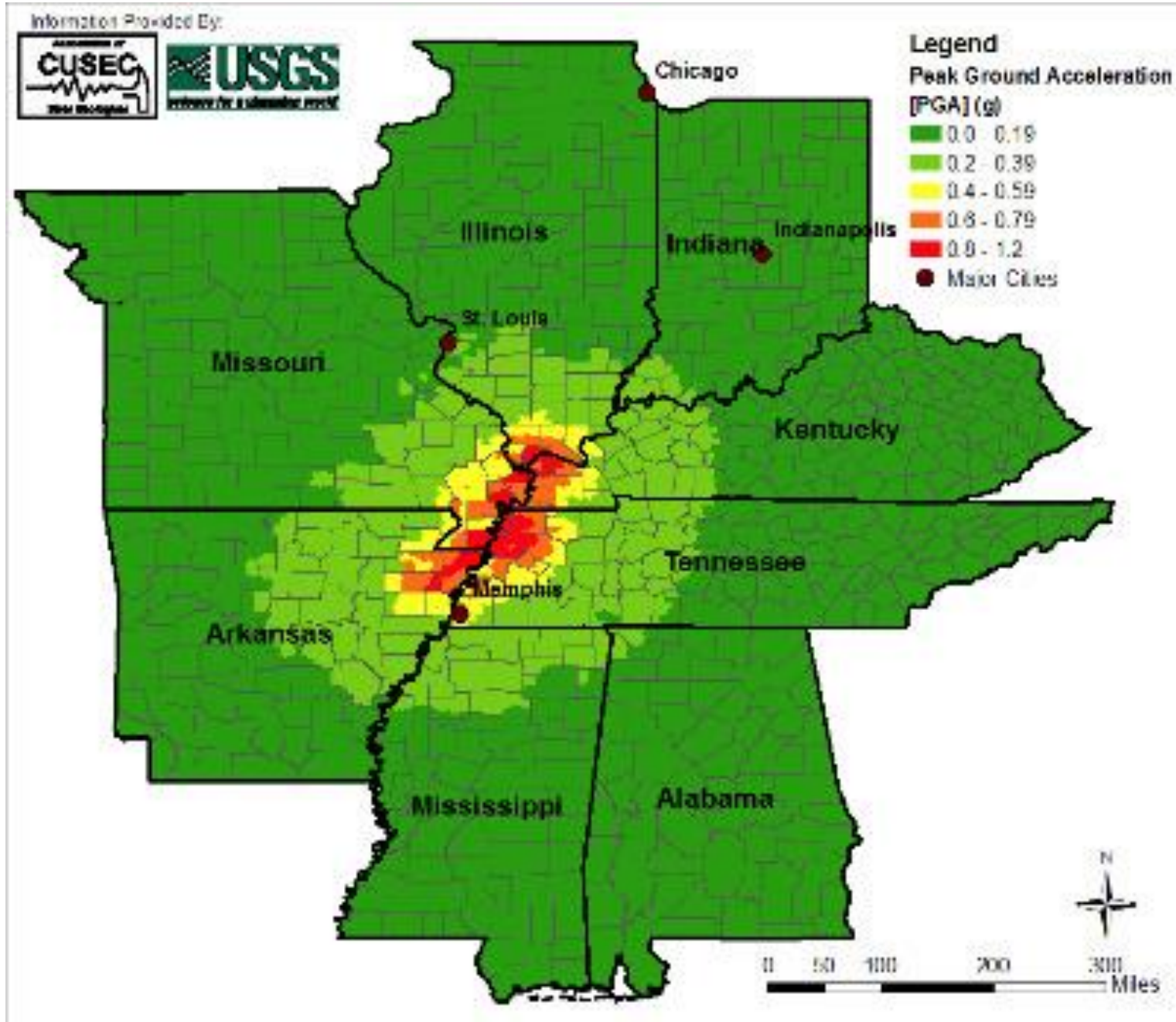
Seismic Requirements for Southern Illinois

ICC PREFERRED EDUCATION PROVIDER


Information Provided By:
CUSEC
USGS
Legend
Peak Ground Acceleration
[PGA] (g)
0.0 - 0.19
0.2 - 0.39
0.4 - 0.59
0.6 - 0.79
0.8 - 1.2
Major Cities
Chicago
Illinois
Indiana
Indianapolis
St. Louis
Missouri
Kentucky
Tennessee
Memphis
Arkansas
Mississippi
Alabama
N
0
50
100
200
300
Miles

New Madrid Earthquakes of 1811-1812

Largest in the U.S. since its settlement by the Europeans.

December 16, 1811: 400 terrified residents in the town of New Madrid, Missouri were abruptly awakened by violent shaking and a tremendous roar.

It was the first of at least three very large (M7 or greater) earthquakes and thousands of aftershocks to rock the region that winter, with the last occurring on February 7, 1812.

- The shaking rang church bells in Boston and Charleston, South Carolina, and toppled chimneys as far as Cincinnati, Ohio.
- After the February 7 earthquake, boatmen reported that the Mississippi actually ran backwards for several hours.
- The force of the land upheaval 15 miles south of New Madrid created Reelfoot Lake
- Drowned the inhabitants of an Indian village.
- Devastated thousands of acres of virgin forest.
- Created two temporary waterfalls in the Mississippi.

McKinley School - Marion, IL
November 9, 1968
Centered near Carmi and registered as a level 5.5 quake

Extensive damage to church & Courthouse in McLeansboro

Windows broken in Mt. Vernon

Damaged schools in W. Frankfort

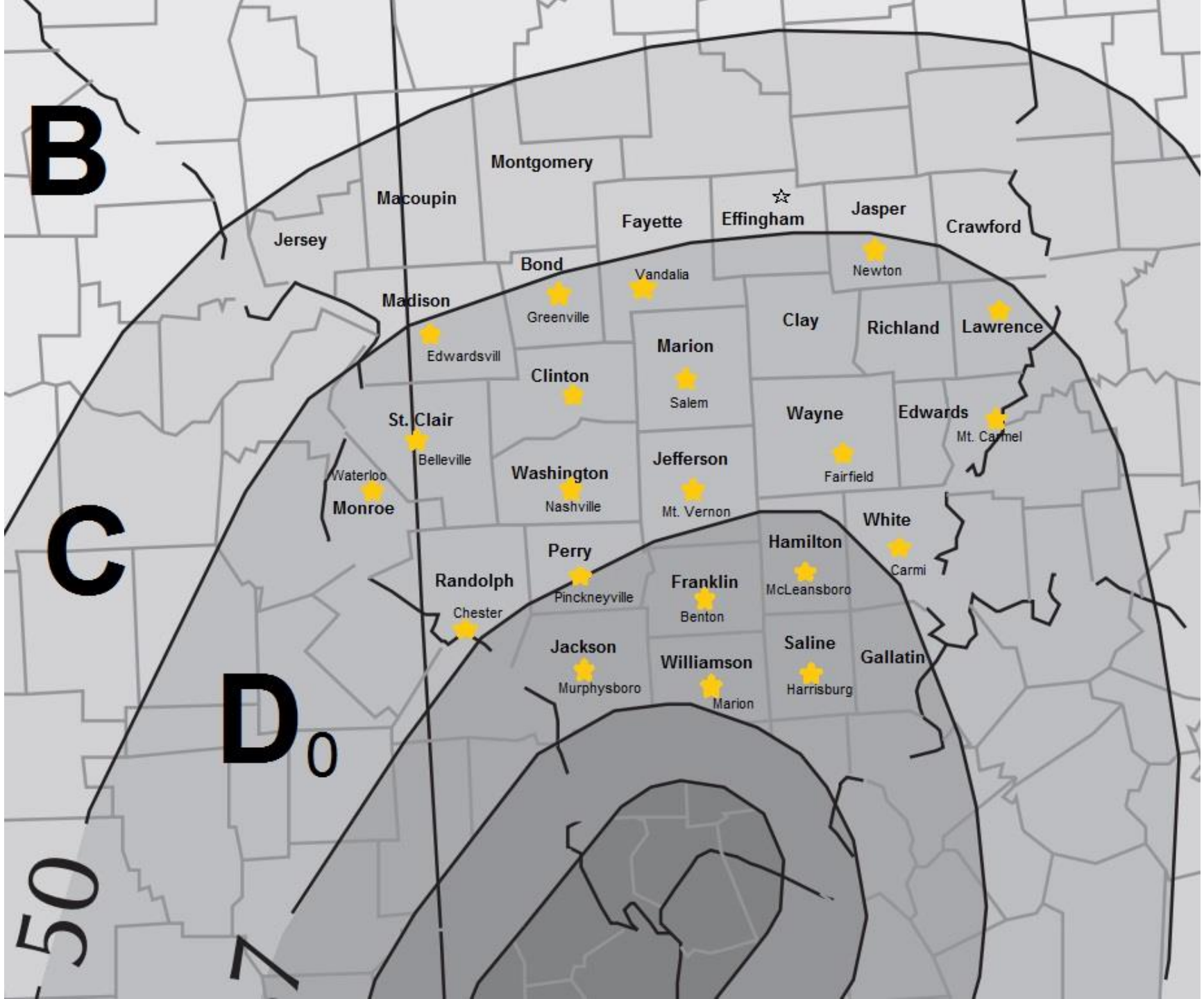
7 year old girl knocked unconscious By falling brick in Benton

Head injury from falling glass in Olney

EARTHQUAKE IN MIDWEST—Map locates, within dark lines, approximate area in the midwest which felt the shock from an earthquake November 9 at 11:00 a.m. The earthquake epicenter was located about 120 miles east of St. Louis at 38.5 degrees north, 88 degrees west. (AP Wirephoto)

W. Frankfort, Benton, Olney Hit

Quake Damage At McLeansboro


B
C
D0
Montgomery
Macoupin
Jersey
Fayette
Effingham
Jasper
Crawford
Bond
Vandalia
Newton
Madison
Greenville
Edwardsvill
Clay
Richland
Lawrence
Marion
Clinton
Salem
St. Clair
Belleville
Wayne
Edwards
Mt. Carmel
Waterloo
Monroe
Washington
Nashville
Jefferson
Mt. Vernon
Fairfield
White
Carmi
Hamilton
McLeansboro
Perry
Pinckneyville
Randolph
Chester
Franklin
Benton
Jackson
Murphysboro
Williamson
Marion
Saline
Harrisburg
Gallatin
50
1

IBC 2006 -2015

- **SECTION 1613**
  EARTHQUAKE LOADS
  1613.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with ASCE 7, excluding Chapter 14 and Appendix 11A. The *seismic design category* for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

Exceptions:

1. Detached one- and two-family dwellings, assigned to *Seismic Design Category* A, B or C, or located where the mapped short-period spectral response acceleration, *SS*, is less than 0.4 g.
2. The seismic force-resisting system of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section.
3. Agricultural storage structures intended only for incidental human occupancy.
4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.

ASCE STANDARD 7-05

Minimum Design Loads for Buildings and Other Structures

Guidelines for determining loads (dead & live loads):

- Handrails, Guardrails, Grab Bars, etc.
- Flood Loads
- Wind loads
- Snow loads
- Rain loads
- Ice loads

ASCE STANDARD 7-05

Minimum Design Loads for Buildings and Other Structures

Chapter 11. Seismic Design Criteria

Chapter 12. Seismic Design Requirements for Building Structures

Chapter 13. Seismic Design Requirements for Nonstructural Components

Chapter 14. Material-Specific Design (* excluded in IBC 1613.1)

13.5.6.2.2 Seismic Design Categories D through F. "Suspended Ceilings"

Suspended ceilings in Seismic Design Categories D, E, and F shall be designed and installed in accordance with:

ASTM C635,

ASTM C636, and

CISCA for Seismic Zones 3-4 (changed to ASTM E580 in ASCE 7-2010)

Ceilings & Interior Systems Construction Association - St. Charles, IL

What seismic design category am I in?

