the terminal or service to the structure above.

7.03 Ceiling-mounted services weighing more than 20 pounds but less than or equal to 56 pounds shall have two #12 gauge slack safety wires (at diagonal corners) connected from the terminal or service to the structure above.

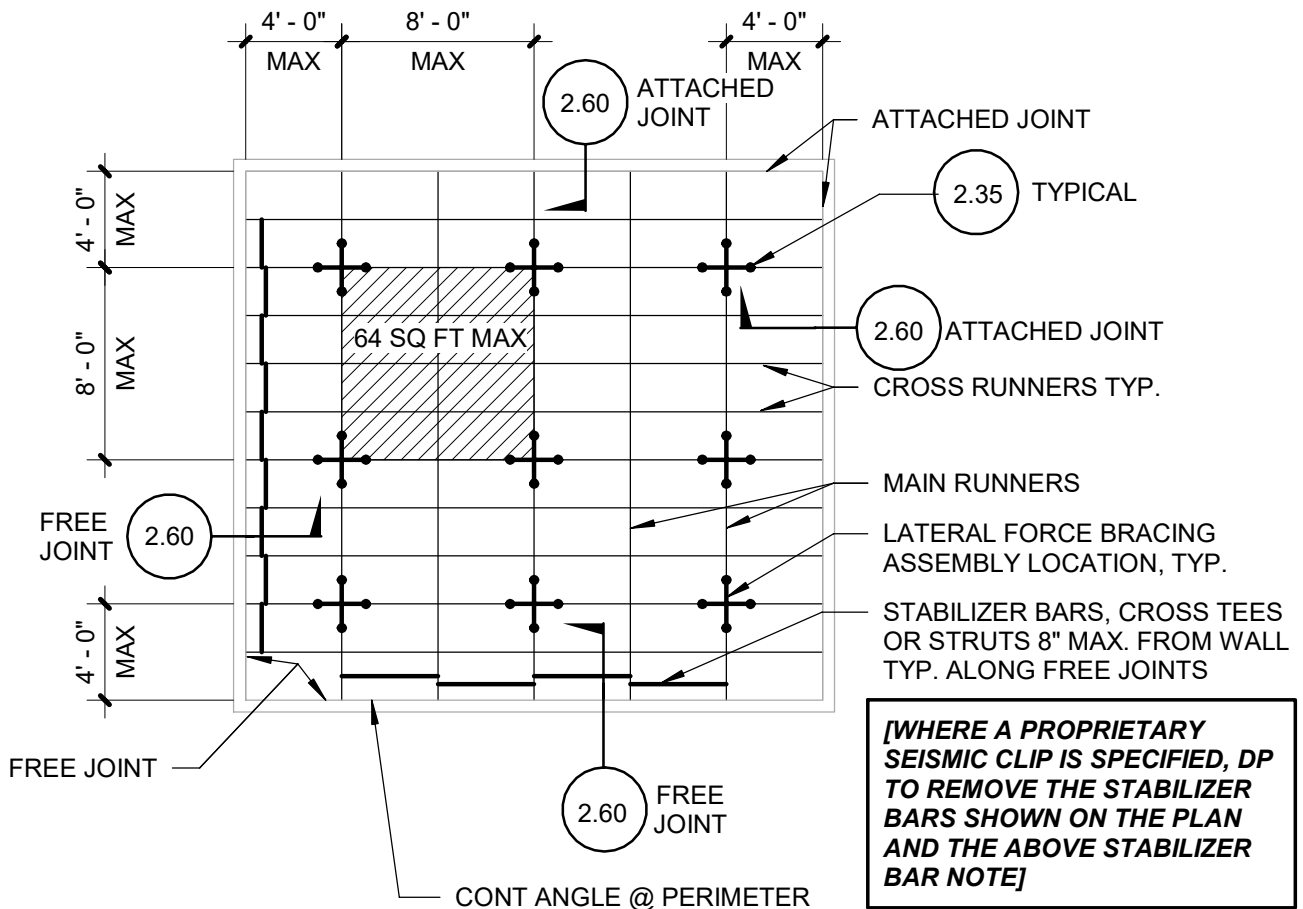
7.04 Ceiling-mounted services weighing more than 56 pounds shall be independently supported from the structure above. See support details on these drawings for more information.

8. OTHER DEVICES WITHIN THE CEILING

8.01 All lightweight miscellaneous devices, such as strobe lights, occupancy sensors, speakers, exit signs, etc., shall be attached to the ceiling grid. Devices weighing more than 10 pounds shall have a #12 gauge slack safety wire anchored to the structure above. Devices weighing more than 20 pounds shall be independently supported from the structure above.

Detail Title: CEILING NOTES	REV: 09/21/2015	Detail No. 1.00
	REV: 03/2022	
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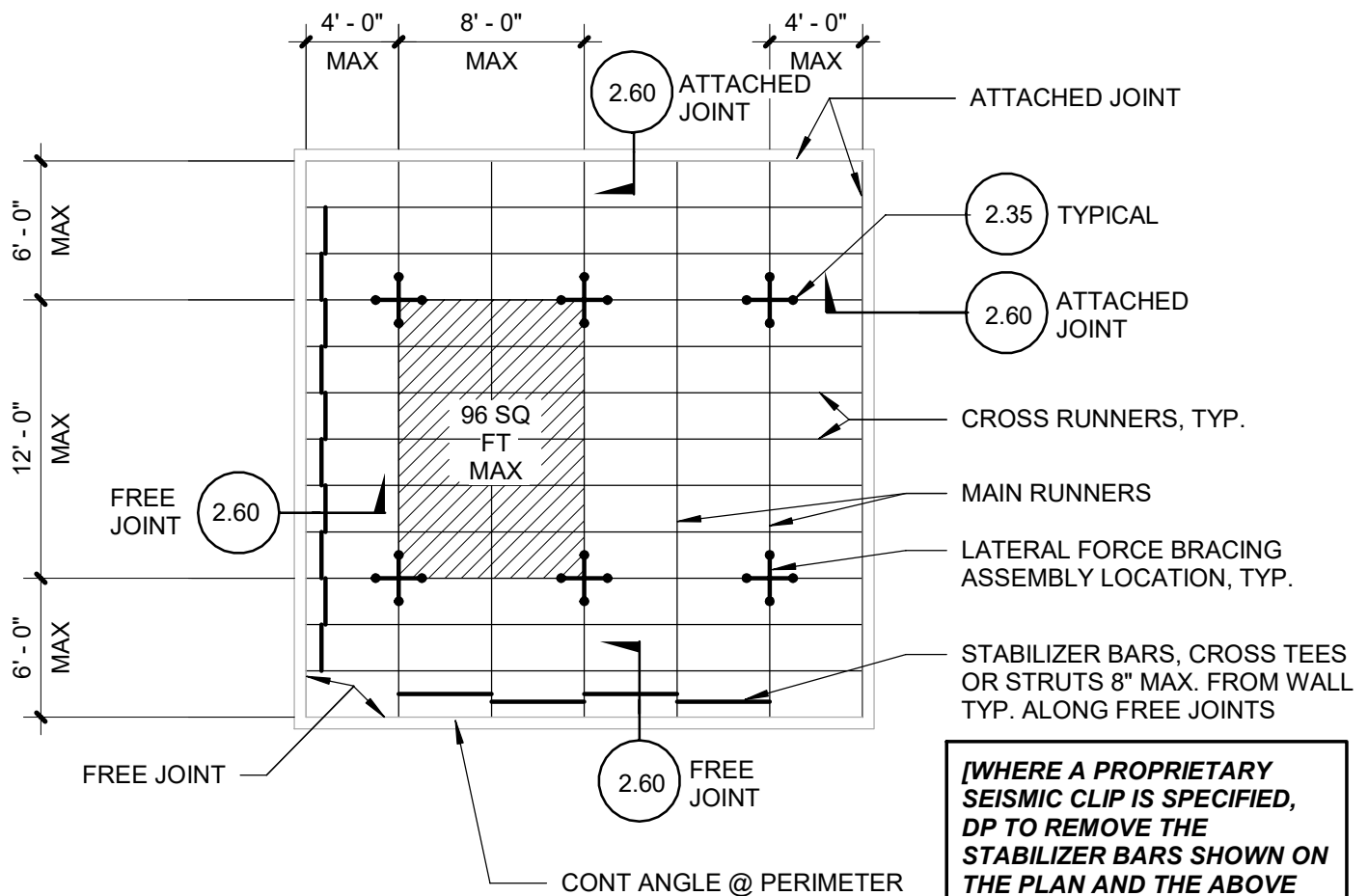
SUSPENDED LAY-IN PANEL CEILING: 2022 CBC



NOTE:
BRACING WIRES AND COMP. STRUT SHALL OCCUR AT EVERY 64 SQ. FT. MAX. IN ROOMS OVER 144 SQ. FT.

Detail Title : TYP. CEILING PLAN FOR 8'-0"x8'-0" BRACE ASSEMBLY SPACING	REV: 09/21/2015	Detail No. 2.10
	REV: 03/2022	

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC



NOTE:

BRACING WIRES AND COMP. STRUT SHALL OCCUR AT EVERY 96 SQ. FT. MAX. IN ROOMS OVER 144 SQ. FT.

[WHERE A PROPRIETARY SEISMIC CLIP IS SPECIFIED, DP TO REMOVE THE STABILIZER BARS SHOWN ON THE PLAN AND THE ABOVE STABILIZER BAR NOTE]

[WHERE BRACING ASSEMBLY SPACING CHANGES OVER THE HEIGHT OF THE BUILDING, DP SHALL INDICATE THE REQUIRED SPACING AT EACH LEVEL ON THE REFLECTED CEILING PLANS.]

Detail Title :

TYP. CEILING PLAN FOR 8'-0"x12'-0" BRACE ASSEMBLY SPACING

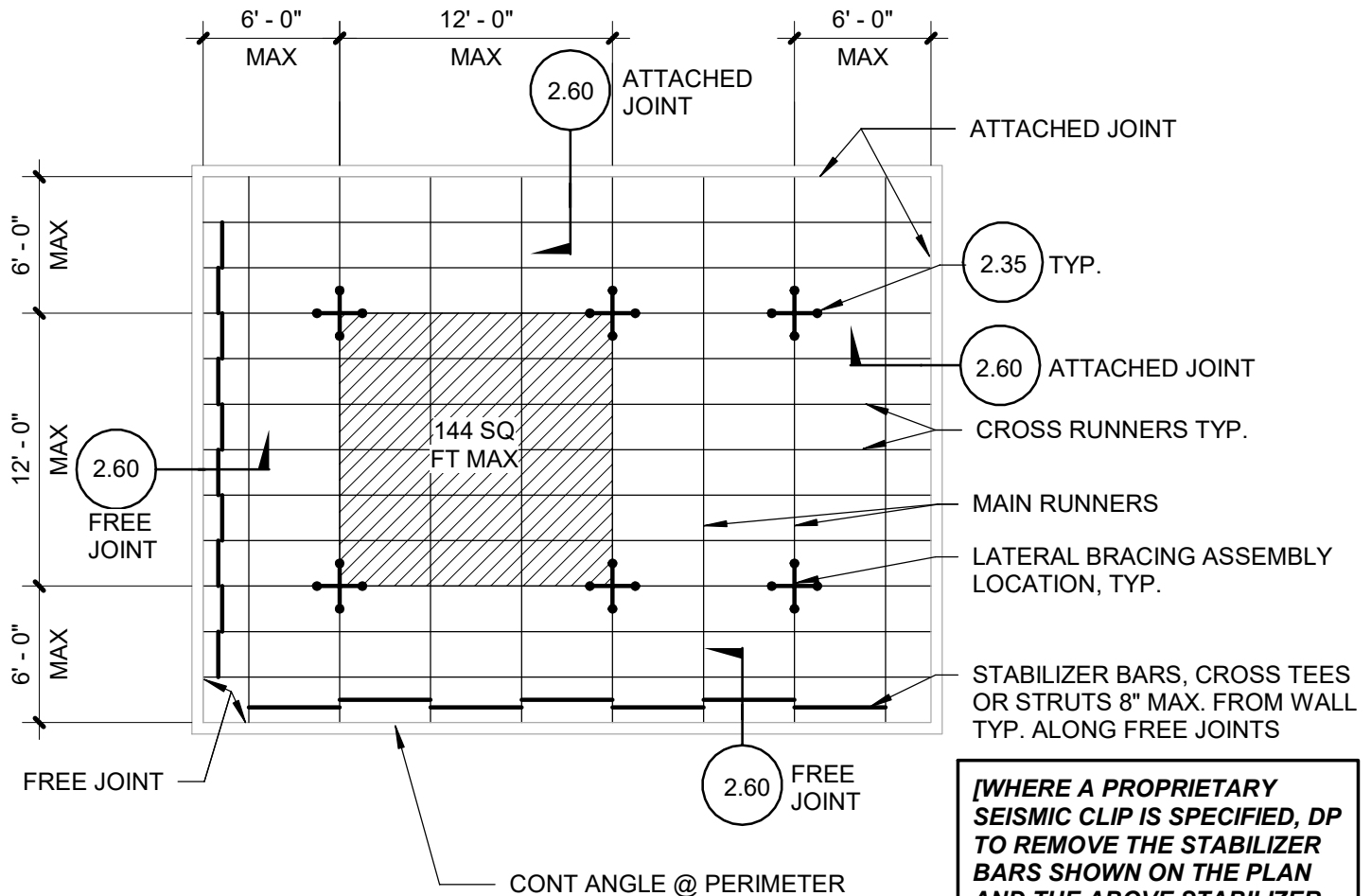
REV: 09/21/2015

Detail No.

REV: 03/2022

2.11

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC



NOTE:

BRACING WIRES AND COMP. STRUT SHALL OCCUR AT EVERY 144 SQ. FT. MAX. IN ROOMS OVER 144 SQ. FT.

[WHERE A PROPRIETARY SEISMIC CLIP IS SPECIFIED, DP TO REMOVE THE STABILIZER BARS SHOWN ON THE PLAN AND THE ABOVE STABILIZER BAR NOTE]

[WHERE BRACING ASSEMBLY SPACING CHANGES OVER THE HEIGHT OF THE BUILDING, DP SHALL INDICATE THE REQUIRED SPACING AT EACH LEVEL ON THE REFLECTED CEILING PLANS.]

Detail Title :

TYP. CEILING PLAN FOR 12'-0"x12'-0" BRACE ASSEMBLY SPACING

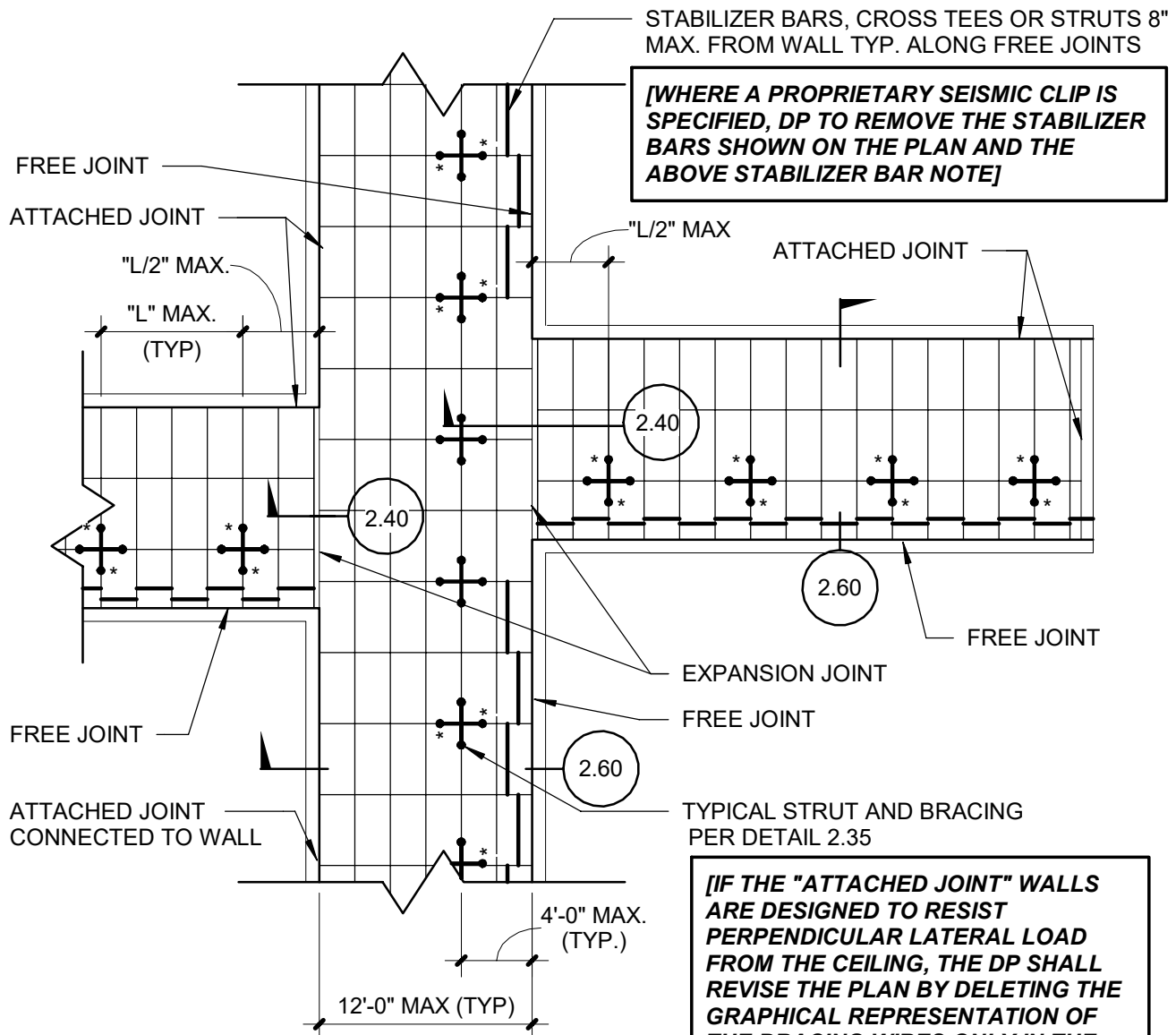
REV: 09/21/2015

REV: 03/2022

Detail No.

2.12

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC



NOTE:
 "L" IS MAX. BRACE ASSEMBLY SPACING PER CEILING PLAN DETAIL, FOR EXAMPLE, WHERE 8' x 12' SPACING IS SPECIFIED, USE "L" = 8'.

[IF THE "ATTACHED JOINT" WALLS ARE DESIGNED TO RESIST PERPENDICULAR LATERAL LOAD FROM THE CEILING, THE DP SHALL REVISE THE PLAN BY DELETING THE GRAPHICAL REPRESENTATION OF THE BRACING WIRES ONLY IN THE DIRECTION PERPENDICULAR TO THE CORRIDOR WALLS AS MARKED WITH AN ASTERISK (*). AT THE LOCATION NOTES HERE THE RESULTING SYMBOL WOULD APPEAR THUS:]

[DP SHALL SHOW EXPANSION JOINT LOCATIONS ON THE PROJECT-SPECIFIC REFLECTED CEILING PLANS.]

[IN ALL CASES THE DP SHALL REVISE THIS PLAN BY DELETING THE ASTERISK (*).]

Detail Title :

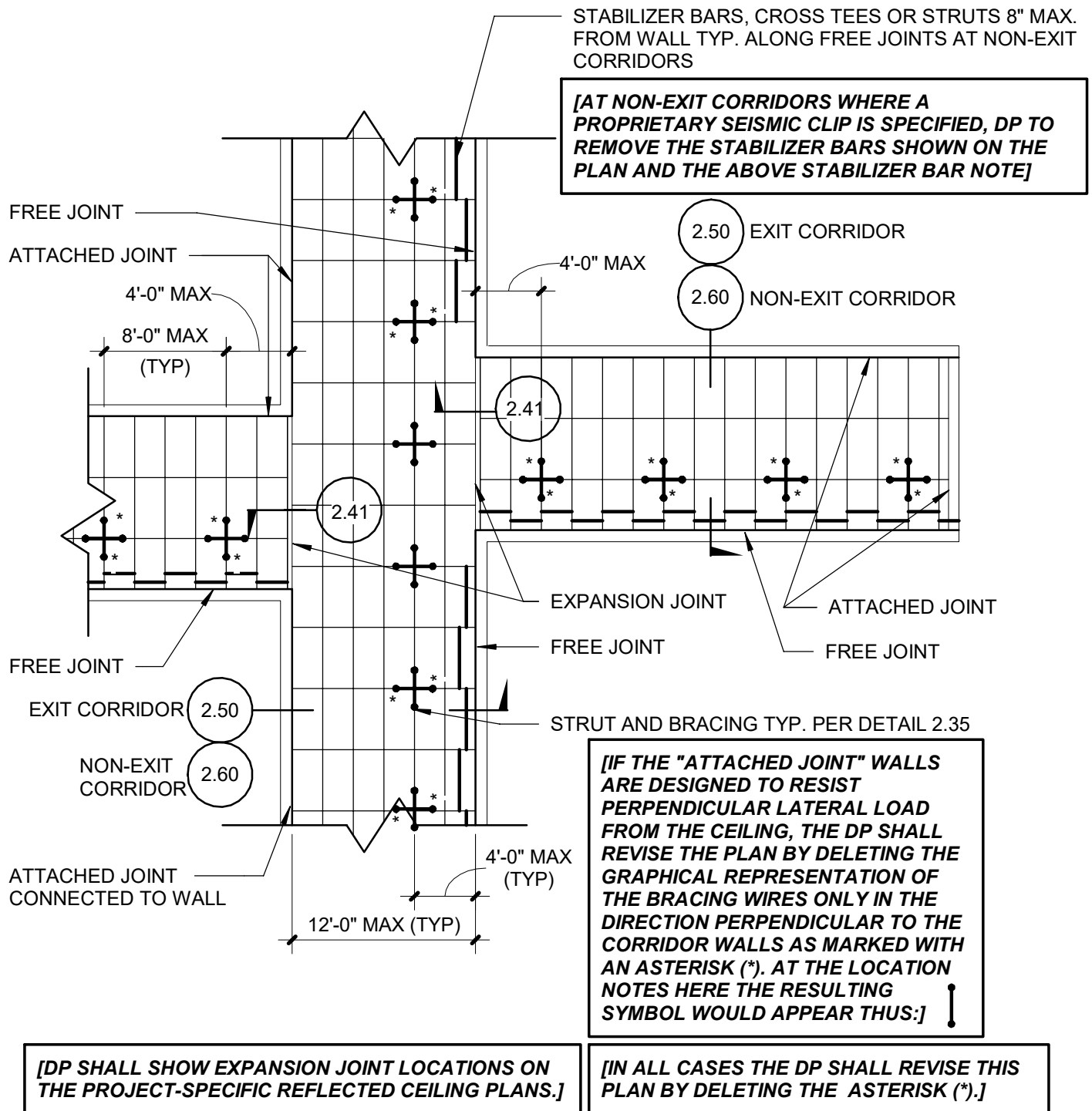
CORRIDOR CEILING PLAN (SCHOOL BUILDING)

REV: 09/21/2015

Detail No.

REV: 03/2022

2.30

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

Detail Title :

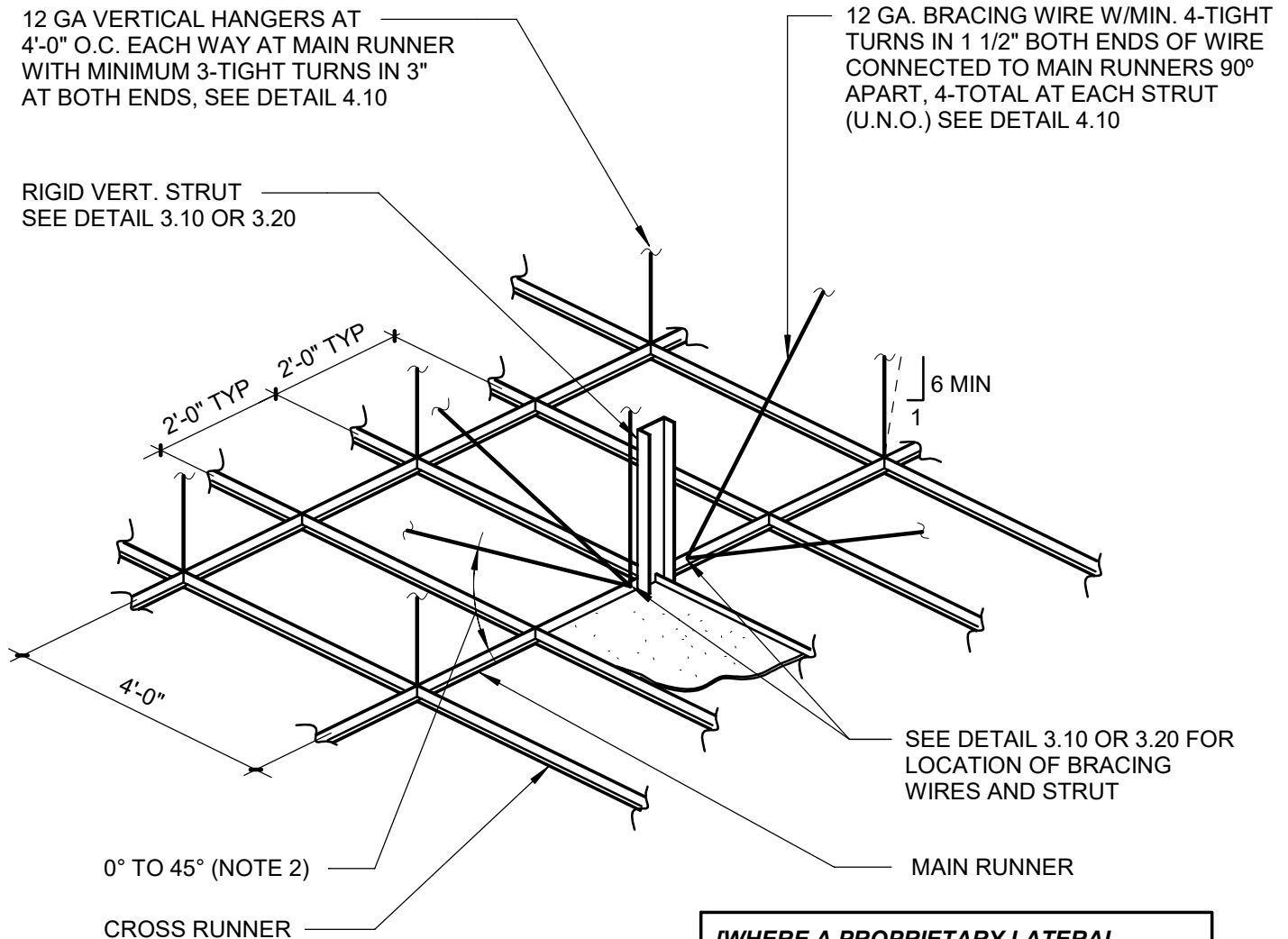
**CORRIDOR CEILING PLAN
(ESSENTIAL SERVICE BUILDING)**

REV: 09/21/2015

Detail No.

