



## Acoustical Lay-in Type Ceilings (Per IBC – Seismic Design Category D, E & F)

This document covers the installation practices recognized by the Technical Services Information Bureau (TSIB) for installation of a suspension system for a lay-in acoustical tile ceiling compliant with the 2009 International Building Code (IBC). The practices listed herein are for ceilings in Seismic Design Categories D, E or F. Refer to TSIB Technical Bulletin 40.100 for Seismic Design Categories.

### REFERENCED DOCUMENTS, AGENCIES AND STANDARDS:

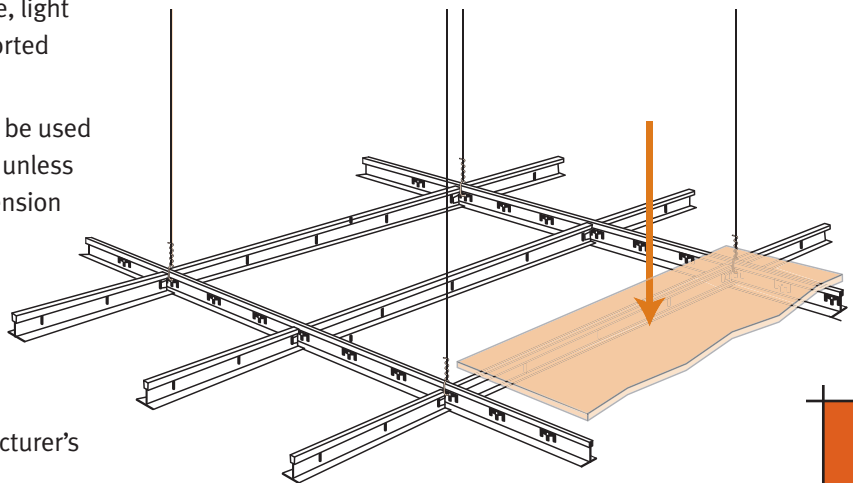
American Society Civil Engineers (ASCE)  
American Society of Testing Materials (ASTM)  
California Building Code (CBC – 2007)  
Ceiling and Interior Systems Construction Association (CISCA)  
International Building Code (IBC)

### GENERAL:

- These recommendations are intended for suspended ceilings to receive lay-in tiles not weighing more than 4 pounds per square foot including grid panels/tile, light fixtures, air terminals and other accessories supported by the suspension system. (ASCE 7-05 item 13.5.6.1)
- The suspension system for lay-in ceilings shall not be used to permanently brace non-load bearing partitions, unless approved by an engineer. Attachment to the suspension system for alignment purposes is acceptable. (ASCE 7-05 section 13.5.8.1) Refer to TSIB Technical Bulletin 20.100 for bracing options.
- All main runners are to be heavy duty (HD) rated. (ASCE 7-05 section 13.5.6.2.2)
- Suspension systems shall be installed per manufacturer's recommendations.

### WALL ANGLE:

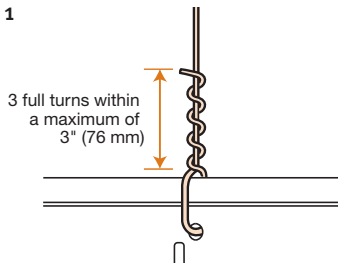
- The width of the perimeter supporting closure angle (wall angle) shall be not less than 2 inches. (ASCE – section 13.5.6.2.2 item b, ASTM E 580 – section 5.2.2)
- Unless perimeter members are a structural part of the approved system, wall angles or channels shall be considered as aesthetic closures and have no structural value assessed to themselves or their method of attachment to the walls. (ASTM E 580 – section 5.2.1, CISCA – Seismic Zones 3 & 4)
- A perimeter member (wall angle) is recommended to be attached to the walls with a combination of nails, staples and/or #6 Phillips head screws.
- Alternate methods to the 2-inch wall angle are allowed if approved by the designer of record and building official.
- The approval of the proprietary “slide clip” may allow the use of the 15/16-inch wall angle. (continued on back)



## HANGER/PERIMETER (SUSPENSION) WIRES:

- Suspension wires made of galvanized, soft-annealed, and/or mild steel shall not be smaller than No. 12 gauge and spaced no more than 4 feet on center along main runners unless calculations justifying the increased spacing or alternate materials are provided. (*ASTM E 580 – section 5.2.7.1, ASTM C 636 – section 2.1.3 and section 2.1.6, CISCA – Seismic Zones 3 & 4*)
- The wire must be wrapped around itself a minimum of three (3) full turns (360° each) within a 3-inch length. See figure 1. (*ASTM E 580 – section 5.2.7.2, ASTM C 636 – section 2.3.4*)