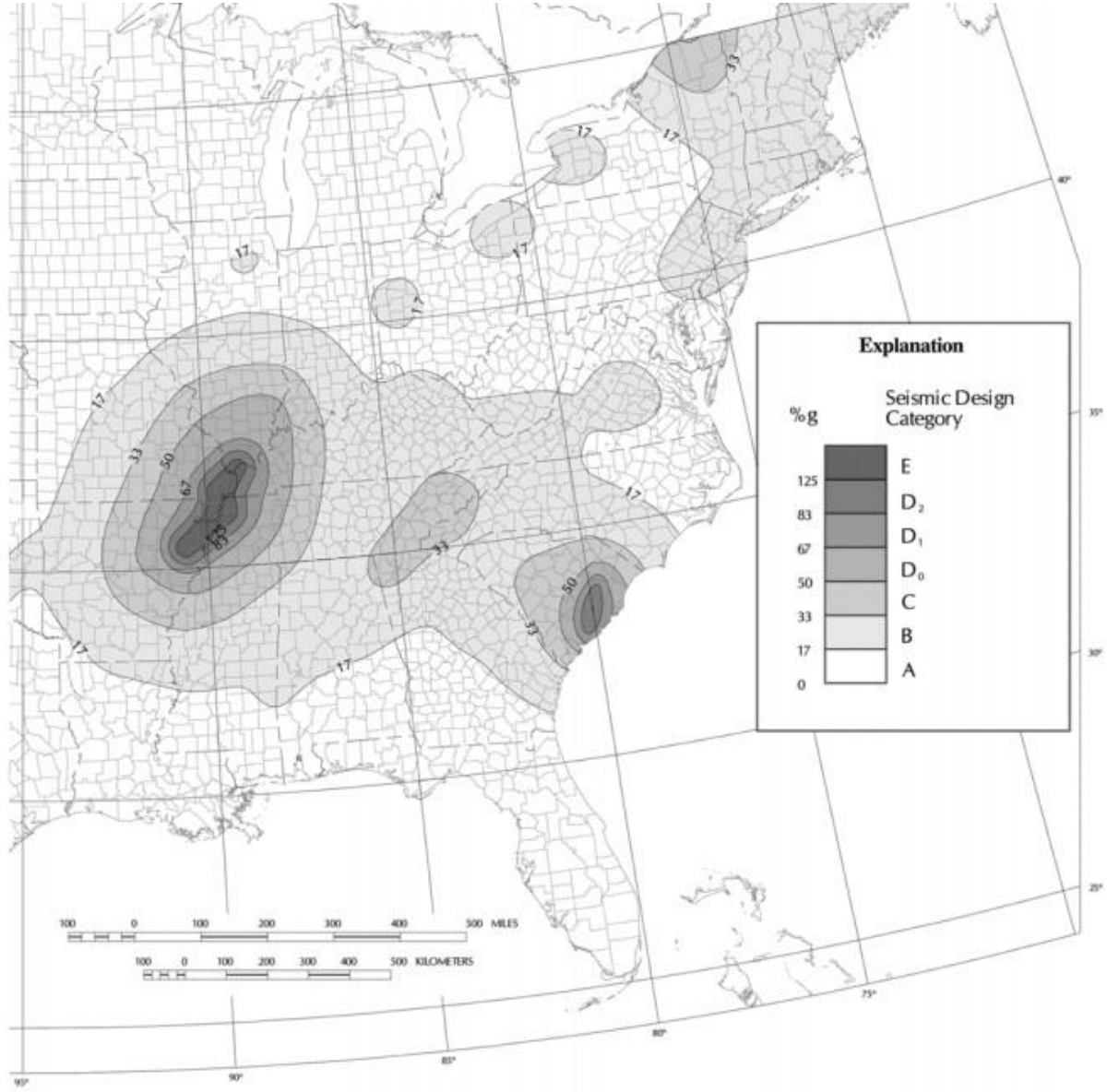


FIGURE R301.2(2)—continued
SEISMIC DESIGN CATEGORIES—SITE CLASS D

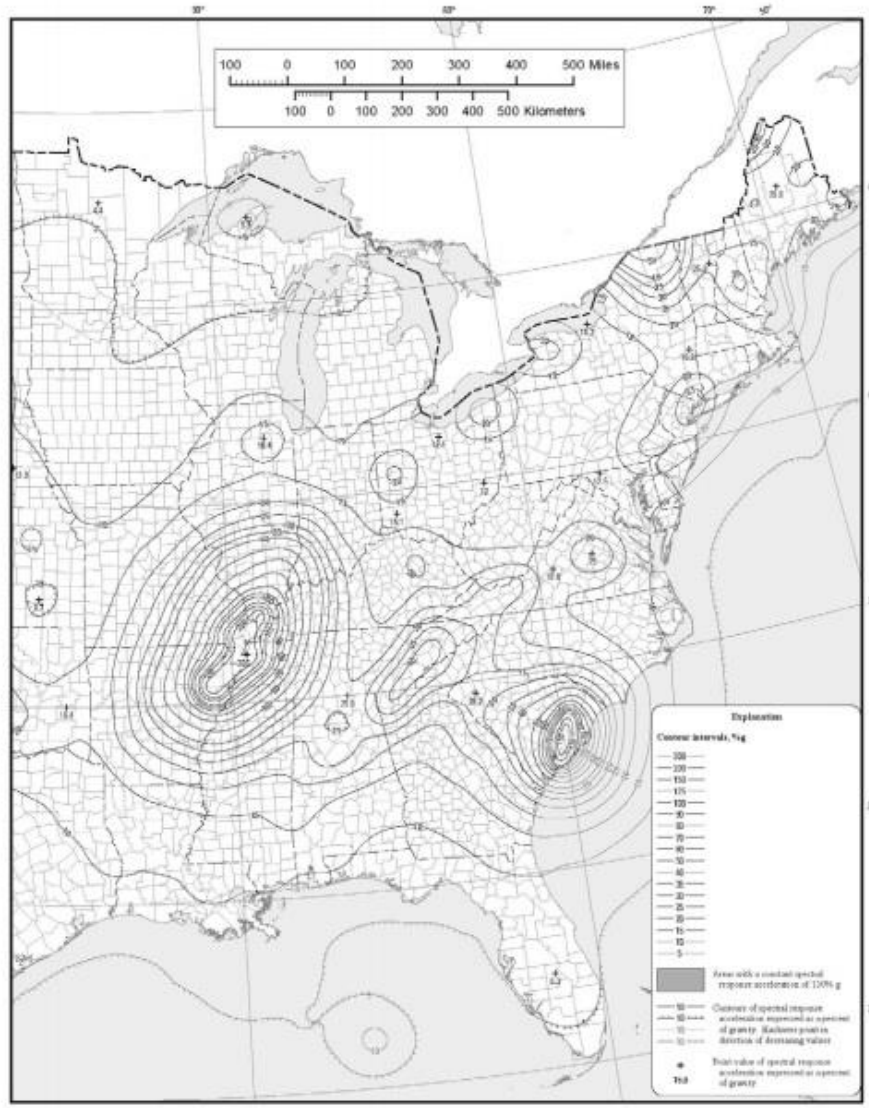
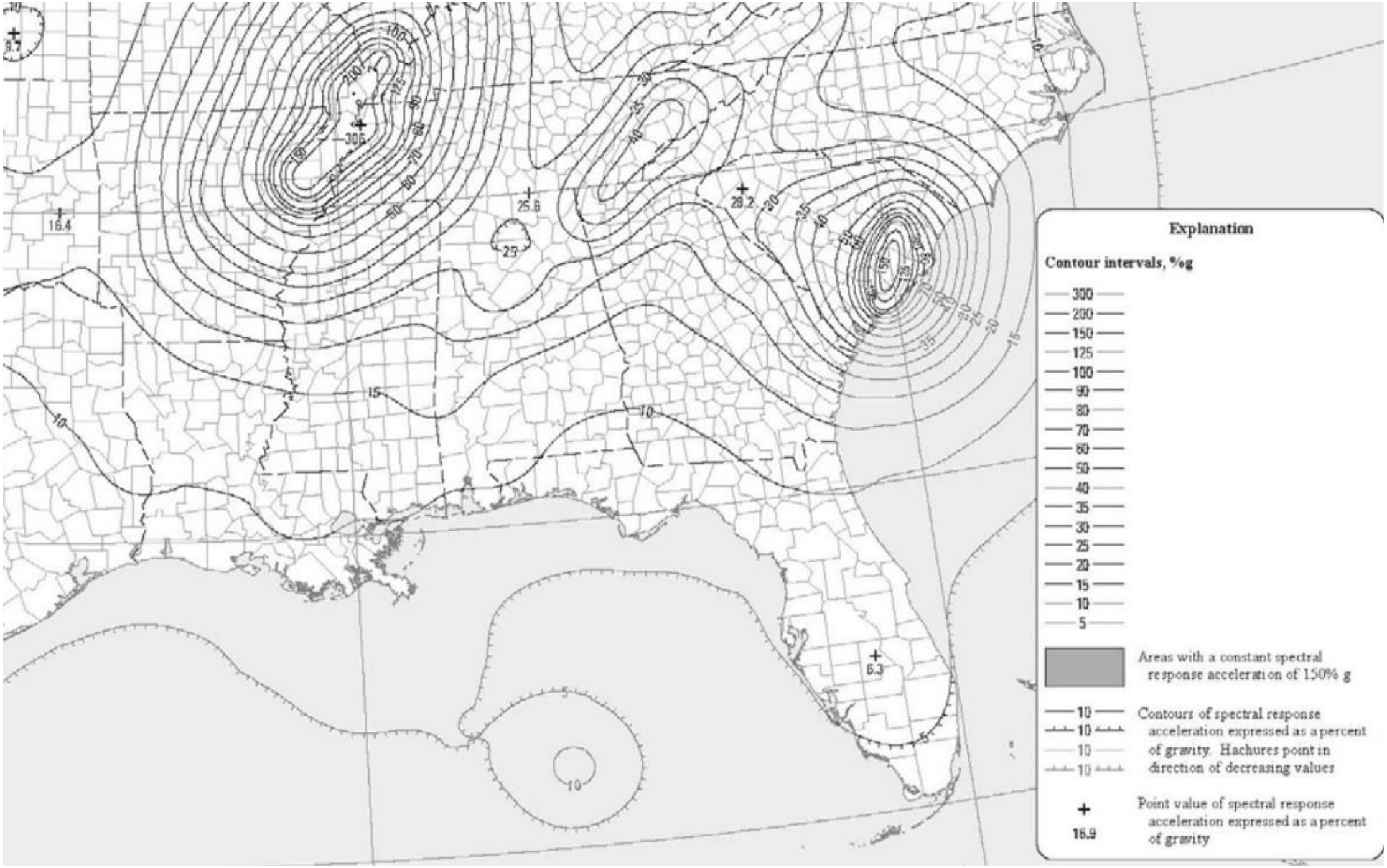


FIGURE 1613.3.1(1)—continued
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS FOR THE CONTERMINOUS UNITED STATES OF 0.2-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B


Explanation
Contour intervals, %g
300
200
150
125
100
90
80
70
60
50
40
35
30
25
20
15
10
5
Areas with a constant spectral response acceleration of 150% g
Contours of spectral response acceleration expressed as a percent of gravity. Hachures point in direction of decreasing values
Point value of spectral response acceleration expressed as a percent of gravity
16.9
16.4
25.6
28.2
6.3

IBC 1613.3.5 Determination of seismic design category.

Structures classified as *Risk Category* I, II or III that are located where the mapped spectral response acceleration parameter at 1-second period, *S1*, is greater than or equal to 0.75 shall be assigned to *Seismic Design Category* E.

Structures classified as *Risk Category* IV that are located where the mapped spectral response acceleration parameter at 1-second period, *S1,* is greater than or equal to 0.75 shall be assigned to *Seismic Design Category* F.

All other structures shall be assigned to a *seismic design category* based on their *risk category* and the design spectral response acceleration parameters, *SDS* and *SD1*, determined in accordance with Section 1613.3.4 or the site-specific procedures of ASCE 7. Each building and structure shall be assigned to the more severe *seismic design category* in accordance with Table 1613.3.5(1) or 1613.3.5(2), irrespective of the fundamental period of vibration of the structure, *T*.

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

IBC TABLE 1604.5

- Until 2009 Referred to as “OCCUPANCY CATEGORY”
- 2012 and later Referred to as “RISK CATEGORY”

TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing Group E occupancies with an occupant load greater than 250. • Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. • Group I-2 occupancies with an occupant load of 50 or more resident care recipients but not having surgery or emergency treatment facilities. • Group I-3 occupancies. • Any other occupancy with an occupant load greater than 5,000.[a] • Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released.[b]
IV	Buildings and other structures designated as essential facilities, including but not limited to: • Group I-2 occupancies having surgery or emergency treatment facilities. • Fire, rescue, ambulance and police stations and emergency vehicle garages. • Designated earthquake, hurricane or other emergency shelters. • Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. • Buildings and other structures containing quantities of highly toxic materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released.[b] • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water storage facilities and pump structures required to maintain water pressure for fire suppression.

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

IMPORTANT DEFINITIONS:

- **SITE CLASS:** A classification assigned to a site based on the types of soils present and their engineering properties as defined in Section 1613.5.2

- **SEISMIC DESIGN CATEGORY:** A classification assigned to a structure based on its Occupancy Category (Table 1604.5) and the severity of the design earthquake ground motion at the site. (as defined in IBC 2006)

1613.3.2 Site class definitions. Based on the site soil properties, the site shall be classified as *Site Class* A, B, C, D, E or F in accordance with Chapter 20 of ASCE 7.

Where the soil properties are not known in sufficient detail to determine the site class, Site Class D shall be used unless the building official or geotechnical data determines Site Class E or F soils are present at the site.

1613.3.3 Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters. The maximum considered earthquake spectral response acceleration for short periods, S_{MS}, and at 1-second period, S_{M1}, adjusted for *site class* effects shall be determined by Equations 16-37 and 16-38, respectively:

$$S_{MS} = F_a S_s \qquad \textbf{(Equation 16-37)}$$

$$S_{M1} = F_v S_1 \qquad \textbf{(Equation 16-38)}$$

where:

F_a = Site coefficient defined in Table 1613.3.3(1).

F_v = Site coefficient defined in Table 1613.3.3(2).

S_S = The mapped spectral accelerations for short periods as determined in Section 1613.3.1.

S_1 = The mapped spectral accelerations for a 1-second period as determined in Section 1613.3.1.

1613.3.4 Design spectral response acceleration parameters. Five-percent damped design spectral response acceleration at short periods, S_{DS}, and at 1-second period, S_{D1}, shall be determined from Equations 16-39 and 16-40, respectively:

$$S_{DS} = \frac{2}{3} S_{MS} \qquad \textbf{(Equation 16-39)}$$

$$S_{D1} = \frac{2}{3} S_{M1} \qquad \textbf{(Equation 16-40)}$$

where:

S_{MS} = The maximum considered earthquake spectral response accelerations for short period as determined in Section 1613.3.3.

S_{M1} = The maximum considered earthquake spectral response accelerations for 1-second period as determined in Section 1613.3.3.

IBC SITE CLASS DEFINITION

1613.3.2 (2015) Site class definitions. Based on the site soil properties, the site shall be classified as *Site Class* A, B, C, D, E or F in accordance with Chapter 20 of ASCE 7.

Where the soil properties are not known in sufficient detail to determine the site class, Site Class D shall be used unless the building official or geotechnical data determines Site Class E or F soils are present at the site.

ENGINEERS DESIGN THINGS,

BUILDING INSPECTORS JUST LOOK STUFF UP!

Go to website:
https://seismicmaps.org/

You can find the latitude and longitude at google maps

OSHPD Seismic Design Maps

Home About Report an Issue Contact

Lat: 38.61206410, Lng: -121.50836650

Search for Address or Coordinates

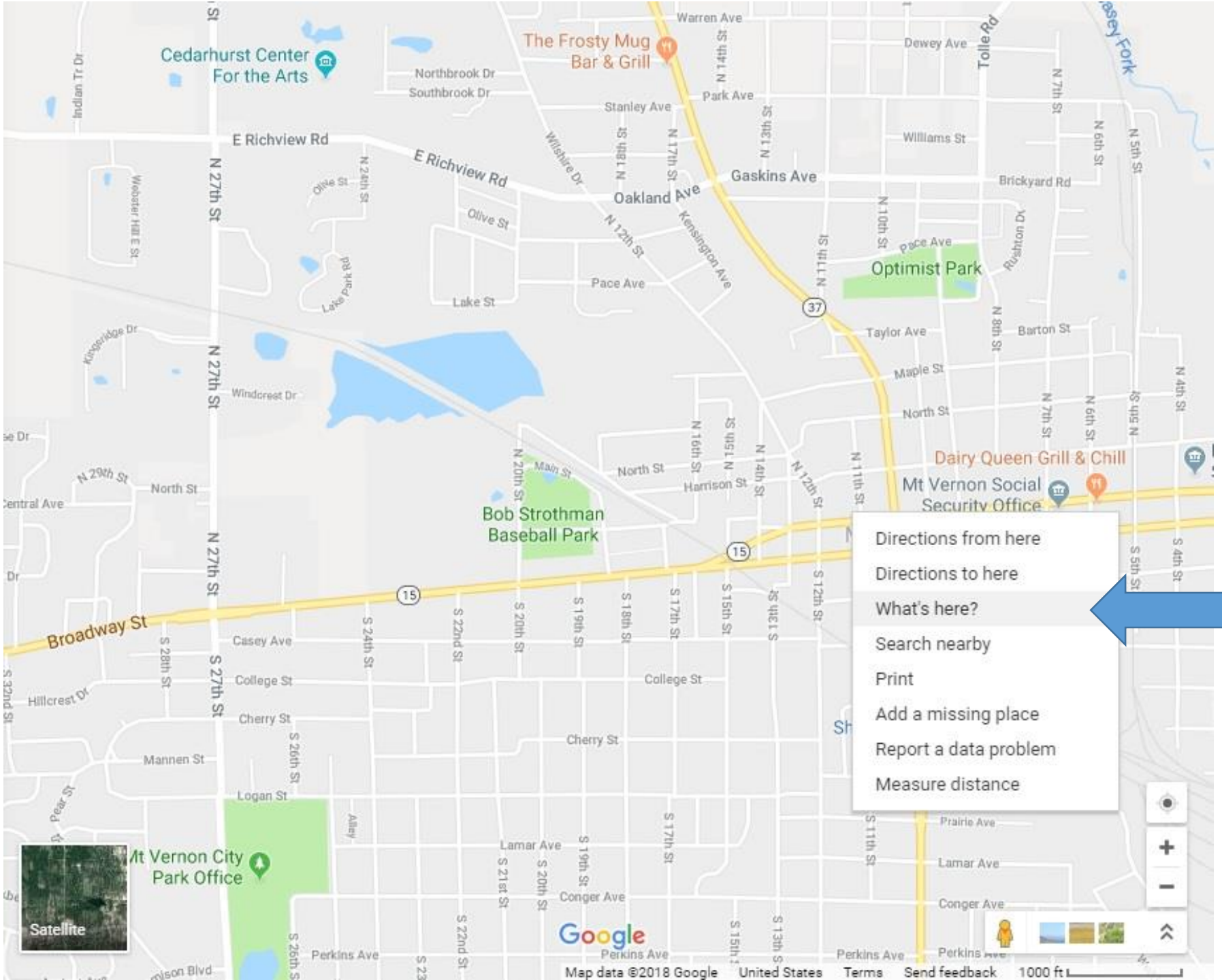
Reference: ASCE 7-10

Risk Category: II

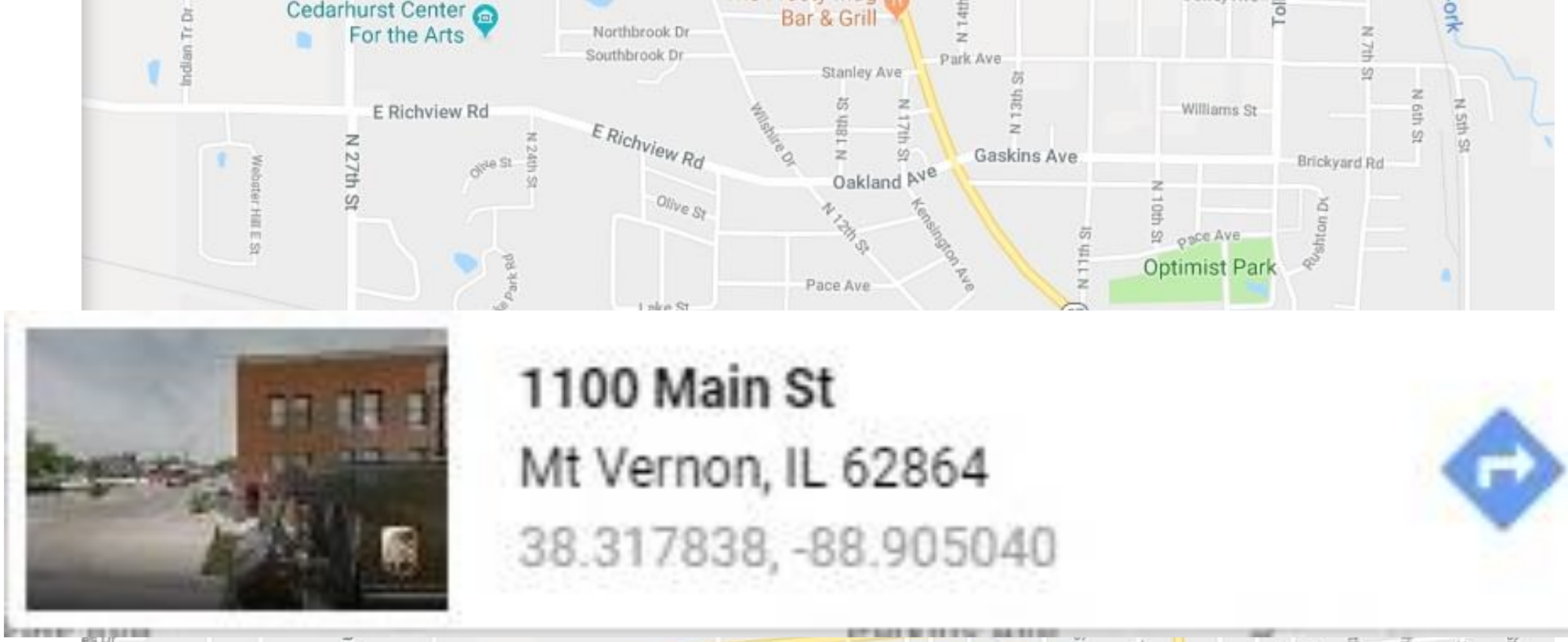
Site Class: D - Stiff Soil

Project Title (optional)