REV: 03/2022

2.31

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**NOTES:**

1. STRUTS SHALL NOT REPLACE HANGER WIRES.
2. THE MINIMUM ACCEPTABLE ANGLE IS DETERMINED SUCH THAT THE WIRES DO NOT INTERFERE WITH THE RUNNERS, LIGHT FIXTURES, ETC. AND REMAIN STRAIGHT AND UNOBSTRUCTED.

[WHERE A PROPRIETARY LATERAL BRACING ASSEMBLY IS SPECIFIED, DP SHALL PROVIDE DETAILS AND SPECIFICATIONS FOR THE INSTALLATION OF THE ENTIRE ASSEMBLY INCLUDING SPACING, APPROVED GRID MANUFACTURER(S), ATTACHMENT TO THE CEILING GRID, BRACING MEMBER SIZES, ATTACHMENT TO THE FLOOR AND ROOF STRUCTURE, ETC.]

Detail Title :

SUSPENSION AND LATERAL BRACING ASSEMBLY

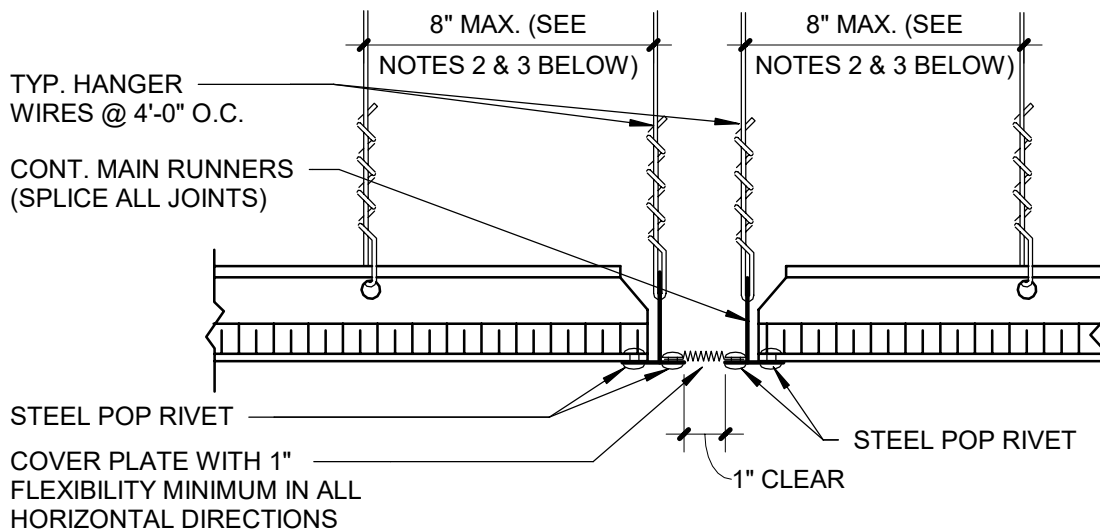
REV: 09/21/2015

Detail No.

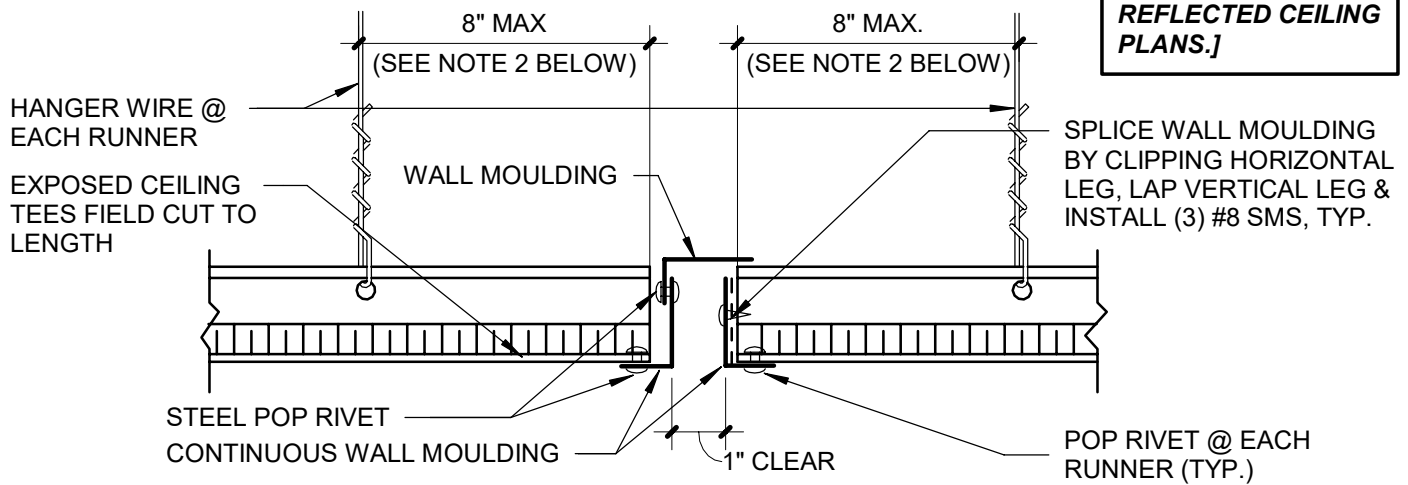
REV: 03/10/2017

REV: 03/2022

2.35

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**EXPANSION JOINT**

**[DP SHALL SHOW
EXPANSION JOINT
LOCATIONS ON THE
PROJECT-SPECIFIC
REFLECTED CEILING
PLANS.]**

**EXPANSION JOINT ALTERNATE****NOTES:**

1. DETAIL APPLIES TO EXPANSION JOINTS AT THE INTERSECTION OF CORRIDORS AND AT THE JUNCTIONS OF CORRIDORS AT LOBBIES AND OTHER SIMILAR AREAS.
2. PROVIDE #12 GAGE HANGER WIRES AT THE ENDS OF ALL MAIN AND CROSS RUNNERS WITHIN EIGHT (8) INCHES OF THE SUPPORT OR WITHIN ONE-FOURTH (1/4) OF THE LENGTH OF THE END TEE, WHICHEVER IS LESS, FOR THE PERIMETER OF THE CEILING AREA.
3. PERIMETER WIRES ARE NOT REQUIRED WHEN THE LENGTH OF THE END TEE IS EIGHT (8) INCHES OR LESS.

Detail Title :

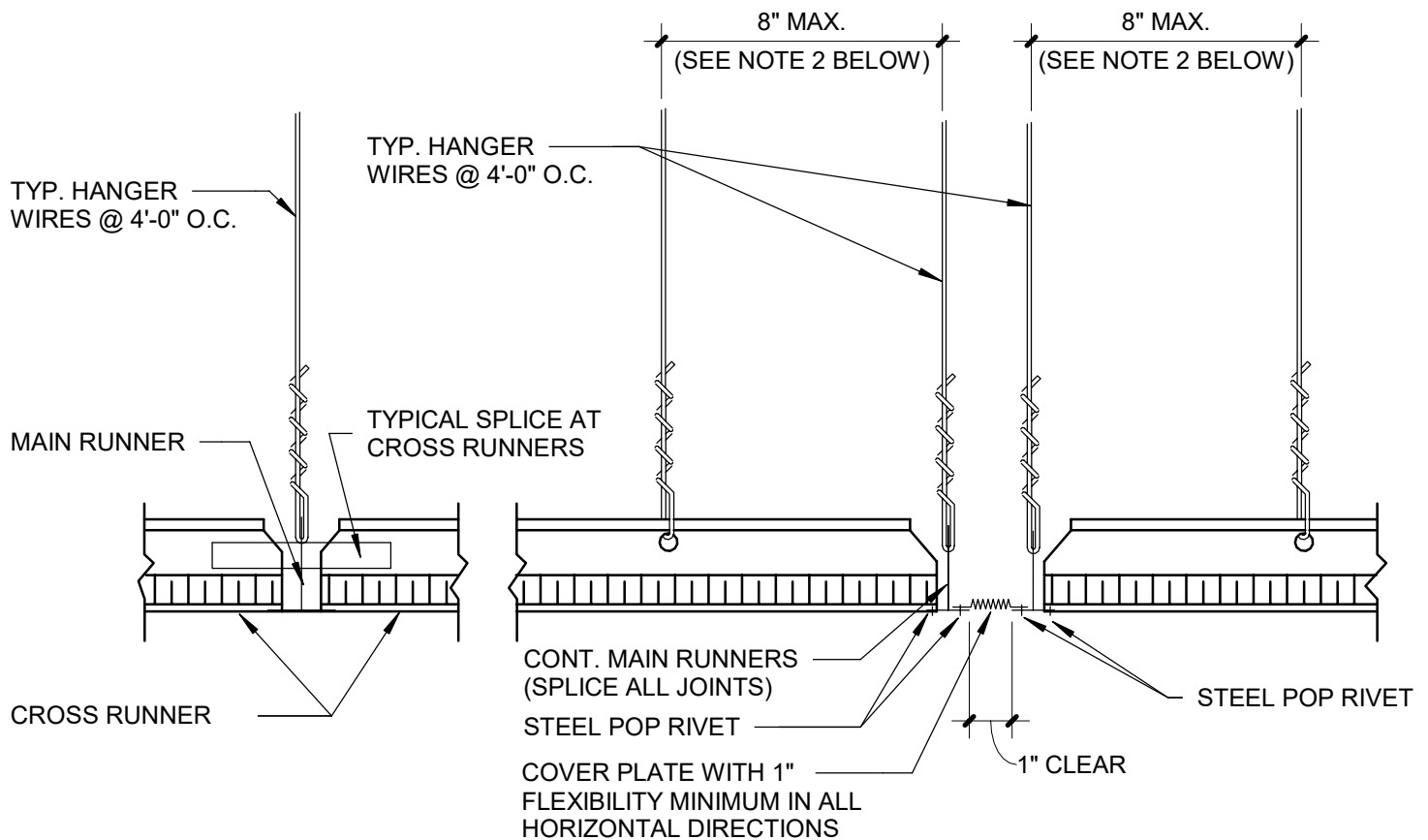
EXPANSION JOINT (SCHOOL BUILDING)

REV: 09/21/2015

Detail No.

REV: 03/2022

2.40

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**RUNNER SPLICE****EXPANSION JOINT****NOTES:**

1. DETAIL APPLIES TO EXPANSION JOINTS AT THE INTERSECTION OF CORRIDORS AND AT THE JUNCTIONS OF CORRIDORS AT LOBBIES AND OTHER SIMILAR AREAS.
2. PROVIDE #12 GAGE HANGER WIRES AT THE ENDS OF ALL MAIN AND CROSS RUNNERS WITHIN EIGHT (8) INCHES OF THE SUPPORT OR WITHIN ONE-FOURTH (1/4) OF THE LENGTH OF THE END TEE, WHICHEVER IS LESS, FOR THE PERIMETER OF THE CEILING AREA. PERIMETER WIRES ARE NOT REQUIRED WHEN THE LENGTH OF THE END TEE IS EIGHT (8) INCHES OR LESS.

**[DP SHALL SHOW
EXPANSION JOINT
LOCATIONS ON THE
PROJECT-SPECIFIC
REFLECTED CEILING
PLANS.]**

Detail Title :

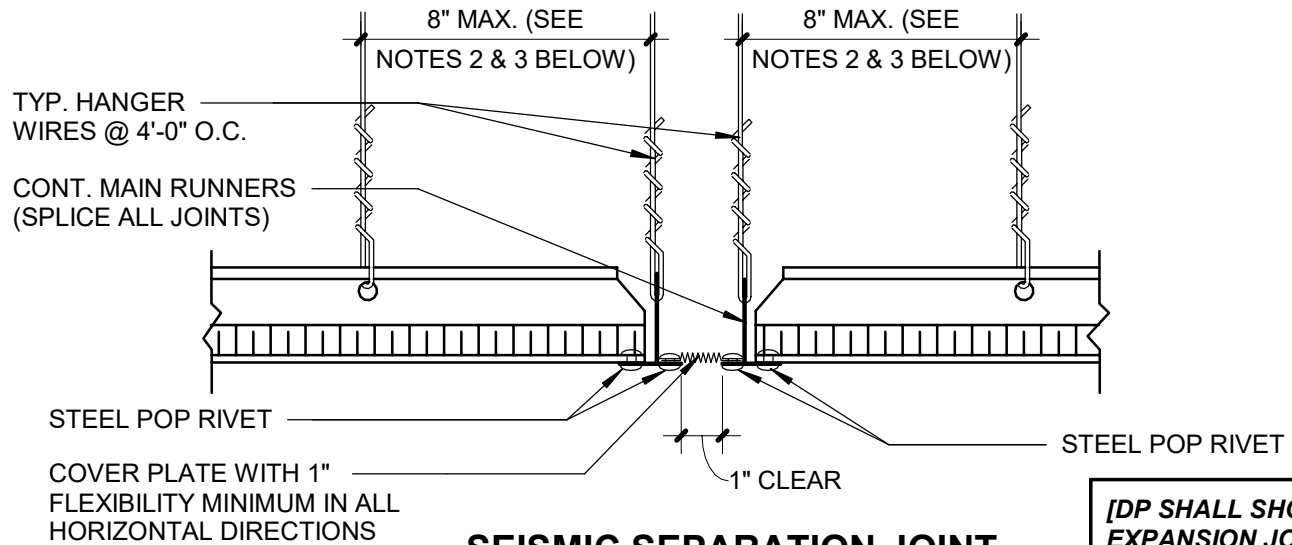
EXPANSION JOINT (ESSENTIAL SERVICE BUILDING)

REV: 09/21/2015

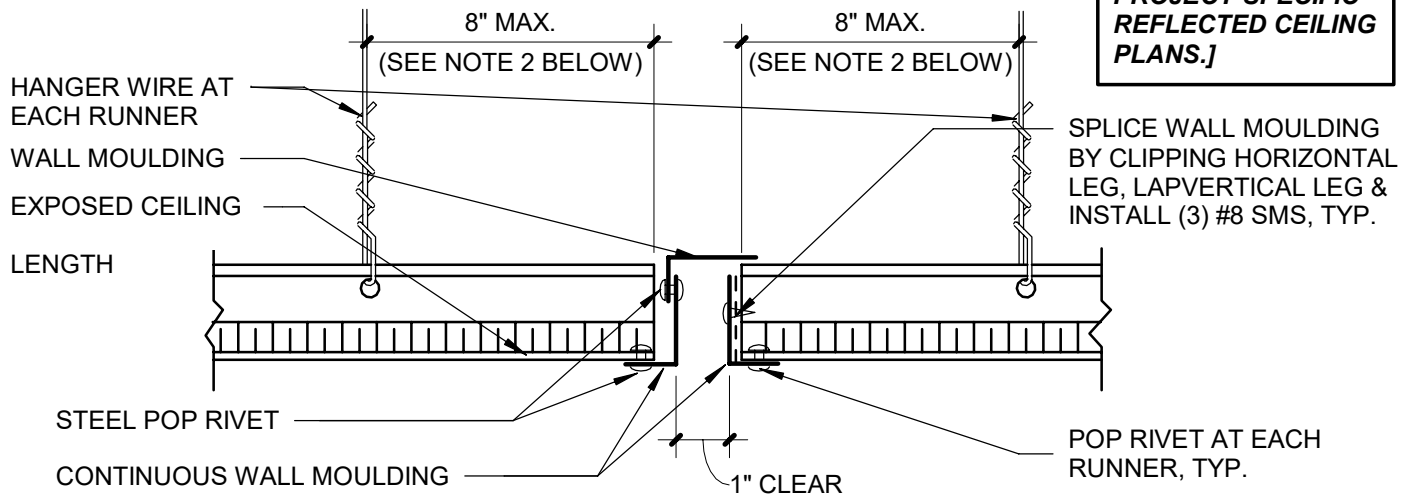
Detail No.

REV: 03/2022

2.41

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**SEISMIC SEPARATION JOINT**

[DP SHALL SHOW EXPANSION JOINT LOCATIONS ON THE PROJECT-SPECIFIC REFLECTED CEILING PLANS.]

**ALTERNATE SEISMIC SEPARATION JOINT****NOTES:**

1. DETAILS APPLIES TO SEISMIC SEPARATION JOINT AT CONTINUOUS CEILING AREAS EXCEEDING 2500 SQ. FT. SEE CEILING PLANS FOR LOCATION.
2. PROVIDE #12 GAGE HANGER WIRES AT THE ENDS OF ALL MAIN AND CROSS RUNNERS WITHIN EIGHT (8) INCHES OF THE SUPPORT OR WITHIN ONE-FOURTH (1/4) OF THE LENGTH OF THE END TEE, WHICHEVER IS LESS, FOR THE PERIMETER OF THE CEILING AREA.
3. PERIMETER WIRES ARE NOT REQUIRED WHEN THE LENGTH OF THE END TEE IS EIGHT (8) INCHES OR LESS.

Detail Title :

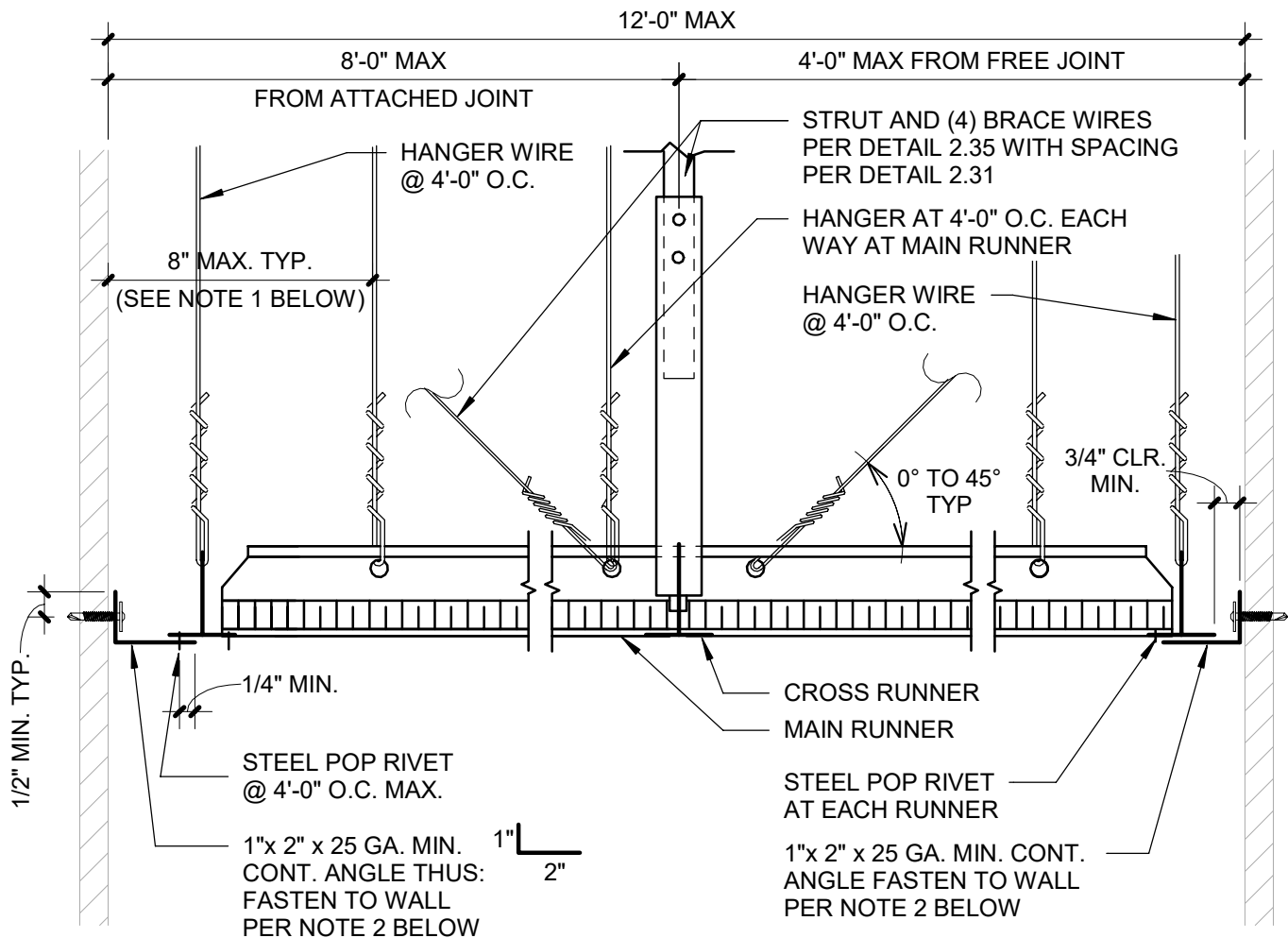
SEISMIC SEPARATION JOINT

REV: 09/21/2015

Detail No.

REV: 03/2022

2.45

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**ATTACHED JOINT****FREE JOINT****NOTES:**

1. PROVIDE #12 GAGE HANGER WIRES AT THE ENDS OF ALL MAIN AND CROSS RUNNERS WITHIN EIGHT (8) INCHES OF THE SUPPORT OR WITHIN ONE-FOURTH (1/4) OF THE LENGTH OF THE END TEE, WHICHEVER IS LESS, FOR THE PERIMETER OF THE CEILING AREA. PERIMETER WIRES ARE NOT REQUIRED WHEN THE LENGTH OF THE END TEE IS EIGHT (8) INCHES OR LESS.
2. FASTEN ANGLE TO WALL FRAMING AS FOLLOWS:
 - A. METAL STUD (20 GA. MIN.) WALL: (1) #10 SMS AT 24" O.C. MAX.
 - B. WOOD STUD WALL: #10x2" LONG WOOD SCREW AT 16" O.C. MAX.

[WHERE A PROPRIETARY LATERAL BRACING ASSEMBLY IS SPECIFIED, DP SHALL PROVIDE DETAILS AND SPECIFICATIONS FOR THE INSTALLATION OF THE ENTIRE ASSEMBLY INCLUDING SPACING, APPROVED GRID MANUFACTURER(S), ATTACHMENT TO THE CEILING GRID, BRACING MEMBER SIZES, ATTACHMENT TO THE FLOOR AND ROOF STRUCTURE, ETC.]

Detail Title :

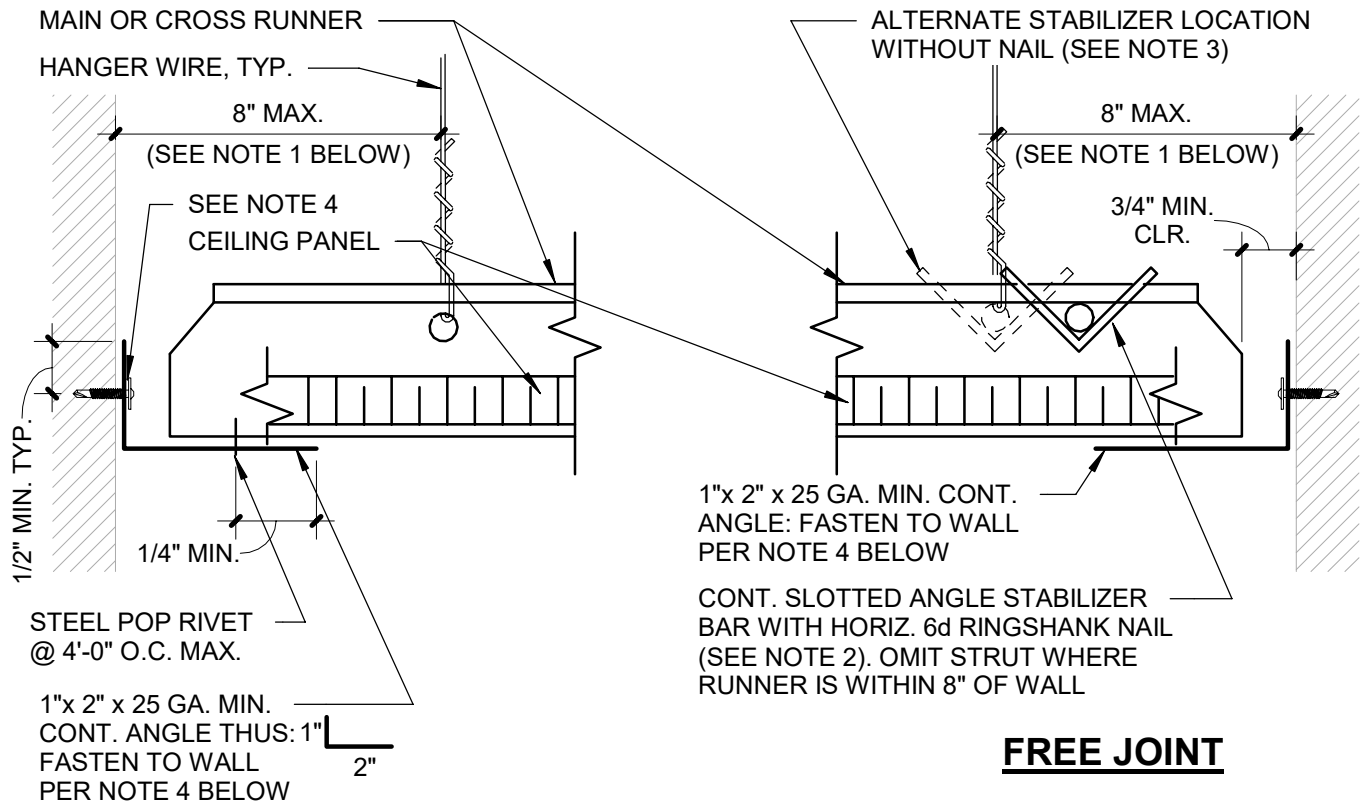
**TYP. SECTION AT EXIT CORRIDOR
(ESSENTIAL SERVICE BUILDING)**

REV: 09/21/2015

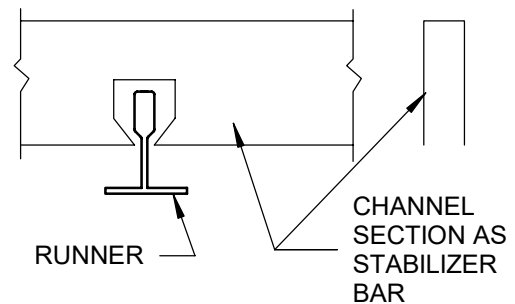
Detail No.

