



**GUIDELINES FOR**

**SEISMIC RESTRAINT**

**FOR DIRECT HUNG SUSPENDED**

**CEILING ASSEMBLIES**

**SEISMIC ZONES 3 & 4**

**May, 2004**

**CISCA**

the power of partnership

Ceilings & Interior Systems Construction Association

These guidelines cover metal ceiling suspension systems used primarily to support acoustical tile or acoustical lay-in panels and are based on Uniform Building Code Standard (UBCS) 47-18 (1988 edition) and on Title 24, CAC, requirements for schools. They are not intended to be a substitute for review by design professionals.

## CLASSIFICATION

The structural performance required from a ceiling suspension system shall be defined in terms of a suspension system structural classification. The load-carrying capacity shall be the maximum uniformly distributed load (pounds per linear foot) that a simply supported main runner section having a span length of 4 feet 0 inch is capable of supporting without a mid-span deflection exceeding 0.133 inch, or 1/360 of the 4-foot 0-inch span length. The structural classification listed in a Manufacturer's recommendations shall be determined by the capability of main runners. These classifications shall be:

- 1. Light-Duty Systems:** Used where ceiling loads other than acoustical tile or lay-in panels are not anticipated, such as residential or light commercial structures.
- 2. Intermediate-Duty Systems:** Used primarily for ordinary commercial structures in which some ceiling loads, due to light fixtures and air diffusers, are anticipated.
- 3. Heavy-Duty Systems:** Used primarily for commercial structures in which the quantities and weights of ceiling fixtures (lights, air diffusers, etc.) are greater than those for an ordinary commercial structure.

Cross runners shall be capable of carrying the design load (as dictated by job conditions) without exceeding the maximum allowable deflection equal to 1/360 of its span.

## LATERAL DESIGN REQUIREMENTS

Suspended ceilings that are designed and constructed to support ceiling panels or tiles, with or without lighting fixtures, ceiling mounted air terminals, or other ceiling mounted services shall comply with the requirements of this standard.

### Exceptions:

1. A ceiling area of 144 square feet or less surrounded by walls that connect directly to the structure above shall be exempt from the lateral load design requirements of these standards.
2. 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 load design requirements of these standards.

## MINIMUM DESIGN LOADS

### 1. Lateral Forces

Such ceiling systems and their connections to the building

structure shall be designed and constructed to resist a lateral force specified, for example, International Building Code (IBC). Where the ceiling system provides lateral support for nonbearing partitions, it shall be designed for the prescribed lateral force reaction from the partitions as specified in the Partitions section of these guidelines. Connection of lighting fixtures to the ceiling system shall be designed for a lateral force of 100 percent of the weight of the fixture.

### 2. Grid Members, Connectors and Expansion Devices

The main runners and cross runners of the ceiling system and their splices, intersection connectors, and expansion devices shall be designed and constructed to carry a mean ultimate test load of not less than 180 pounds or twice the actual load, whichever is greater, in tension with a 5-degree misalignment of the members in any direction and in compression. In lieu of a 5-degree misalignment, the load may be applied with a 1-inch eccentricity on a sample not more than 24 inches long on each side of the splice. The connectors at splices and intersections all shall be of the mechanical interlocking type. Where composition or configuration of ceiling system members or assemblies and their connections are such that calculations of their allowable load-carrying capacity cannot be made in accordance with established methods of analysis, their performance shall be established by test. Evaluation of test results shall be made on the basis of the mean values resulting from tests of not fewer than three identical specimens, provided the deviation of any individual test result from the mean value does not exceed plus or minus 10 percent.

### 3. Substantiation

Each ceiling system manufacturer shall furnish lateral loading systems, indicating the following: a. Maximum bracing pattern and minimum wire sizes. b. Tension and compression force capabilities of main runner splices, cross runner connections, and expansion devices. All tests shall be conducted by an approved testing agency.

## INSTALLATION

### 1. Vertical Hangers

Suspension wires shall not be smaller than No. 12 gage spaced at 4 feet on center or No. 10 gage spaced at 5 feet on center along each main runner unless calculations justifying the increased spacing are provided. Each vertical wire shall be attached to the ceiling suspension member and to the support above with a minimum of three turns. Any connection device at the supporting construction shall be capable of carrying not less than 100 pounds. Suspension wires shall not hang more than 1 in 6 out-of-plumb unless countersloping wires are provided. 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 1-1/4 inch cold-rolled channels for spans exceeding 48 inches.

