FIELD TECHNICAL INFORMATION

Application recommendations for work at the wall or ceiling

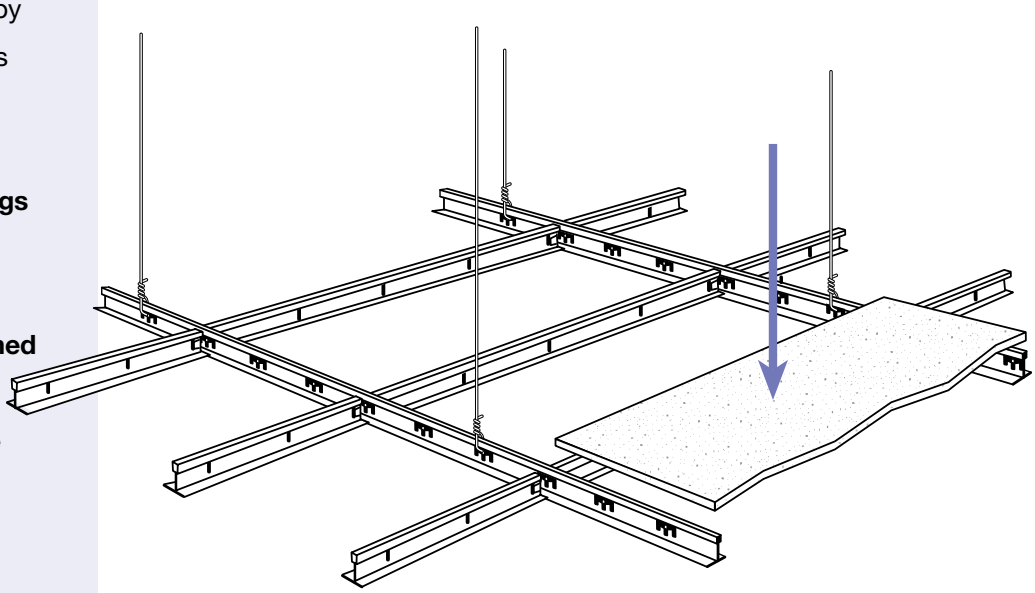
401 OREGON

REVISED 4/07

Suspension Systems for Acoustical Lay-in Ceilings

This document has been reviewed by the State of Oregon, Building Codes Division. In all buildings, other than structures classified as occupancy category III and IV, **suspended ceilings installed in accordance with the prescriptive provisions of the 401-OREGON document are deemed by the State of Oregon, Building Codes Division to comply with the statewide code interpretation.**

This document provides the IBC-referenced standards for the installation of suspension systems for acoustical lay-in ceilings. Incorporation of this document will provide a more uniform standard for installation and inspection. This document is designed to accomplish the intent of the International Building Code (IBC) with regard to the requirements for seismic design category D, E and F for suspended ceilings and related items. Unless supported by engineering, the suspension system shall be installed per the requirements for Seismic Design Category (SDC) D, E and F per the IBC. Manufacturers' recommendations should be followed.



General Recommendations

- Referenced sources per hierarchy: 2006 IBC (International Building Code), American Society of Testing Materials (ASTM C 635, ASTM C 636), American Society of Civil Engineers (ASCE 7-05) and Ceilings and Interior Systems Construction Association (CISCA).
- Partitions that are tied to the ceiling and all partitions greater than 6 feet in height shall be laterally braced to the structure. Bracing shall be independent of the ceiling splay bracing system. *Source IBC section 1621.1.2*
- For further information on bracing of non-load bearing partitions refer to NWCB technical document #201.
- All main beams are to be Heavy Duty (HD). *Source ASCE 7-05 item 9.6.2.6.2.2a*
- All cross tees shall be capable of carrying the design load without exceeding deflection equal to 1/360 of its span. *Source CISCA zones 3-4*