REV: 03/2022

2.50

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**ATTACHED JOINT****NOTES:**

1. PROVIDE #12 GAGE HANGER WIRES AT THE ENDS OF ALL MAIN AND CROSS RUNNERS WITHIN EIGHT (8) INCHES OF THE SUPPORT OR WITHIN ONE-FOURTH (1/4) OF THE LENGTH OF THE END TEE, WHICHEVER IS LESS, FOR THE PERIMETER OF THE CEILING AREA. PERIMETER WIRES ARE NOT REQUIRED WHEN THE LENGTH OF THE END TEE IS EIGHT (8) INCHES OR LESS.
2. NAILS AT ENDS OF HORIZONTAL STABILIZERS ARE TO BE PLACED WITH NAIL HEAD TOWARD CENTER LINE OF SPAN OF STRUT.
3. STABILIZER BAR MAY BE SLOTTED APPROVED ANGLES OR CHANNELS WITH "DIAMOND POINTS" OF SPRING STEEL WHICH SNAP TIGHT TO PREVENT MOVEMENT OF STRUT.
4. FASTEN ANGLE TO WALL STUD OR BLOCKING AS FOLLOWS:
 - A. METAL STUD (20 GA. MIN.) WALL: (1) #10 SMS AT 24" O.C. MAX.
 - B. WOOD STUD WALL: #10x2" LONG WOOD SCREW AT 16" O.C. MAX.

**STABILIZER (SEE NOTE 3)**

[WHERE PROPRIETARY CLIPS ARE SPECIFIED, DP SHALL REVISE THIS DETAIL ACCORDINGLY, WHICH INCLUDES REMOVING ALL REFERENCES TO STABILIZERS. DP SHALL PROVIDE PRODUCT SPECIFIC INFORMATION INCLUDING SMALLER WALL ANGLE (IF APPLICABLE), ATTACHMENT OF THE CLIP TO THE RUNNERS AT THE ATTACHED AND FREE JOINTS, ATTACHMENT OF THE CLIP TO THE WALL ANGLE, AND CLEARANCE OF THE RUNNER TO WALL ANGLE AT THE FREE END.]

Detail Title :

CEILING PERIMETER

REV: 09/21/2015

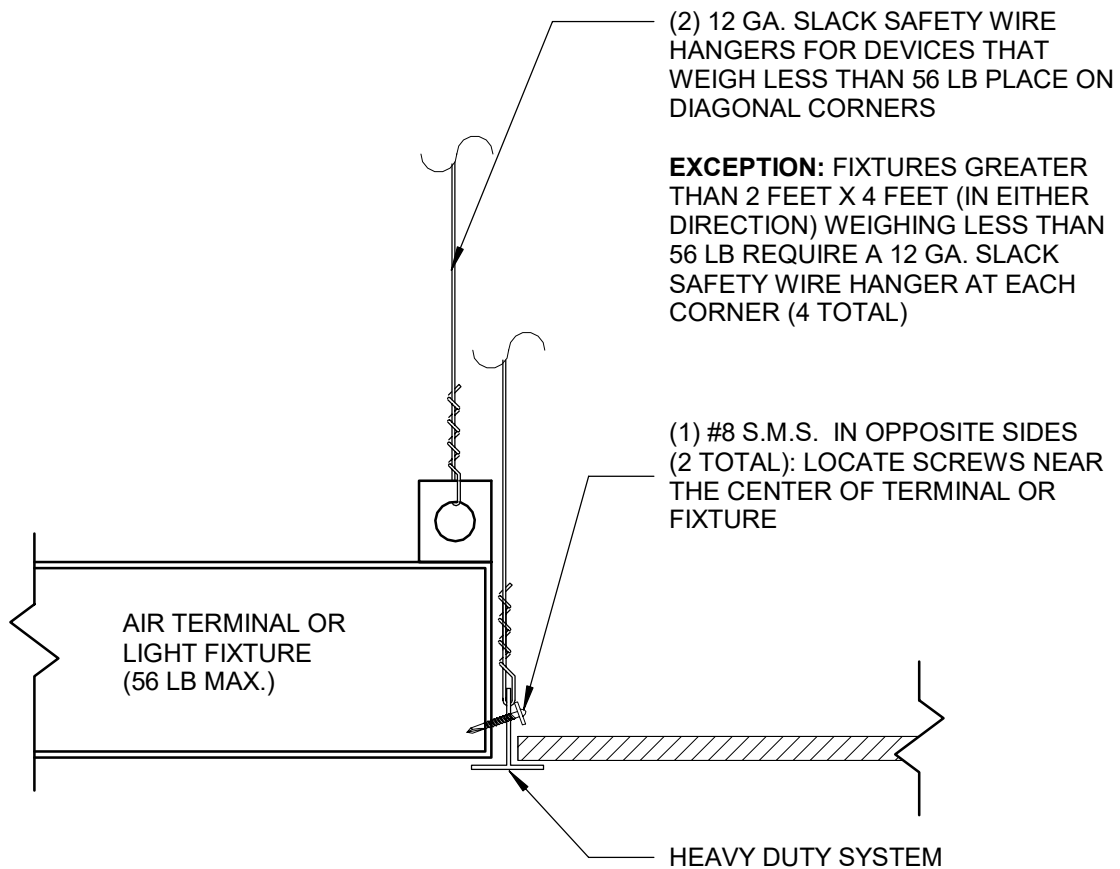
Detail No.

REV: 03/10/2017

REV: 03/2022

2.60

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC



Detail Title :

LUMINAIRE / AIR TERMINAL SUPPORT

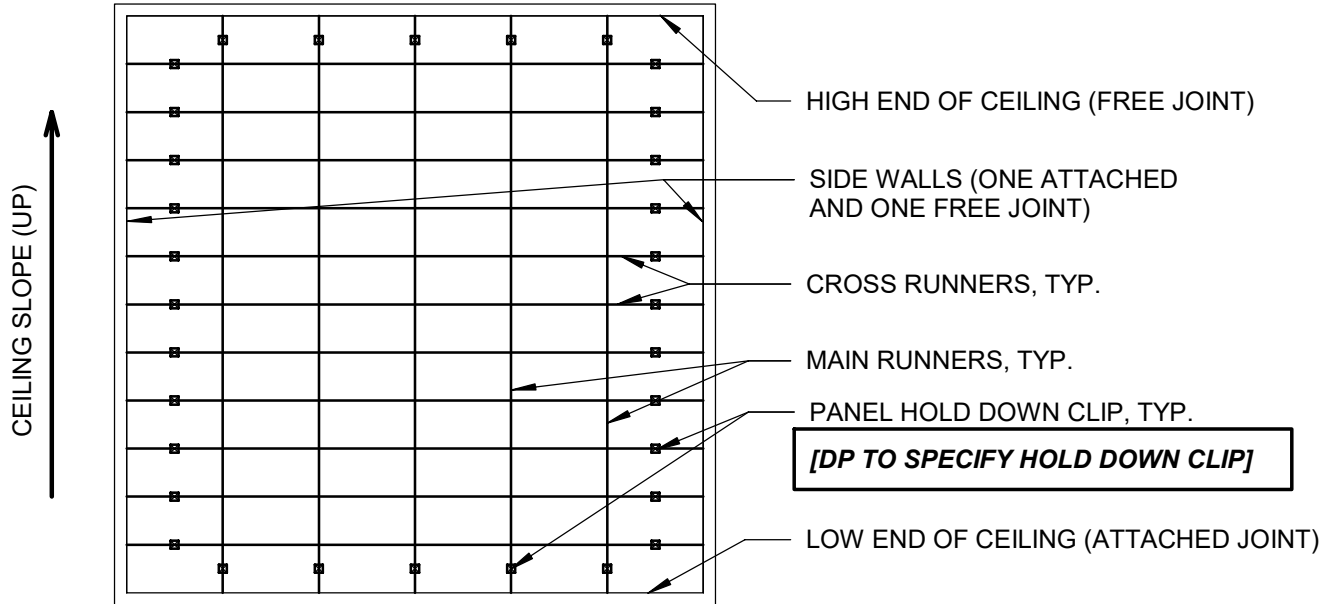
REV: 09/21/2015

Detail No.

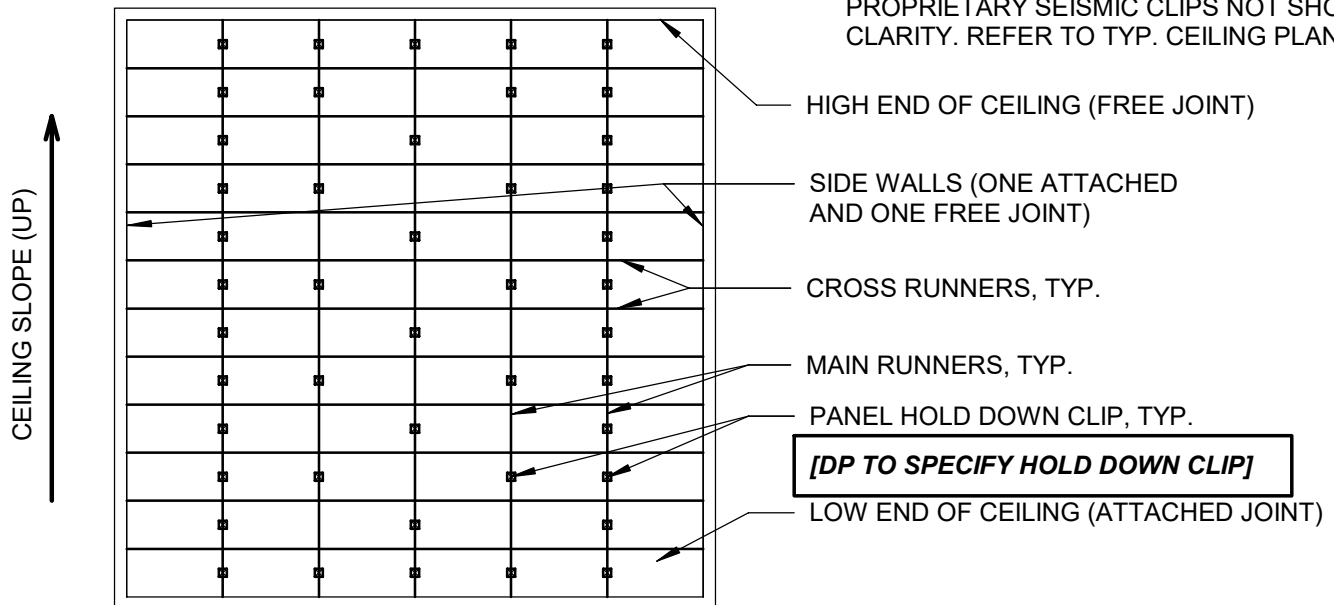
REV: 02/10/2016

REV: 03/2022

2.80

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**CEILING PLAN: SLOPE $\leq 15^\circ$** **NOTE:**

1. LATERAL FORCE BRACING ASSEMBLIES NOT SHOWN FOR CLARITY. REFER TO TYP. CEILING PLAN.
2. STABILIZER BARS, PERIMETER ANGLES, AND PROPRIETARY SEISMIC CLIPS NOT SHOWN FOR CLARITY. REFER TO TYP. CEILING PLAN.

**CEILING PLAN: $15^\circ < \text{SLOPE} \leq 25^\circ$**

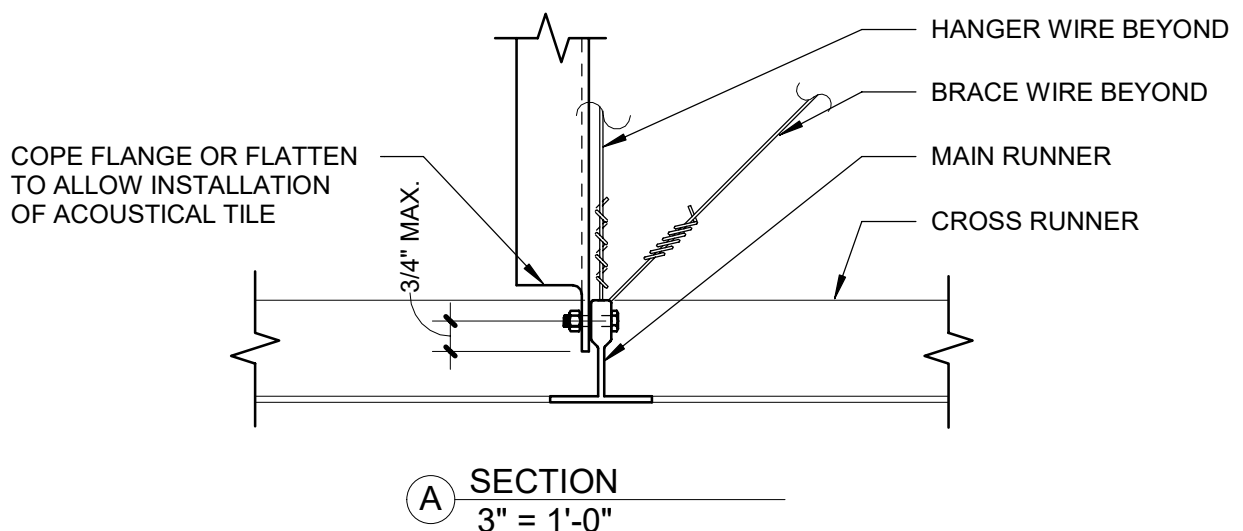
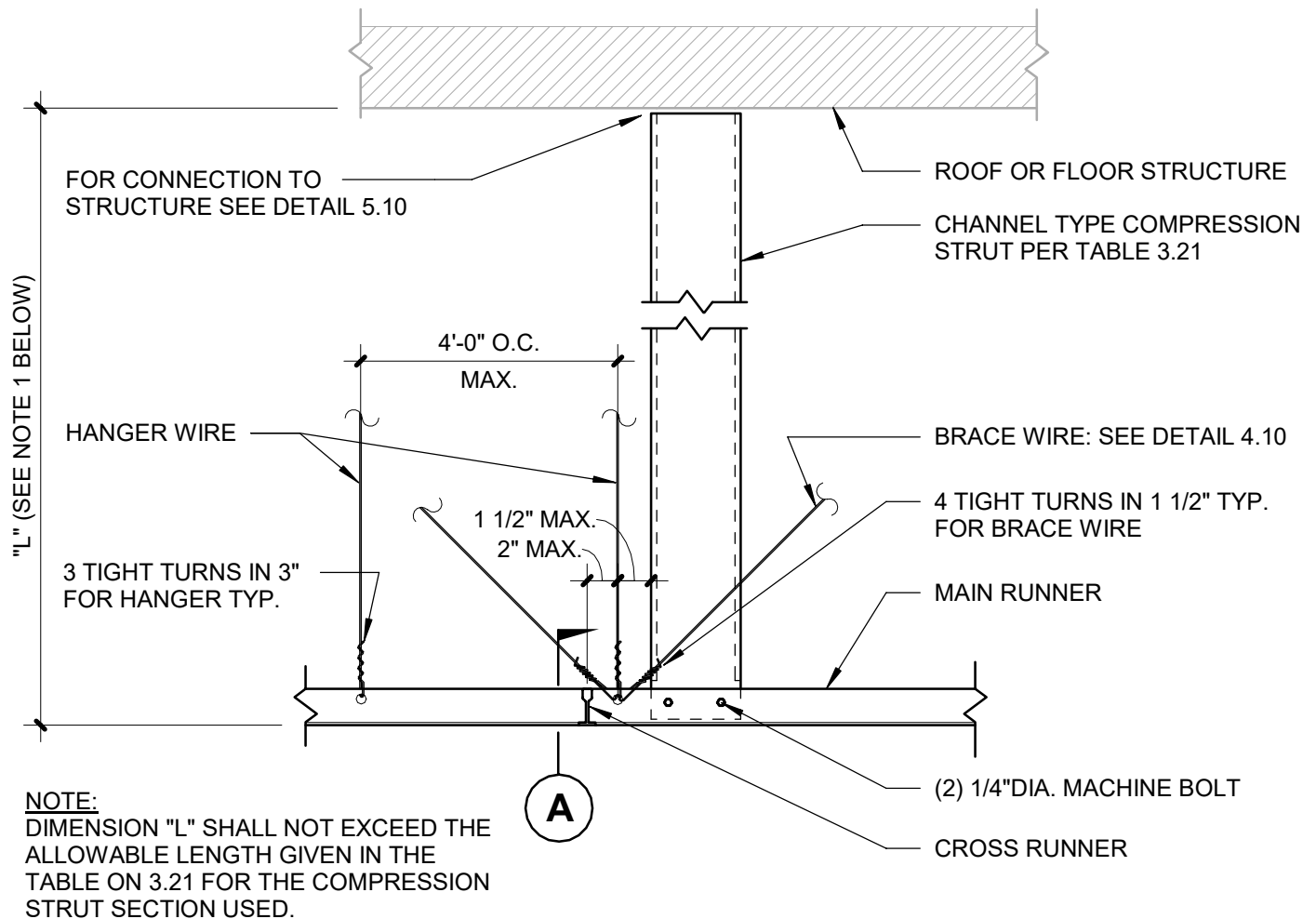
Detail Title :

PANEL HOLD DOWN CLIPS AT SLOPED CEILING

REV: 03/2022

Detail No.

2.90

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

Detail Title :

COMPRESSION STRUT - CHANNEL TYPE

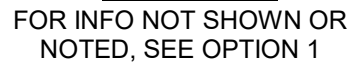
REV: 09/21/2015

Detail No.

REV: 03/2022

REV: 11/2023

3.10



1. MACHINE BOLT IS NOT REQUIRED ON OPTION 3.
2. OPTION 3 IS PERMITTED ONLY WHERE THE ROOF OR FLOOR STRUCTURE IS SAWN TIMBER WITHOUT GYPSUM BOARD.
3. DIMENSION "L" SHALL NOT TO EXCEED THE ALLOWABLE LENGTH GIVEN IN THE TABLE ON 3.21 FOR THE COMPRESSION STRUT USED.

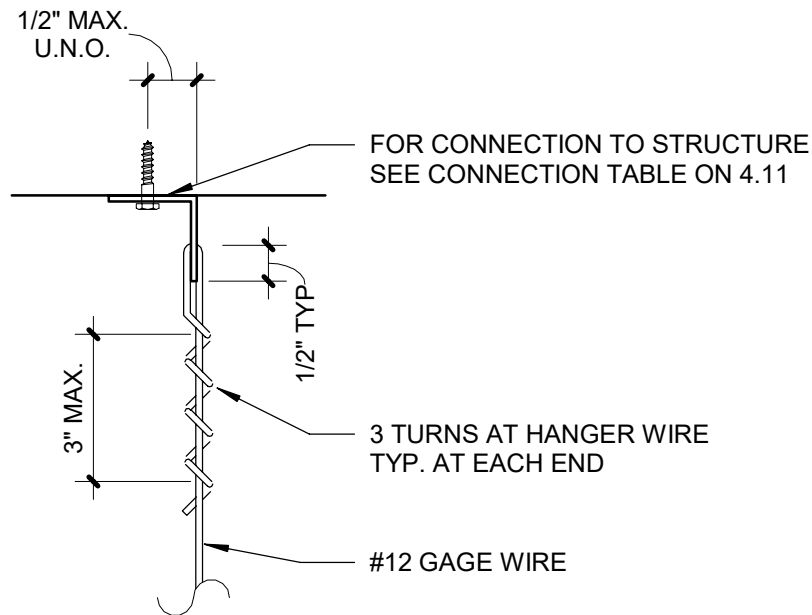
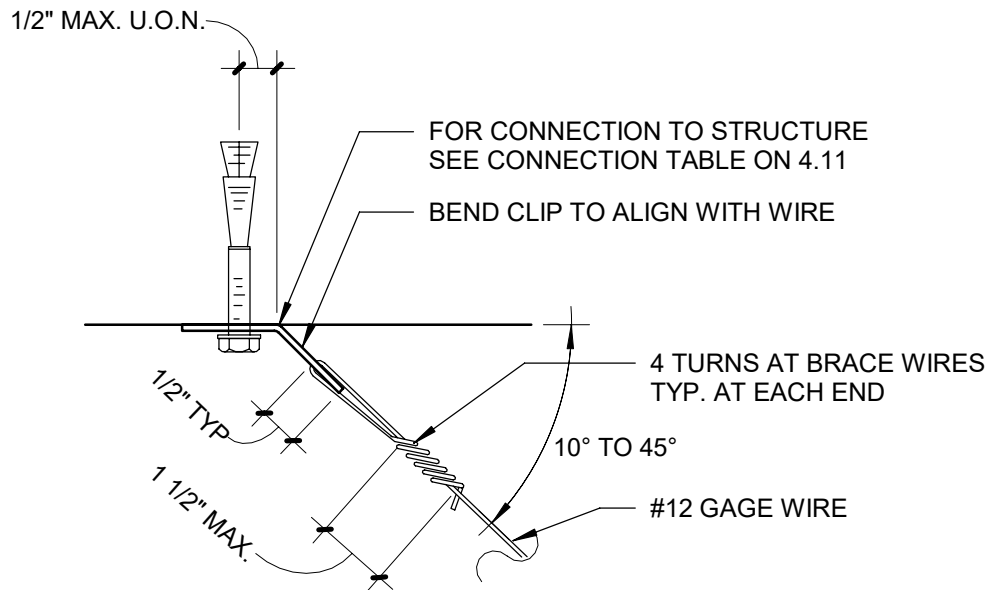
Detail Title : COMPRESSION STRUT - EMT TYPE	REV: 09/21/2015	Detail No. 3.20
	REV: 03/2022	
	REV: 11/2023	

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

COMPRESSION STRUT EMT SECTION	MAXIMUM LENGTH
1/2" DIAMETER EMT (0.042" WALL THICKNESS)	3' - 11"
3/4" DIAMETER EMT (0.049" WALL THICKNESS)	6' - 4"
1" DIAMETER EMT (0.057" WALL THICKNESS)	9' - 9"
1 1/4" DIAMETER EMT (0.065" WALL THICKNESS)	12' - 9"
1 1/2" DIAMETER EMT (0.065" WALL THICKNESS)	14' - 9"
2" DIAMETER EMT (0.065" WALL THICKNESS)	18' - 10"

COMPRESSION STRUT CHANNEL SECTION	MAXIMUM LENGTH
250S125-33	5' - 10"
250S137-33	6' - 10"
362S137-33	8' - 0"
250S137-43	8' - 10"
400S137-43	10' - 10"

Detail Title : COMPRESSION STRUT TABLE	REV: 09/21/2015	Detail No. 3.21
	REV: 03/10/2017	
	REV: 03/2022	

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**HANGER WIRE****BRACE WIRE**

Detail Title :

**HANGER AND BRACE WIRE
CONNECTION - TYP. WIRE TURNS**

REV: 09/21/2015

Detail No.