### 2. Perimeter Hangers

The perimeter ends of each cross runner and main runner

shall be supported independently a maximum of 8 inches from each wall or ceiling discontinuity with No. 12 gage wire or approved wall support. These wires shall not hang more than 1 in 6 out-of-plumb and must be connected to an adjacent wall or to the structure above.

### 3. Lateral Force Bracing

Where substantiating design calculations are not provided, horizontal restraints shall be effected by four No. 12 gage wires secured to the main runner within 2 inches of the cross runner intersection and splayed 90 degrees from each other at an angle not exceeding 45 degrees from the plane of the ceiling. A strut fastened to the main runner shall be extended to and fastened to the structural members supporting the roof or floor above. The strut shall be adequate to resist the vertical component induced by the bracing wires. These horizontal restraint points shall be placed 12 feet on center in both directions with the first point within 6 feet from each wall. Attachment of the restraint wires to the structure above shall be adequate for the load imposed. Lateral force bracing members 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. Bracing 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.

### 4. Perimeter Members

Unless perimeter members are a structural part of the approved system, wall angles or channels shall be considered as aesthetic closures and shall have no structural value assessed to themselves or their method of attachment to the walls. Ends of main runners and cross members shall be tied together to prevent their spreading.

### 5. Attachment of Members to the Perimeter

To facilitate installation, main runners and cross runners may be attached to the perimeter member at two adjacent walls with clearance between the wall and the runners maintained at the other two walls or as otherwise shown or described for the approved system.

## LIGHTING FIXTURES

Only Intermediate and Heavy Duty ceiling systems as defined in the **Classification** section of these guidelines may be used for the support of lighting fixtures.

All lighting fixtures shall be positively attached to the suspended ceiling system. The attachment device shall have a capacity of 100 percent of the lighting fixture weight acting in any direction.

When intermediate-duty systems are used, supplementary, No. 12 gage hanger wires shall be attached to the grid members within 3 inches of each corner of each fixture. Tandem fixtures may utilize common wires.

Where heavy-duty systems are used, supplemental hangers wires are not required if a 48-inch modular hanger wire pattern is followed. When cross runners are used without supplemental hangers wires to support the ends of lighting

fixtures (see figure 7), these cross runners must provide the same carrying capacity as the main runner. If the cross runners are not the same carrying capacity as the main tees, supplementary, No. 12 gage hanger wires shall be attached to the grid members within 3 inches of each corner of each fixture supported by a cross tee.

Light fixtures weighing less than 10 pounds shall have one, No. 12 gage hanger wire connected from the fixture housing to the structure above. This wire may be slack. Supplementary hanger wires are not required.

Lighting fixtures weighing more than 10 pounds but less than 56 pounds shall have, in addition to the requirements outlined above, two No. 12 gage hanger wires connected from the fixture housing to the structure above. These wires may be slack.

Lighting fixtures weighing 56 pounds or more shall be supported directly from the structure above by approved hangers. Supplementary hangers are not required.

Pendant-hung lighting fixtures shall be supported directly from the structure above using No.9 gage wire or an approved alternate support without using the ceiling suspension system for direct support.

## MECHANICAL SERVICES

Ceiling mounted air terminals or services weighing less than 20 pounds shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.

Terminals or services weighing 20 pounds but not more than 56 pounds shall have, in addition to the above, two No. 12 gage hanger wires connected from the terminal or service to the ceiling system hangers or to the structure above. These wires may be slack.

Terminals or services weighing more than 56 pounds shall be supported directly from the structure above by approved hangers.