Address | Coords | Address | Go



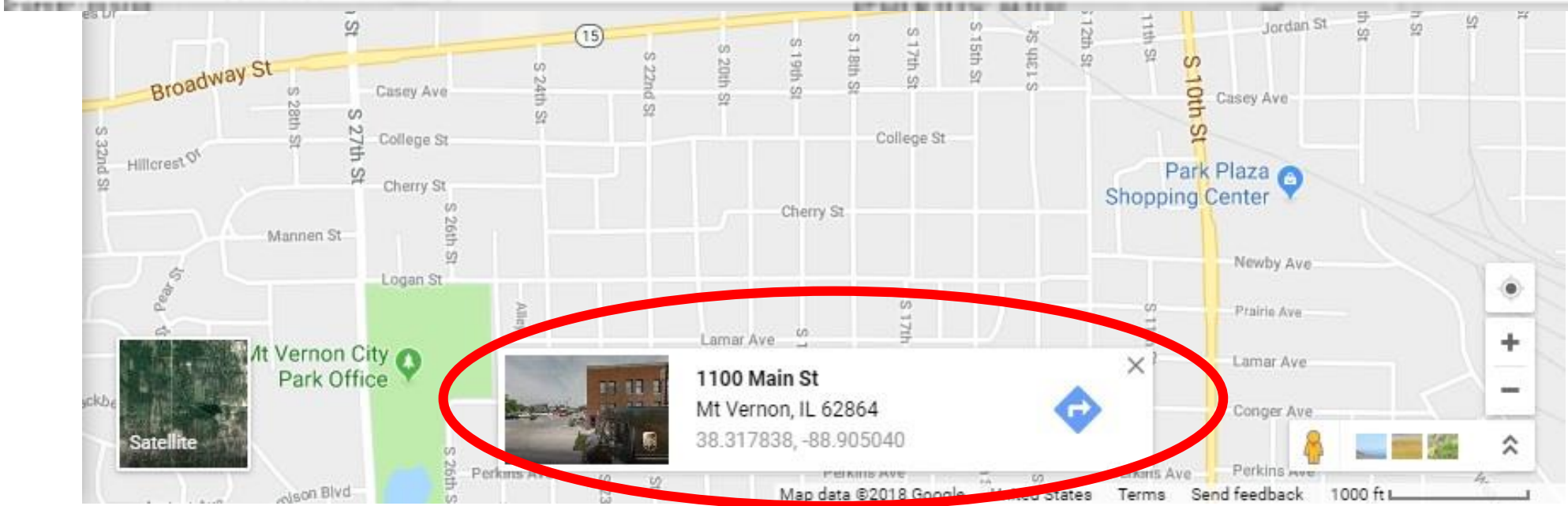
Point to location
And right click



1100 Main St

Mt Vernon, IL 62864

38.317838, -88.905040



38.317838, -88.905040

38°19'04.2"N 88°54'18.1"W
38.317838, -88.905040

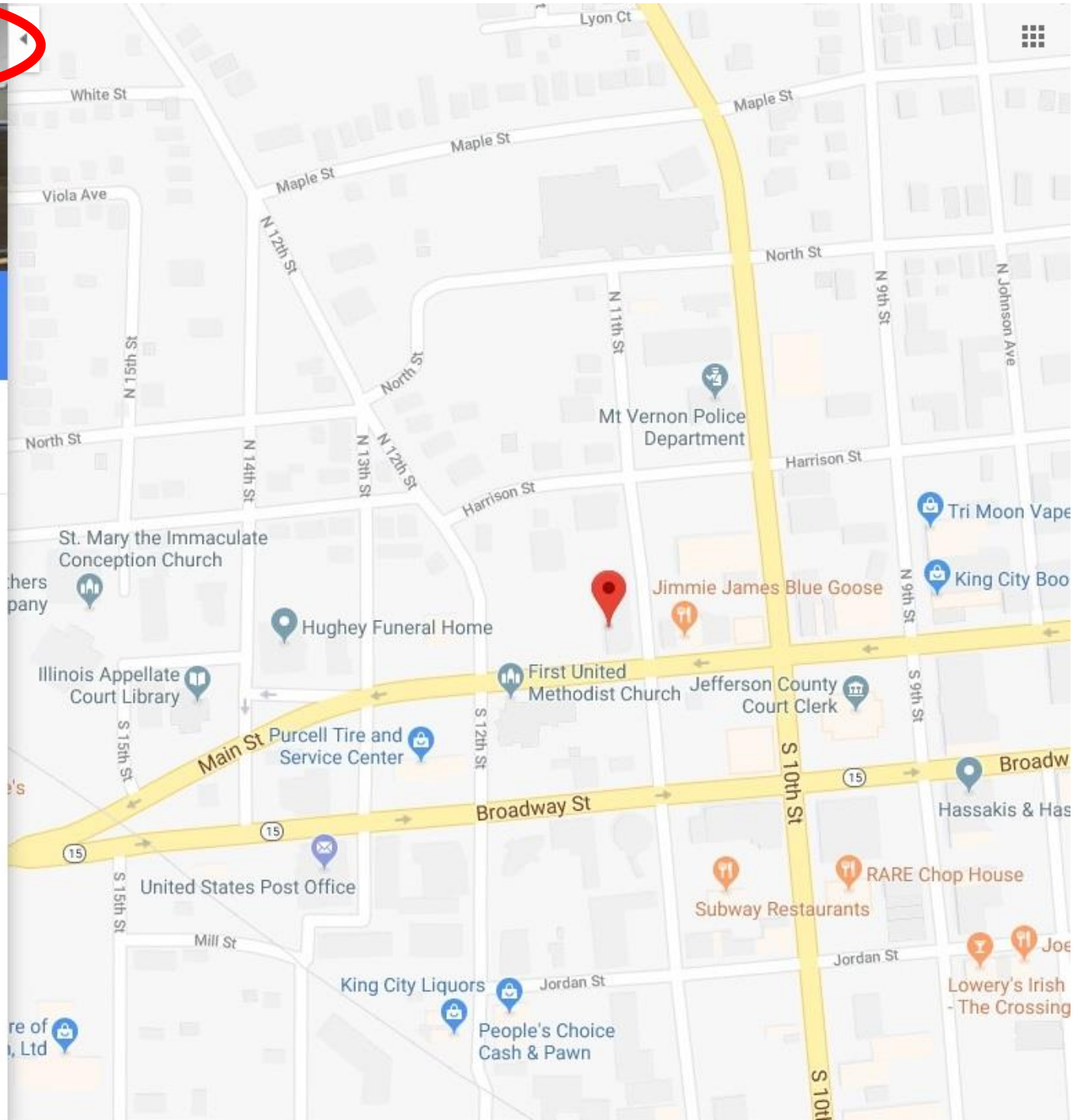
Directions

SAVE NEARBY SEND TO YOUR PHONE SHARE

1100 Main St, Mt Vernon, IL 62864

839V+4X Mt Vernon, Illinois

Add a missing place



OSHPD Seismic Design Maps Home About Report an Issue Contact

Lat: 38.31777574, Lng: -88.90488166

Search for Address or Coordinates

Reference: ASCE 7-10 | Risk Category: II | Site Class: D - Stiff Soil

Mt Vernon | Address | Coords | 38.31777574 | -88.90488166 | Go

OSHPD

Latitude, Longitude: 38.319623, -88.906241

Date	12/18/2018, 4:19:39 PM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	0.65	MCE_R ground motion. (for 0.2 second period)
S_1	0.223	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.832	Site-modified spectral acceleration value
S_{M1}	0.436	Site-modified spectral acceleration value
S_{DS}	0.555	Numeric seismic design value at 0.2 second SA
S_{D1}	0.291	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1.28	Site amplification factor at 0.2 second
F_v	1.953	Site amplification factor at 1.0 second
PGA	0.358	MCE_G peak ground acceleration
F_{PGA}	1.142	Site amplification factor at PGA
PGA_M	0.408	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	0.65	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.752	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.223	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.268	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.865	Mapped value of the risk coefficient at short periods
C_{R1}	0.834	Mapped value of the risk coefficient at a period of 1 s

S_{DS}	0.555	Numeric seismic design value at 0.2 second SA
S_{D1}	0.291	Numeric seismic design value at 1.0 second SA

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$ **0.555**	D	D	D

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$ **0.291**	D	D	D

EXAMPLES:

Now that we know the design category:

- We know the architects and engineers designed the building structure to withstand the effects of ground motion, snow load, etc.
- Inspectors ensure that building is built in accordance with drawings.
- Specifications & detailed information are often not shown on plans.
- Inspectors check for prescriptive code compliance at job site.

We can now look at ASCE 7

ASCE STANDARD 7-05

Minimum Design Loads for Buildings and Other Structures

Chapter 11. Seismic Design Criteria

Chapter 12. Seismic Design Requirements for Building Structures

Chapter 13. Seismic Design Requirements for Nonstructural Components

Chapter 14. Material-Specific Design (* excluded in IBC 1613.1)

13.5.6.2.2 Seismic Design Categories D through F. "Suspended Ceilings"

Suspended ceilings in Seismic Design Categories D, E, and F shall be designed and installed in accordance with:

ASTM C635,

ASTM C636, and

CISCA for Seismic Zones 3-4 (changed to ASTM E580 in ASCE 7-2010)

Ceilings & Interior Systems Construction Association - St. Charles, IL

ASCE STANDARD 7-05
Minimum Design Loads for Buildings and Other Structures

ASTM C635

Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

Inspector only needs confirmation that components were manufactured in compliance (tags, labels, cut-sheets, etc.)

ASTM C636

Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

Summary:

1. Hangers for carrying channels or main runners 4 feet on centers.

2. Each suspension wire shall not hang more than one in six out of plumb unless a countersloping wire or horizontal bracing is provided. Suspension wires should not press against ducts or pipe.

3. Wire hangers shall be a minimum of No. 12-gage galvanized, soft-annealed, mild steel wire.

4. Local kinks or bends shall not be made in hanger wires as a means of leveling carrying channels.

5. In installations where hanger wires are wrapped around carrying channels, the wire loops shall be tightly formed to prevent any vertical movement or rotation of the member within the loop.es.

ASTM C636

Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

Main Runners:

1. Install main runners so that they are all level to within 1/4 inch in 10 ft after completion of the ceiling installations but prior to building occupancy.

2. Local kinks or bends shall not be made in hanger wires as a means of leveling main runners.

3. In installations where hanger wires are wrapped through or around main runners, the wire loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops. The wire must be wrapped around itself a minimum of three full turns (360° each) within a 3-inches length. For safety purposes, the bottom of the hanger wires shall either be cut close to the vertical portion of the wire or shall be bent upward parallel to the vertical portion of the hanger wire.

ASTM C636

Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

Cross Runners:

1. Install cross runners supported by either main runners or by other cross runners to within 1/32 inch [.8 mm] of the required center distances. This tolerance shall be noncumulative beyond 12 ft.

2. The exposed surfaces of the two intersecting runners shall lie within a vertical distance of .015 inch (less than 1/64 inch) [.4 mm] of each other with the abutting (cross) member always above the continuous (main) member.

ASTM C636

Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

Assembly Devices:

1. Join abutting sections of the main runner by means of suitable connection such as splices, interlocking ends, tab locks, pin locks, and so forth. A joint connection shall be judged suitable both before and after ceiling loads are imposed if the joint provides sufficient alignment so that the exposed surfaces of two abutting main runners lie within a vertical distance of .015 inch (less than 1/64 inch) of each other.

2. There shall be no visually apparent angular displacement of the longitudinal axis of one runner with respect to the other.

3. Assembly devices shall provide sufficient spacing control so that horizontal gaps between exposed surfaces of either abutting or intersecting member shall not exceed .020 inch.

4. Fixtures shall not be supported from main runners or cross runners if the weight of the fixture causes the total dead load to exceed the deflection capability of the ceiling suspension system. In such cases, the fixture load shall be support by supplemental hangers within 6 inches of each corner, or the fixture shall be separately supported.

ASTM C636

Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

Inspection:

Ceiling inspection shall be made with final building occupancy lighting conditions. If temporary lighting must be used, temporary conditions will approximate the final lighting condition.

ASTM E 580M (previously CISCA)

1. Scope

1.1 This practice covers the installation of suspended systems for acoustical tile and lay-in panels and their additional requirements for two groups of buildings that are constructed to resist the effects of earthquake motions as defined by ASCE 7 and the International Building Code. These groupings are for Seismic Design Category C and Seismic Design Categories D, E and F.

1.2 The authority having jurisdiction shall determine the applicability of this practice.

1.3 Specification C 635 and Practice C 636 cover suspension systems and their installation without special regard to seismic lateral restraint needs. They remain applicable and shall be followed when this practice is specified.

ASTM E 580M (previously CISCA)

1. Scope

1.5 Ceiling areas of 1000 ft^2 or less shall be exempt from the lateral force bracing requirements of 5.2.8

Ceilings less than or equal to 144 square feet and surrounded by walls connected to the structure above are exempt from the requirements of this practice.