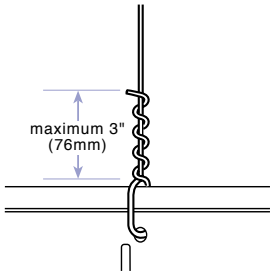


figure 1

- These recommendations are intended for suspended ceilings including grid, panel or tile, light fixtures and air terminals weighing no more the 4 lbs. per square foot. *Source ASCE 7-05 item 9.6.2.6.1*
- All wire ties are to be three tight turns around itself within three inches. Twelve gage Hanger wire spaced 4 foot on center *(figure 1)*. *Source ASTM C 636 item 2.3.4*
- Changes in ceiling planes will require positive bracing.
  Source ASCE 7-05 Section 9.6.2.6.2.2. item f.

figure 2

Lateral force Bracing

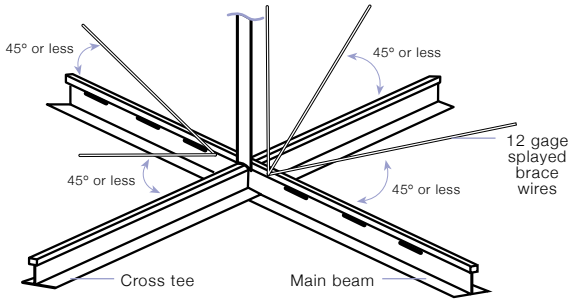


figure 3

Maximum Recommended Lengths for Vertical Struts

EMT CONDUIT	
½" EMT conduit	up to 5'10"
¾" EMT conduit	up to 7'8"
1" EMT conduit	up to 9'9"
METAL STUDS	
Single 1⅝" metal stud (20 gauge)	up to 12'0"
Back-to-back 1⅝" metal stud (20 gauge)	up to 15'0"
Single 2½" metal stud (20 gauge)	up to 13'6"
Back-to-back 2½" metal stud (25 gauge)	up to 15'0"

Source: Portland Building Department

Note: Plenum areas greater than 15'0" will require engineering calculations.

figure 4a

Attached Wall Molding Requirements

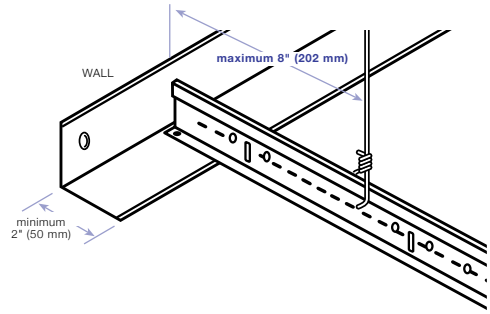
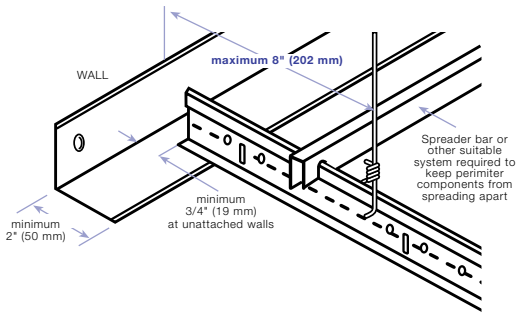