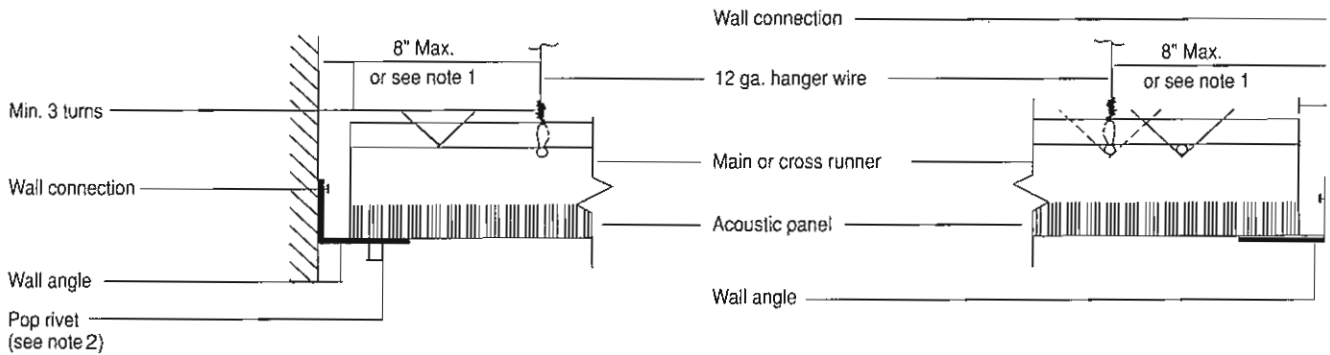
## PARTITIONS

The drawings shall clearly identify all systems and shall define or show all supporting details, lighting fixture attachment, lateral force bracing, partition bracing, etc. Such definition may be by reference to this standard, or approved system, in whole or in part. Deviations or variations must be shown or defined in detail.

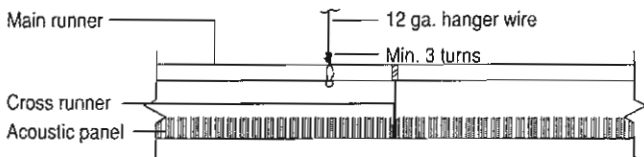
## DRAWINGS AND SPECIFICATIONS

The drawings shall clearly identify all systems and shall define or show all supporting details, lighting fixture attachment, lateral force bracing, partition bracing, etc. Such definition may be by reference to this standard, or approved system, in whole or in part. Deviations or variations must be shown or defined in detail.

**FIGURE 1 CEILING GRID DETAILS**



**Detail B**  
Acceptable hanger wire connection to grid

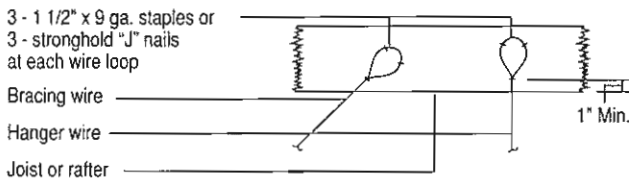


**Notes**

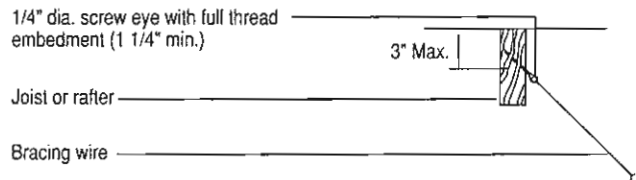
1. Eight inches or 1/4 the length of the end runner — whichever is less
2. Optional, if used, attach only to two adjacent walls