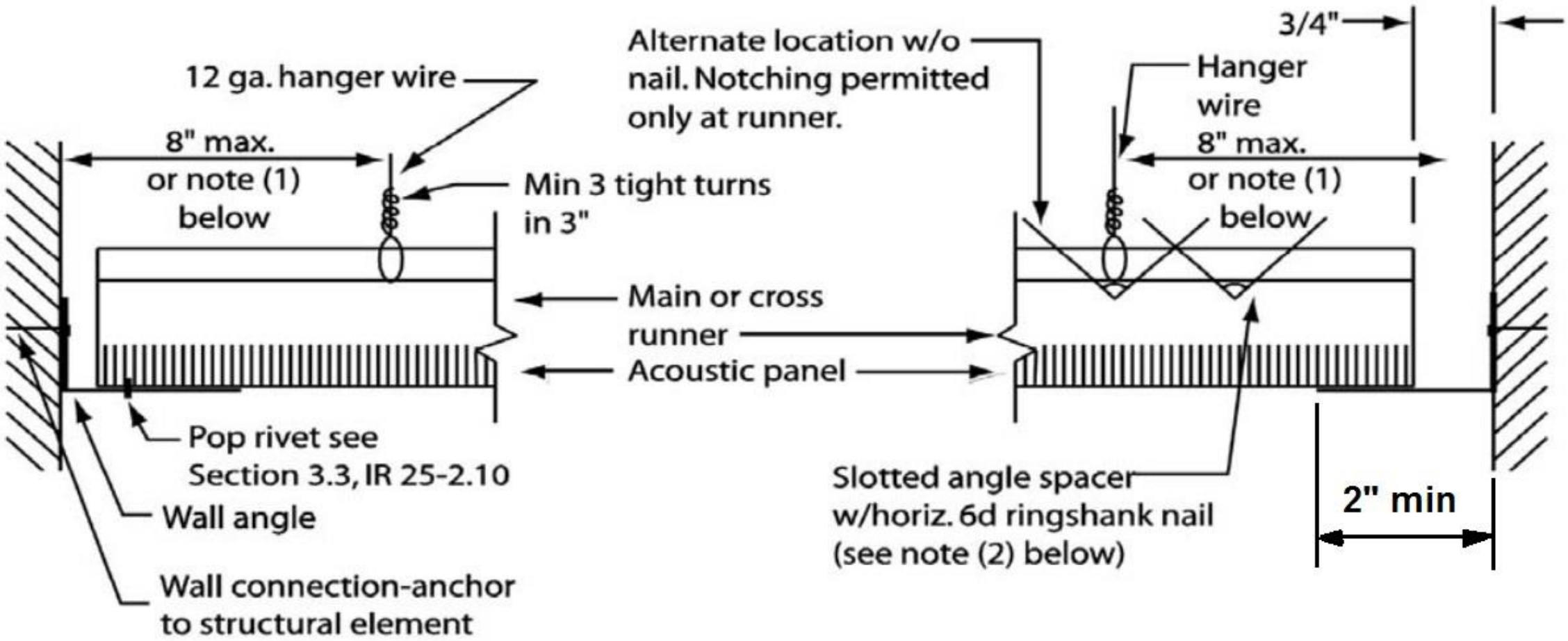
(added in 2010, applicable to 2012 IBC)

ASCE 7
13.5.6.2.2 Seismic Design Categories D through F.

a. A heavy duty T-bar grid system shall be used.

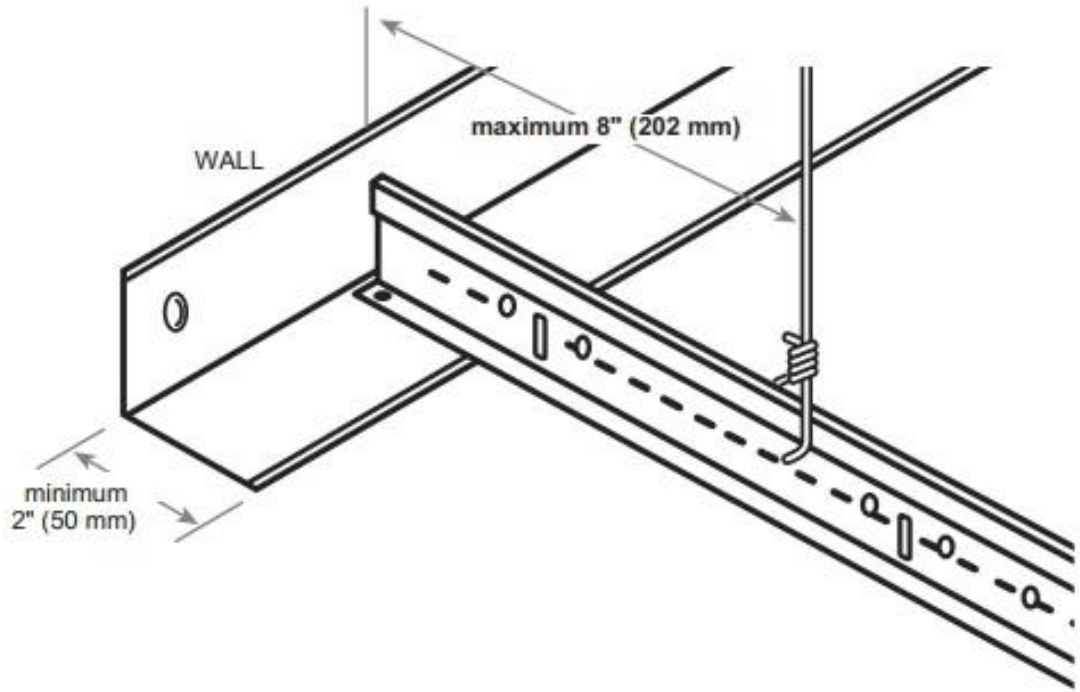
b. The width of the perimeter supporting closure angle shall be not less than 2.0 inch. In each orthogonal horizontal direction, one end of the ceiling grid shall be attached to the closure angle. The other end in each horizontal direction shall have a 0.75 inch (3/4”) clearance from the wall and shall rest upon and be free to slide on a closure angle.

Perimeter Detail

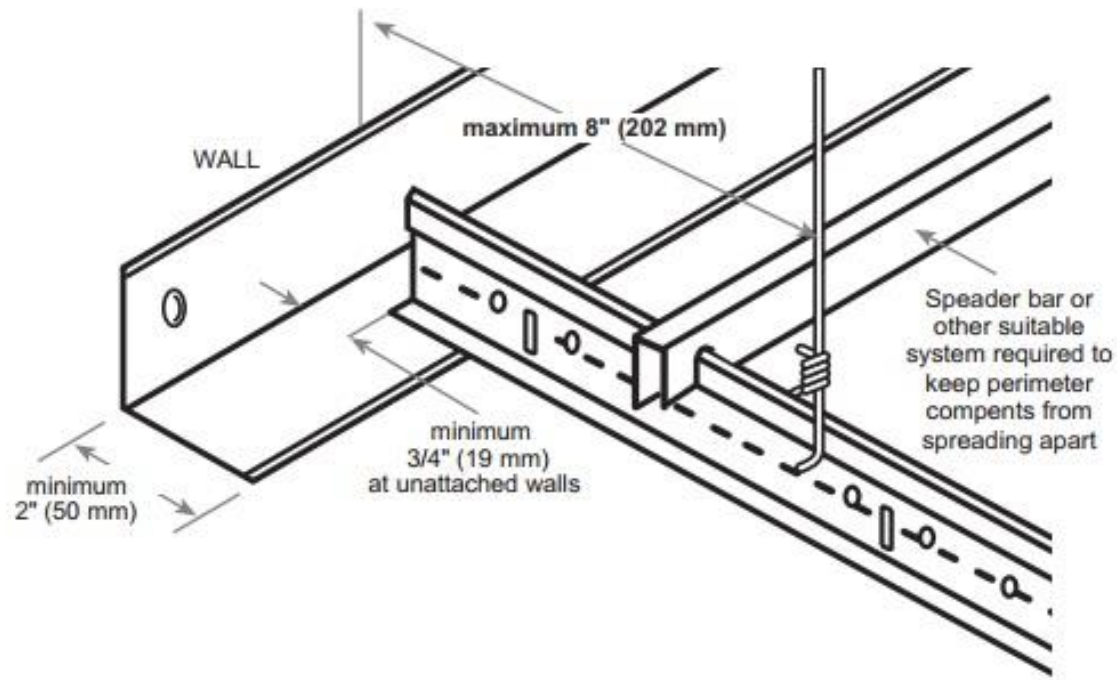


Perimeter Detail

Attached Wall Molding Requirements



Unattached Wall Molding Requirements



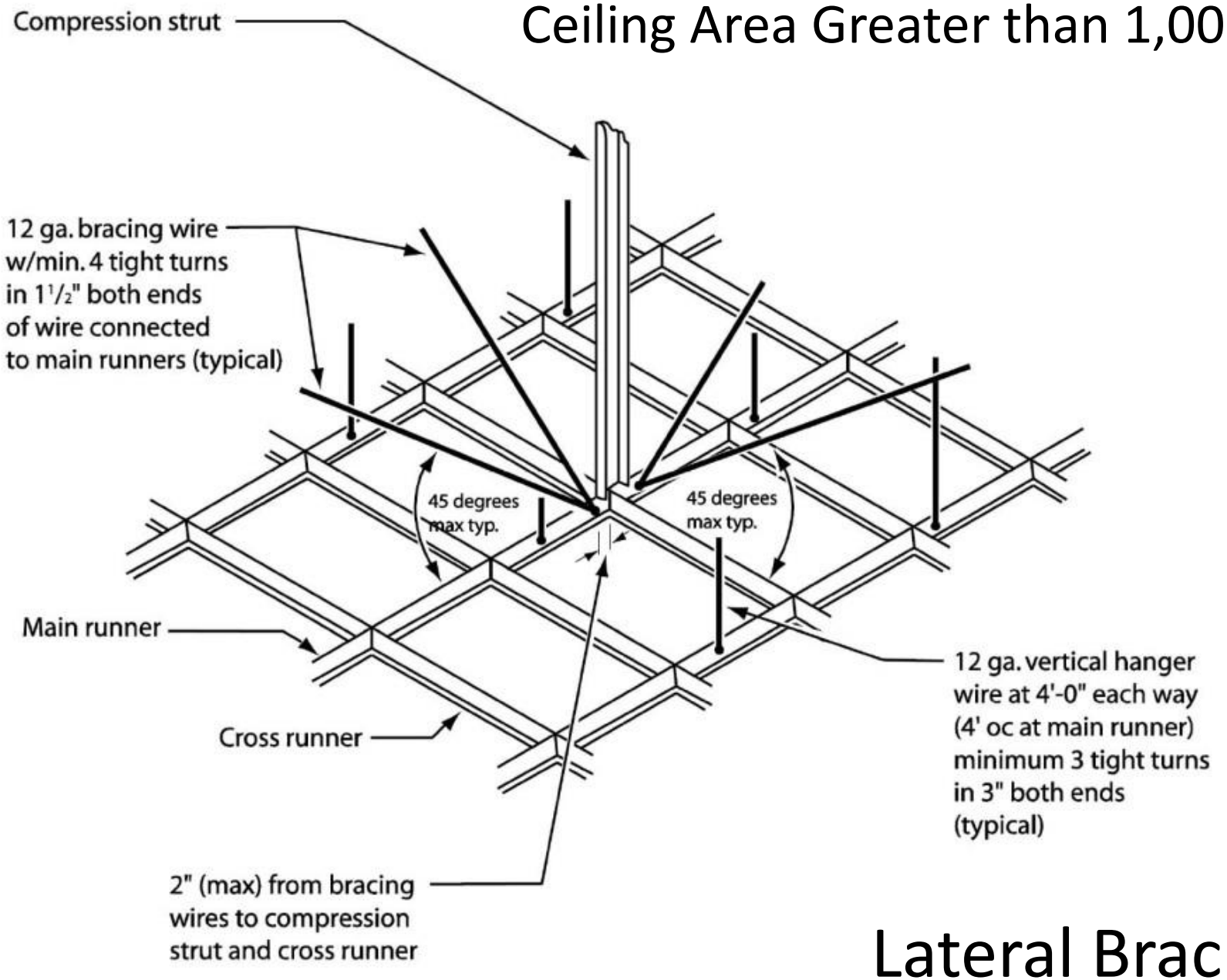
ASCE 7
13.5.6.2.2 Seismic Design Categories D through F.

c. For ceiling areas exceeding 1,000 ft^2 (92.9 m2),horizontal restraint of the ceiling to the structural system shall be provided.

e. Except where rigid braces are used to limit lateral deflections, sprinkler heads and other penetrations shall have a 2 inch oversize ring, sleeve, or adapter through the ceiling tile to allow for free movement of at least 1 inch in all horizontal directions. Alternatively, a swing joint that can accommodate 1 inch of ceiling movement in all horizontal directions is permitted to be provided at the top of the sprinkler head extension.

g. Cable trays and electrical conduits shall be supported independently of the ceiling.

Ceiling Area Greater than 1,000 square feet

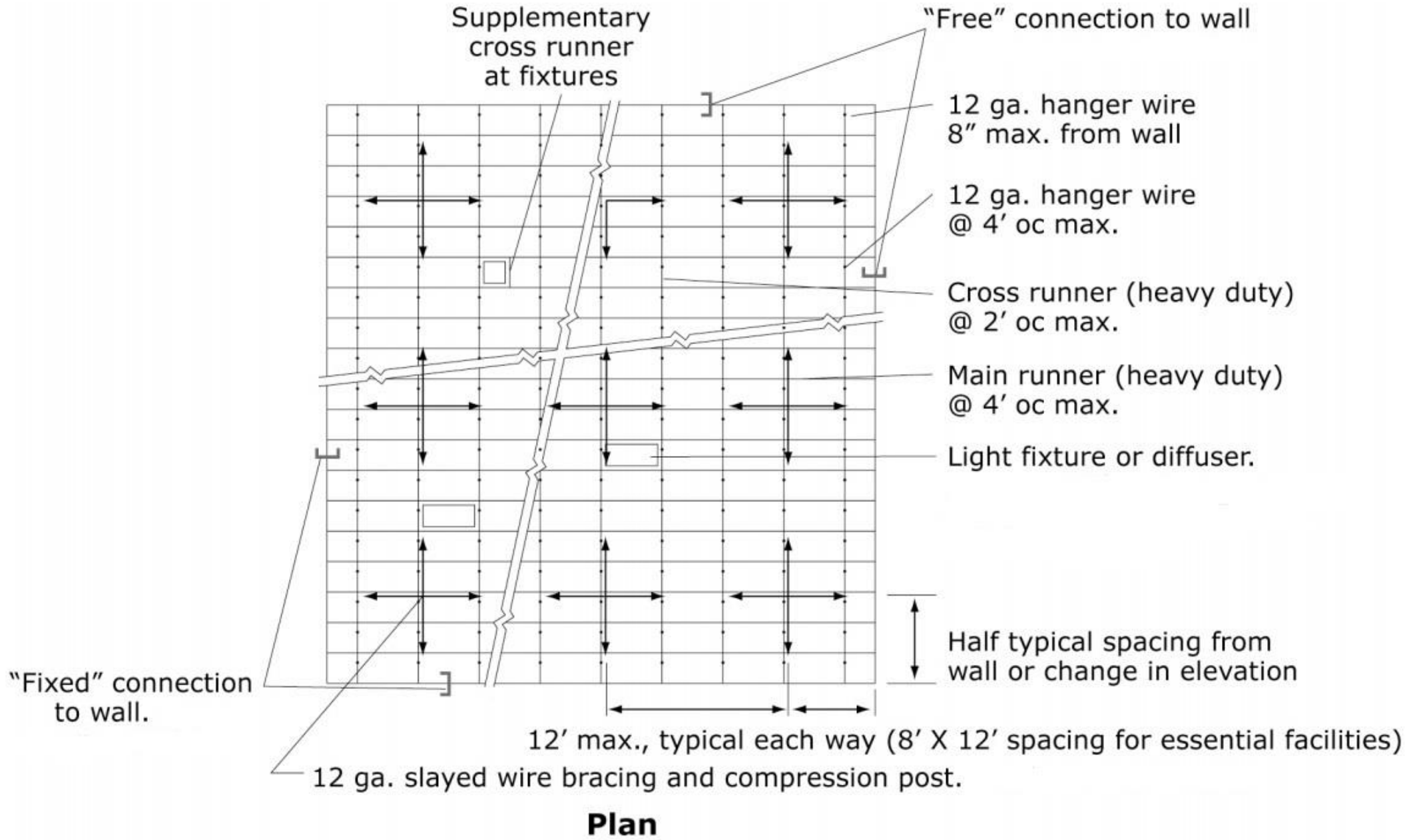


Lateral Bracing

The compression strut shall be adequate to resist the vertical component induced by the bracing wires, and shall not be more than 1 (horizontal) in 6 (vertical) out of plumb. Unless justified by engineering calculations, the strut shall not exceed the maximum length listed below:

1/2" EMT	Up to 5'-0"
3/4" EMT	Up to 8'-0"
1" EMT	Up to 10'-0"
2½" x 25 gauge metal stud	Up to 10'-0"
Double 3⅝" x 25 gauge metal stud*	Up to 15'-0"

* stitched with #6 screw at 16" o.c.


Supplementary cross runner at fixtures
"Free" connection to wall
12 ga. hanger wire 8" max. from wall
12 ga. hanger wire @ 4' oc max.
Cross runner (heavy duty) @ 2' oc max.
Main runner (heavy duty) @ 4' oc max.
Light fixture or diffuser.
Half typical spacing from wall or change in elevation
"Fixed" connection to wall.
12' max., typical each way (8' X 12' spacing for essential facilities)
12 ga. slayed wire bracing and compression post.