Figure 1



- Each vertical wire shall be attached to the ceiling suspension member and to the support above such that the wire loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops. (*ASTM C 636 – section 2.3.4, ASTM E 580 – section 5.2.7.2*)
- The perimeter ends of each cross runner and main runner shall be suspended independently a maximum of 8 inches from each wall or ceiling discontinuity with No. 12 gauge wire or approved wall support. See figures 2 and 3. (*ASTM E 580 – section 5.2.6, CISCA – Seismic Zones 3 & 4*)
- Suspension wires shall not hang more than 1 in 6 out of plumb unless counter-sloping wires are provided. (*ASTM E 580 – section 5.2.7.3, ASTM C 636 – section 2.1.4, CISCA – Seismic Zones 3 & 4*)
- Wires shall not attach to or bend around interfering material or equipment. (*ASTM E 580 – section 5.2.7.4, ASTM C 636 – section 2.1.4, CISCA – Seismic Zones 3 & 4*)
- A trapeze or equivalent device shall be used where obstructions preclude direct suspension. (*ASTM E 580 – section 5.2.7.4, CISCA – Seismic Zones 3 & 4*)
- Connection devices for hanger/perimeter wires shall be capable of carrying no less than 100 pounds. (*ASTM E 580 – section 5.2.7.2, CISCA – Seismic Zones 3 & 4*)
- Powder actuated fasteners may be used, if approved for such loading. (*ASCE 7-05 section 13.4.5*)
- Cable trays, data lines, electrical conduits, etc... shall be supported independently of the ceiling. (*ASCE 7-05 – section 13.5.6.2.2 item g, ASTM E 580 – section 5.2.8.7*)

## SUSPENSION SYSTEM (MAIN RUNNERS & CROSS TEES):

- All main runners are to be heavy duty (HD) rated. (*ASCE – section 13.5.6.2.2 item a, ASTM E 580 – section 5.1.1*)
- Main runners shall be installed and leveled to within 1/4-inch in 10 feet. Determine elevation of levelness from measurements taken below hanger points and after completion of the ceiling installations. (*ASTM C 636 – section 2.3.1*)
- Main runner and/or cross tee ends shall be attached to the perimeter (wall angle) on two (2) adjacent walls. A clearance of 3/4-inch shall be maintained between the main runner and/or cross tee ends and the wall angle on the non-attached walls. (*ASCE – section 13.5.6.2.2 item b, ASTM E 580 – section 5.2.3, CISCA – Seismic Zones 3 & 4*)
- Changing in ceiling plane elevations shall be provided with positive bracing. (*ASCE – section 13.5.6.2.2 item f, ASTM E 580 – section 5.2.8.6*)
- All fire expansion relief cut outs in the main runner shall be installed within 3 inches of a vertical support hanger wire. (*ASTM C 636 – section 2.3.5*)