**FIGURE 2 SUGGESTED DETAILS: WIRE CONNECTIONS TO WOOD CONSTRUCTION**

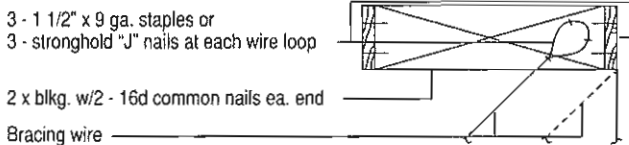
**Detail A**  
Wood joist or rafter



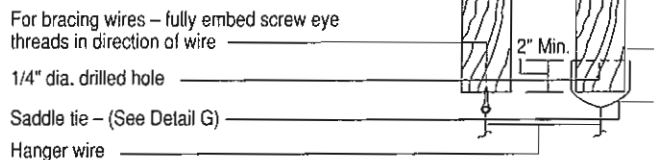
**Detail B**  
At wood joist or rafter



**Detail C**  
At wood joist or block

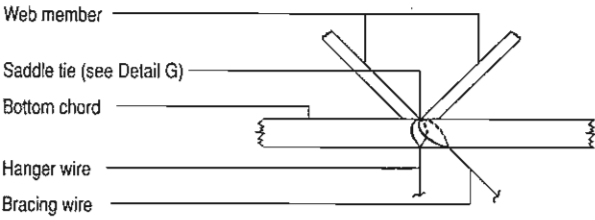


**Detail D**  
To bottom of joist

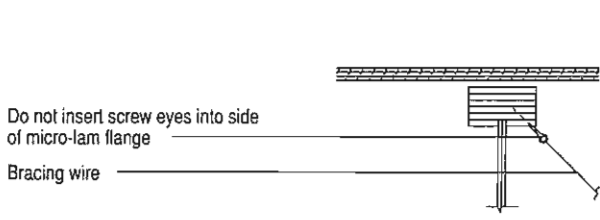


**Note: Solid blocking required for either type of bracing**

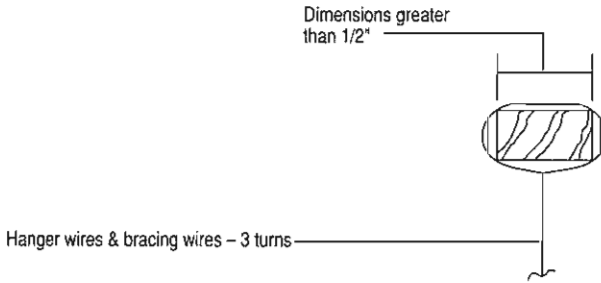
**Detail E**  
Bracing wire parallel to wood truss



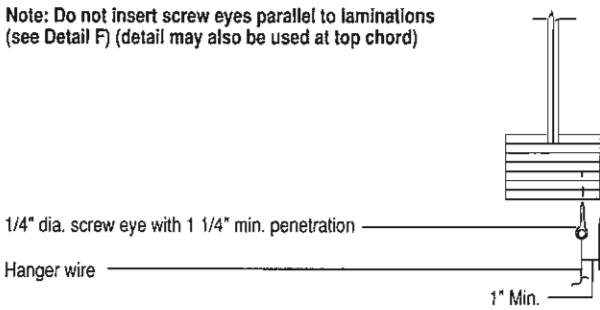
**Detail F**  
Micro-lam upper flange



**Detail G**  
Typical saddle tie

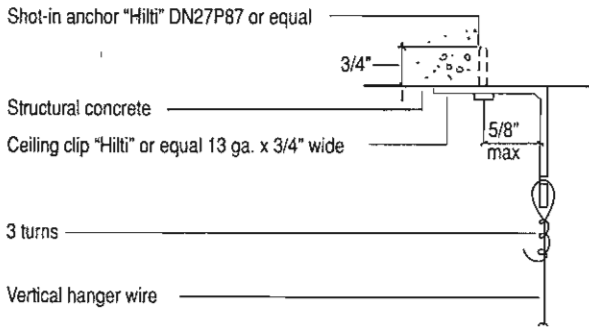


**Detail H**  
Micro-lam lower flange

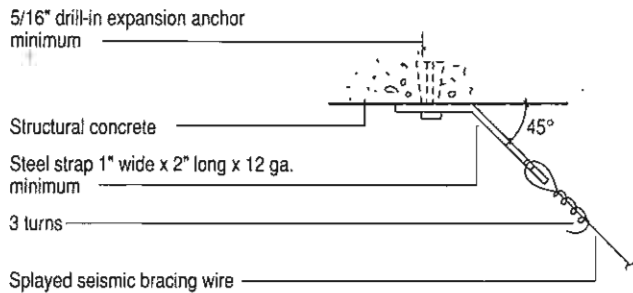


**FIGURE 3 WIRE ATTACHMENT TO CAST-IN-PLACE CONCRETE CONSTRUCTION**

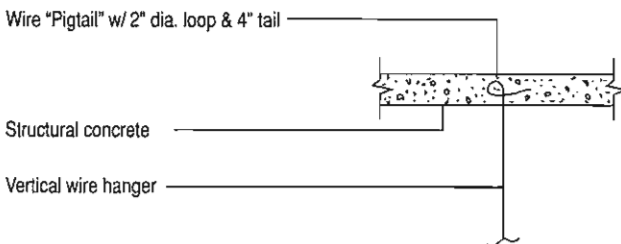
**Detail A**  
Vertical hanger wire attachment



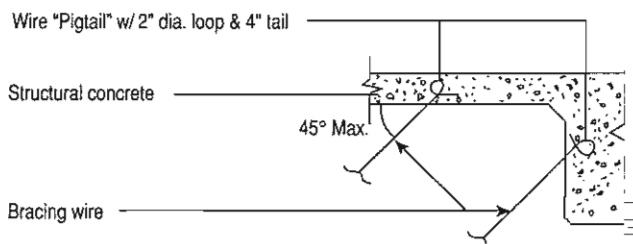
**Detail B**  
Splayed seismic bracing wire attachment