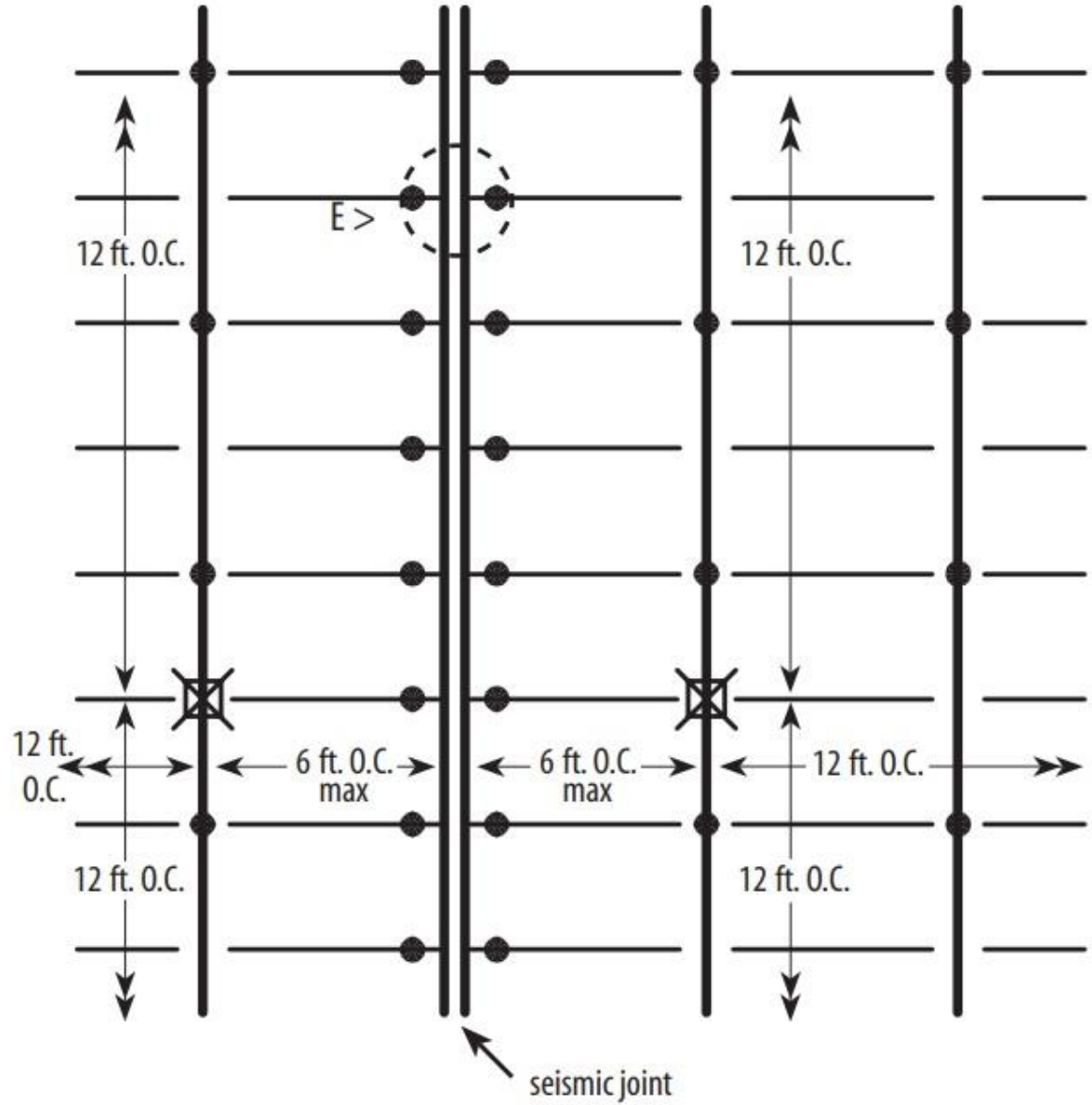
Plan

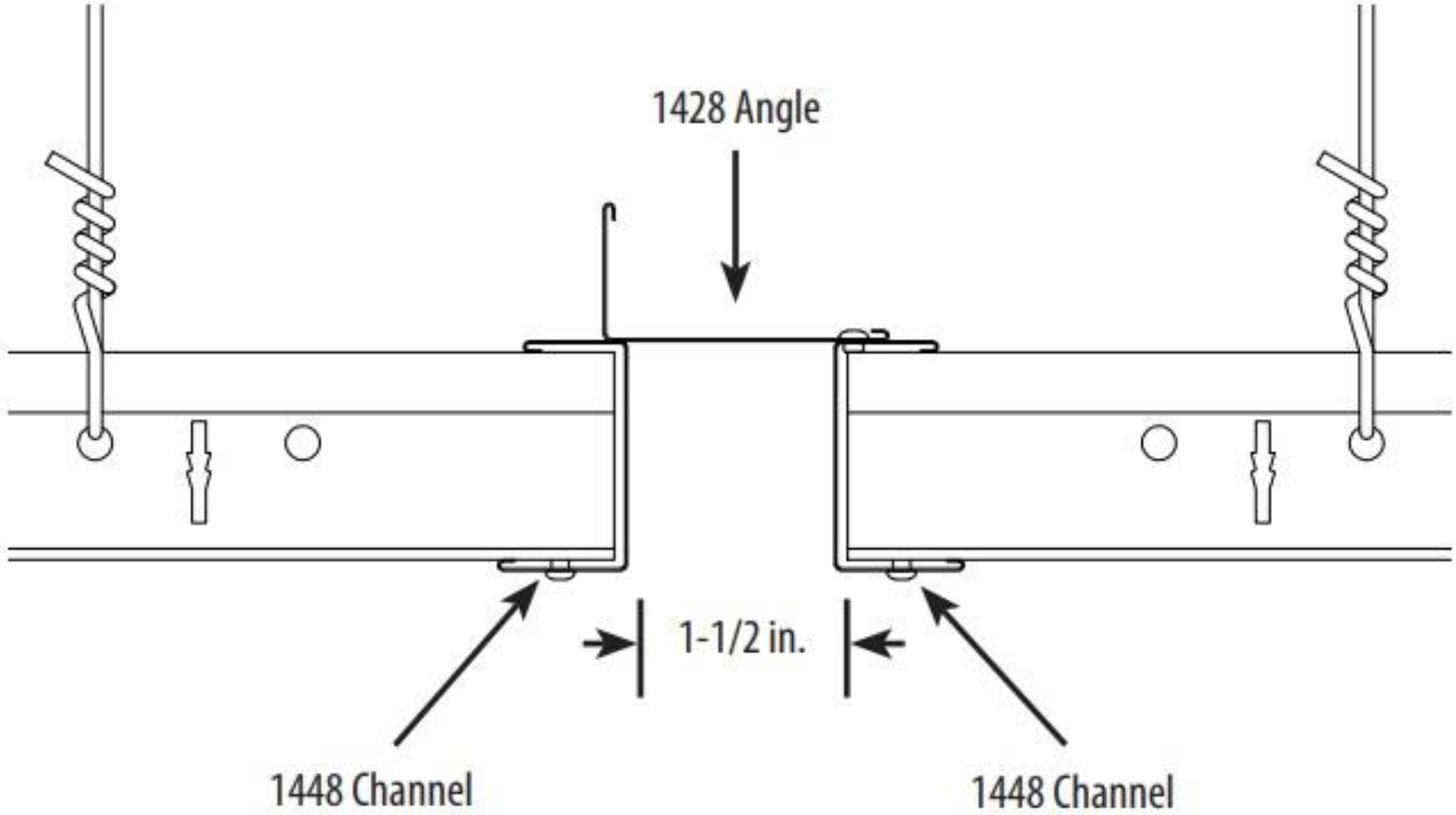
Seismic Separation Joints

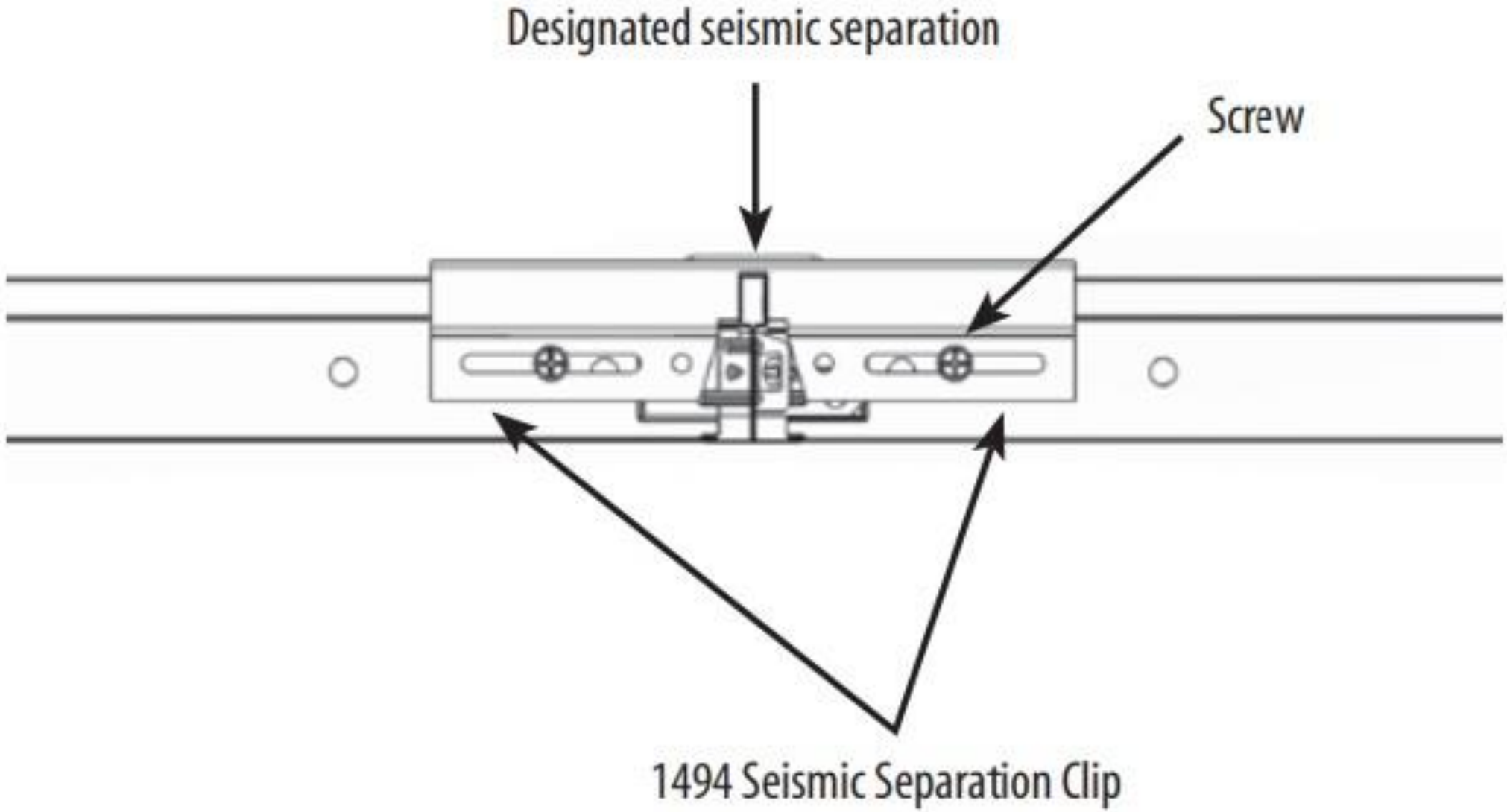
For ceiling areas exceeding 2,500 square feet, a seismic separation joint or full height wall partition that breaks the ceiling shall be provided unless analyses are performed of the ceilings bracing system, closure angles and penetrations to provide sufficient clearance.

Source: ASCE 7-10 Section 13.5.6.2.2 b

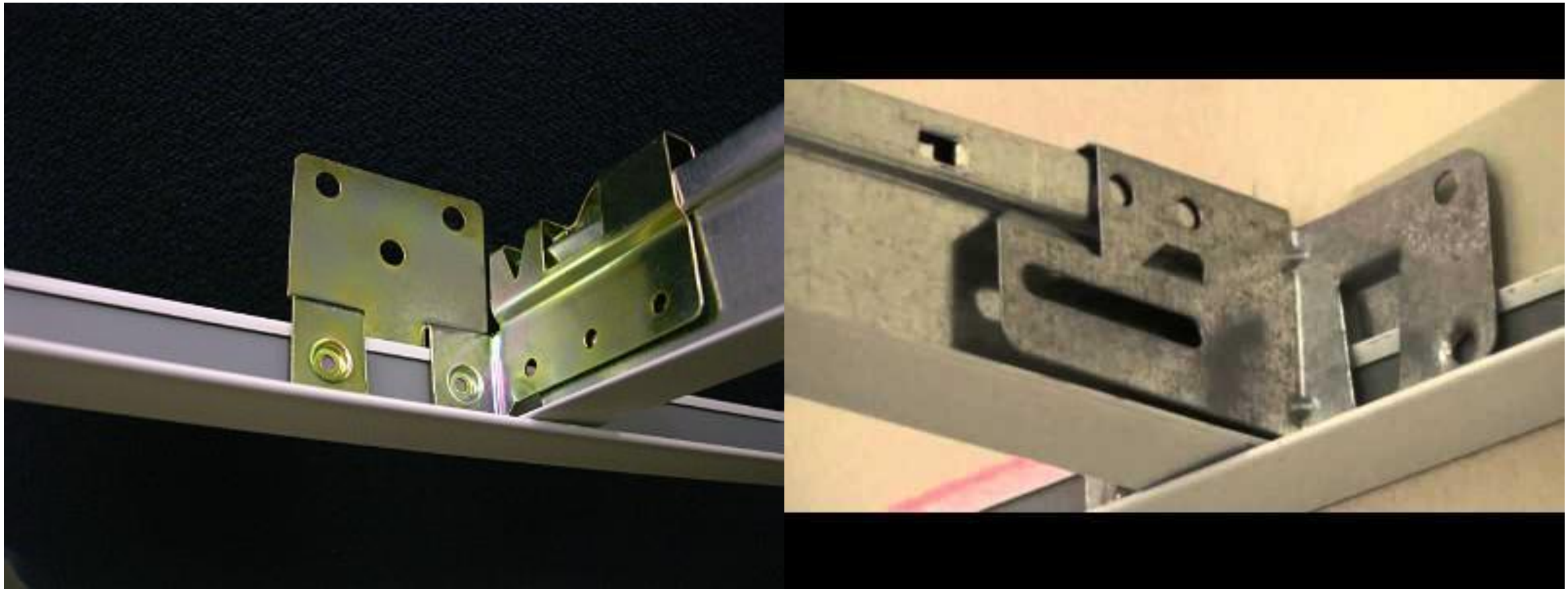
Conventional IBC Installation




1428 Angle
1-1/2 in.
1448 Channel
1448 Channel


Designated seismic separation
Screw
1494 Seismic Separation Clip

If you see grid > 144 sq.ft. < 2” angle, look for:



SEISMIC CLIPS

When using seismic clips in place of 2 inch perimeter angle, MANUFACTURER’S INSTRUCTIONS MUST BE FOLLOWED

- Armstrong
- CertainTeed
- Rockfon
- USG (CGC Logix Systems)

ICC EVALUATION SERVICE

In Cooperation with Innovation Research Labs

Most Widely Accepted and Trusted

ICC-ES Evaluation Report

ESR-1308

ICC-ES | (800) 423-6587 | (562) 699-0543 | www.icc-es.org

Reissued 12/2017

This report is subject to renewal 12/2018.

DIVISION: 09 00 00—FINISHES

SECTION: 09 22 26—SUSPENSION SYSTEMS

SECTION: 09 53 00—ACOUSTICAL CEILING SUSPENSION ASSEMBLIES

REPORT HOLDER:

WORTHINGTON ARMSTRONG VENTURE (WAVE)

101 LINDENWOOD DRIVE, SUITE 350
MALVERN, PENNSYLVANIA 19355

EVALUATION SUBJECT:

FIRE- AND NONFIRE-RESISTANCE-RATED SUSPENDED CEILING FRAMING SYSTEMS

ICC ES C ICC ES PMG C ICC ES LISTED

Look for the trusted marks of Conformity!