REV: 03/2022

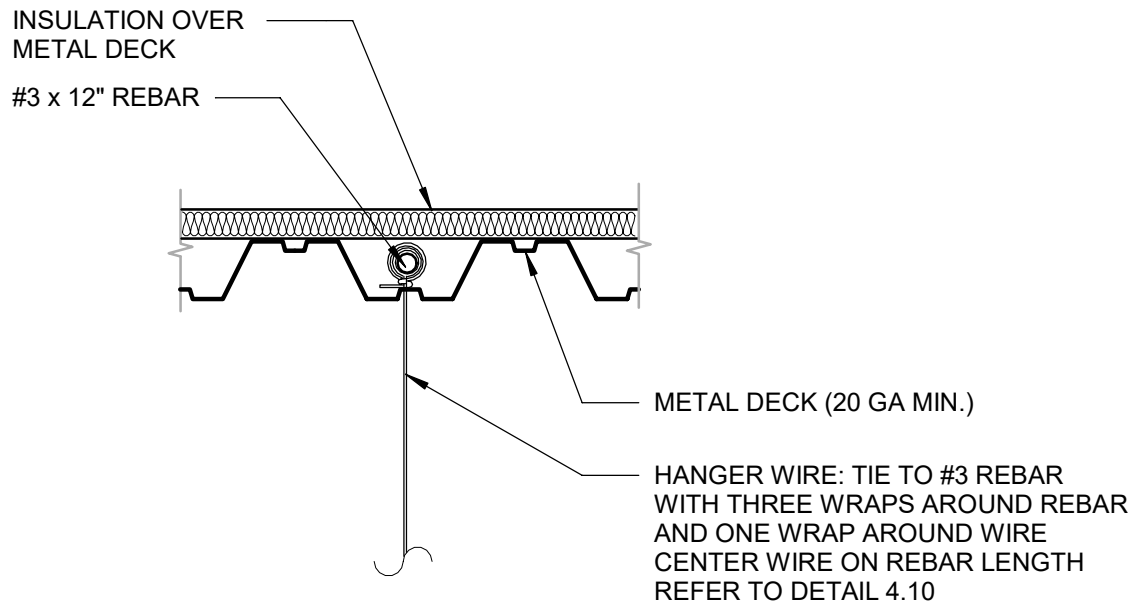
4.10

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

STRUCTURAL SYSTEM OF FLOOR/ ROOF ABOVE SUSPENDED CEILING	APPLICABLE HANGER WIRE DETAIL	APPLICABLE BRACE WIRE DETAIL
BARE METAL DECK	4.20	[TO BE PROVIDED BY DP]
CONCRETE OVER METAL DECK	4.21	4.30 & 4.31
CONCRETE SLAB, BEAM, OR JOIST	4.22	4.32
STRUCTURAL STEEL	4.23	4.33
METAL STUD WALL	4.24	4.34
SAWN TIMBER	4.25 & 4.29	4.35
WOOD I-JOIST	4.26	4.36 & 4.37
WOOD CHORD TRUSS	4.27 & 4.29	4.38 & 4.29
OPEN WEB STEEL JOIST	4.28 & 4.29	4.39 & 4.29

Detail Title : HANGER AND BRACE WIRE CONNECTION TABLE	REV: 09/21/2015	Detail No. 4.11
	REV: 03/2022	
	REV: 11/2023	

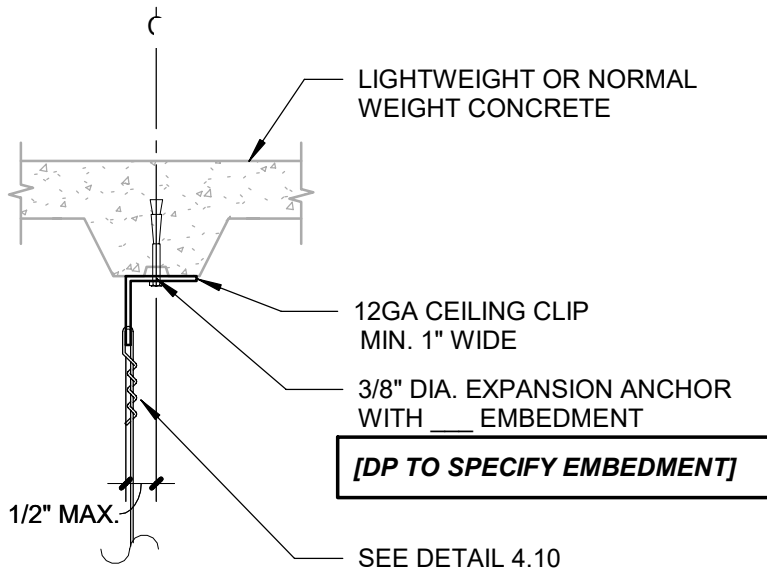
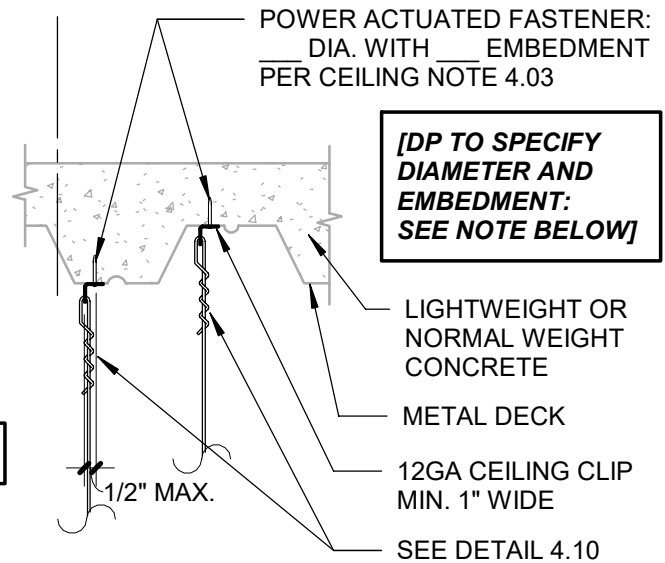
SUSPENDED LAY-IN PANEL CEILING: 2022 CBC



NOTES:

1. REFER TO DETAIL 4.10 FOR ADDITIONAL INFORMATION.

Detail Title : HANGER WIRE CONNECTION TO METAL DECK	REV: 09/21/2015	Detail No. 4.20
	REV: 03/2022	

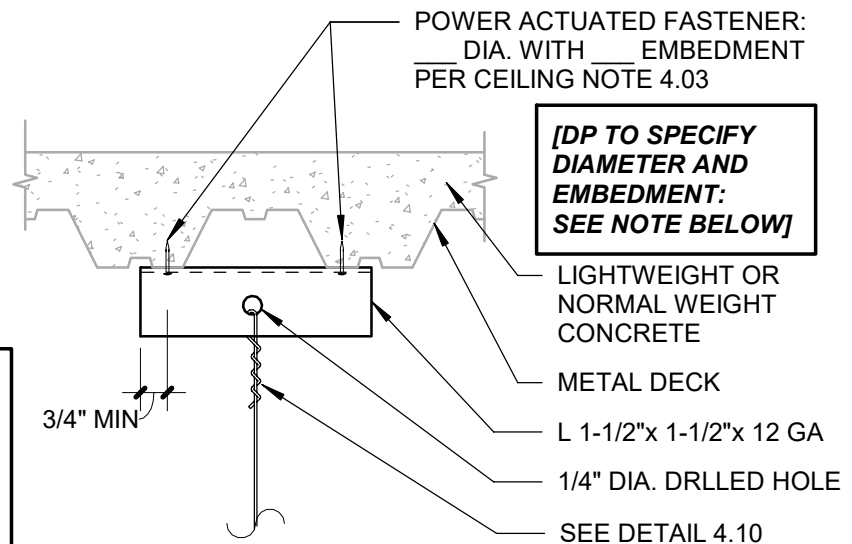
SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**OPTION 1****OPTION 2****NOTES:**

1. REFER TO DETAIL S4.10 FOR ADDITIONAL INFORMATION.
2. POST INSTALLED ANCHORS TO BE PLACED NO MORE THAN 1" OFFSET FROM CENTERLINE OF DECK LOW FLUTE.
3. TEST POST-INSTALLED ANCHORS IN ACCORDANCE WITH CEILING NOTES 5.01 AND 5.02.

[DP TO SPECIFY ALL OF THE FOLLOWING FOR POWER ACTUATED FASTENERS:

- DIAMETER (0.145" MINIMUM)
 - EMBEDMENT (1 1/4" MINIMUM)
- AN EMBEDMENT DEPTH LESS THAN 1-1/4" CAN BE PERMITTED IF BOTH OF THE FOLLOWING ARE MET:**

1. LESSER EMBEDMENT APPROVED BY THE EVALUATION REPORT.
2. ANCHOR IS CAPABLE OF RESISTING A 90 LB ALLOWABLE LOAD WHEN TESTED PER ASTM E3090 AS REQUIRED BY ASTM E380 SECTION 5.2.7.2]

**OPTION 3**

Detail Title :

**HANGER WIRE CONNECTION TO
CONCRETE OVER METAL DECK**

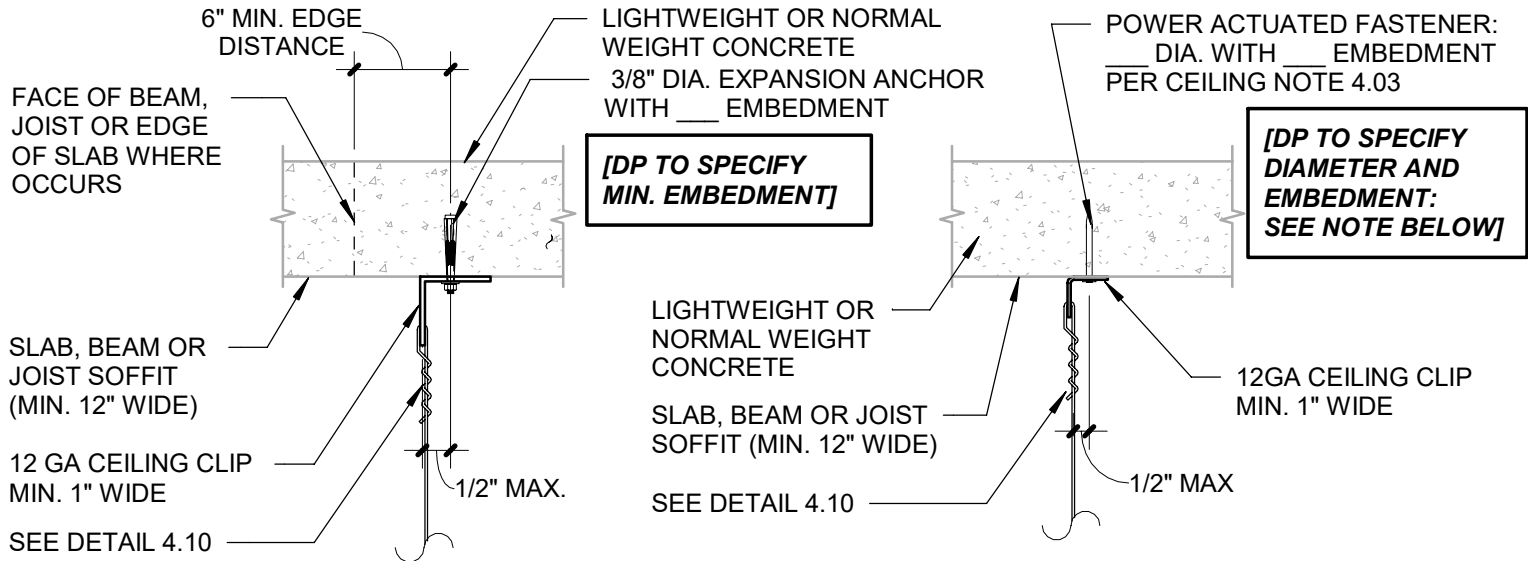
REV: 09/21/2015

Detail No.

REV: 03/2022

REV: 11/2023

4.21

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**OPTION 1****OPTION 2****NOTES:**

1. REFER TO 4.10 FOR ADDITIONAL DETAILS.
2. TEST POST INSTALLED ANCHORS IN ACCORDANCE WITH CEILING NOTE 5.01.
3. DSA APPROVAL OF A CONSTRUCTION PLAN IS REQUIRED PRIOR TO INSTALLING POST-INSTALLED ANCHORS IN PRESTRESSED CONCRETE. THE CONSTRUCTION PLAN SHALL DEMONSTRATE HOW THE LOCATION OF PRESTRESSING TENDONS AND STRANDS WILL BE LOCATED AND DENOTED AS NECESSARY TO AVOID INTERFERENCE.

[DP TO SPECIFY ALL OF THE FOLLOWING FOR POWER ACTUATED FASTENERS:

- DIAMETER (0.145" MINIMUM)
- EMBEDMENT (1 1/4" MINIMUM)

AN EMBEDMENT DEPTH LESS THAN 1-1/4" CAN BE PERMITTED IF BOTH OF THE FOLLOWING ARE MET:

1. LESSER EMBEDMENT APPROVED BY THE EVALUATION REPORT.
2. ANCHOR IS CAPABLE OF RESISTING A 90 LB ALLOWABLE LOAD WHEN TESTED PER ASTM E3090 AS REQUIRED BY ASTM E380 SECTION 5.2.7.2.]

Detail Title :

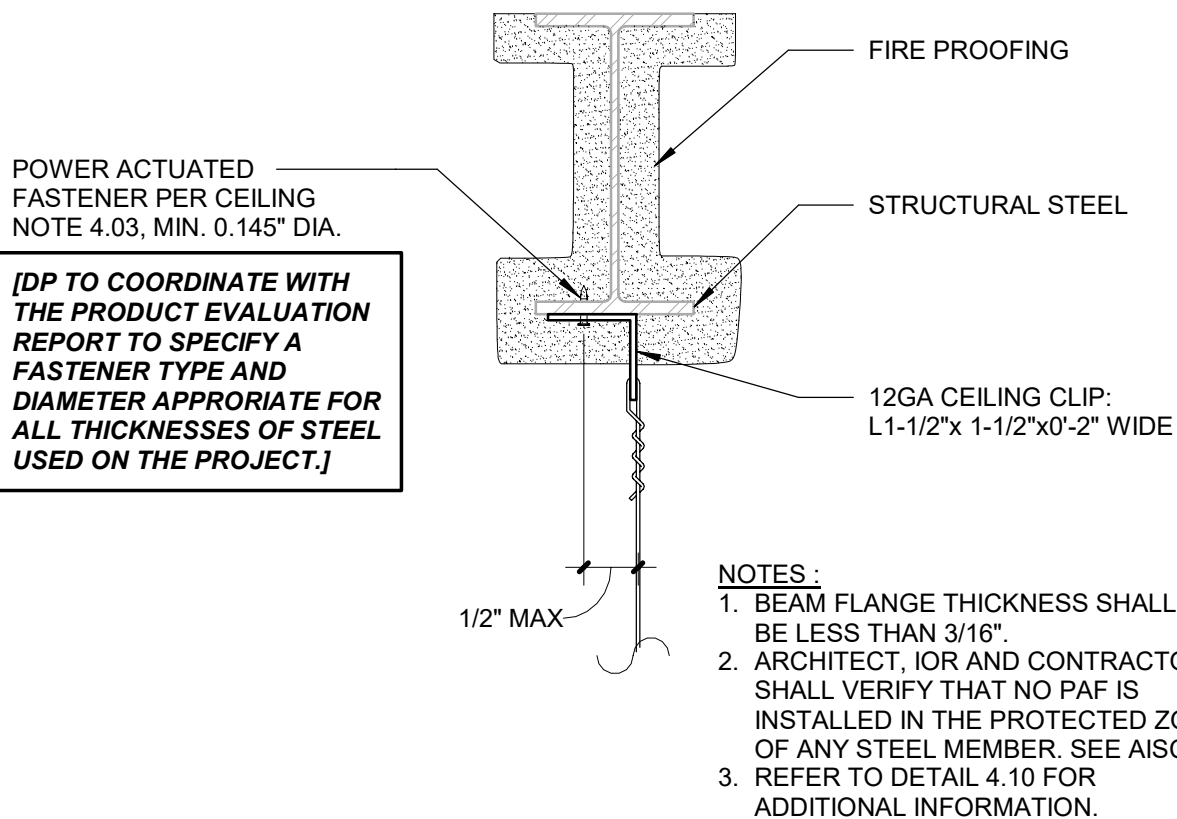
HANGER WIRE CONNECTION TO CONCRETE SLAB, BEAM, OR JOIST

REV: 09/21/2015

Detail No.

REV: 03/2022

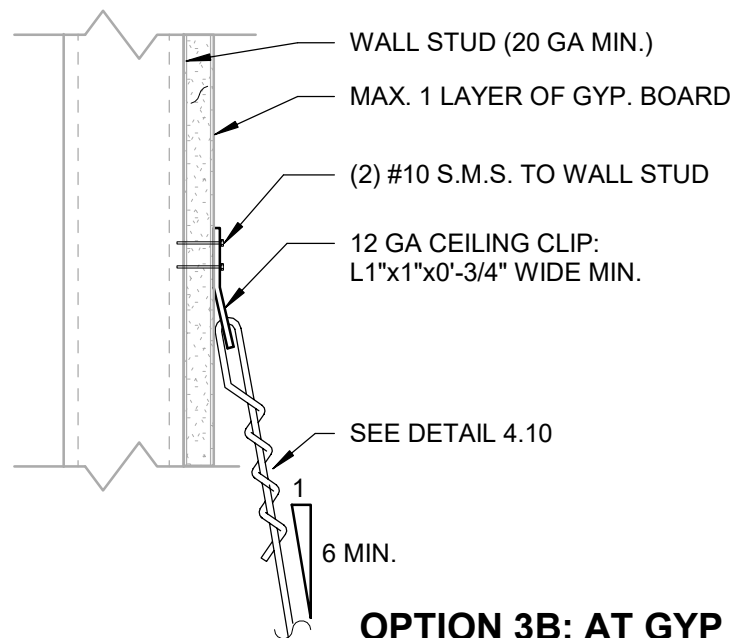
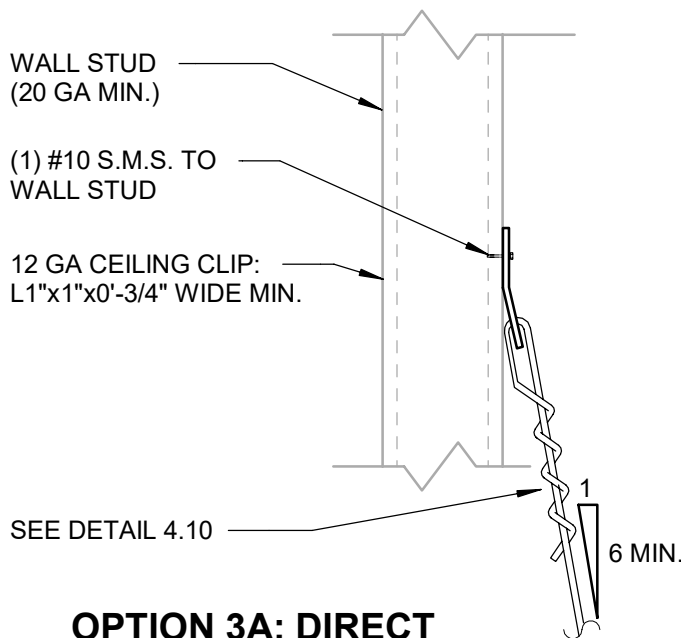
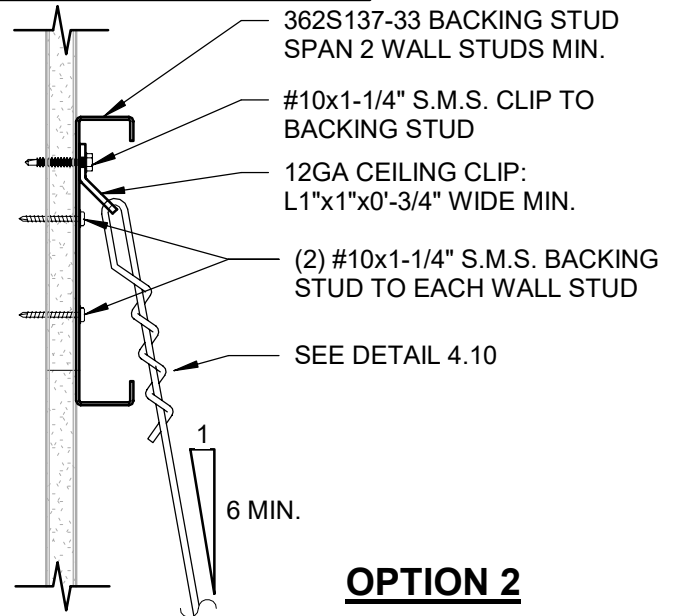
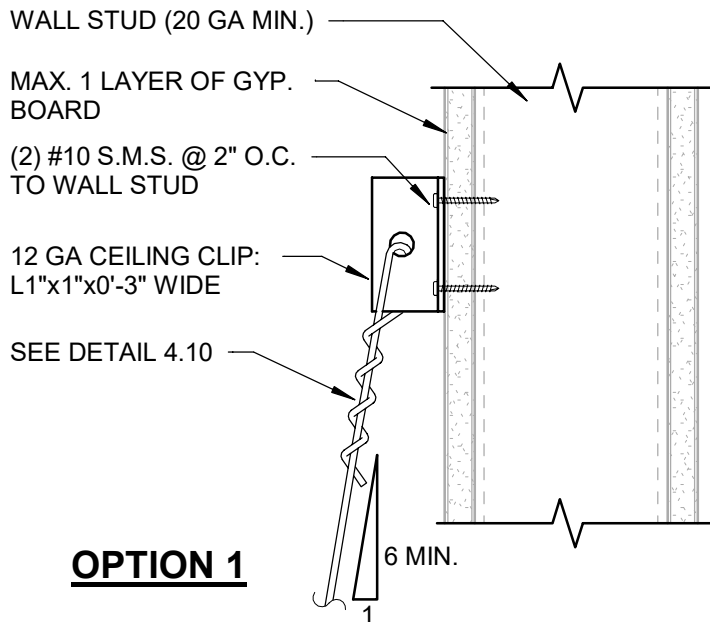
4.22

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**HANGER WIRE**

Detail Title : HANGER WIRE CONNECTION TO STRUCTURAL STEEL	REV: 09/21/2015	Detail No. 4.23
	REV: 03/2022	

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

[DP MAY MODIFY THIS DETAIL FOR WOOD STUD WALLS BY REPLACING THE FASTENERS TO THE STUDS WITH No. 10 x 3" LONG WOOD SCREWS.]

**NOTE:**

THIS DETAIL APPLIES AT PERIMETER WIRE ATTACHMENT OR WHERE OBSTRUCTION PREVENTS ATTACHMENT TO THE STRUCTURE ABOVE.

Detail Title :

HANGER WIRE CONNECTION TO METAL STUD WALL

REV: 09/21/2015

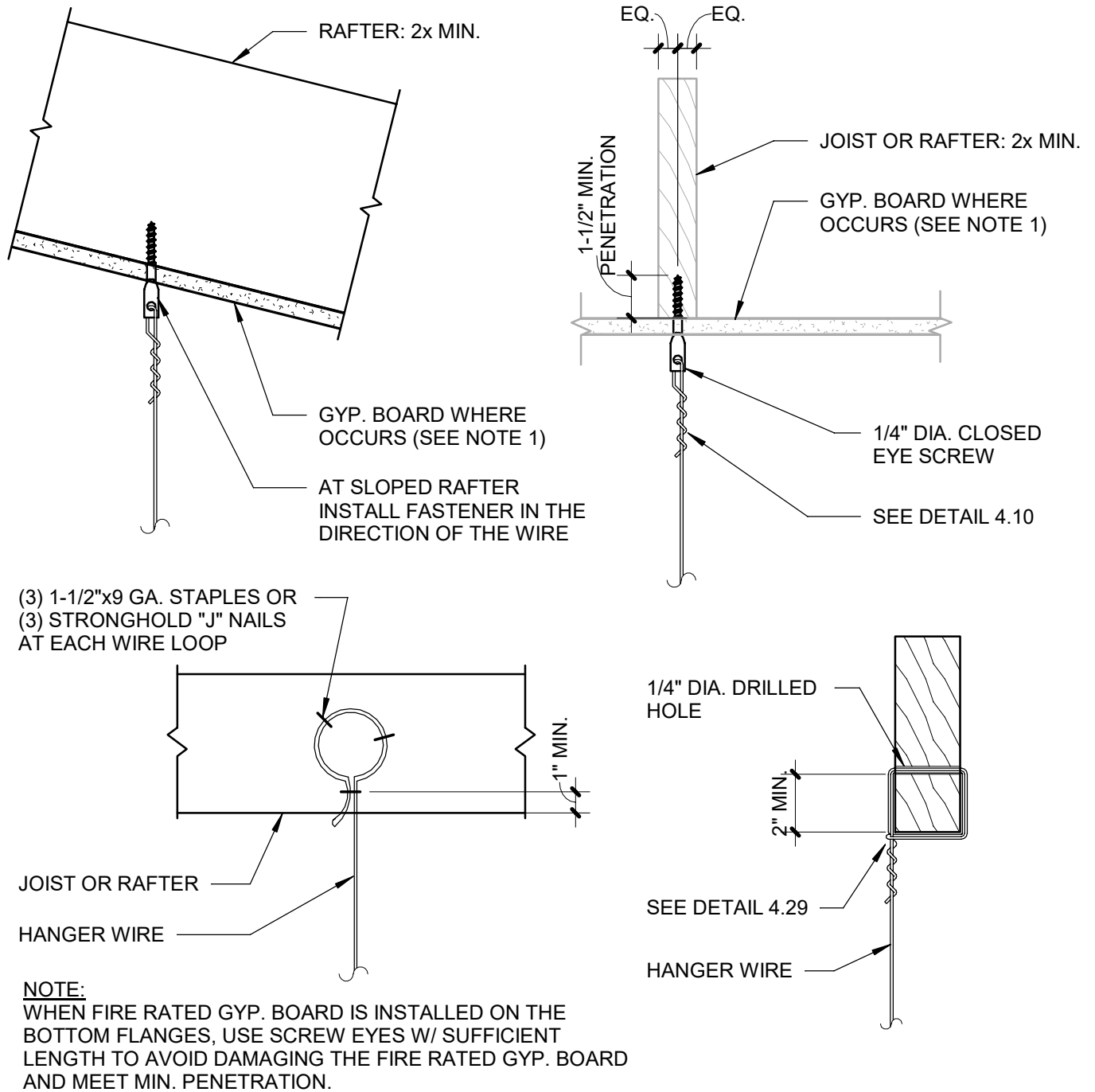
Detail No.

REV: 03/2022

REV: 11/2023

4.24

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC



Detail Title :

HANGER WIRE CONNECTION TO SAWN TIMBER

REV: 09/21/2015

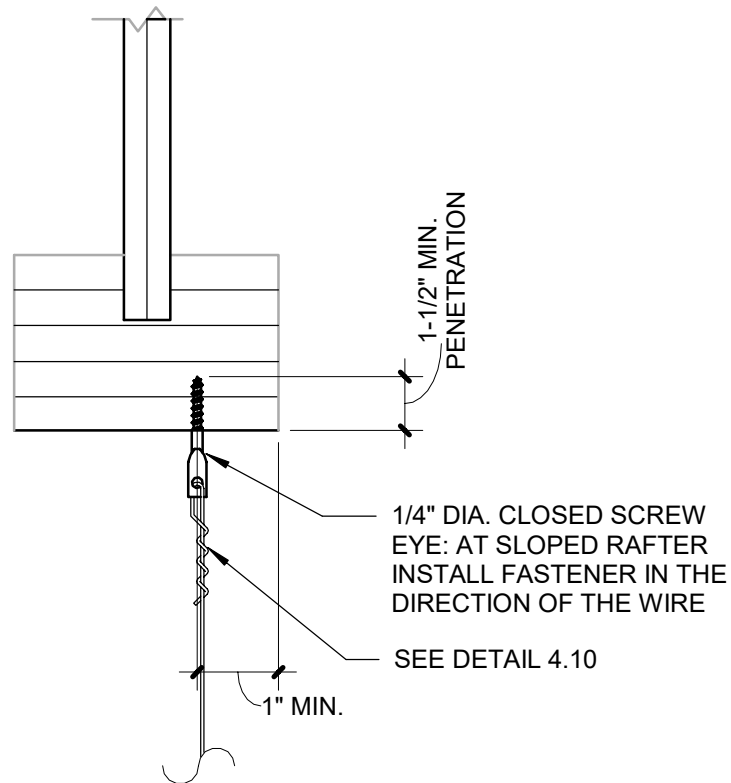
Detail No.

REV: 03/2022

REV: 11/2023

4.25

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

**NOTE:**

WHEN FIRE RATED GYP. BOARD IS INSTALLED ON THE BOTTOM FLANGES, USE SCREW EYES W/ SUFFICIENT LENGTH TO AVOID DAMAGING THE FIRE RATED GYP. BOARD AND MEET MIN. PENETRATION.