**Detail C**



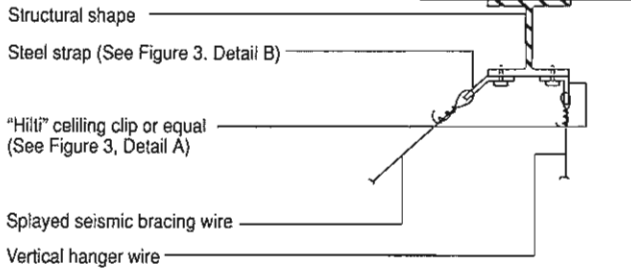
**Detail D**



**FIGURE 4 SUGGESTED DETAILS: WIRE CONNECTIONS TO STEEL CONSTRUCTION**

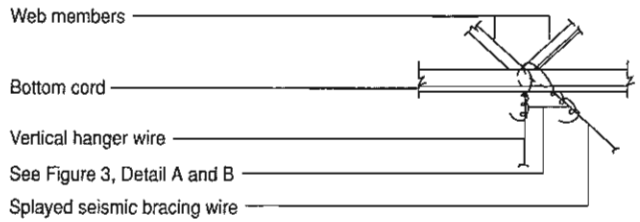
**Detail A**

**At steel beams**



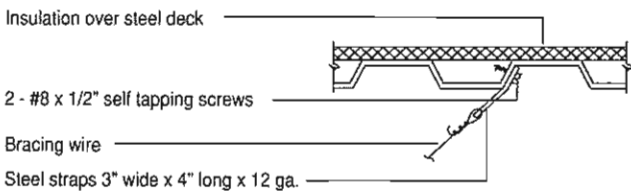
**Detail B**

**At open-web steel joist**



**Detail C**

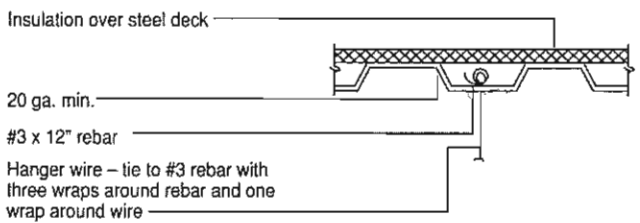
**At steel roof deck**



Note: If self tapping screws are used with concrete fill, set screws before placing concrete.