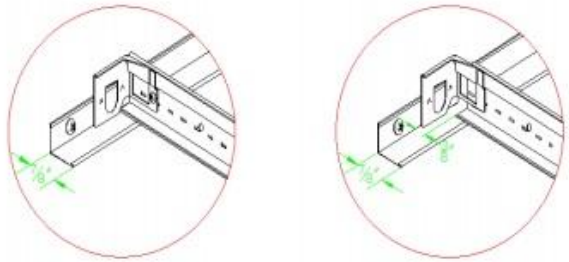
"2014 Recipient of Prestigious Western States Seismic Policy Council (WSSPC) Award in Excellence"

A Subsidiary of ICC INTERNATIONAL CODE COUNCIL

ICC-ES Evaluation Reports are not to be construed as representing aesthetics or any other attributes not specifically addressed, nor are they to be construed as an endorsement of the subject of the report or a recommendation for its use. There is no warranty by ICC Evaluation Service, LLC, express or implied, as to any finding or other matter in this report, or as to any product covered by the report.

ANSI ACCREDITED ISO/IEC 17065 Product Certification Body #1080

ICC Accredited CB-PCB OCPS Accredited CCN



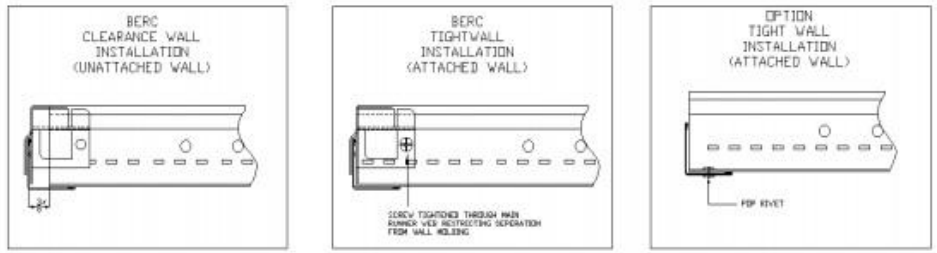
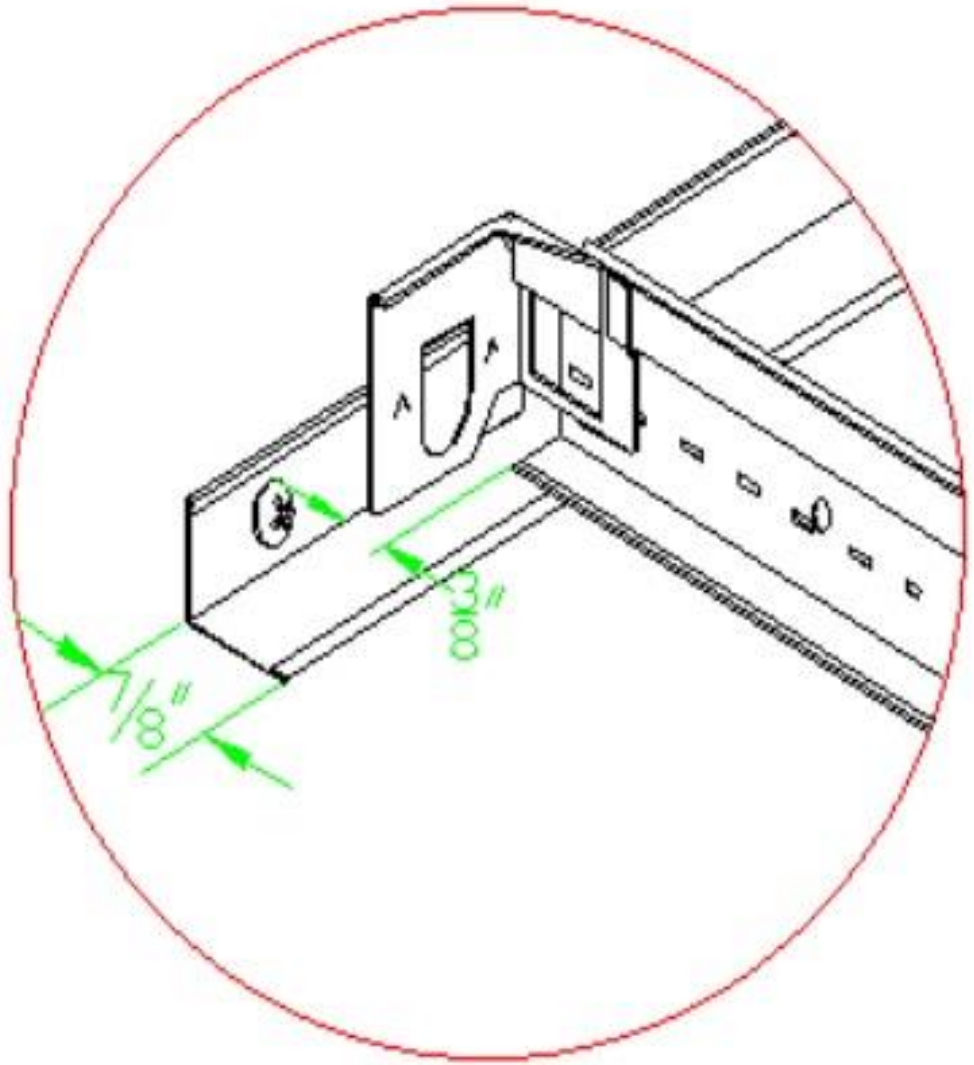
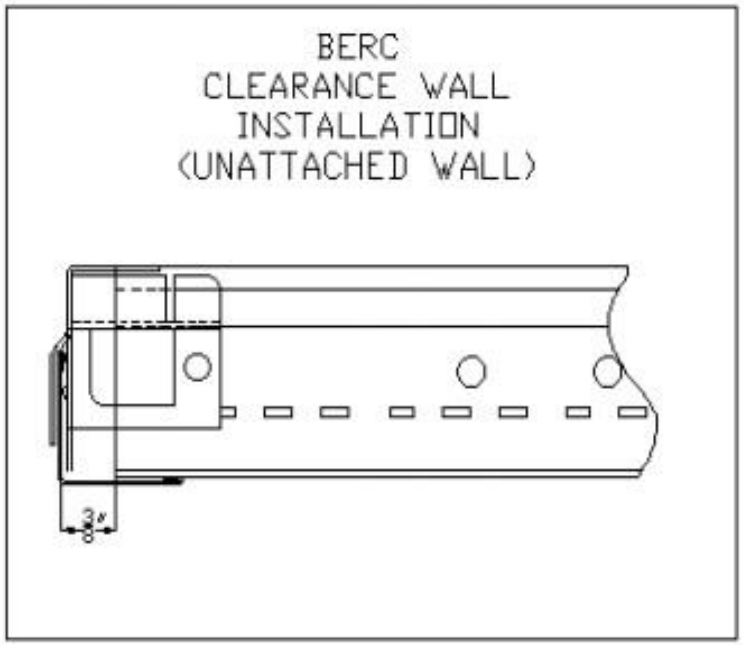
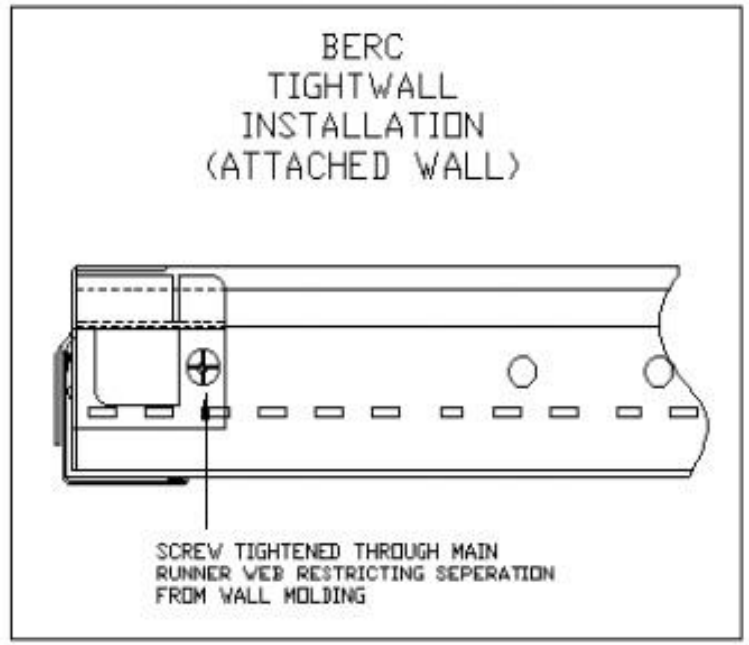


FIGURE 3—BERC CLIP







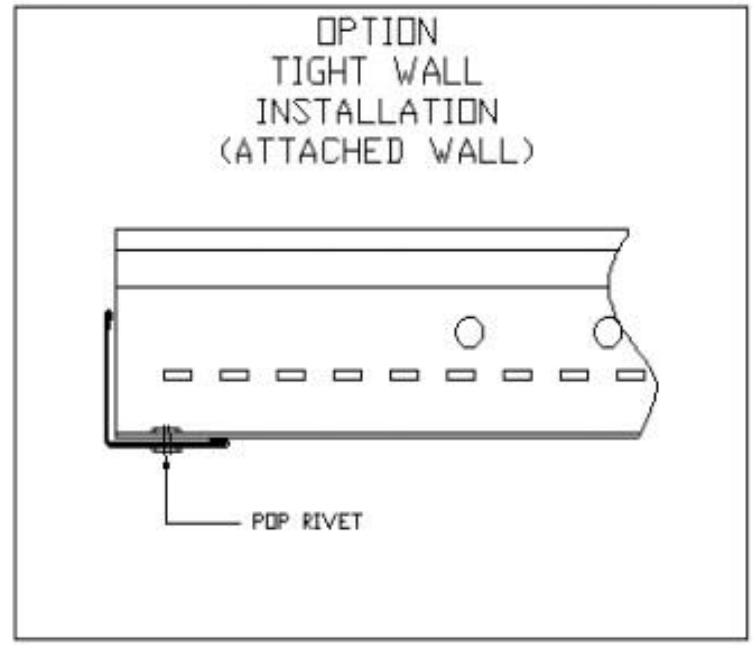
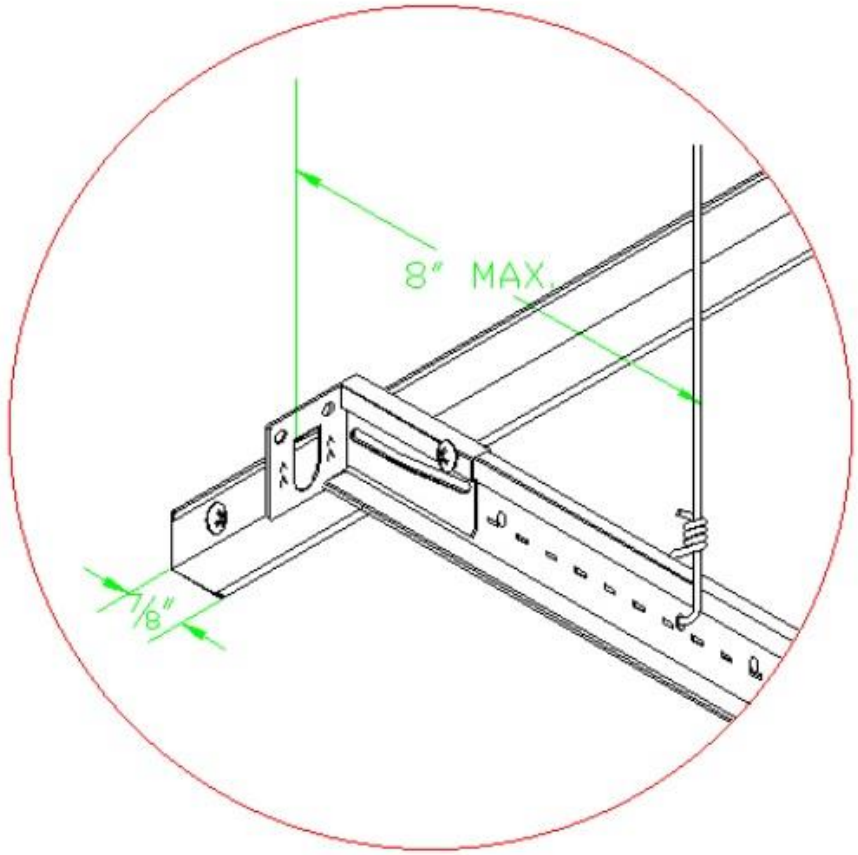
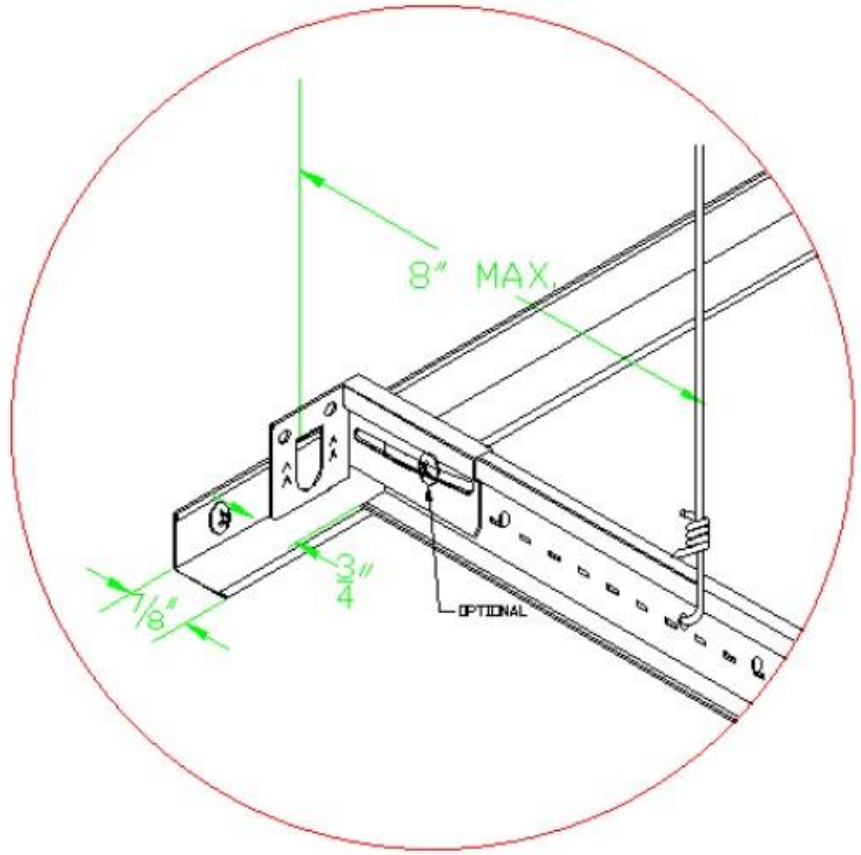
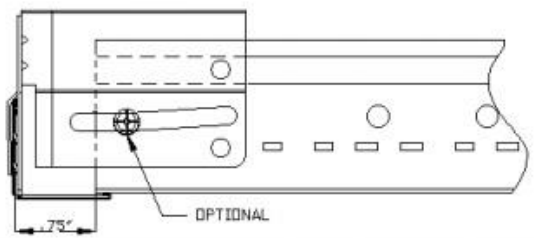


FIGURE 3—BERC CLIP

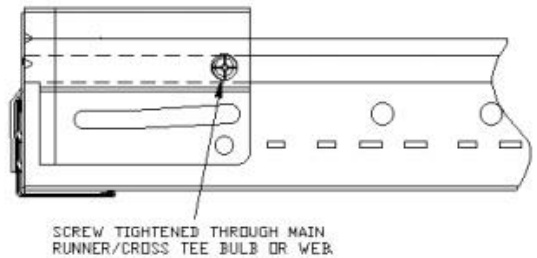




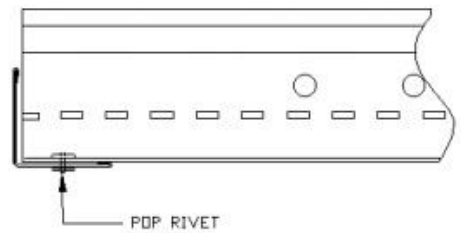
BERC 2
CLEARANCE WALL
INSTALLATION
(UNATTACHED WALL)



BERC 2
TIGHT WALL
INSTALLATION
(ATTACHED WALL)



OPTION
TIGHT WALL
INSTALLATION
(ATTACHED WALL)



When seismic clips are being used

Must check for testing/listing documents from ICC, UL, etc.