Detail Title :

HANGER WIRE CONNECTION TO WOOD I-JOIST

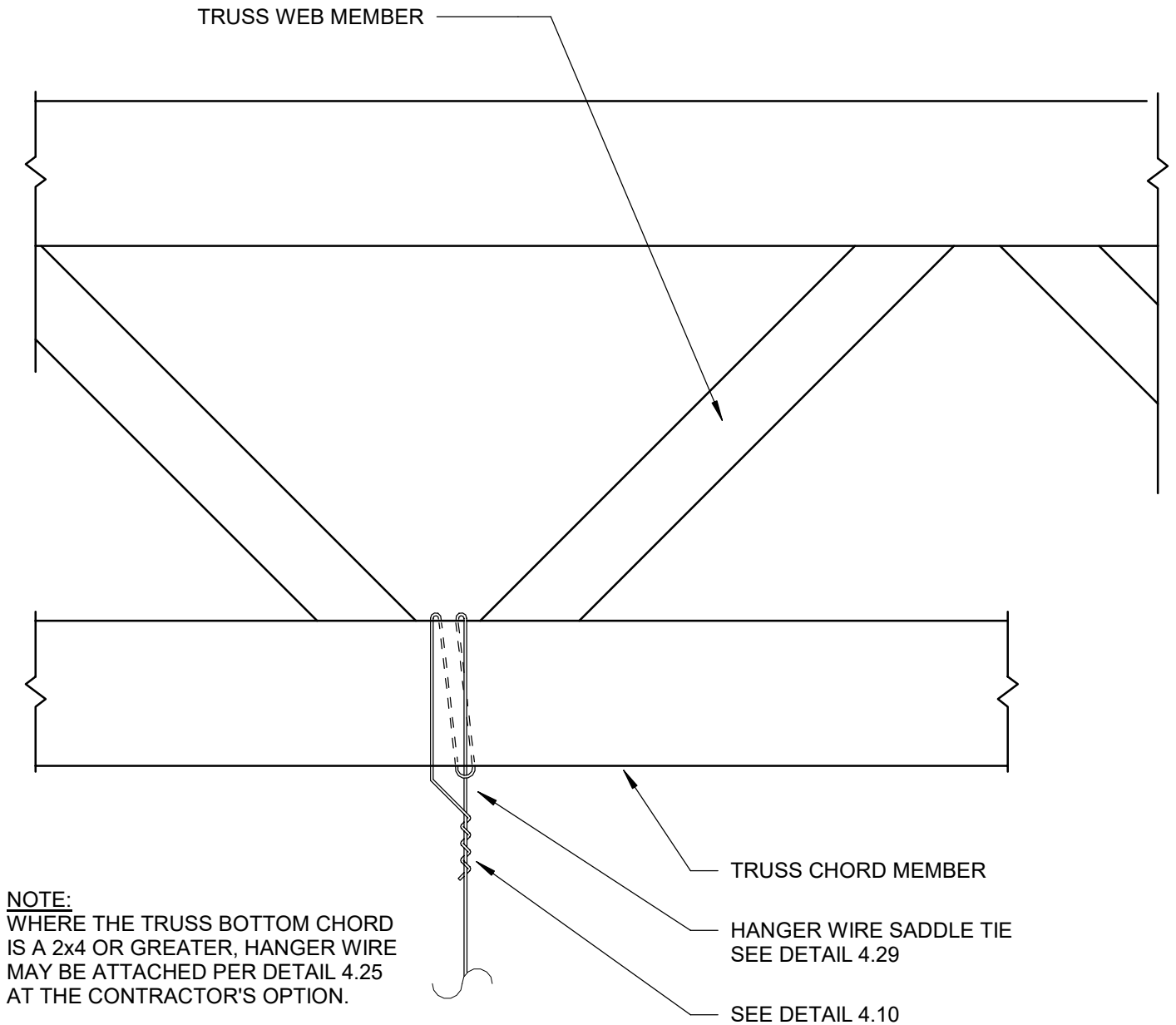
REV: 09/21/2015

Detail No.

REV: 03/2022

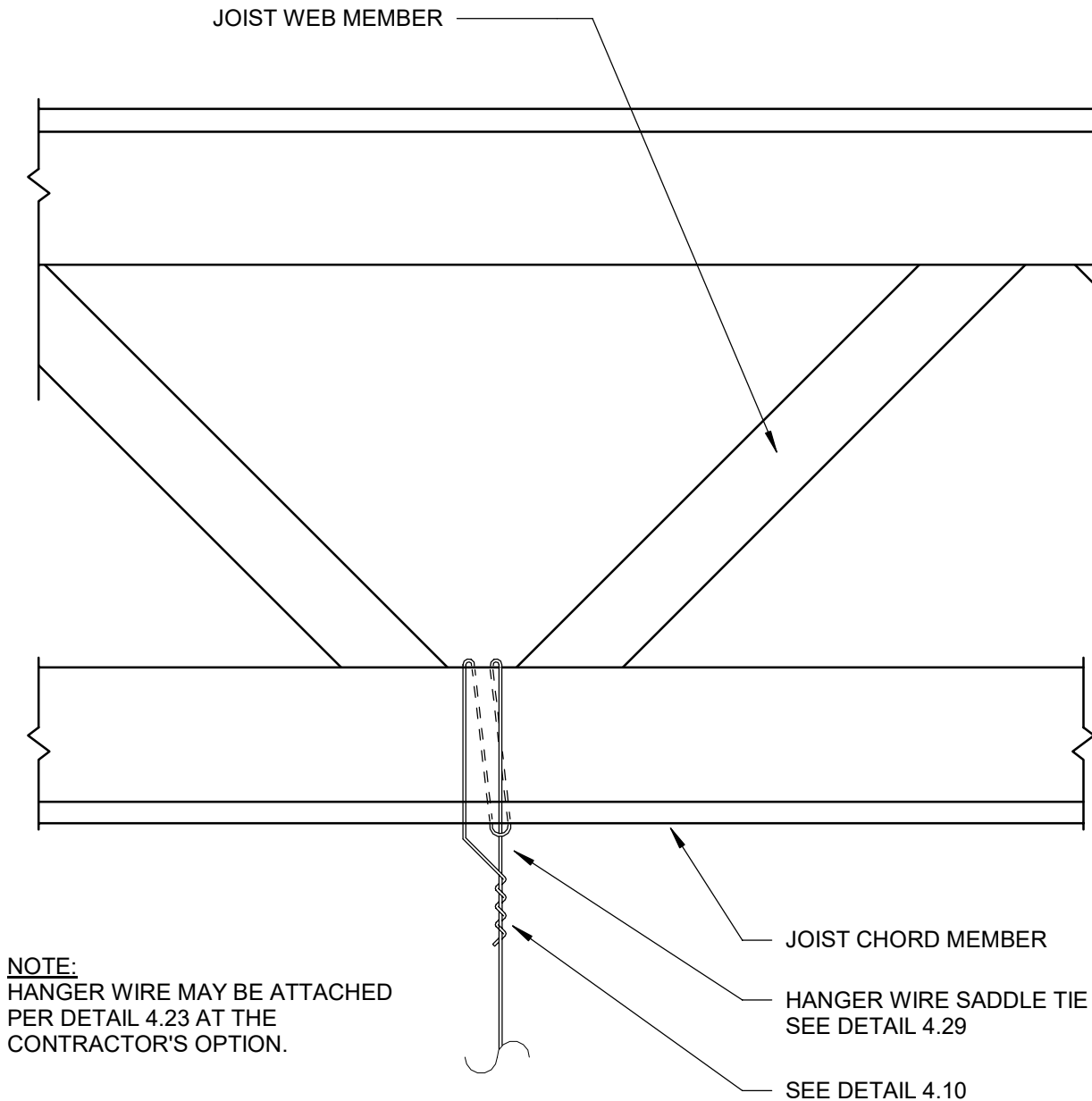
4.26

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC



Detail Title : HANGER WIRE CONNECTION TO WOOD CHORD TRUSS	REV: 09/21/2015	Detail No. 4.27
	REV: 03/2022	

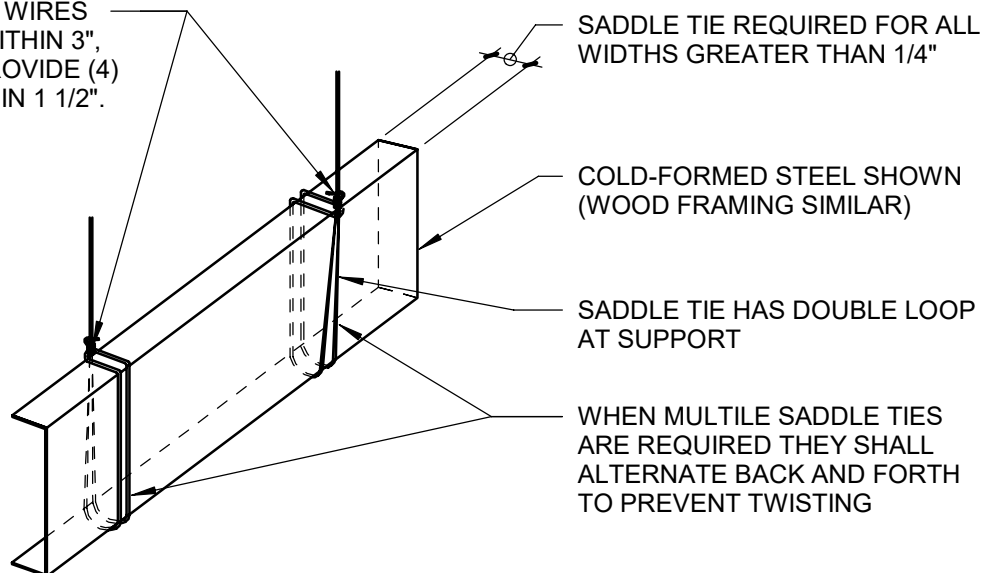
SUSPENDED LAY-IN PANEL CEILING: 2022 CBC



Detail Title : HANGER WIRE CONNECTION TO OPEN WEB STEEL JOIST	REV: 09/21/2015	Detail No. 4.28
	REV: 03/2022	

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

#12 GAGE HANGER WIRES
(3) TIGHT TURNS WITHIN 3",
AT BRACE WIRE PROVIDE (4)
TIGHT TURNS WITHIN 1 1/2".



Detail Title :

TYPICAL SADDLE TIE DETAIL

REV: 09/21/2015

Detail No.

REV: 03/2022

4.29

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

LIGHTWEIGHT OR NORMAL
WEIGHT CONCRETE

12GA CEILING CLIP:
L1-1/2"x1-1/2"x0'-2" WIDE MIN.
BEND TO ALIGN WITH WIRE

SEE DETAIL 4.10

5/8" DIA EXPANSION ANCHOR
WITH ____ EMBEDMENT

**[DP TO SPECIFY EMBEDMENT.
THE SPECIFIED ANCHOR DIA. MAY
BE REDUCED TO 3/8" WHEN THE
PROJECT CONDITIONS MEET THE
REQUIREMENTS (S_{DS} , BRACE
ASSEMBLY SPACING, DECK TYPE)
OF THE SCHEDULE IN DETAIL
CL4.31 OF HCAI PREAPPROVED
DETAILS OPD-0002-13.]**

OPTION 1

LIGHTWEIGHT OR NORMAL
WEIGHT CONCRETE

(2) 3/8" DIA EXPANSION
ANCHORS WITH ____
EMBEDMENT

**[DP TO SPECIFY
MIN. EMBEDMENT]**

12 GA ANGLE:
L1-1/2"x1-1/2"

3/4" MIN. TYP

SEE DETAIL 4.10

NOTES:

1. TEST POST INSTALLED ANCHORS IN ACCORDANCE WITH CEILING NOTE 5.03.
2. REFER TO DETAIL 4.10 FOR ADDITIONAL INFORMATION.
3. POST-INSTALLED ANCHORS TO BE PLACED NO MORE THAN 1" OFFSET FROM CENTERLINE OF DECK LOW FLUTE.

OPTION 2

Detail Title :

BRACE WIRE CONNECTION TO CONCRETE OVER METAL DECK

REV: 09/21/2015

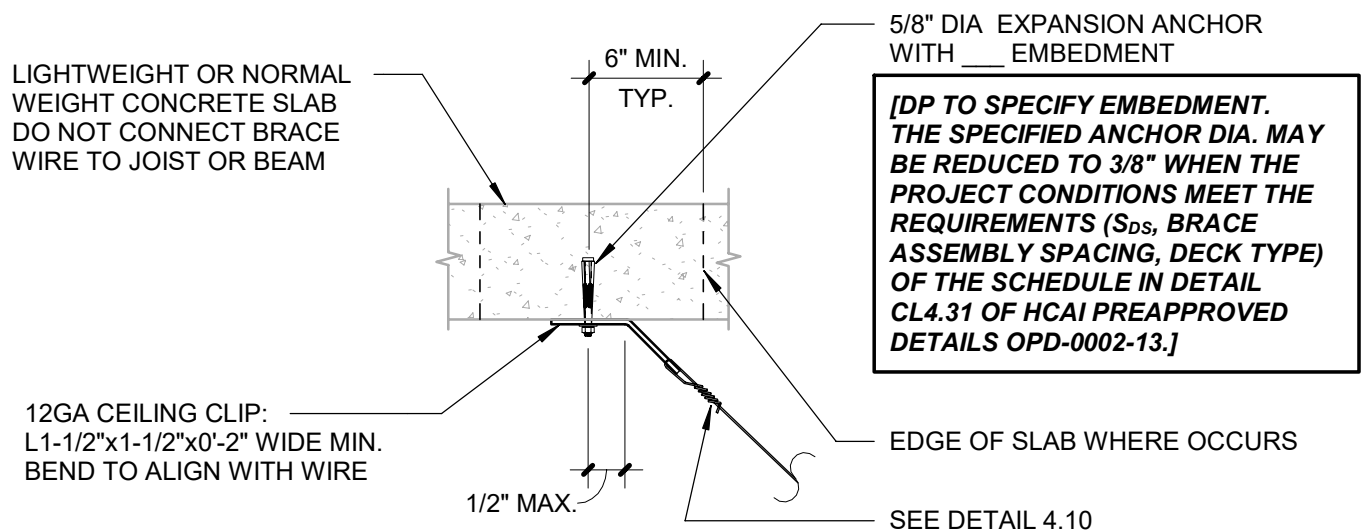
REV: 03/2022

REV: 11/2023

Detail No.

4.31

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC



NOTES:

1. TEST POST-INSTALLED ANCHORS IN ACCORDANCE WITH CEILING NOTE 5.03.
2. REFER TO DETAIL 4.10 FOR ADDITIONAL INFORMATION.
3. DSA APPROVAL OF A CONSTRUCTION PLAN IS REQUIRED PRIOR TO INSTALLING POST-INSTALLED ANCHORS IN PRESTRESSED CONCRETE. THE CONSTRUCTION PLAN SHALL DEMONSTRATE HOW THE LOCATION OF PRESTRESSING TENDONS AND STRANDS WILL BE LOCATED AND DENOTED AS NECESSARY TO AVOID INTERFERENCE.

Detail Title :

BRACE WIRE CONNECTION TO CONCRETE SLAB, BEAM, OR JOIST

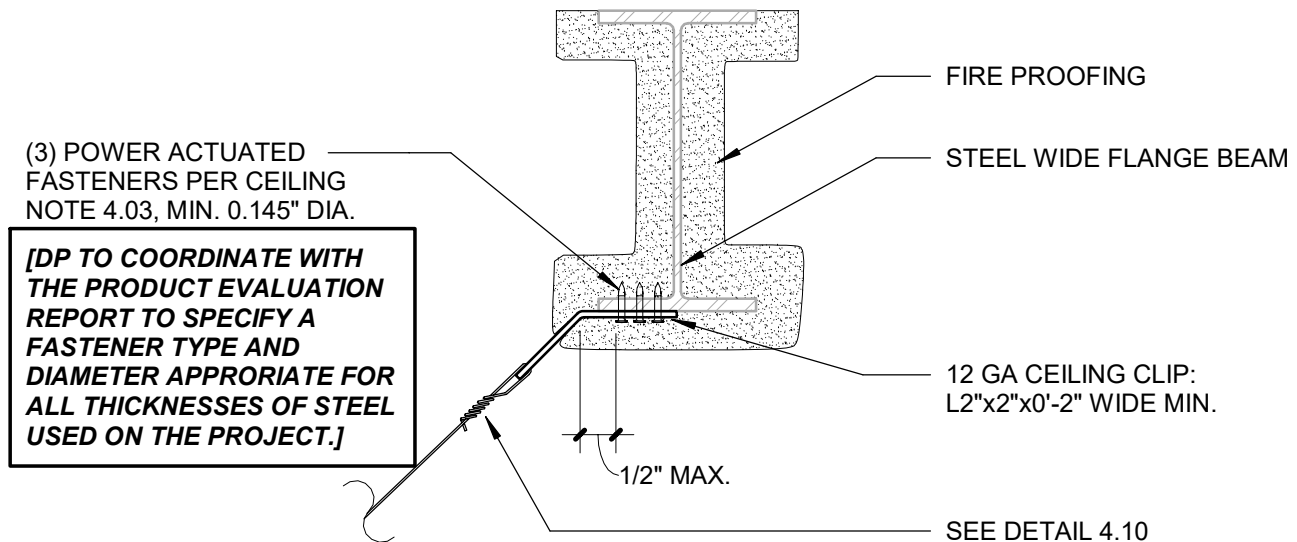
REV: 09/21/2015

Detail No.

REV: 03/2022

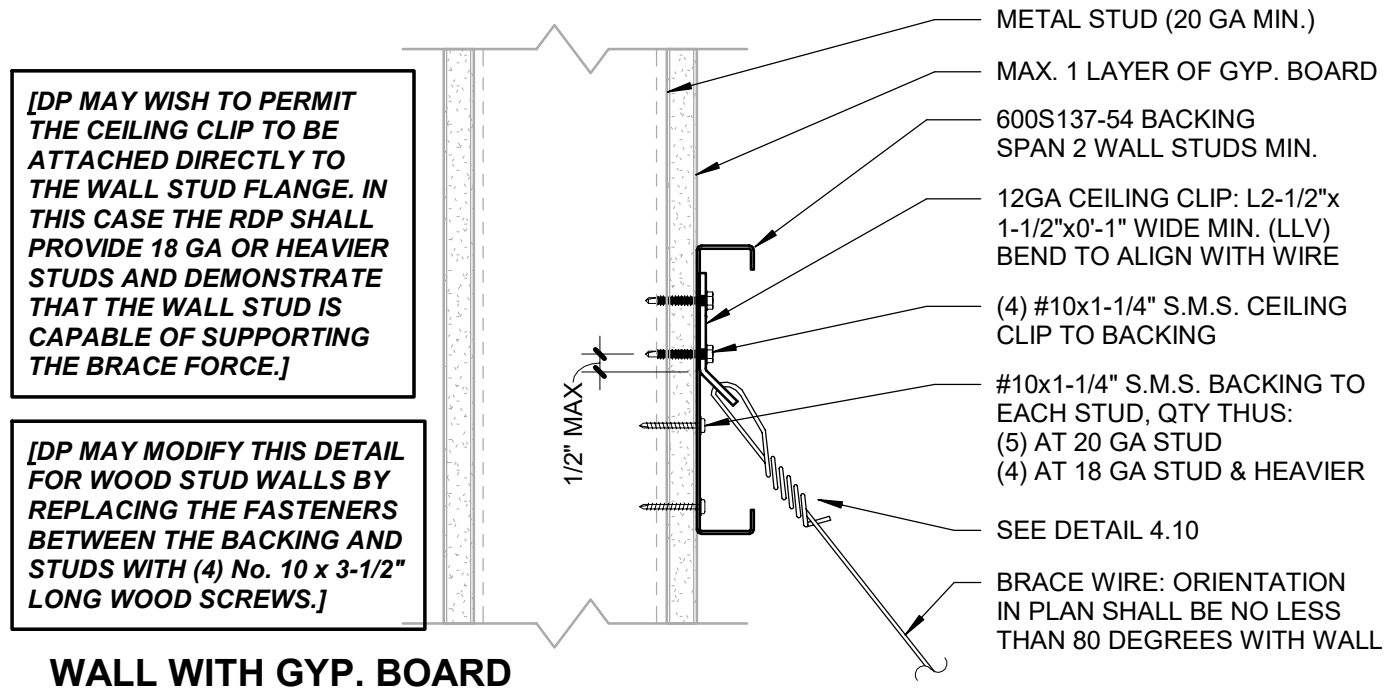
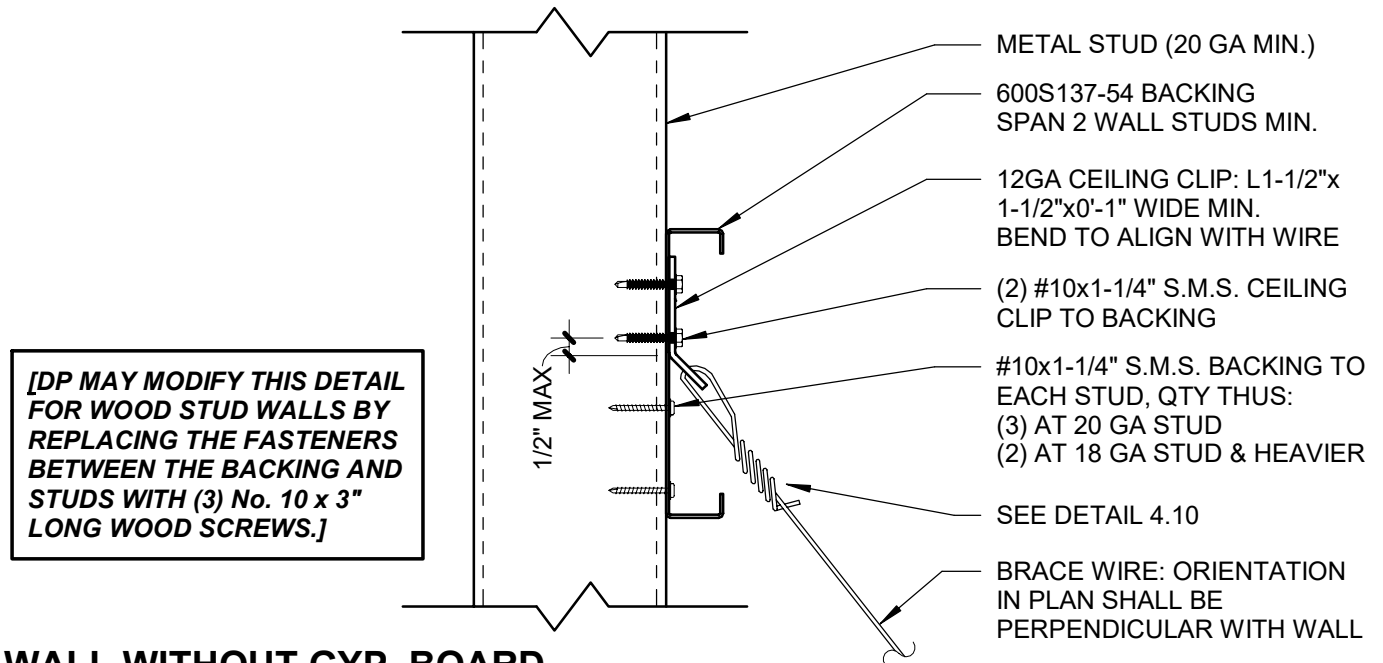
REV: 11/2023

4.32

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**BRACING WIRE****NOTES :**

1. BEAM FLANGE THICKNESS SHALL NOT BE LESS THAN 3/16".
2. ARCHITECT, IOR, AND CONTRACTOR SHALL VERIFY THAT NO POWER ACTUATED FASTENER IS INSTALLED IN THE PROTECTED ZONE OF ANY STEEL MEMBER. SEE AISC 341.
3. REFER TO DETAIL 4.10 FOR ADDITIONAL INFORMATION.

Detail Title : BRACE WIRE CONNECTION TO STRUCTURAL STEEL	REV: 09/21/2015	Detail No. 4.33
	REV: 03/2022	

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

Detail Title :

**BRACE WIRE CONNECTION TO
METAL STUD WALL**

REV: 09/21/2015

Detail No.

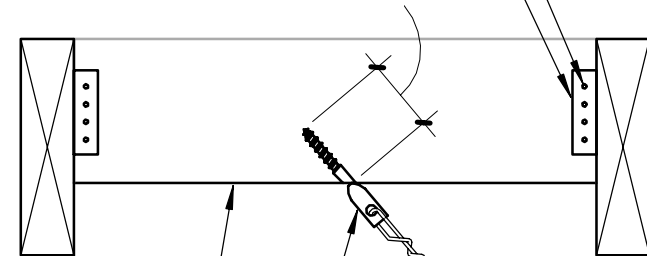
REV: 03/10/2017

REV: 03/2022

4.34

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

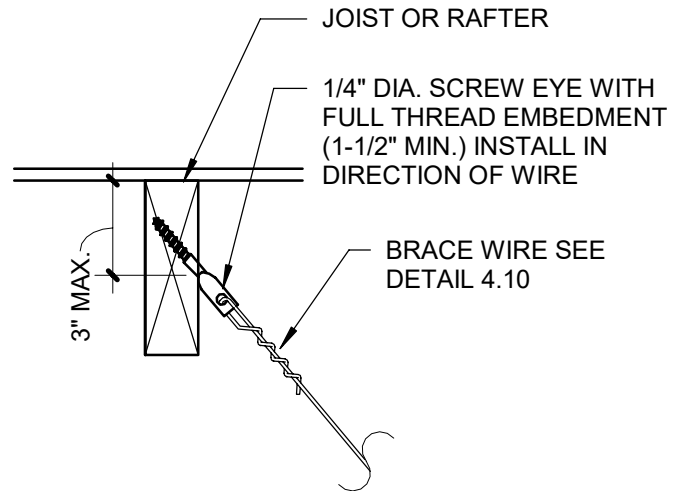
(4) 8d EACH LEG OF EACH CLIP

18GA CLIP: L1-1/2"x1-1/2"x0'-4" MIN.
EACH SIDE, EACH END OF BLKG.