Figure 2

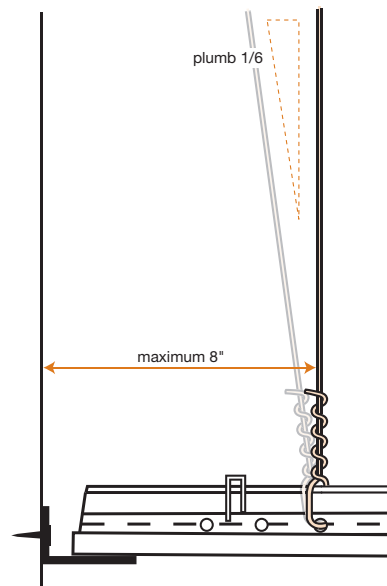


Figure 3

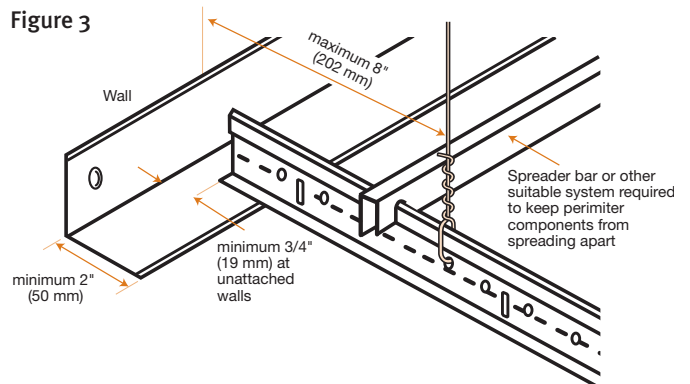
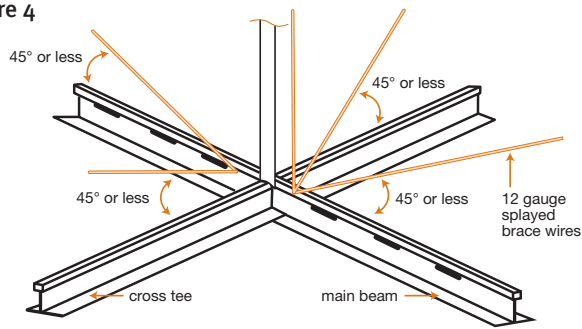


Figure 4



**LATERAL FORCE BRACING (LFB):**

- Lateral force bracing is the use of vertical struts (compression posts) and splay wires to minimize ceiling uplift of lightweight lay-in ceilings. See figure 4. (ASTM E 580 – section 5.2.8.2)
- Vertical struts may be metal studs, EMT, conduit, or a proprietary compression post. See Table 1.

Table 1: Maximum Recommended Lengths for Vertical Struts

EMT Conduit	
1/2" EMT conduit	up to 6 feet, 0 inches
3/4" EMT conduit	up to 8 feet, 6 inches
1" EMT conduit	up to 10 feet, 0 inches
1 Metal Stud	
1-5/8" metal stud (25-gauge)	up to 6 feet, 2 inches
2-1/2" metal stud (25-gauge)	up to 10 feet, 6 inches

Note: Plenum areas greater than 11 feet require engineering calculations.

- The compression post is designed to handle the uplift load of the ceiling; the attachment of this post is only designed to hold the post in place.
- The four (4) splay wires shall be secured to the main runner within 2 inches of the cross tee intersection and splayed 90° from each other and at an angle not exceeding 45° from the plane of the ceiling. (ASTM E 580 – section 5.2.8.2, CISCA – Seismic Zones 3 & 4)
- Splay wires shall be spaced a minimum of 6 inches from all horizontal piping or duct work that is not provided with bracing restraints for horizontal forces. (ASTM E 580 – section 5.2.8.3, CISCA – Seismic Zones 3 & 4)
- Splay wires shall be attached to the main runner and to the structure in such a manner that they can support a design load of not less than 200 pounds or two (2) times the actual design load, whichever is greater. (ASTM E 580 – section 5.2.8.3, CISCA – Seismic Zones 3 & 4)
- Areas less than 1,000 square feet are exempt from LFB. (ASTM E 580 – section 1.5 and 5.2.8.1)
- Areas greater than 1,000 square feet, shall have LFB, they shall be spaced 12 feet on center in both directions with the first point within 6 feet from each wall. (ASTM E 580 – section 5.2.8.2, CISCA – Seismic Zones 3 & 4)

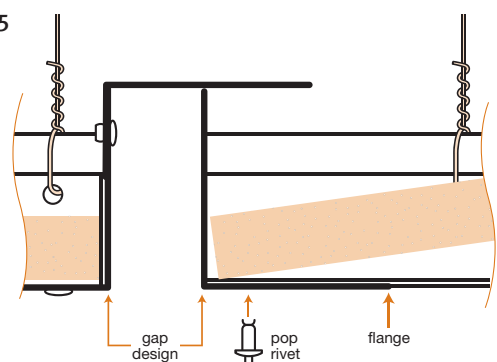
**SPREADER BARS:**

- Spreader bars, stabilizer bars or spacer bars are used to prevent the ends of the grid system from opening and allowing tiles to fall during a seismic event.
- The unattached ends of the main runners and cross tees shall be tied together or have some other approved means to prevent their spreading. Stabilizer bars or other means to prevent spreading shall occur within 8 inches of the walls. (ASTM E 580 – section 5.2.4, CISCA – Seismic Zones 3 & 4)
- Wire tying is acceptable in lieu of spreader bars.
- The installation of perimeter wires does not exempt the use of spreader bars.
- Spreader bars are not required if a 90° intersecting cross tees or main runners is within 8 inches of the perimeter wall.
- Proprietary slide clips may be used in lieu of spreader bars if so approved by the manufacturer of the clip.