figure 4b

Unattached Wall Molding Requirements



Lateral Force Bracing *(figures 2 and 3)*

- Ceilings constructed of lath and plaster or gypsum board, screw or nail attached to suspended members that support a ceiling on one level extending from wall to wall shall be exempt from the lateral force bracing requirements. *Source: CISCA zones 3-4*
- Lateral force bracing is the use of vertical struts (compression posts) and splay wires (see figure 2).
- Lateral force bracing is required for ceilings over 144 square feet and not required for ceilings less than 144 square feet provided they are surrounded by four walls and braced to structure. *Source: State of Oregon, Building Codes Divsion*
- Lateral Force Bracing shall be 12 feet on center (maximum) and begin no farther than 6 feet from walls. *Source: CISCA Seismic zones 3-4*
- Seismic splay wires are to be four 12 gage wires attached to the main beam. Wires are arrayed 90° from each other and at an angle not exceeding 45° from the plane of the ceiling. *Source: CISCA Seismic zones 3-4*
- Seismic splay wires shall be attached to the grid and to the structure in such a manner that they can support a design load of not less than 200 pounds or the actual design load, with a safety factor of 2, whichever is greater (figure 6b). *Source: CISCA zones 3-4*
- "Powder driven shot-in-anchors" when used for seismic application as part of the prescriptive path in Seismic Design Categories D, E and F shall have an ICC-ES approval for seismic applications and shall require "special inspection" irrespective of the type of occupancy category the structure is in. Anchors for kicker wires (splayed wires installed for purposes other than seismic restraint) are exempt from this requirement. *Source: State of Oregon, Building Codes Division*
- Splay wires are to be within 2 inches of the connection of the vertical strut to suspended ceiling. *Source: CISCA Seismic zones 3-4*
- Rigid bracing may be used in lieu of splay wires. *Source: ASCE section 9.6.2.6.2.2*
- Ceilings with plenums less than 12 inches to structure are not required to have lateral force bracing. *Source: Portland Building Department*
- Vertical struts must be positively attached to the suspension systems and the structure above. *Source: CISCA 3-4*
- The vertical strut may be EMT conduit, metal studs or a proprietary compression post (see figure 3).

Wall Moldings *(figures 4a and 4b)*

- Wall moldings (perimeter closure angles) are required to have a horizontal flange 2 inches wide. One end of the ceiling grid shall be attached to the wall molding, the other end shall have a ¾ inch clearance from the wall and free to slide. *Source: ASCE 7-05 section 9.6.2.6.2.2 item b*
- Where substantiating documentation has been provided to the local jurisdiction, perimeter clips may be used to satisfy the requirements for the 2-inch closure angle. *Source: State of Oregon, Building Codes Division*
- The grid shall be attached at two adjacent walls (pop rivets or approved method). Soffits extending to a point at least level with the bottom plane of the grid and independently supported and laterally braced to the structure above are deemed to be equivalent to walls. *Source: State of Oregon, Building Codes Divsion*
- There shall be a minimum ¾ inch clearance from the end of the grid system at un-attached walls. *Source: ASCE 7-05 section 9.6.2.6.2.2 item b*

Spreader Bars *(figure 4b)*

- Spreader (spacer) bars shall be used to prevent the ends of the main beams and cross tees at perimeter walls from spreading open during a seismic event. Perimeter wires shall not be in lieu of spreader bars. *Source: CISCA Seismic zones 3-4*
- Spreader bars are not required at perimeters where runners are attached directly to closure angles.
- Wire tying is an acceptable alternative to spreader bars.
- Spreader bars are not required if a 90 degree intersecting cross or main is within 8 inches of the perimeter wall.
- Where substantiating documentation has been provided to the local jurisdiction, perimeter clips may be used to satisfy the requirements for spreader bars. *Source: State of Oregon, Building Codes Division*

Hanger (Suspension) Wires *(figures 5a and 5b)*

- Hanger and perimeter wires must be plumb within 1 in 6 unless (figure 5a) counter sloping wires are provided (figure 5b). *Source: ASTM C 636 section 2.1.4*
- Hanger wires shall be 12 gage and spaced 4 feet on center or 10 gage spaced 5 feet on center. *Source: ASTM C 636*
- Any connection device at the supporting construction shall be capable of carrying not less than 100 pounds. *Source: CISCA zones 3-4*
- Powder driven shot-in-anchors are an approved method of attachment for hanger wires. *Source: State of Oregon, Building Codes Division*
- Terminal ends of each main beam and cross tee must be supported within 8 inches of each wall with a perimeter wire (see figure 4 & 5 b). *Source: CISCA zones 3-4*
- Wires shall not attach to or bend around interfering material or equipment. A trapeze or equivalent device shall be used where obstructions preclude direct suspension. Trapeze suspensions shall be a minimum of back-to-back 1¼ inch cold-rolled channels for spans exceeding 48 inches. *Source: CISCA zones 3-4*