2x BLOCKING

1/4" DIA. CLOSED
SCREW EYE, INSTALL
IN THE DIRECTION OF
THE BRACE WIRE

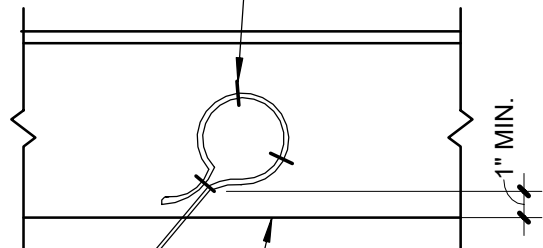
SEE DETAIL 4.10



JOIST OR RAFTER

1/4" DIA. SCREW EYE WITH
FULL THREAD EMBEDMENT
(1-1/2" MIN.) INSTALL IN
DIRECTION OF WIREBRACE WIRE SEE
DETAIL 4.10(3) 1-1/2"x9 GA. STAPLES OR
(3) STRONGHOLD "J" NAILS
AT EACH WIRE LOOP2x BLKG. WITH (2)
16d AT EACH END

BRACING WIRE

(3) 1-1/2"x9 GA. STAPLES OR
(3) STRONGHOLD "J" NAILS
AT EACH WIRE LOOP

JOIST OR RAFTER

BRACING WIRE

Detail Title :

**BRACE WIRE CONNECTION TO
SAWN TIMBER**

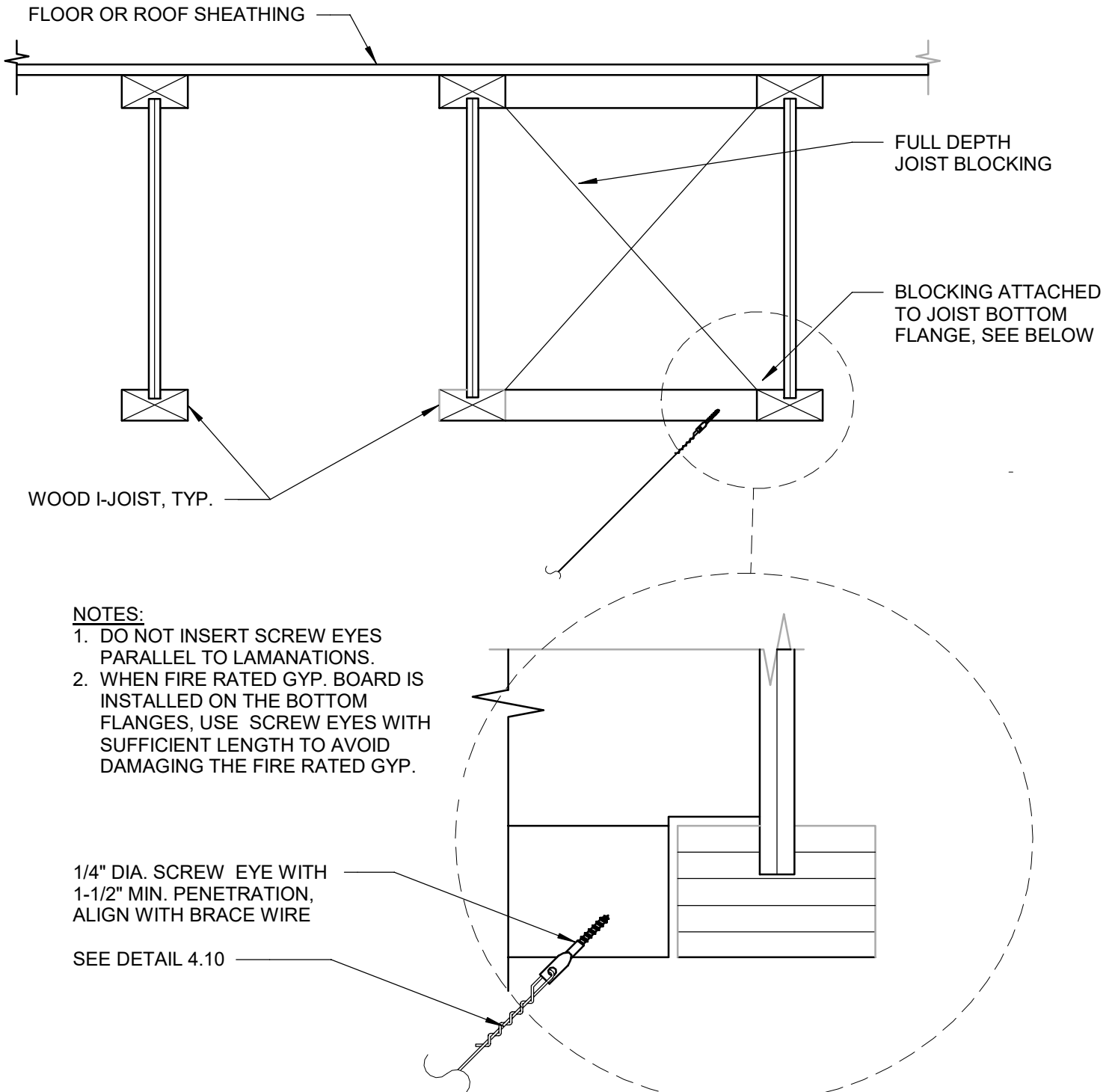
REV: 09/21/2015

REV: 03/2022

REV: 11/2023

Detail No.

4.35

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

Detail Title :

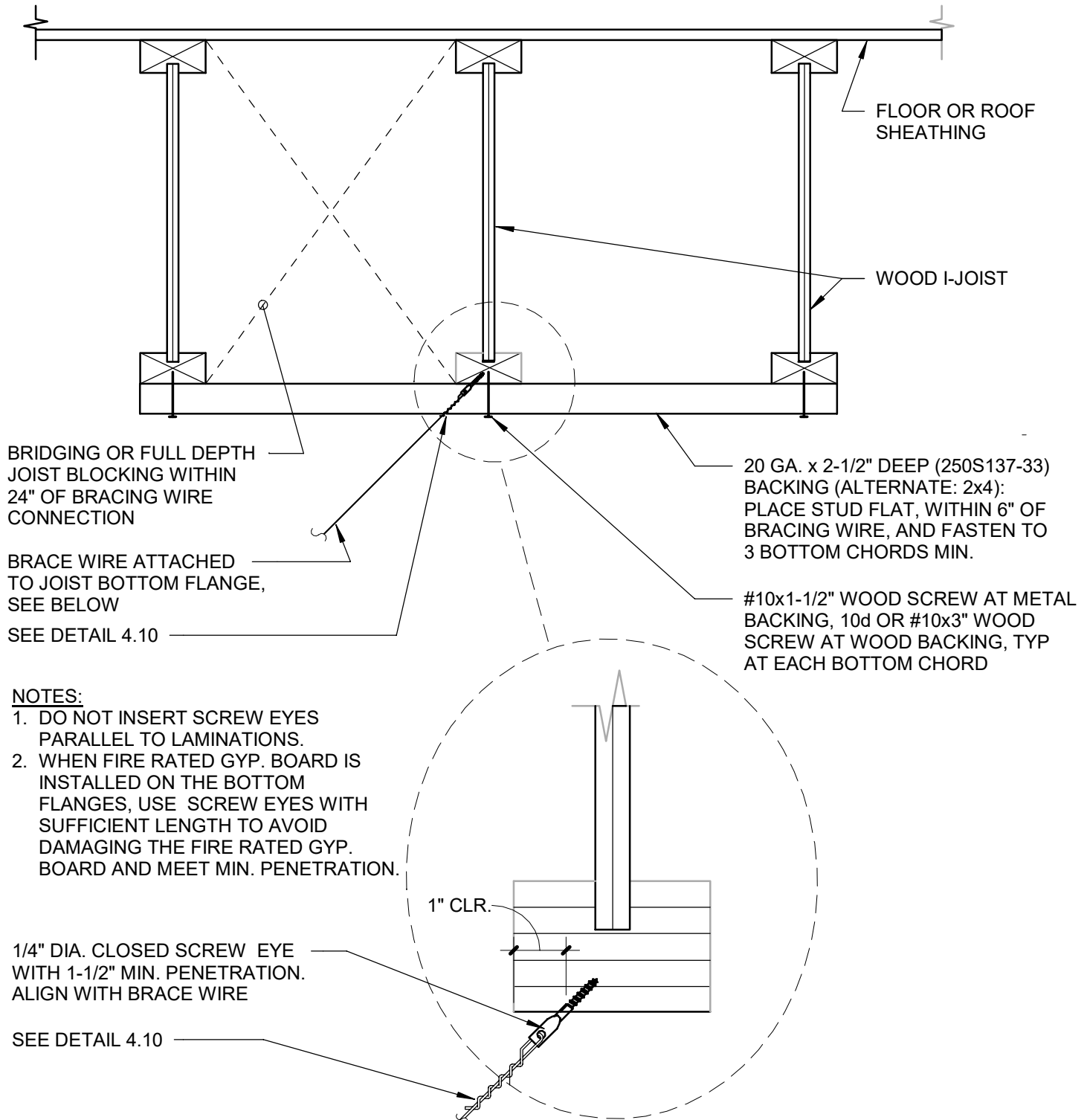
BRACE WIRE CONNECTION TO WOOD I-JOIST

REV: 09/21/2015

Detail No.

REV: 03/2022

4.36

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

Detail Title :

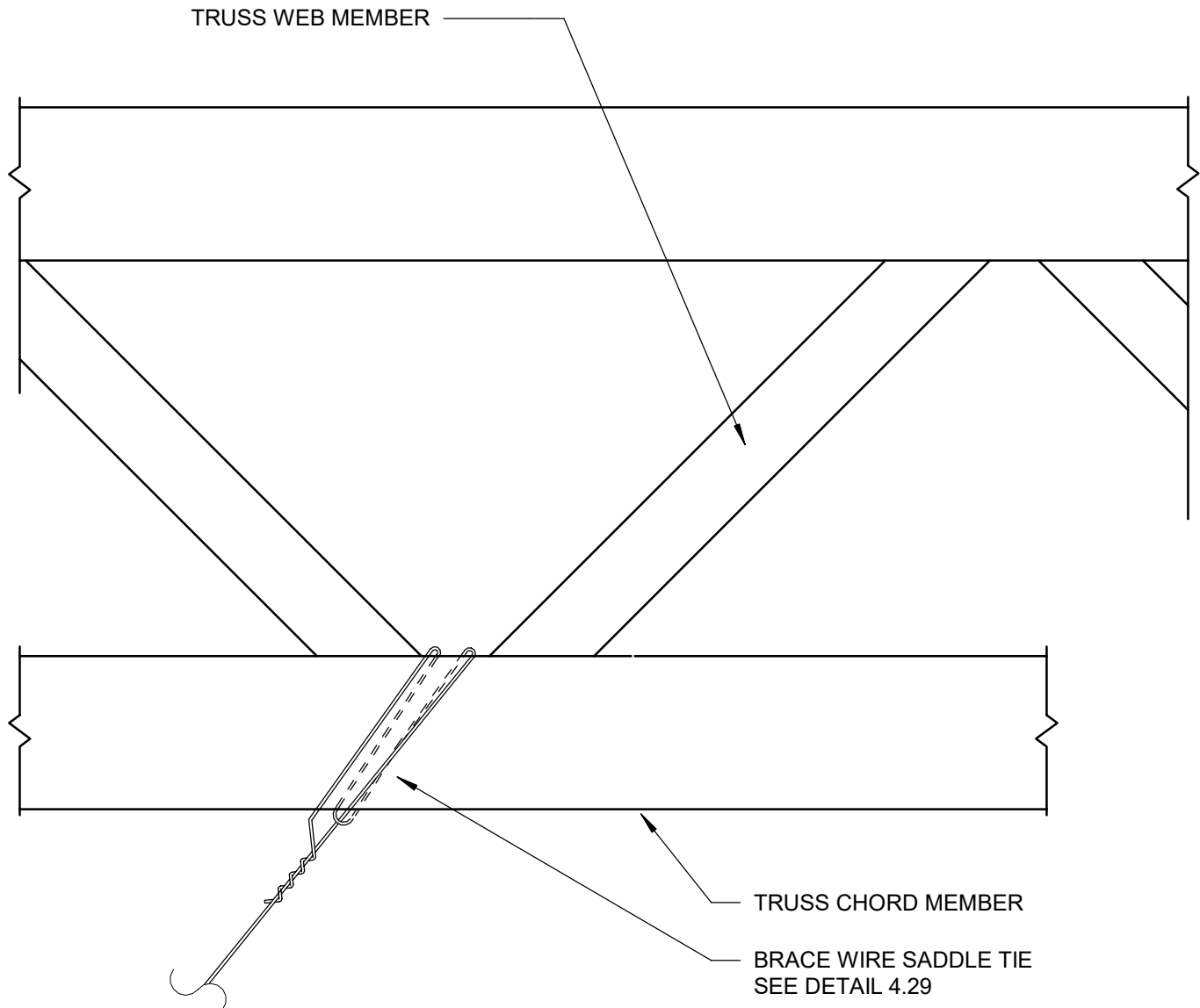
**BRACE WIRE CONNECTION TO
WOOD I - JOIST**

REV: 09/21/2015

Detail No.

REV: 03/2022

4.37

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**NOTES:**

1. BRACE WIRE SHALL ALIGN PARALLEL WITH THE TRUSS BOTTOM CHORD.
2. BRACE WIRES PERPENDICULAR TO THE TRUSS SHALL BE INSTALLED TO BLOCKING BETWEEN TRUSS TOP CHORDS PER DETAIL 4.35.
3. WHERE TRUSS BOTTOM CHORD IS A 2x4 OR GREATER, BRACE WIRES PARALLEL TO THE TRUSS MAY BE ATTACHED TO THE TOP OR BOTTOM CHORD PER DETAIL 4.35 AT THE CONTRACTOR'S OPTION.

Detail Title :

BRACE WIRE CONNECTION TO WOOD CHORD TRUSS

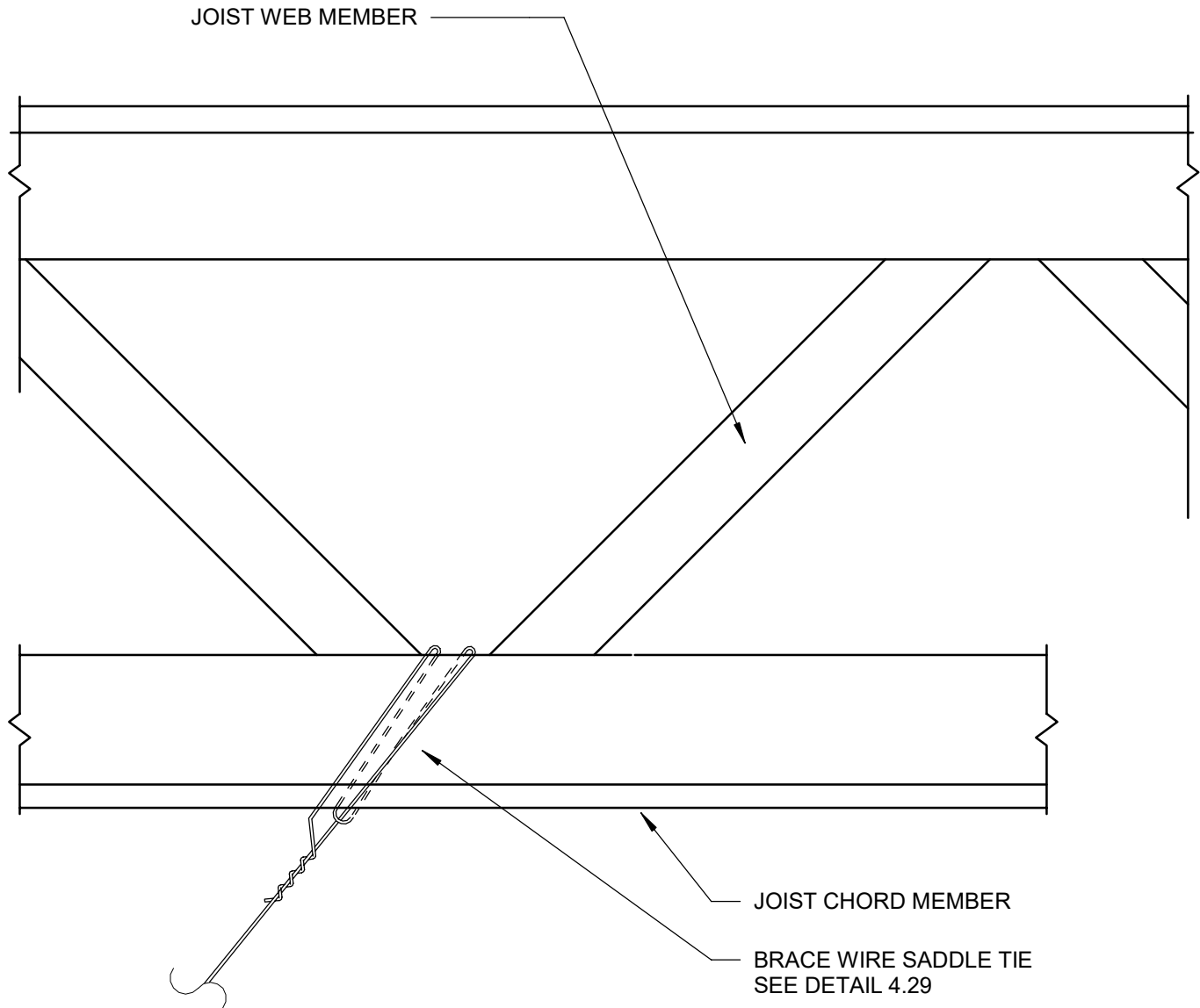
REV: 09/21/2015

Detail No.

REV: 03/2022

4.38

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC



NOTES:

1. BRACE WIRE SHALL ALIGN PARALLEL WITH THE TRUSS BOTTOM CHORD.
2. BRACE WIRES PERPENDICULAR TO THE TRUSS SHALL BE ATTACHED TO THE HORIZONTAL LEG OF THE TOP CHORD ANGLE PER DETAIL 4.33.
3. BRACE WIRES PARALLEL TO THE TRUSS MAY BE ATTACHED TO THE BOTTOM CHORD PER DETAIL 4.33 AT THE CONTRACTOR'S OPTION.

Detail Title :

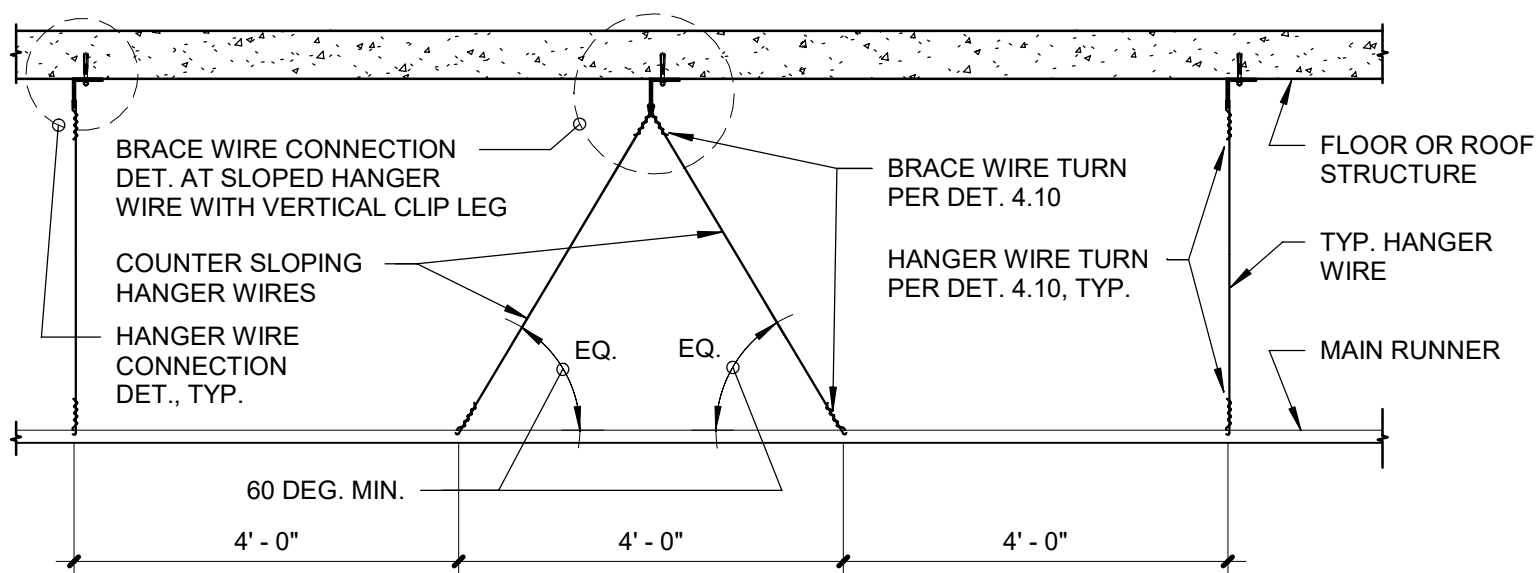
BRACE WIRE CONNECTION TO OPEN-WEB STEEL JOIST

REV: 09/21/2015

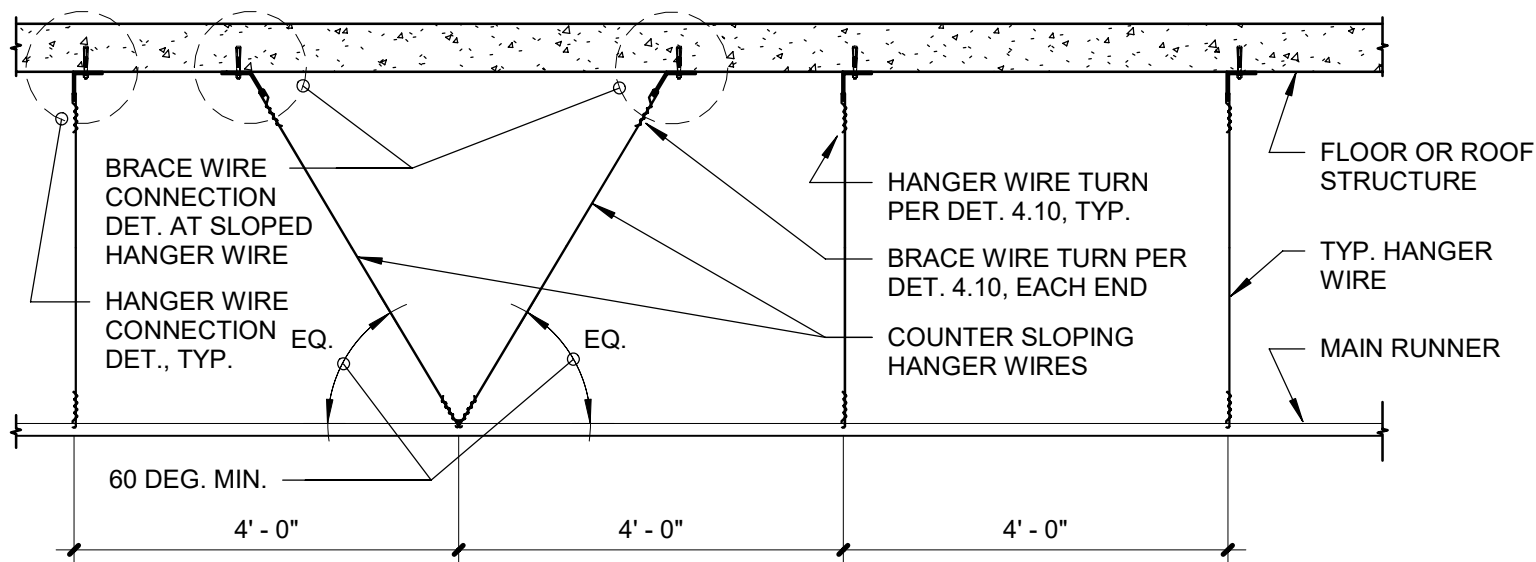
Detail No.