The manufacturer’s SYSTEM is being tested, not just the clips.

Therefore the manufacturer’s instructions should match the testing documentation and installer’s must install EXACTLY as shown in instructions/listing.

SUMMARY:

Determine Seismic Design Category

- Use Site Class “D” if soil type is not known
- Find S_{DS} & S_{D1} using internet
- Refer to Tables 1613.5.6 (1&2)[2006&2009 IBC], 1613.3.5(1&2)[2012&2015 IBC]

SUMMARY:

If ceiling area >144 square feet:

- Look for 2” perimeter or seismic clips, attachment & supports within 8” of wall
- Unattached sides must be tied together to prevent spreading
- If seismic clips are used, look for manufacturer’s instructions & test
- Two adjacent sides must be attached and opposite sides free
- Ensure light fixtures adequately supported
- Allowance for 1 inch movement of sprinkler heads

SUMMARY:

If ceiling area >1,000 square feet:

- Same perimeter requirements
- Look for lateral bracing every 12 feet, no more than 6 feet from edges
- Verify compression struts are installed properly
- Splay wires not more than 45^{o} from horizontal in all 4 directions

SUMMARY:

If ceiling area >2,500 square feet:

- Same perimeter & lateral bracing requirements
- Must have separation joints

IRC SEISMIC PROVISIONS

2006 - 2009 Section R301.2.2

The seismic provisions of this code shall apply to buildings constructed in Seismic Design Categories C, D_0, D_1 and D_2…..

Exception: Detached 1 & 2 family in Category C are exempt.

(1 & 2 family dwellings, seismic provisions apply to “D”)

IRC SEISMIC PROVISIONS
2012 - 2015 Section R301.2.2

The seismic provisions of this code shall apply as follows:

1. Townhouses in Categories C, D_0, D_1 and D_2

2. Detached 1 & 2 family in Categories D_0, D_1 and D_2

(effectively the same as 2006-2009 editions)

DETERMINATION OF SEISMIC DESIGN CATEGORY

… in accordance with Figure R301.2(2)

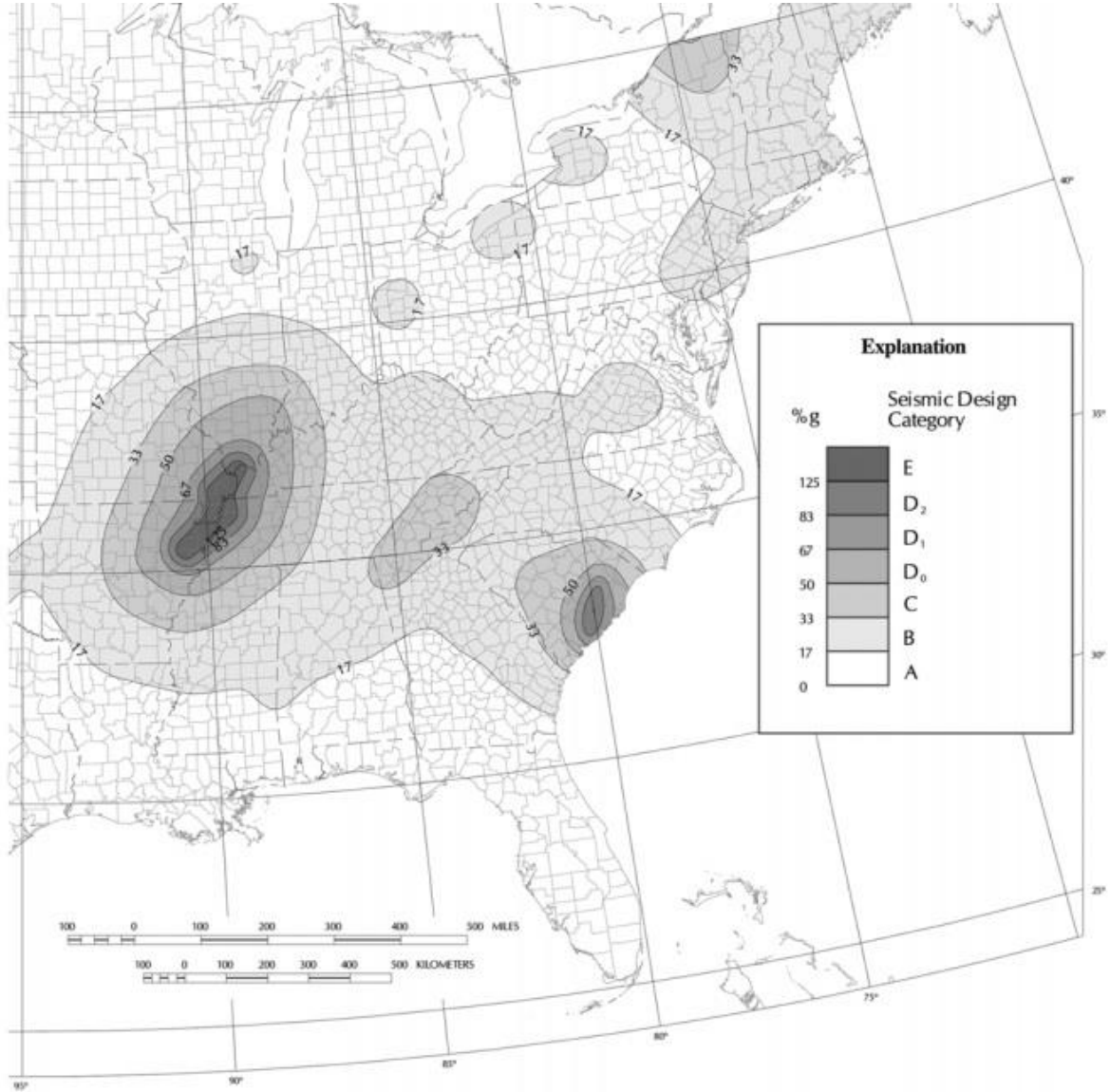
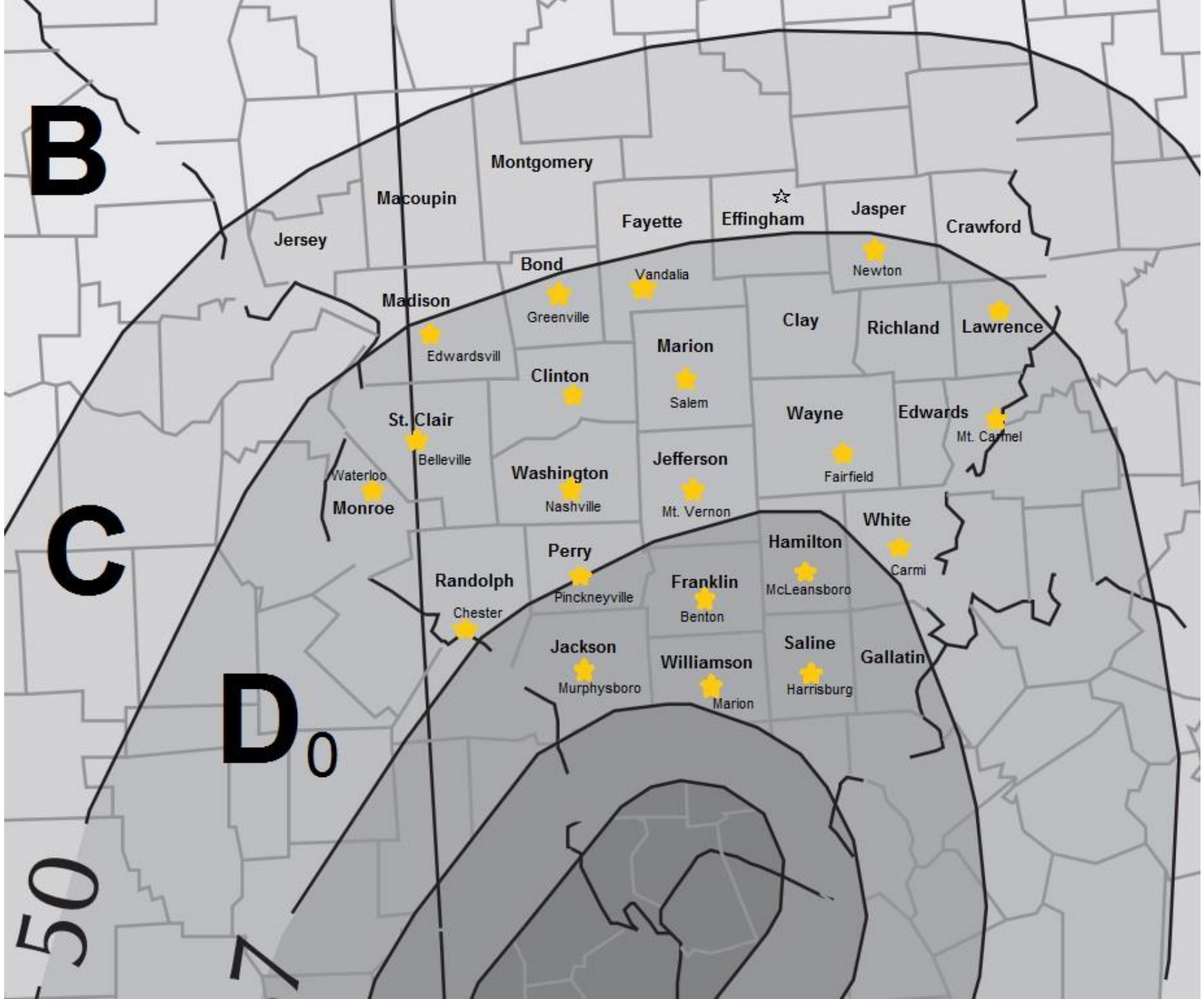


FIGURE R301.2(2)—continued
SEISMIC DESIGN CATEGORIES—SITE CLASS D


B
C
D0
Montgomery
Macoupin
Jersey
Fayette
Effingham
Jasper
Crawford
Bond
Vandalia
Newton
Madison
Greenville
Edwardsvill
Clay
Richland
Lawrence
Marion
Clinton
Salem
St. Clair
Belleville
Wayne
Edwards
Mt. Carmel
Waterloo
Monroe
Washington
Nashville
Jefferson
Mt. Vernon
Fairfield
White
Carmi
Hamilton
McLeansboro
Perry
Pinckneyville
Randolph
Chester
Franklin
Benton
Jackson
Murphysboro
Williamson
Marion
Saline
Harrisburg
Gallatin
50
1

R301.2.2.1.1
Alternate determination of seismic design category.

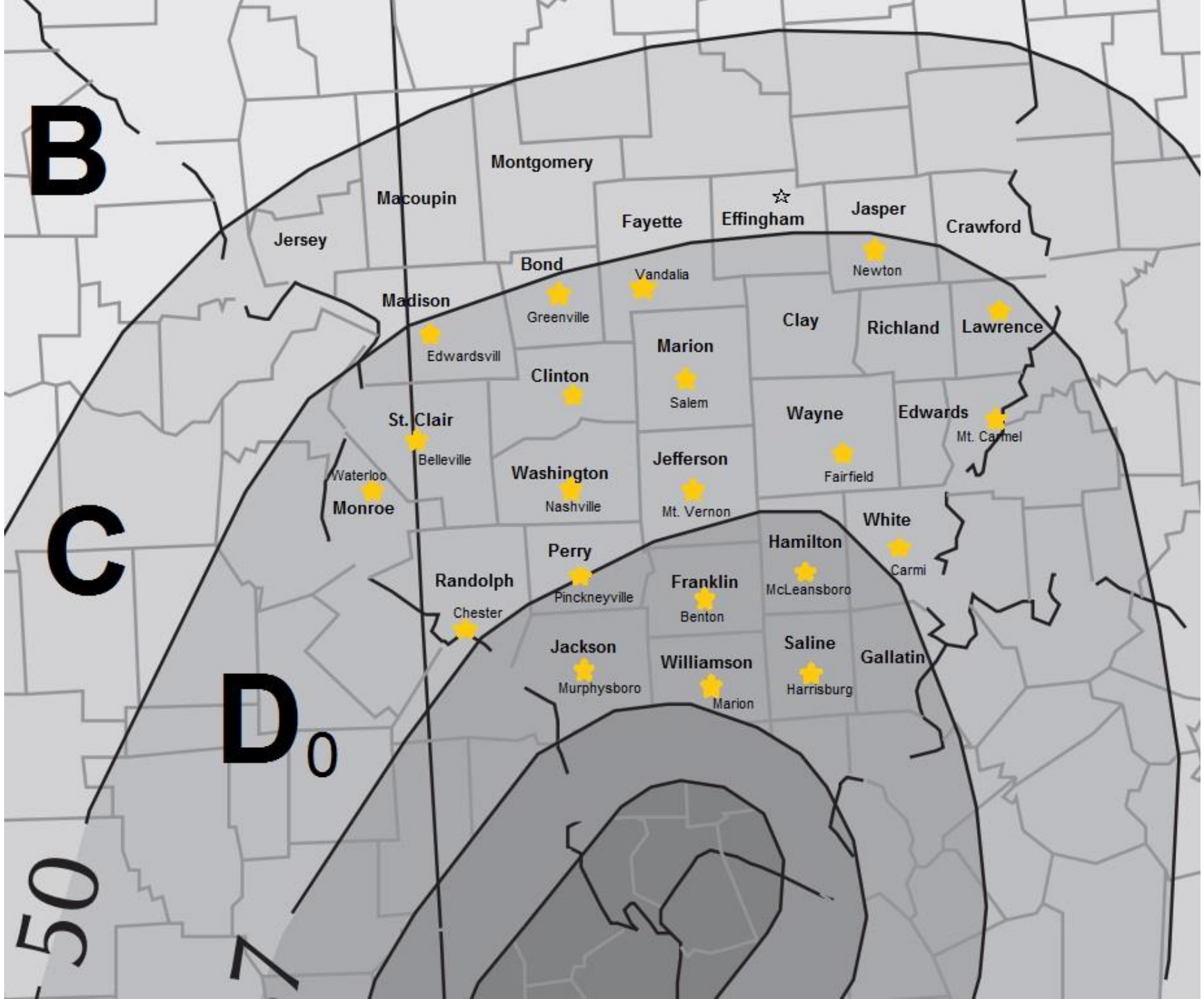
Use S_{DS} for site class with Table R301.2.2.1.1

(similar to IBC method)

R301.2.2.2 Seismic Design Category C. (2009-2015)
(section numbers & format changed after 2006)

R301.2.2.2.1 Weights of materials.

Average dead loads shall not exceed 15 pounds per square foot for the combined roof and ceiling assemblies (on a horizontal projection) or 10 pounds per square foot for floor assemblies, except as further limited by Section R301.2.2……..
(required in all design categories in 2006)


B
C
D0
Montgomery
Macoupin
Jersey
Fayette
Effingham
Jasper
Crawford
Bond
Vandalia
Newton
Madison
Greenville
Edwardsvill
Clay
Richland
Lawrence
Marion
Clinton
Salem
St. Clair
Belleville
Wayne
Edwards
Mt. Carmel
Waterloo
Monroe
Washington
Nashville
Jefferson
Mt. Vernon
Fairfield
White
Carmi
Hamilton
McLeansboro
Perry
Pinckneyville
Randolph
Chester
Franklin
Benton
Jackson
Murphysboro
Williamson
Marion
Saline
Harrisburg
Gallatin
50
1

R301.2.2.3 (2009 – 2015) Seismic Design Categories D_0, D_1, and D_2.

This section changed significantly from 2006 – 2009 including different section numbers.

R301.2.2.4 Seismic Design Category E. (added 2009)

Dwellings in Category E shall be designed in accordance with IBC. (Cairo & Vienna?)