**Detail D**

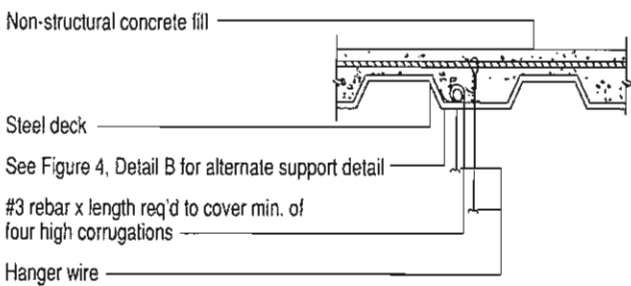
**At steel roof deck**



**FIGURE 5 SUGGESTED DETAILS: WIRE CONNECTIONS TO STEEL CONSTRUCTION**

**Detail A**

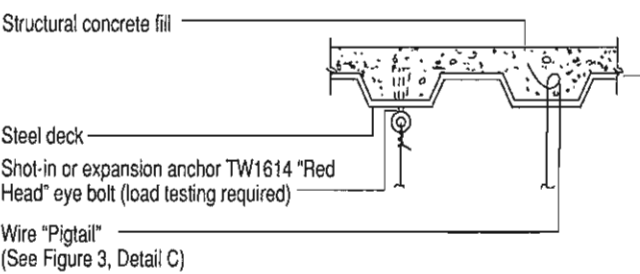
**At steel deck with insulating fill**



Note: Bracing wire detail similar

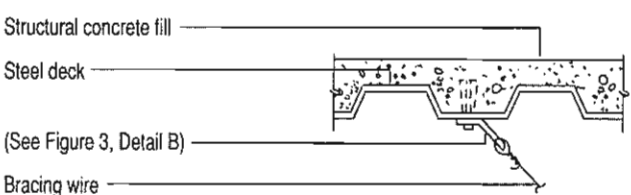
**Detail B**

**At steel deck with concrete fill**



**Detail C**

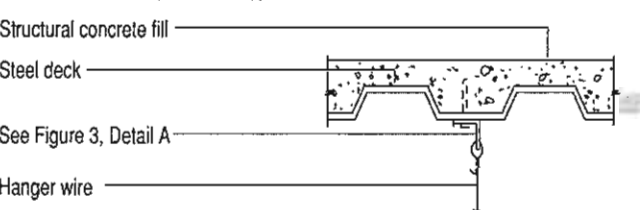
**At steel deck with concrete fill**



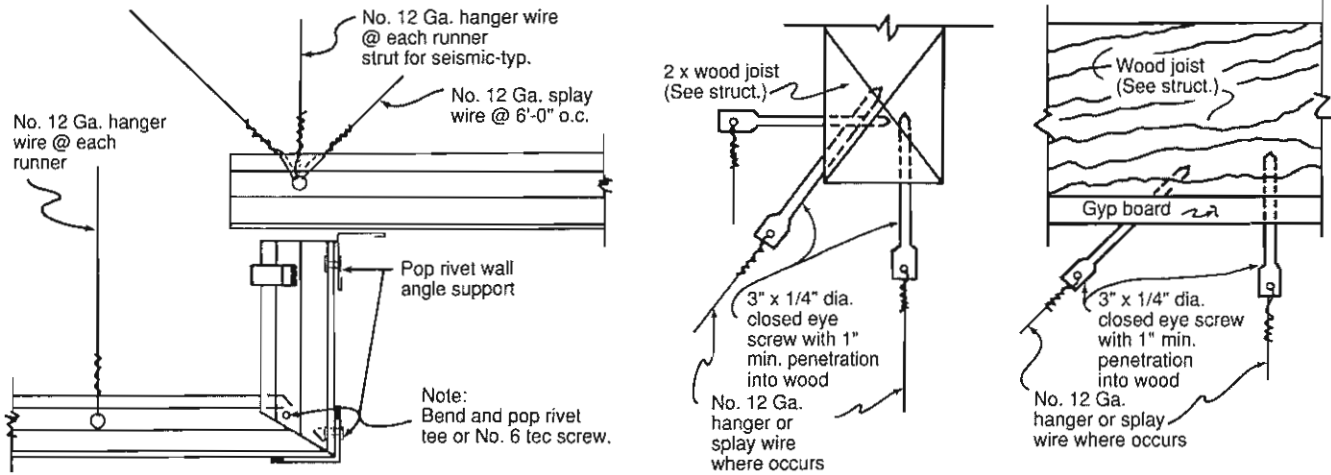
Note: If self tapping screws are used with concrete fill, set screws before placing concrete