REV: 03/2022

4.39



METHOD 1: COMMON POINT AT STRUCTURE



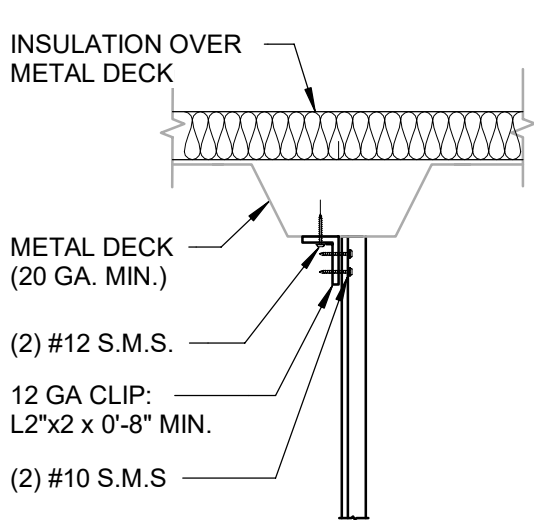
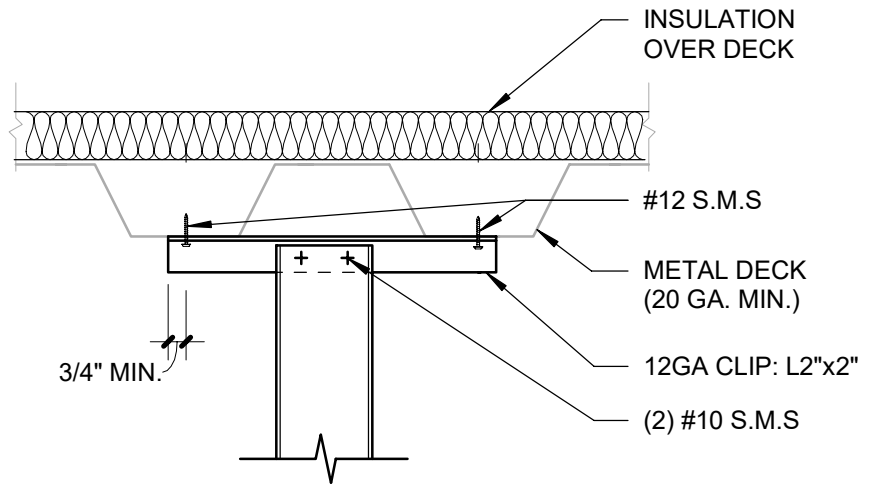
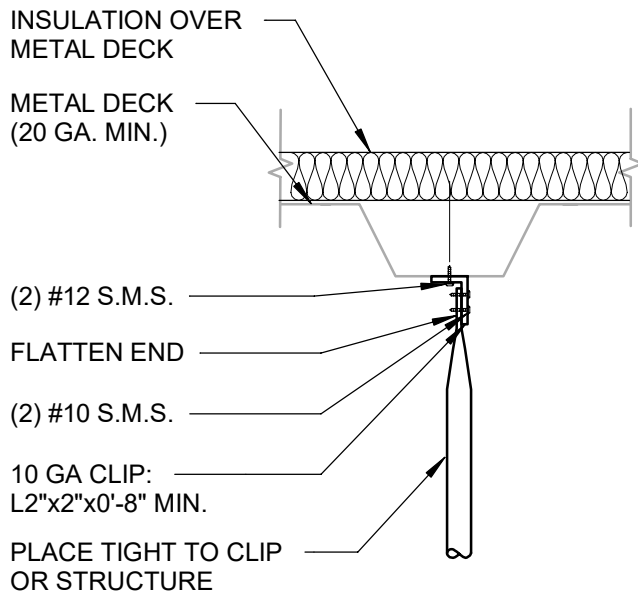
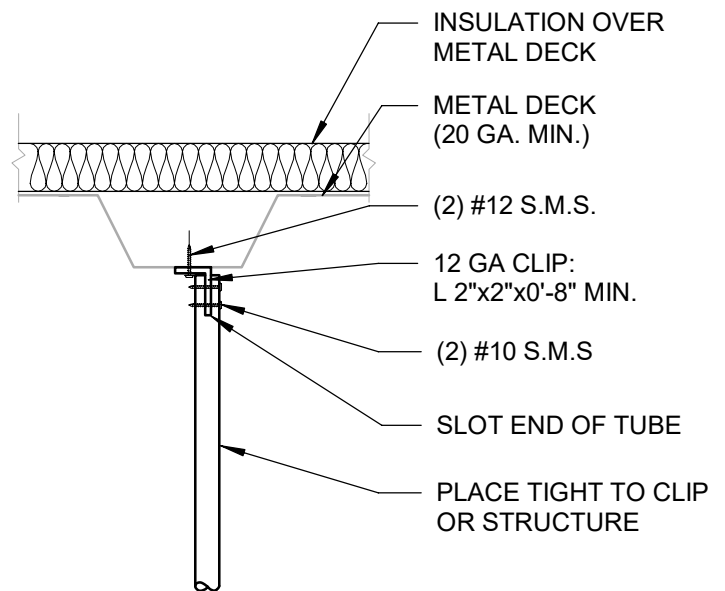
METHOD 2: COMMON POINT AT CEILING

Detail Title : HANGER WIRE COUNTERSLOPING METHODS (REF. ASTM C636)	REV: 03/2022	Detail No. 4.40

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

STRUCTURAL SYSTEM OF FLOOR/ ROOF ABOVE SUSPENDED CEILING	APPLICABLE DETAIL
BARE METAL DECK	5.20
CONCRETE OVER METAL DECK	5.21
CONCRETE SLAB, BEAM, OR JOIST	5.30
STRUCTURAL STEEL	5.40
SAWN TIMBER WITH GYPSUM BOARD	5.50
SAWN TIMBER WITHOUT GYPSUM BOARD	5.51
WOOD I-JOIST	5.52

Detail Title : COMPRESSION STRUT CONNECTION TABLE	REV: 09/21/2015	Detail No. 5.10
	REV: 03/2022	

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**CHANNEL STRUT: OPTION 1****CHANNEL STRUT: OPTION 2****EMT STRUT: OPTION 1****EMT STRUT: OPTION 2**

Detail Title :

STRUT CONNECTION TO BARE METAL DECK

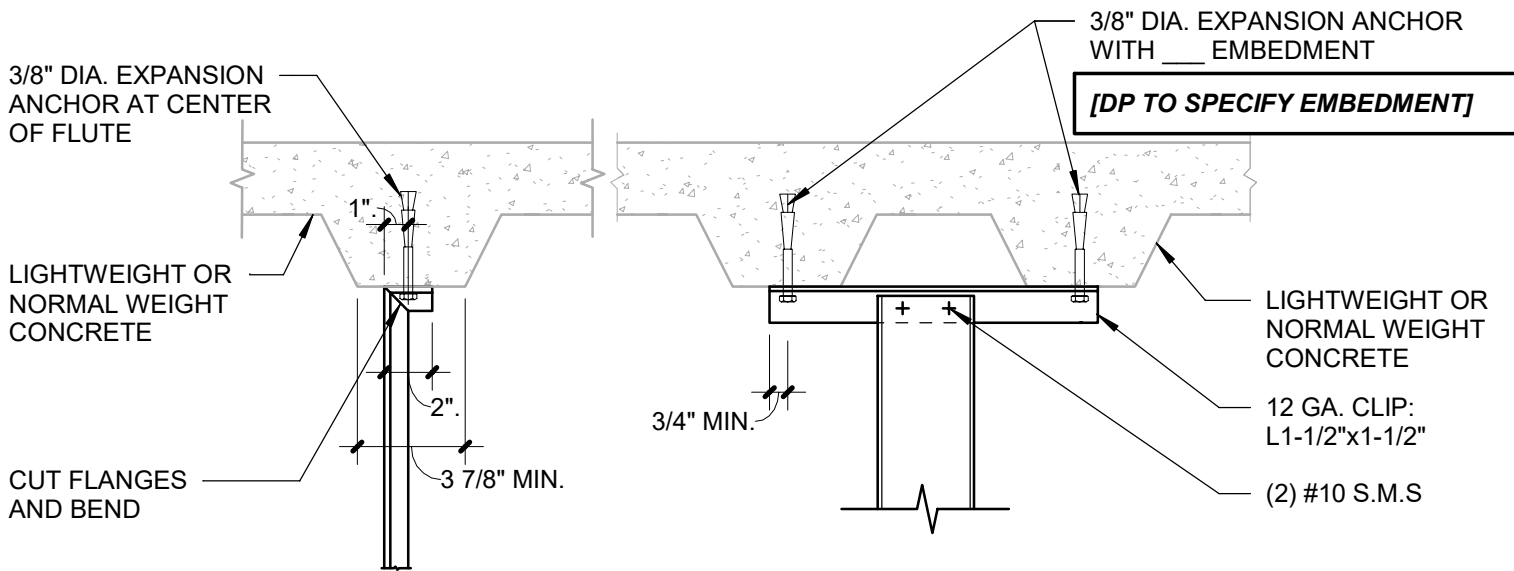
REV: 09/21/2015

Detail No.

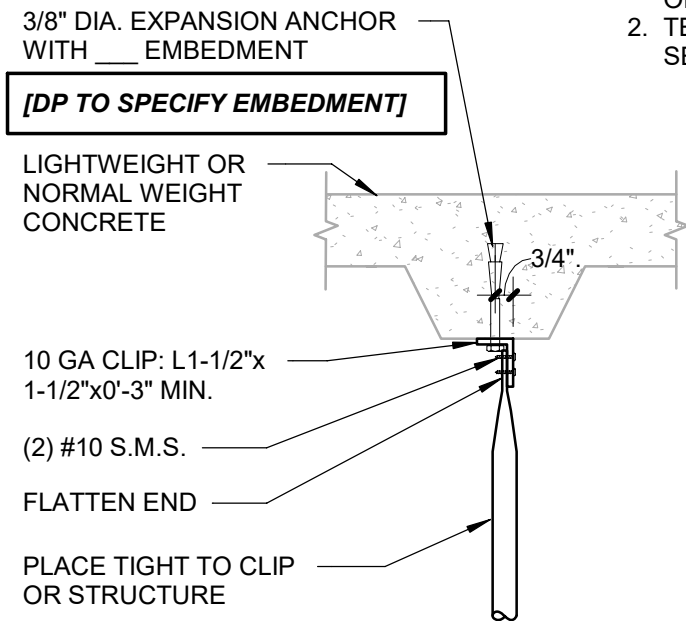
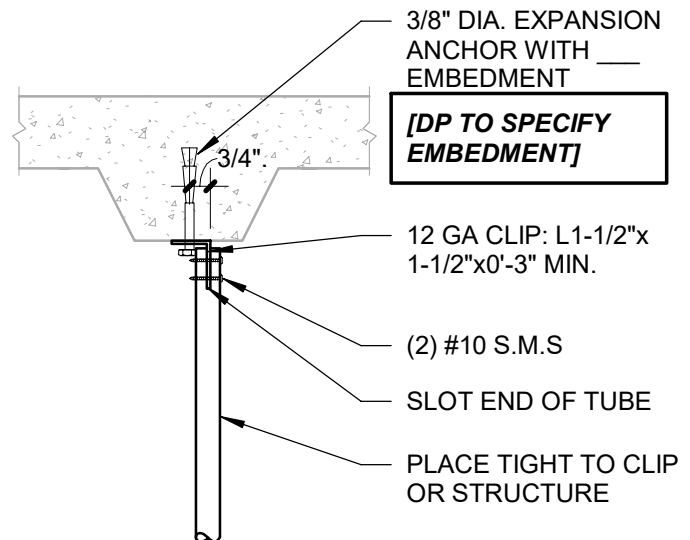
REV: 03/2022

REV: 11/2023

5.20

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**CHANNEL STRUT: OPTION 1****CHANNEL STRUT: OPTION 2****NOTES:**

1. POST-INSTALLED ANCHORS TO BE PLACED NO MORE THAN 1" OFFSET FROM CENTERLINE OF DECK LOW FLUTE.
2. TEST POST INSTALLED ANCHORS IN ACCORDANCE WITH CBC SECTION 1910A.5.

**EMT STRUT: OPTION 1****EMT STRUT: OPTION 2**

Detail Title :

**STRUT CONNECTION TO
CONCRETE OVER METAL DECK**

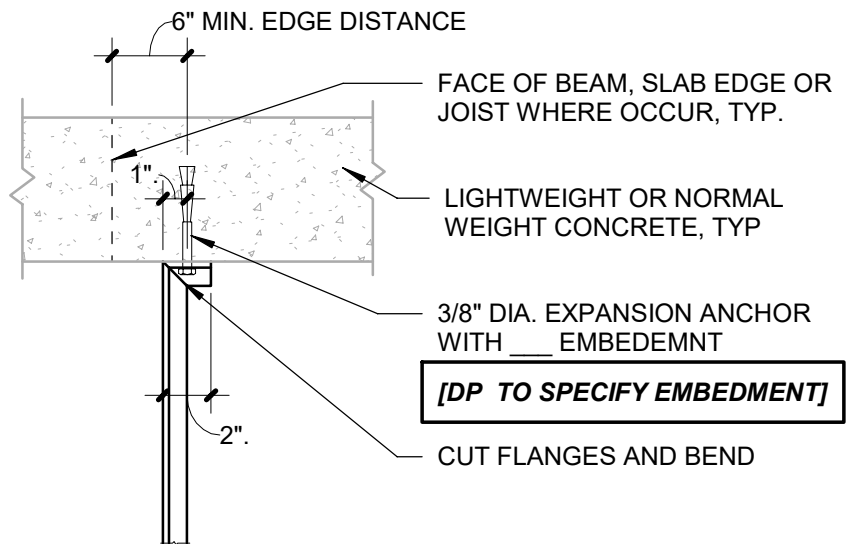
REV: 09/21/2015

Detail No.

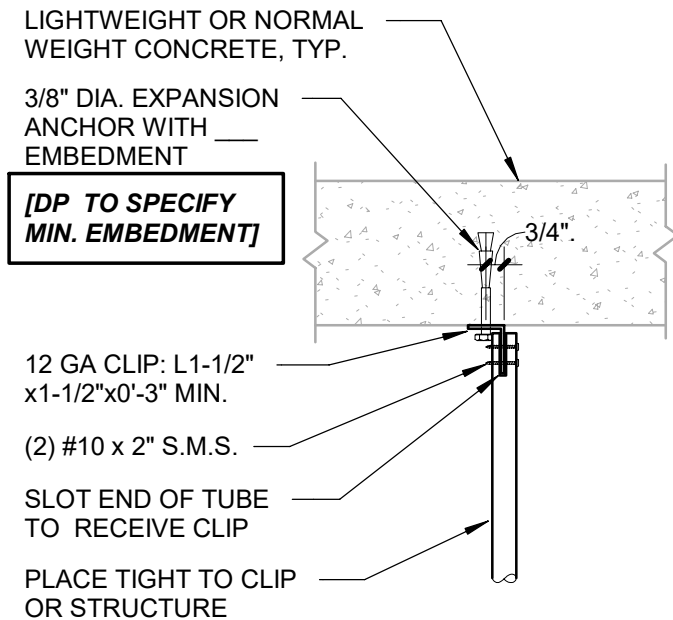
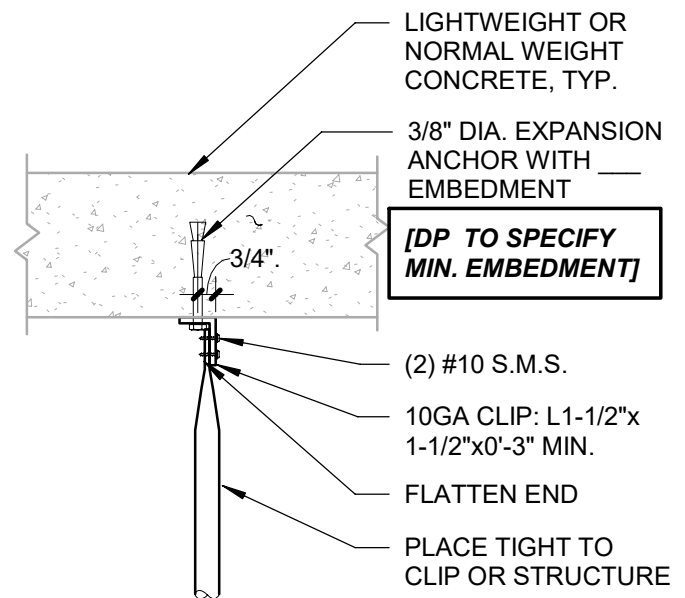
REV: 03/2022

REV: 11/2023

5.21

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**NOTE:**

TEST POST INSTALLED ANCHORS IN ACCORDANCE WITH CEILING NOTE 5.01.

CHANNEL STRUT**EMT STRUT: OPTION 1****EMT STRUT: OPTION 2**

Detail Title :

STRUT CONNECTION TO CONCRETE SLAB, BEAM, OR JOIST

REV: 09/21/2015

Detail No.

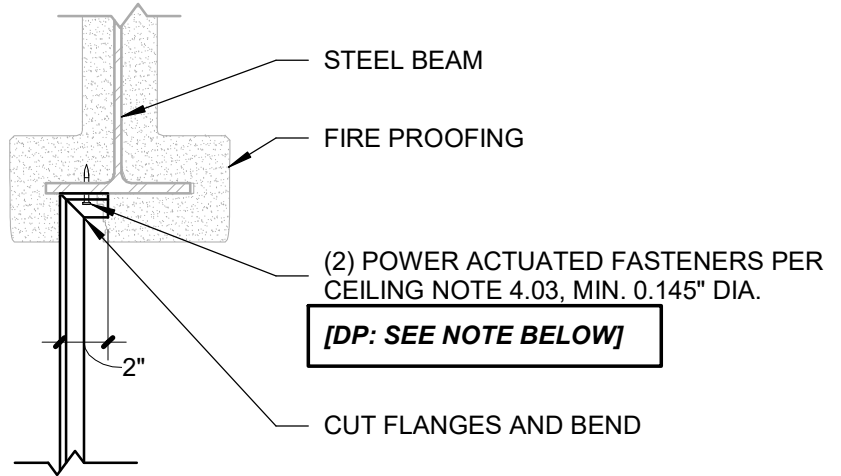
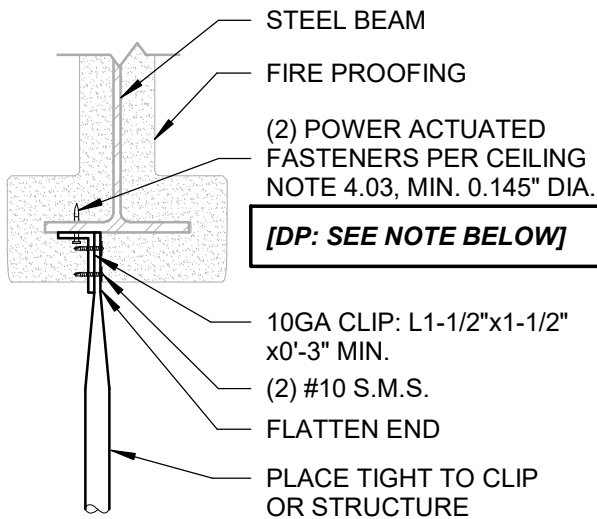
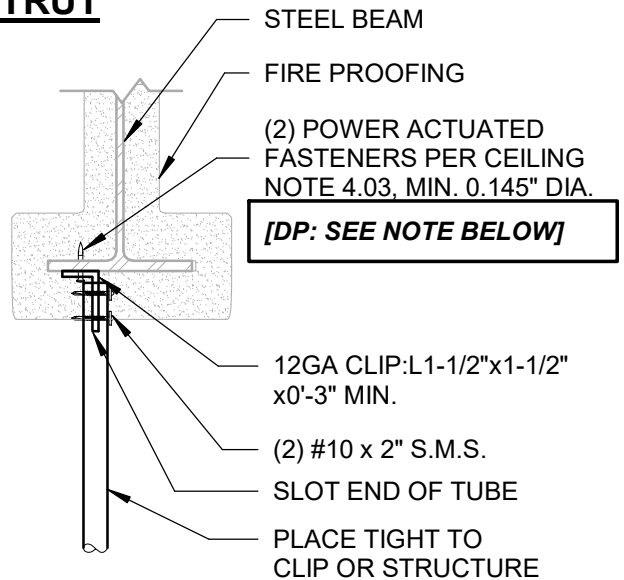
REV: 03/2022

REV: 11/2023

5.30

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**NOTES:**

1. STRUCTURAL STEEL MEMBER SHALL NOT BE LESS THAN 3/16".
2. ARCHITECT, I.O.R. AND CONTRACTOR SHALL VERIFY THAT NO POWER ACTUATED FASTENER IS INSTALLED IN THE PROTECTED ZONE OF ANY STEEL MEMBER, SEE AISC 341.

**CHANNEL STRUT****EMT STRUT: OPTION 1****EMT STRUT: OPTION 2**

[DP TO COORDINATE WITH THE PRODUCT EVALUATION REPORT TO SPECIFY A FASTENER TYPE AND DIAMETER APPROPRIATE FOR ALL THICKNESSES OF STEEL USED ON THE PROJECT.]

Detail Title :

STRUT CONNECTION TO STRUCTURAL STEEL

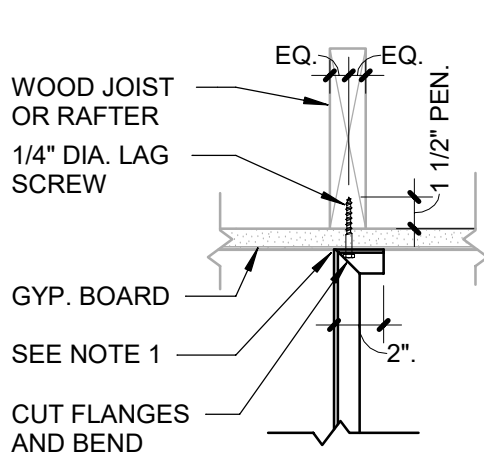
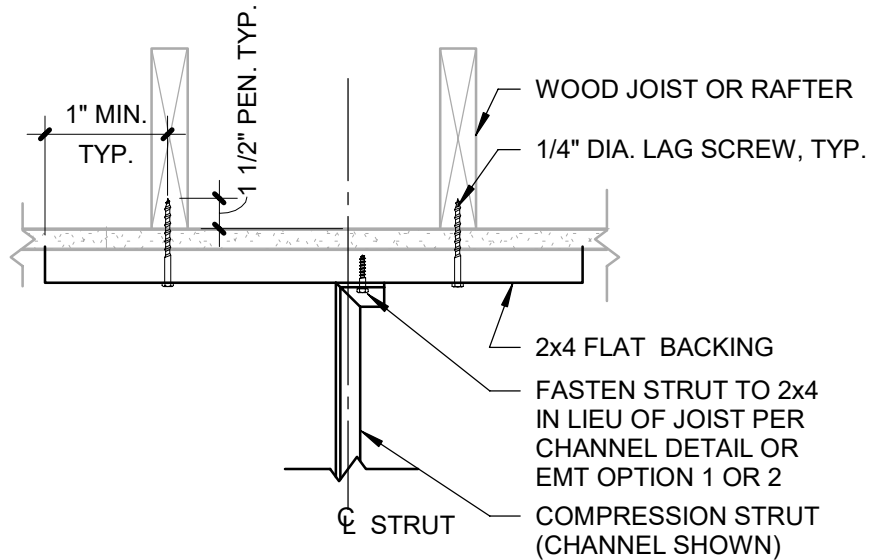
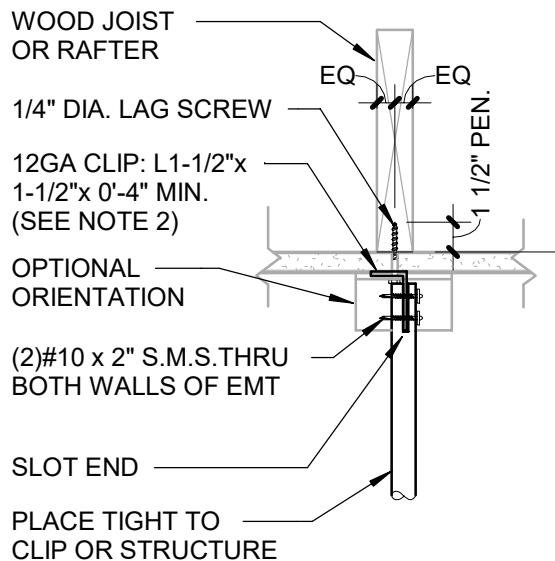
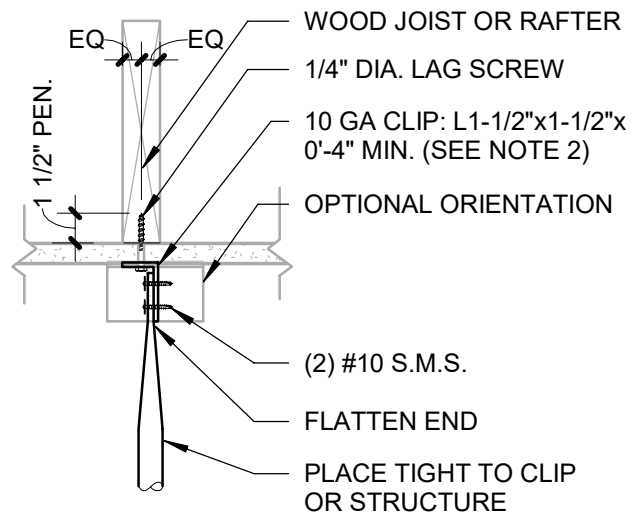
REV: 09/21/2015

Detail No.

REV: 03/2022

REV: 11/2023

5.40

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**CHANNEL STRUT****CHANNEL OR EMT STRUT:
BETWEEN JOIST****EMT STRUT: OPTION 1****EMT STRUT: OPTION 2****NOTES:**

1. WEB OF CHANNEL TO BEAR WITHIN WIDTH OF THE WOOD MEMBER.
2. FOR ANGLE ORIENTED IN THE STANDARD POSITION, VERTICAL LEG TO FALL WITHIN THE WIDTH OF THE WOOD MEMBER.
3. PEN. = MINIMUM PENETRATION OF LAG SCREW THREADS INTO THE WOOD MEMBER.
4. NO. 14 WOOD SCREW MAY BE USED IN LIEU OF 1/4" LAG SCREW.

Detail Title :

**STRUT CONNECTION TO SAWN
TIMBER WITH GYPSUM BOARD**

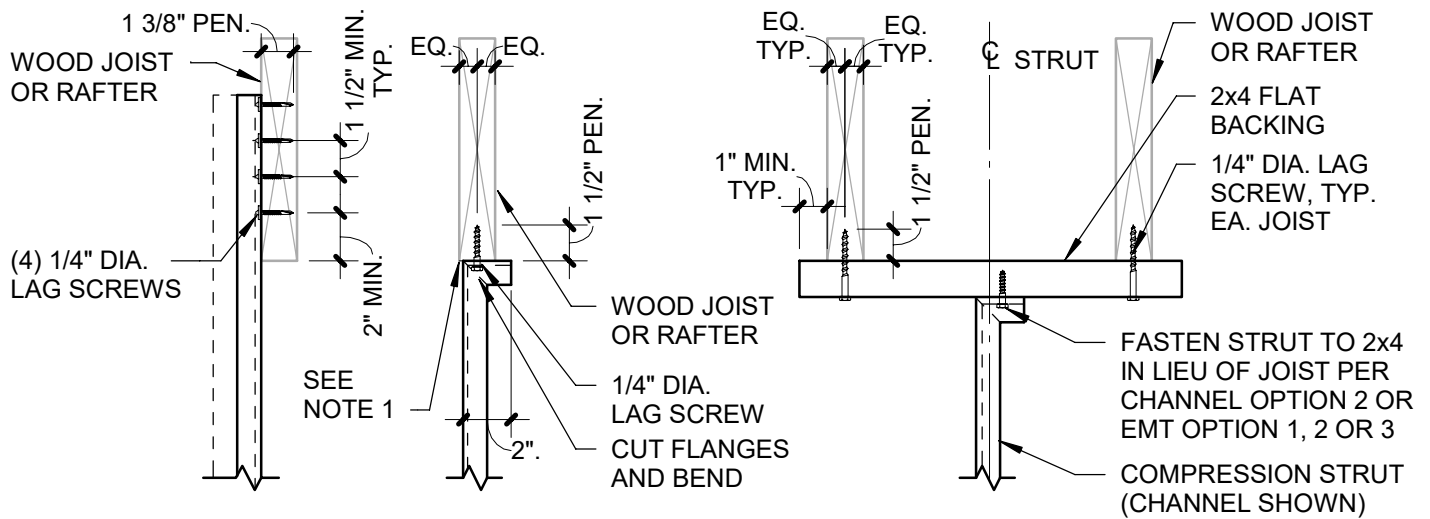
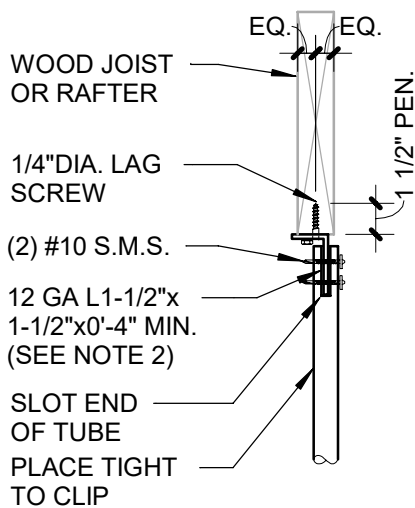
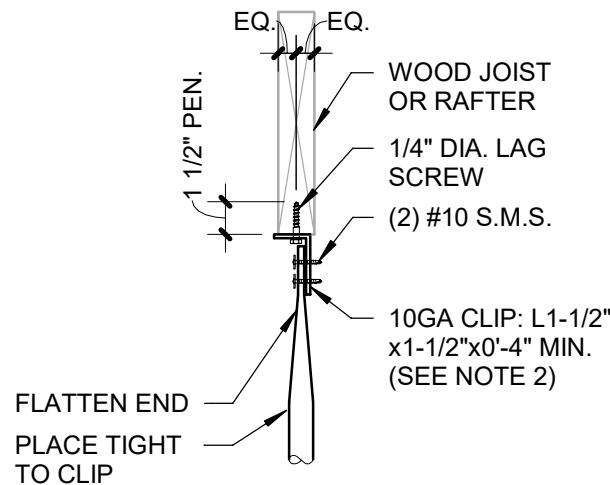
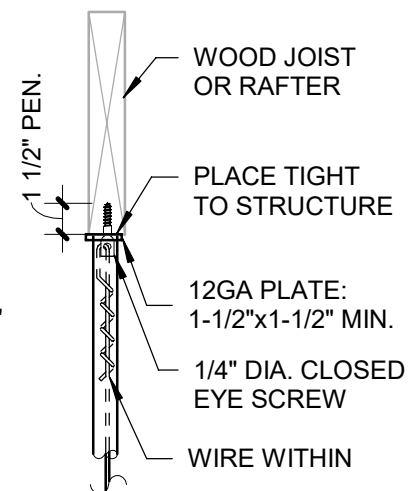
REV: 09/21/2015

Detail No.