**SEISMIC SEPARATION JOINTS:**

- Suspended ceilings in excess of 2,500 square feet require a seismic separation joint or full height wall partition dividing areas not to exceed 2,500 square feet, unless analysis by the designer of record and provided that the bracing is sufficient to accommodate the anticipated lateral displacement. See figure 5. (ASTM E 580 – section 5.2.9.1, ASCE 7-05 Section 13.5.6.2.2 item d)
- A seismic separation joint is intended to have the same closure angles required at the perimeter of walls. (ASTM E 580 – section 5.2.9.1, ASCE 7-05 – section 13.5.6.2.2 item d)
- The seismic separation joint (gap design) shall be capable of allowing +/- 3/4-inch axial movement. (ASTM E 580 – section 5.2.9.1)
- Proprietary seismic separation joints may be used if manufacturer’s installation recommendations are strictly followed. (continued on back)

Figure 5



## SPRINKLERS:

- Ceilings without braces to limit lateral movement will require penetrations, such as sprinkler heads, free movement of 1 inch in all horizontal directions. Flexible sprinkler heads that allow a minimum of 1 inch in all horizontal directions shall be allowed a substitution. (ASCE – section 13.5.6.2.2 item e, ASTM E 580 – section 5.2.8.5)

## ELECTRICAL FIXTURES:

- Light fixtures weighing less than 10 pounds shall have one (1) 12-gauge safety wire connected from the fixture to the structure above, wire may be slack. (ASTM E 580 – section 5.3.4, CISCA – Seismic Zones 3 & 4)
- Light fixtures weighing greater than 10 pounds and less than 56 pounds shall have two (2) 12-gauge safety wires attached at opposing ends (corners) of the fixture to the structure above, wires may be slack. (ASTM E 580 – section 5.3.5, CISCA – Seismic Zones 3 & 4)
- Light fixtures weighing in excess of 56 pounds must be supported directly from the structure above by approved hangers. (ASTM E 580 – section 5.3.5, CISCA – Seismic Zones 3 & 4)
- Tandem fixtures may utilize common wires. (CISCA – Seismic Zones 3 & 4)

## MECHANICAL SERVICES:

- Ceiling mounted terminals or services weighing more than 20 pounds but less than 56 pounds must have two (2) 12-gauge hanger wires connecting from the terminal or service to the structure above that act as safety wires. It is not necessary for these wires to be taut. (ASTM E 580 – section 5.4.2, CISCA – Seismic Zones 3 & 4)
- Terminals or services weighing more than 56 pounds must be independently supported directly from structure above, wires must be taut. (ASTM E 580 – section 5.4.3, CISCA – Seismic Zones 3 & 4)

## SPECIAL INSPECTIONS:

- Special inspections of the suspension systems may be required by the jurisdiction or municipality. (ASCE 7-05 section 13.5.6.2.2 item h)

## GLOSSARY OF TERMS:

**Closure Angles:** Perimeter wall molding that is integral with the suspension system.

**Cross Tees:** The cross member that interlocks with the main runners. Also known as cross runners.

**Diffuser:** A circular or rectangular grill used in a suspended ceiling system in conjunction with an air duct system.

**Grid:** The main runners and cross tees of the suspension system, often referred to as a grillage or a T-bar system.

**Hanger Wire:** 12-gauge soft annealed wire used as the primary support for the grid system. Also known as suspension wires.

**Lateral Force Bracing:** The bracing used for horizontal restraint to prevent ceiling uplift and limit lateral movement during a seismic event. Lateral force bracing includes vertical struts and splay wires.

**Main Runner:** The primary suspension member supported by the hanger wires. Also known as mains or main beam.

**Perimeter Wires:** Hanger wires placed within eight inches of the surrounding walls.

**Plenum:** The space between the horizontal plane of the suspended ceiling and the structure above.

**Slack Wire:** A 12-gauge wire that is not taut or tight.

**Spreader Bar:** A bar/strut with notches that installs on and around the grid to prevent from separating during a seismic event. Also known as stabilizer or spacer bars.

**Splay Wires:** Wires installed at an angle rather than perpendicular to the suspension system. Also known as bracing wires.

**Vertical Struts:** The rigid vertical member used in lateral force bracing of the suspension system. Also known as compression posts or seismic struts. Common materials are electrical conduit (EMT), metal studs or proprietary posts.

**Wall Angle:** A light gauge metal angle or channel fastened to the wall or partition to support the perimeter of the lay-in acoustical tile.

*This Technical Document is to serve as a guideline and is not intended for any specific construction project. The TSIB makes no warranty or guarantee, express or implied.*