**Detail D**

**At steel deck with concrete fill**

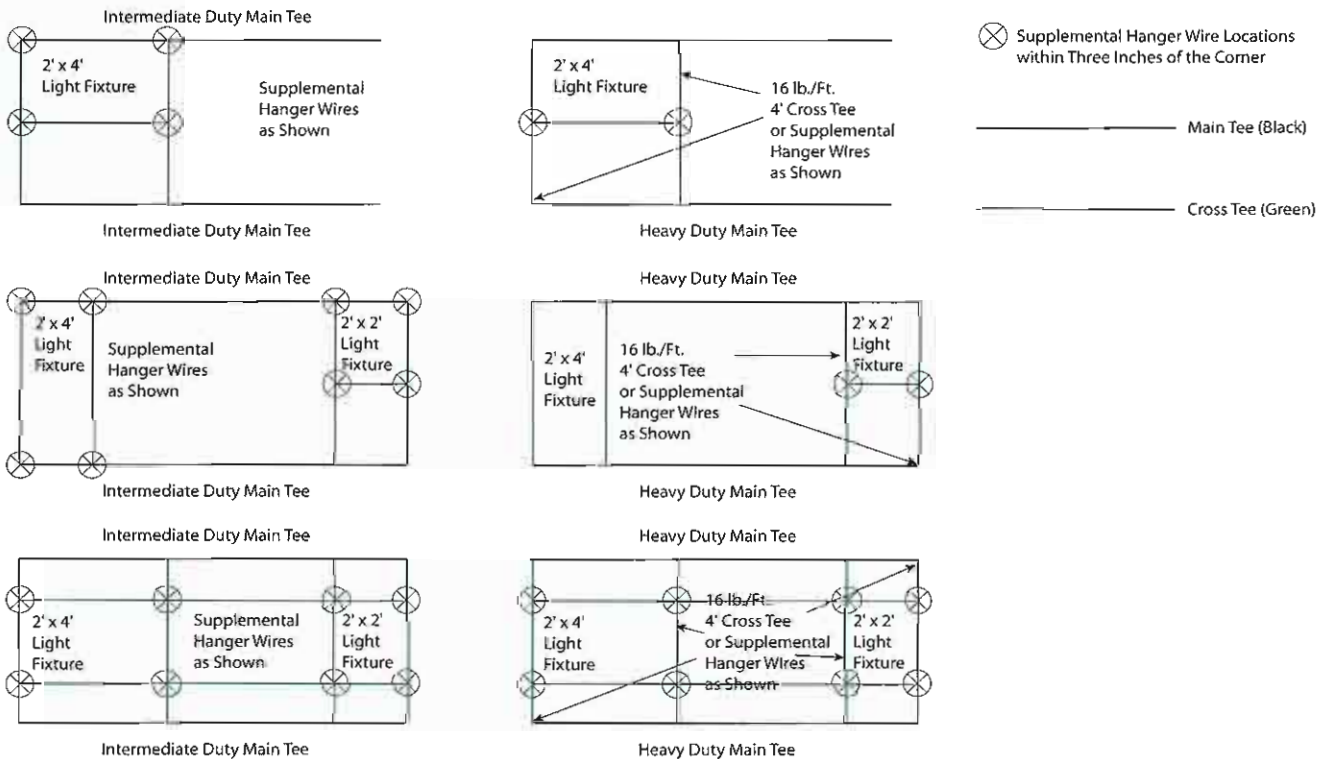


**FIGURE 6 SOFFIT DETAIL**



Note:  
Wires shall be attached to suspension members with a minimum of three turns.