Electrical fixtures

- Light fixtures weighing less than 10 pounds shall have one 12 gage hanger wire connected from the fixture to the structure above. This wire may be slack. *Source: CISCA Seismic zones 3-4*
- Light fixtures weighing more than 10 pounds and less than 56 lbs. shall have two 12 gage wires attached at opposing corners of the light fixture to the structure above. These wires may be slack. *Source: CISCA Seismic zones 3-4.*
- Light Fixtures weighing more than 56 lbs. shall be supported by directly from the structure above. These wires must be taut. *Source: CISCA Seismic zones 3-4*
- Pendant mounted fixtures shall be directly supported from the structure above using a 9 gage wire or an approved alternate support without using the ceiling suspension system for direct support. *Source: CISCA Seismic zones 3-4*
- Tandem fixtures may utilize common wires.

Mechanical Services

- Terminals or services weighing 20 lbs. but not more than 56 lbs. must have two 12 gage wires connecting them to the ceiling system hangers or the structure above. These wires may be slack. *Source: CISCA Seismic zones 3-4*
- Terminals or services weighing more than 56 lbs. must be independently supported directly from the structure above. These wires must be taut. *Source: CISCA Seismic zones 3-4*

Seismic Separation Joints *(figure 7)*

- For ceiling areas exceeding 2,500 square feet, a seismic separation joint or full height wall partition that breaks the ceiling shall be provided unless analyses are performed of the ceilings bracing system, closure angles and penetrations to provide sufficient clearance. *Source: ASCE 7-05 item 9.6.2.6.2.2 d*
- The layout and location of the seismic separation joint shall be per the designer of record and noted on the plans. If a seismic separation joint is required by the designer, the designer may use the generic joint detailed in this document or a proprietary joint. The amount of free movement (gap design) shall be a minimum of ¾ inch. *Source: State of Oregon, Building Codes Division*
- In lieu of seismic separation joints, the ceiling may be divided into areas less than 2500 square feet by the use of partitions or soffits as follows: partitions shall extend a minimum of 6 inches above the level of the plane of the grid and shall be independently braced to the structure above. Soffits shall extend to a point at least level with the bottom plane of the grid and shall be independently supported and laterally braced to the structure above. *Source: State of Oregon Building Codes Division*
- Other than partitions and soffits, seismic joints may not be used as part of a fire rated ceiling assembly unless substantiating documentation is provided. *Source: State of Oregon Building Codes Division*