REV: 03/2022

REV: 11/2023

5.50

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**CHANNEL STRUT:
OPTION 1****CHANNEL STRUT:
OPTION 2****CHANNEL OR EMT STRUT:
BETWEEN JOIST****EMT STRUT:
OPTION 1****EMT STRUT:
OPTION 2****EMT STRUT:
OPTION 3****NOTES:**

1. WEB OF CHANNEL TO BEAR WITHIN WIDTH OF WOOD MEMBER.
2. VERTICAL LEG OF MEMBER TO FALL WITHIN THE WIDTH OF THE WOOD MEMBER.
3. SEE DETAIL 5.50 FOR ADDITIONAL INFORMATION.
4. PEN. = MINIMUM PENETRATION OF LAG SCREW THREADS INTO THE WOOD MEMBER.
5. NO. 14 WOOD SCREW MAY BE USED IN LIEU OF 1/4" LAG SCREW.

Detail Title :

**STRUT CONNECTION TO SAWN
TIMBER WITHOUT GYPSUM BOARD**

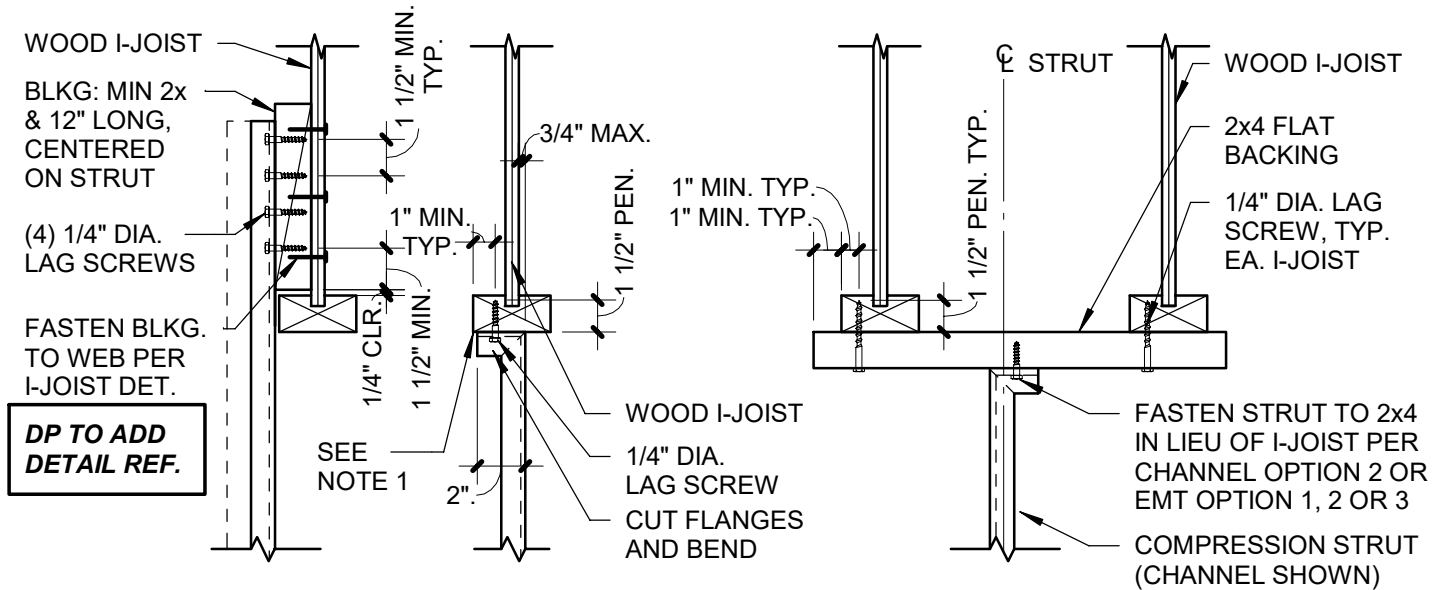
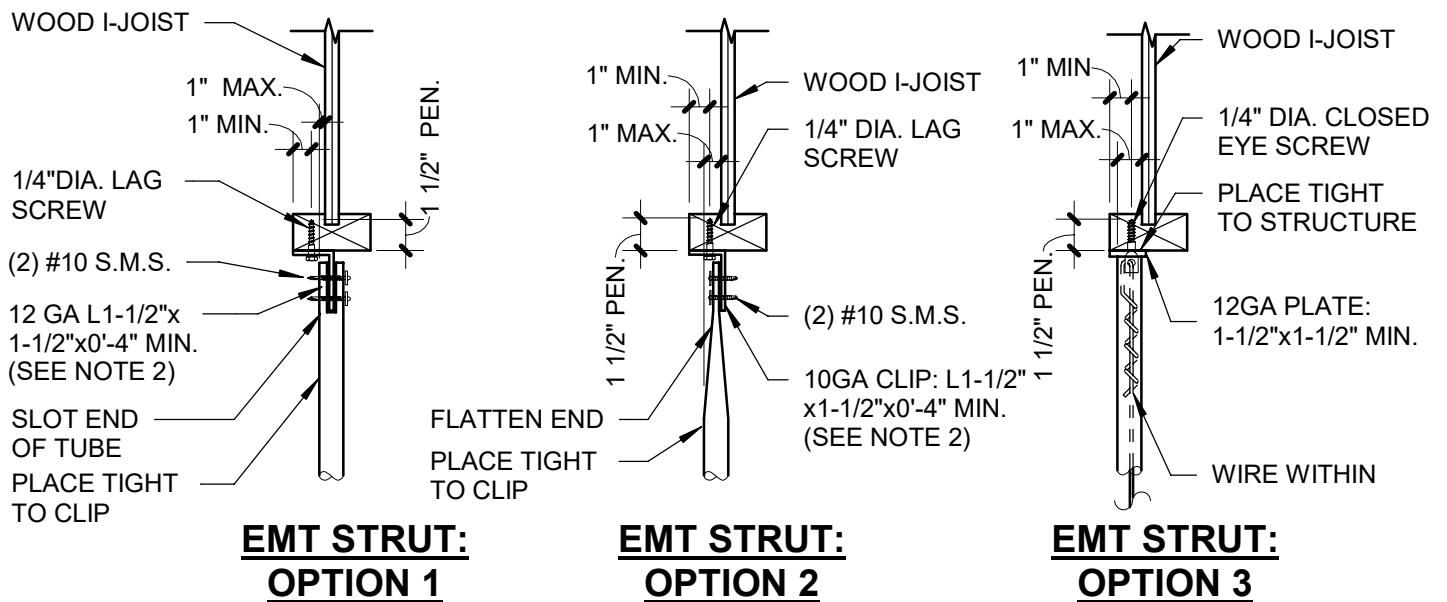
REV: 09/21/2015

Detail No.

REV: 03/2022

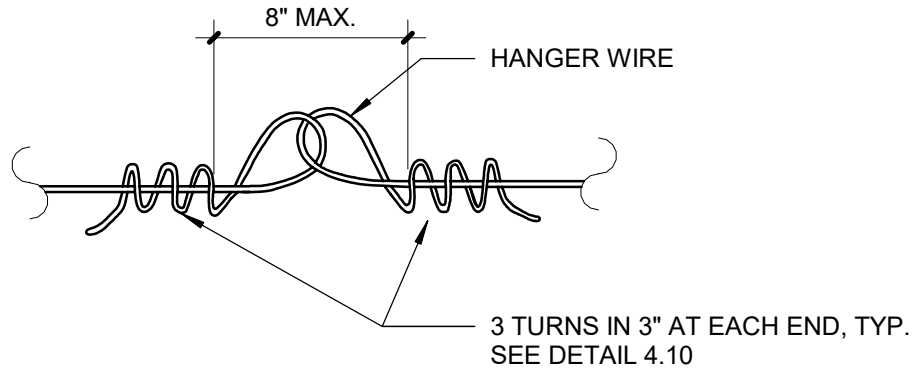
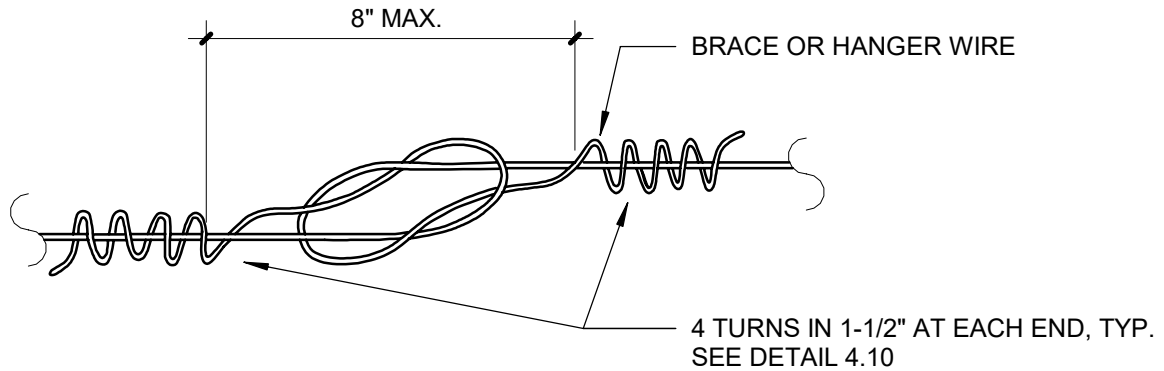
REV: 11/2023

5.51

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**CHANNEL STRUT:**
OPTION 1**CHANNEL STRUT:**
OPTION 2**CHANNEL OR EMT STRUT:**
BETWEEN I-JOIST**NOTES:**

1. WEB OF CHANNEL TO BEAR WITHIN WIDTH OF WOOD MEMBER.
2. VERTICAL LEG OF MEMBER TO FALL WITHIN THE WIDTH OF THE WOOD MEMBER.
3. SEE DETAIL 5.50 FOR ADDITIONAL INFORMATION.
4. PEN = MINIMUM PENETRATION OF LAG SCREW THREADS INTO THE WOOD MEMBER.
5. NO. 14 WOOD SCREW MAY BE USED IN LIEU OF 1/4" LAG SCREW.

Detail Title : STRUT CONNECTION TO I-JOIST	ISS: 03/2022	Detail No. 5.52
	REV: 11/2023	

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**HANGER WIRE ONLY****HANGER OR BRACE WIRE****NOTES:**

1. WIRE SPLICES ARE SHOWN LOOSELY TIED FOR ILLUSTRATIVE PURPOSES ONLY AND SHALL BE DRAWN TIGHT TO COMPLETE INSTALLATION WHEN CONSTRUCTED.
2. WIRE LOOPS SHALL BE TIGHTLY WRAPPED AND SHARPLY BENT TO PREVENT ANY VERTICAL MOVEMENT OR ROTATION WITHIN THE LOOPS.
3. EACH HANGER AND BRACE WIRE SHALL BE SPLICED NO MORE THAN ONCE ALONG ITS LENGTH.

Detail Title :

CEILING WIRE SPLICES

REV: 09/21/2015

Detail No.

REV: 03/2022

6.10

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**APPENDIX B: GUIDANCE FOR RECESSED LINEAR LUMINAIRES**

Recessed linear luminaires require specific detailing where they interrupt consecutive cross runners in the length of the luminaire. Light-gauge steel yokes are commonly used to vertically support the grid where the cross runners are interrupted. The lateral tie between cross runners is essential to maintaining a continuous ceiling grid system. Yokes require testing to confirm their capacity to transfer the required 180-pound force between cross runners per ASTM E580 Section 5.1.2.

B.1 Option 1

Linear luminaires meeting the following requirements can be detailed in a similar manner as a 2-foot wide by 4-foot long troffer luminaire. The grid and luminaires can be detailed and installed according to the provisions of this section. See Figure B1 below for reference.

B.1.1 Luminaire is 4-feet long or less in length and fits within the typical grid layout.

B.1.2 Luminaire interrupts no more than a single cross runner along its length where oriented parallel to a main runner.

B.1.3 Where oriented parallel to a main runner, the luminaire is attached to a main runner on one side.

B.1.4 Where oriented parallel to a cross runner, the luminaire is attached to a continuous line of cross runners on at least one side.

B.1.5 Runners shall be installed to bound the luminaire on all sides.

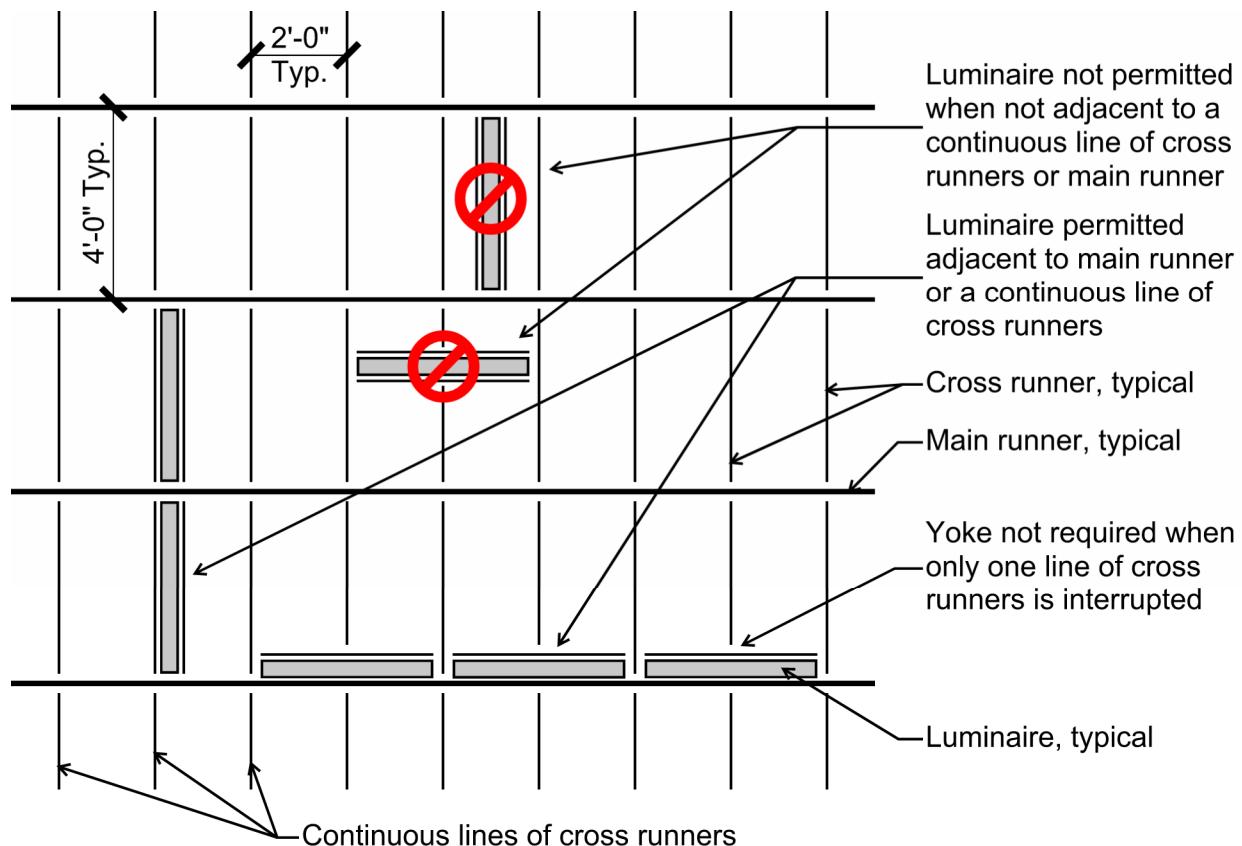


Figure B1: Option 1 Reflected Ceiling Plan

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**B.2 Option 2**

Linear luminaires up to 12-feet long and oriented parallel to the main runners can be detailed according to the provisions of this section. See Figure B2 for reference.

B.2.1 The luminaire shall be manufactured as a single, continuous unit in the determination of its length (multiple units screwed together may be considered an individual unit). A short cross runner attached to the main runner shall be installed at the end of each luminaire unit. The maximum weight of each luminaire unit shall be 56 pounds.

B.2.2 Linear luminaires shall be oriented parallel to the main runners.

B.2.3 Linear luminaires shall be installed with main runners on both its longitudinal sides and extend the entire length of the ceiling (wall to wall).

B.2.4 Where consecutive cross runners are interrupted, a yoke shall be installed at each end of the luminaire and at four feet on center maximum along its length.

B.2.4.1 When the proprietary yoke has evaluation report approval in accordance with IR A-5 confirming use in Seismic Design Category D, E, and F, including capacity to resist the 180-pound force required by ASTM E580 Section 5.1.2, supplemental framing is not required at the yoke. Evaluation report approvals based on testing per the Acceptance Criteria for Suspended Ceiling Framing Systems (AC 368) published by the International Code Council Evaluation Service (ICC-ES), include testing for this force.

B.2.4.2 When the yoke does not have evaluation report approval complying with Section B.2.4.1 above, supplemental framing is required at the yoke to demonstrate compliance with the requirements of ASTM E580 Section 5.1.2. See Section B.2.5.8 below.

B.2.5 The following information shall be provided on the construction documents:

B.2.5.1 A typical plan or isometric detail showing the layout of the main runners and cross runners, linear luminaires, yokes, and brace assembly spacing relative to luminaires.

B.2.5.2 Manufacturer's yoke part, model, or catalog number.

B.2.5.3 Detail illustrating the screw attachment of the yoke legs to each other.

B.2.5.4 Detail illustrating the connection of the yoke to the main and cross runners along the length of the linear luminaire.

B.2.5.5 Detail illustrating the connection of the yoke to the pair of main runners and cross runners at the end of the linear luminaire.

B.2.5.7 Detail illustrating the attachment of the hanger wire(s) to the yoke. Where the yoke is vertically supported by a single hanger wire, the hanger wire shall be centered on the top horizontal span of the yoke.

B.2.5.7 Detail(s) illustrating the attachment of the hanger wire to the floor or roof above.

B.2.5.8 Detail(s) illustrating supplemental framing when required by Section B.2.4.2 above to transfer the 180-pound lateral force at the cross runner across the yoke in accordance with ASTM E580 Section 5.1.2. A schematic illustration of this supplemental framing is shown in Figure B3.

B.2.6 Linear luminaires shall be fastened to the grid system as follows:

B.2.6.1 A minimum of four screws for linear luminaires up to 8-feet long.

B.2.6.2 A minimum of six screws for linear luminaires greater than 8-feet long and up to 12-feet long.

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC

B.2.6.3 Fasteners shall be uniformly distributed.

B.2.7 In addition to the requirements of Section 1.7 above, slack safety wires shall be installed at linear luminaires as follows. Each individual unit shall be supported as noted.

B.2.7.1 Luminaire units up to 8-feet long: Install at opposite corners (2 minimum).

B.2.7.2 Luminaire units greater than 8-feet long and up to 12-feet long: Install at each corner (4 total).

B.2.8 The spacing of lateral force bracing assemblies (refer to Section 1.3 above) shall be coordinated to not exceed the maximum spacing even though an additional main runner has been added for the linear luminaire. For example, if a 6-inch-wide luminaire is used and the maximum spacing of lateral force bracing assemblies is specified as 12-feet, one of the following layouts would comply:

B.2.8.1 Reduce the main runner spacing adjacent to the luminaire to 3'-6" and space bracing assemblies at 12'-0" on center.

B.2.8.2 Maintain the 4'-0" main runner spacing on each side of the luminaire and space bracing assemblies at 8'-6" in the direction perpendicular to the main runners.

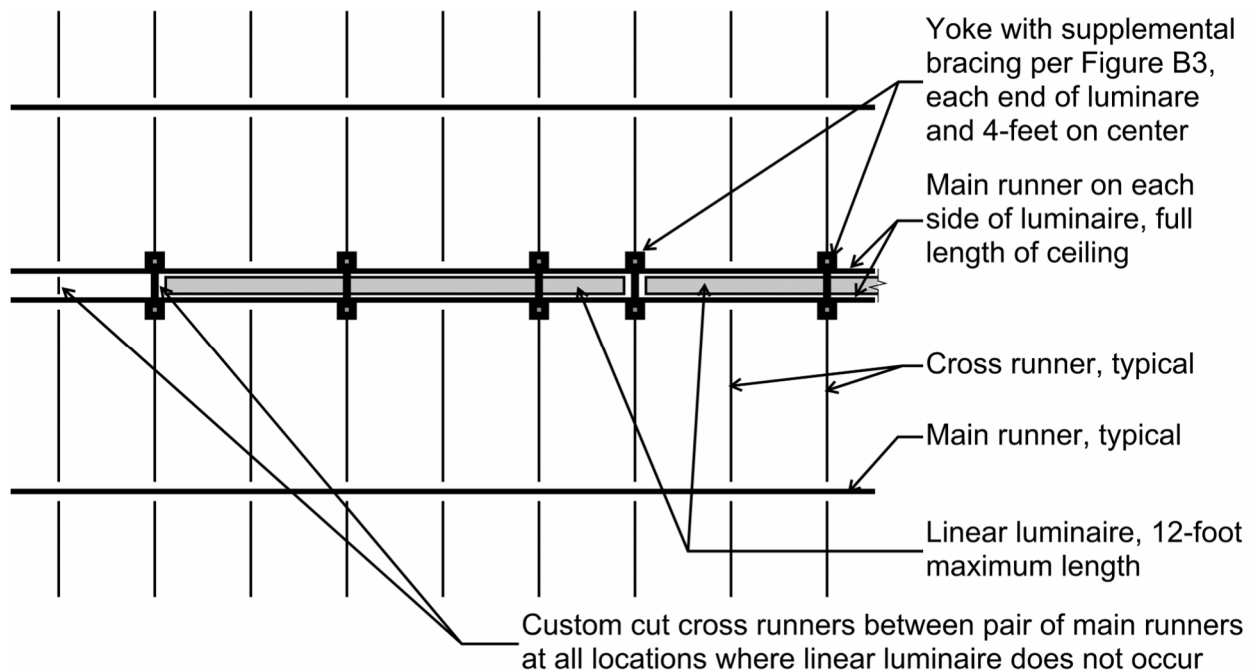
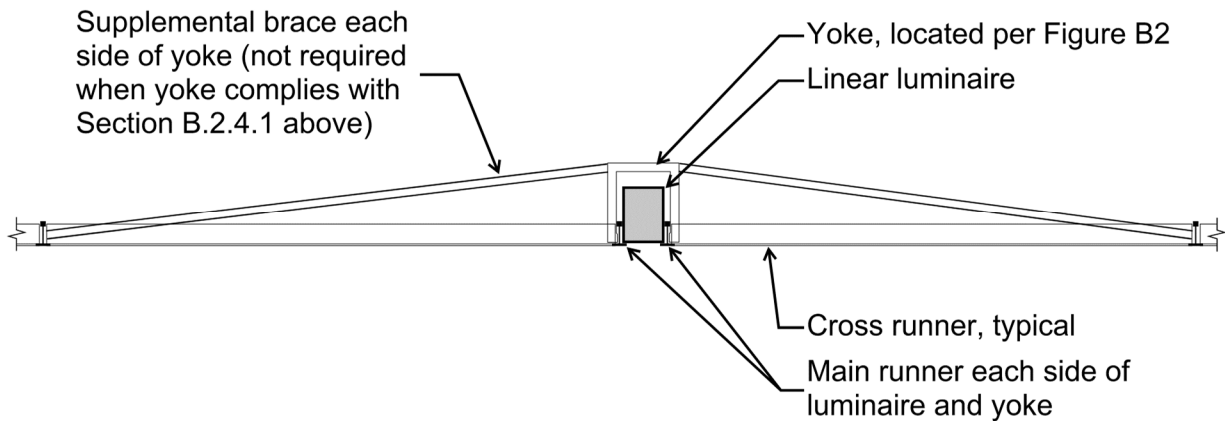


Figure B2: Option 2 Reflected Ceiling Plan

SUSPENDED LAY-IN PANEL CEILING: 2022 CBC**Figure B3: Option 2 Supplemental Yoke Bracing Section****B.3. Option 3**

Linear luminaires oriented parallel to the main runners can be installed according to the provisions of this section. This option considers the ceiling in separate laterally supported zones between linear luminaires. All the requirements of Section B.2 above apply except as noted below.

B.3.1 Seismic separation joint shall be provided immediately adjacent to one of the main runners located on either side of the linear luminaire. The seismic separation joint shall extend the entire length of the ceiling (wall to wall). The 180-pound tie force required by ASTM E580 Section 5.1.2 does not apply at the seismic separation joint; therefore, compliance with Sections B.2.4.1 or B.2.4.2 above is not required.

B.3.2 At each cross runner that is interrupted at the linear luminaire, an additional hanger wire shall be installed 8" max from the end of the cross runner.

B.3.3 A lateral force bracing assembly (refer to Section 1.3 above) shall be located within one-half the distance of the required spacing from each side of the seismic separation joint. For example, where 8-foot spacing is specified, bracing assemblies shall be located 4-feet maximum from each side of the joint.