**FIGURE 7 LOCATION OF SUPPLMENTAL HANGERS OR REQUIRED CROSS TEE STRENGTHS**



**FIGURE 8 TYPICAL BRACING**

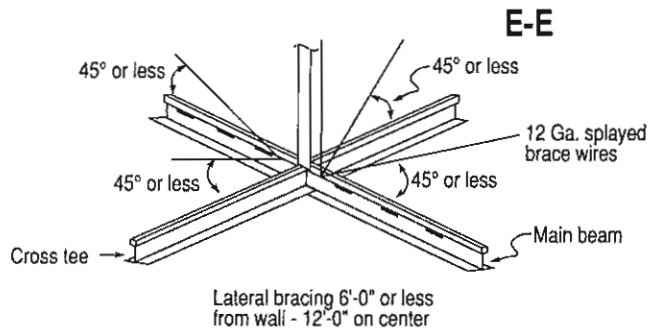
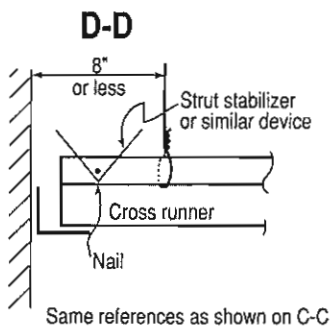
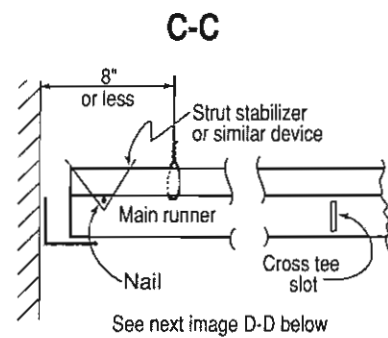
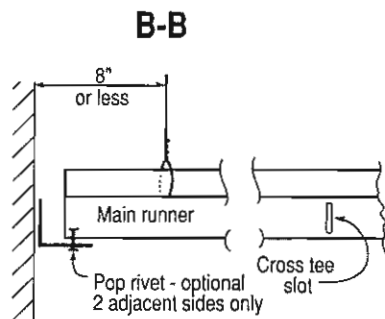
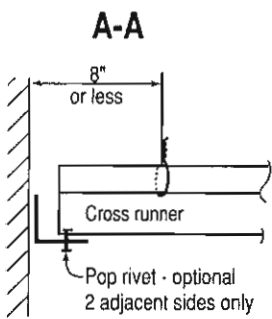
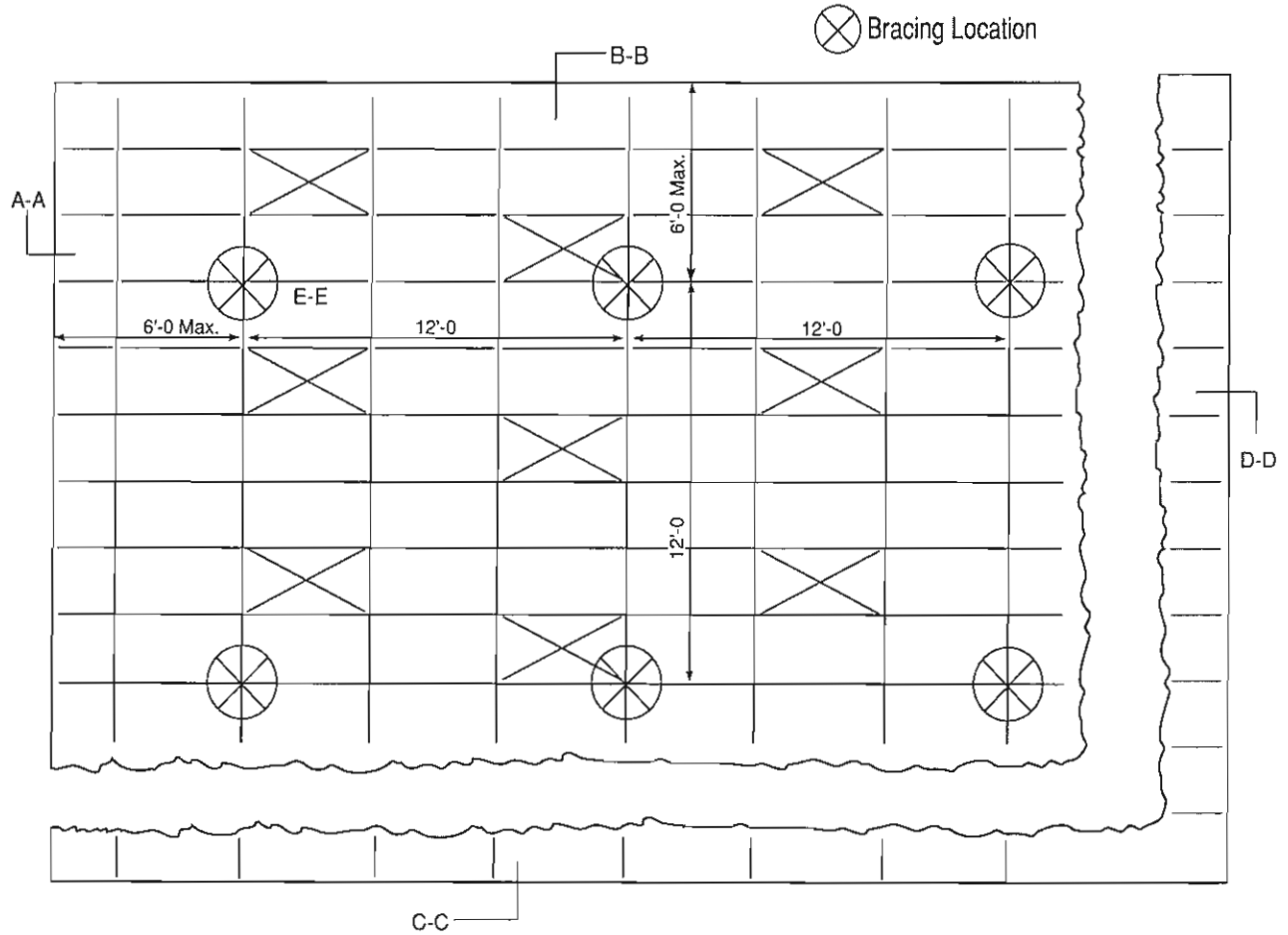


FIGURE 9 SEISMIC ZONE MAP OF THE UNITED STATES



- Zone 3
- Zone 4

## **CISCA SEISMIC COMMITTEE**

Mike Hankins, Chairman	Acoustics & Specialties, Inc.
Dennis Alvarez	USG, Inc.
Jerry Davis	Bonitz Contracting Company, Inc.
Douglas Gehring	BPB America
Paul Hough	Armstrong World Industries
Tony Ingratta	Chicago Metallic Corporation
Joe Kelly	WAVE
Charles McDonald	USG, Inc.
Bob Stone	CSI Interior Contractors



### **CEILINGS & INTERIOR SYSTEMS CONSTRUCTION ASSOCIATION**

1500 Lincoln Highway, Suite 202, St. Charles, Illinois 60174  
Phone 630-584-1919 • Fax 630-584-2003 • E Mail [CISCA@cisca.org](mailto:CISCA@cisca.org)  
[www.CISCA.org](http://www.CISCA.org)