figure 5a

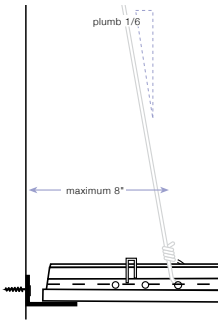


figure 5b • **Countersloping**

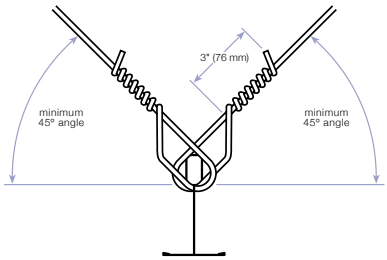


figure 6a

Vertical hanger wire attachment

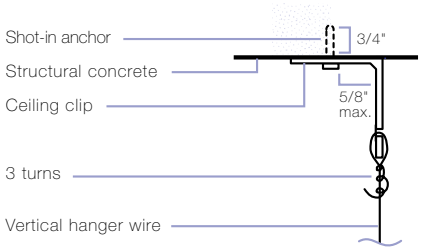


figure 6b

Splayed seismic bracing wire attachment

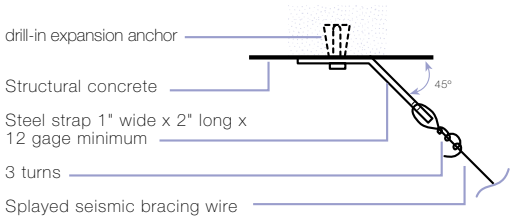
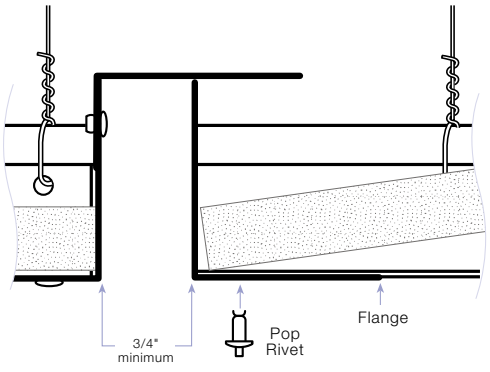


figure 7



Sprinklers

For ceilings without rigid bracing, sprinkler head penetrations shall have a 2 inch oversize ring, sleeve or adapter through the ceiling tile to allow free movement of at least 1 inch in all horizontal directions. Flexible head design that can accommodate 1 inch free movement shall be permitted as an alternate. *Source: ASCE 7-05 9.6.2.6.2.2. item e*

GLOSSARY FOR THIS DOCUMENT (regional terminology may vary)

CROSS TEES
The cross member that interlock with the main beams, also known as cross runners or cross T-bars.

DIFFUSER
A circular or rectangular metal grill used for the passage of air from a ducted system.

ESSENTIAL SERVICE BUILDINGS
Any buildings designed to be used by public agencies as a fire station, police station, emergency operations center, State Patrol office, sheriff's office, or emergency communication dispatch center.

GRID
The main beams and cross tees of the suspension system.

HANGER WIRE
10 or 12 gage soft annealed wire used as primary support for the grid system. Also called suspension wires.

LATERAL FORCE BRACING
The bracing method used to prevent ceiling uplift or restrict lateral movement during a seismic event. Lateral force bracing consists of vertical struts and splay wires.

MAIN BEAM
The primary suspension member supported by hanger wires, also known as the main runner, carrying tee, carrying runner or mains.

MOLDING/CLOSURE ANGLE
A light gauge metal angle or channel fastened to the perimeter wall or partition to support the perimeter ends of an acoustical ceiling grid.

PERIMETER CLIPS
Proprietary angle bracket attached directly to the wall molding/closure angle which allows for ¾" movement in the event of seismic activity and interlocks properly with ends of grid system.

PERIMETER WIRES
Hanger wires placed within eight inches of the surrounding walls.

PLENUM
The space above a suspended ceiling.

SLACK WIRE
A 12 gage wire that is not tight or taut.

SPREADER or SPACER BAR
A bar with notches to prevent the suspension system from separating, also called a stabilizer bar.

SPLAY WIRES
Wires installed at an angle rather than perpendicular to the grid.

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

Northwest Wall and Ceiling Bureau

1032-A NE 65th St.
Seattle, WA 98115
Phone (206) 524-4243
Fax (206) 524-4136
Toll Free (800) 524-4215
info@nwcb.org
www.nwcb.org

NWCB - Oregon
Phone: (503) 295-0333
Fax: (503) 295-2733

B.C. Wall and Ceiling Association
Phone: (604) 597-7180
Fax: (604) 597-7208

Alberta Wall and Ceiling Association
Phone: (403) 250-7045
Fax: (403) 291-9515

The NWCB has been serving the construction industry for over forty years. It is recognized as a technical authority, educational body and spokesperson for the wall and ceiling industry. It provides services to architects and the construction community on all matters relating to the diversified wall and ceiling industry.

As the industry's development and coordination organization, the NWCB saw the need to establish a document to provide clarification and the intent of NEHRP (National Earthquake Hazards Reduction Program) an agency of FEMA (Federal Emergency Management Agency). It is meant to serve as a set of recommendations and is not intended for any specific construction project.