Construction affected in Category “D”

- Height limitations
- Stone & masonry veneer & chimneys
- Masonry & concrete construction
- Anchorage of water heaters (2009 – 2015)
- Footings & slabs with turned-down footings (R403)
- Foundations (R404)
- Floors (Chapter 5)
- Wall construction & bracing (Chapter 6)
- Roof Sheathing (R803)

Residential mechanical affected in Category “D”

- Anchorage of appliances D_1 & D_2 2006 - 2012, D_0 (M1307 added 2015)
- Thermal storage unit for solar energy systems (M2301 added 2015)
- Fuel gas supports (G2404)

Residential Footing/Foundation Reinforcement

SECTION R403 FOOTINGS (2006-2015 IRC)
R403.1 General. All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footings, crushed stone footings, wood foundations, or other *approved* structural systems… of sufficient design…

…shall be supported on undisturbed natural soils or engineered fill.

Residential Footing/Foundation Reinforcement

R403.1.2 Continuous footing in Seismic Design Categories D_0, D_1 and D_2. Exterior walls of buildings located in Seismic Design Categories D_0, D_1 and D_2 shall be supported by continuous solid or fully grouted masonry or concrete footings. (2015 IRC) added 2 story requirement & exceptions

2006-2012 Editions "The *braced wall panels* at exterior walls… shall be supported by continuous footings."

All required interior *braced wall panels* with plan dimensions greater than 50 feet shall be supported by continuous footings.

Seismic Reinforcing

R403.1.3 Footing and stem wall reinforcing in Seismic Design Categories D_0, D_1, and D_2. (2015)
Concrete footings located in Seismic Design Categories D_0, D_1 and D_2, as established in Table R301.2(1), shall have minimum reinforcement in accordance with this section and Figure R403.1.3. Reinforcement shall be installed with support and cover in accordance with Section R403.1.3.5

Seismic Reinforcing. (2006-2012)
Concrete footings located… as established in Table R301.2(1), shall have minimum reinforcement. “Bottom reinforcement shall be located a minimum of 3 inches clear from bottom of footing.”

TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

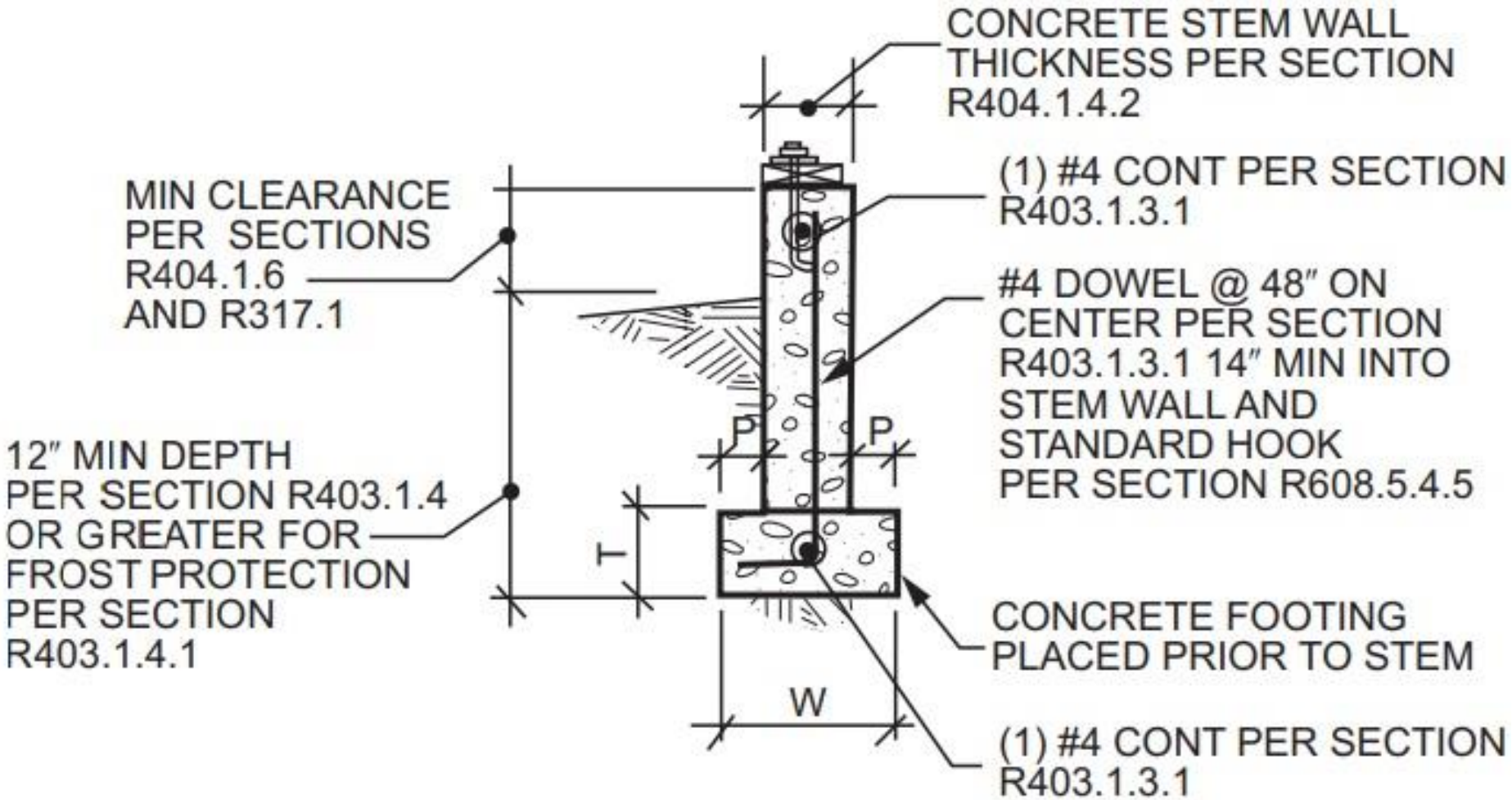
GROUND SNOW LOAD	WIND DESIGN				SEISMIC DESIGN CATEGORY[f]	SUBJECT TO DAMAGE FROM			WINTER DESIGN TEMP[e]	ICE BARRIER UNDERLAYMENT REQUIRED[h]	FLOOD HAZARDS[g]	AIR FREEZING INDEX[i]	MEAN ANNUAL TEMP[j]
	Speed[d] (mph)	Topographic effects[k]	Special wind region[l]	Wind-borne debris zone[m]		Weathering[a]	Frost line depth[b]	Termite[c]					

For SI: 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.

2009 added wind “Topographic effects”

2015 added “Special wind region” and “Wind-born debris zone”

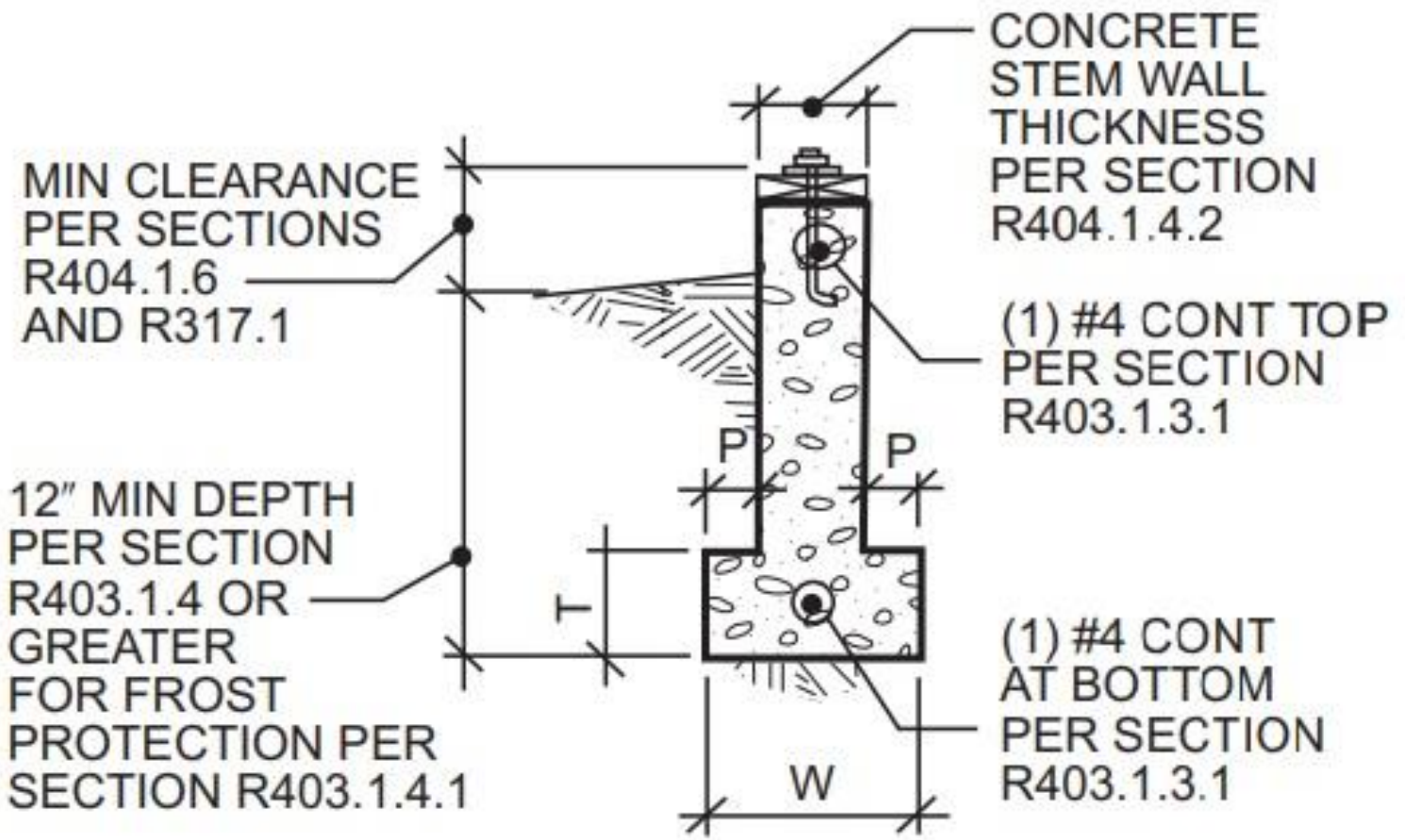
Figure R403.1.3 (2015 IRC)



5 BASEMENT OR CRAWL SPACE
CONCRETE STEM WALL AND SPREAD FOOTING

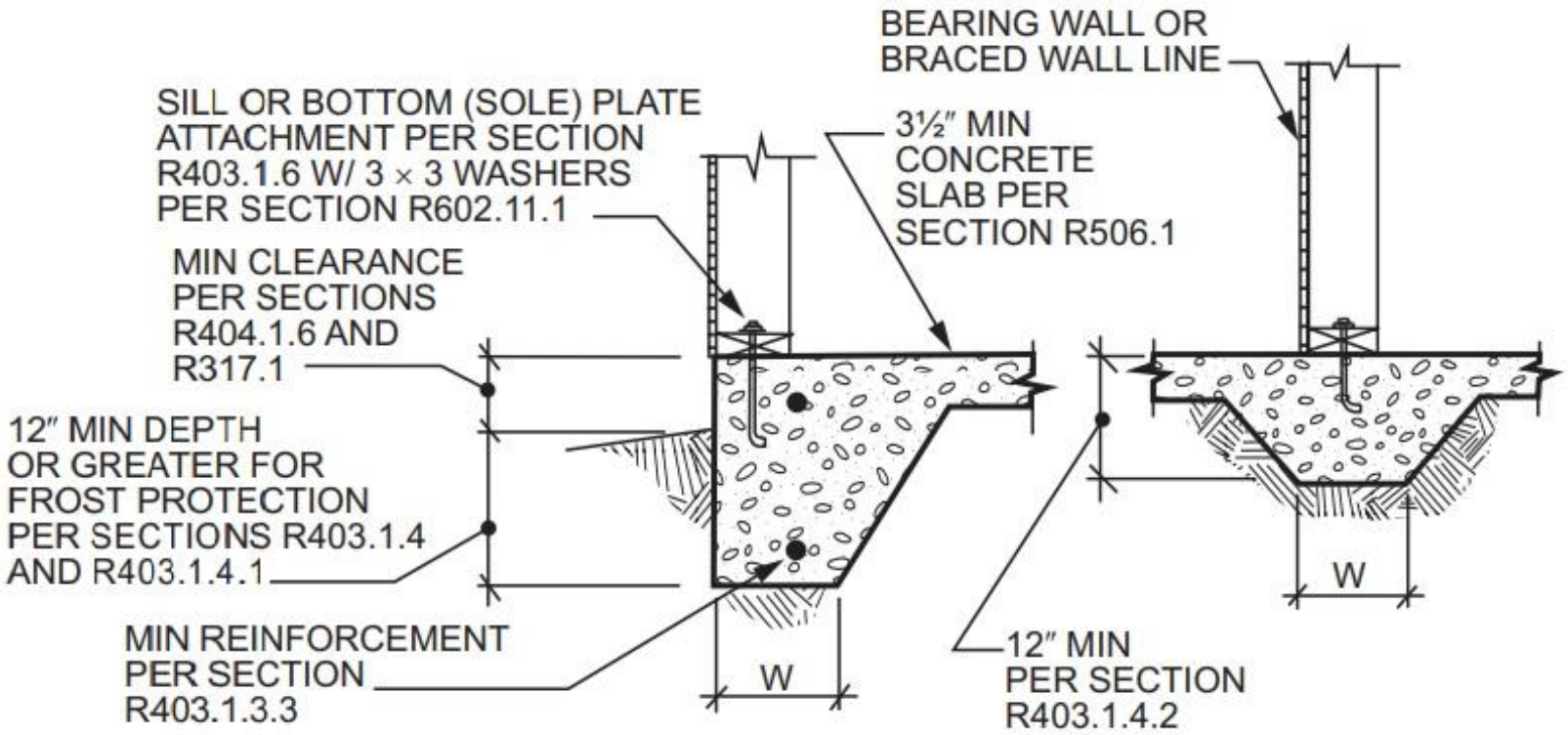
SCALE: NOT TO SCALE

Figure R403.1.3 (2015 IRC)



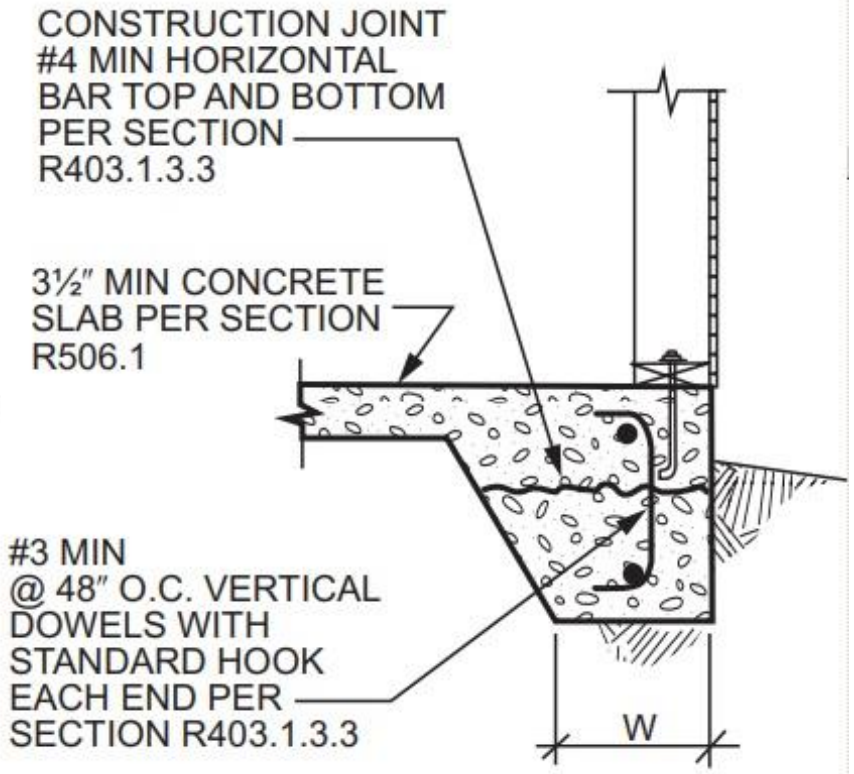
6 BASEMENT OR CRAWL SPACE WITH MONOLITHIC CONCRETE STEM WALL AND SPREAD FOOTING

SCALE: NOT TO SCALE



1 SLAB-ON-GROUND WITH MONOLITHIC TURNED-DOWN FOOTING

SCALE: NOT TO SCALE



2 DOWELS FOR SLAB-ON-GROUND WITH TURNED-DOWN FOOTINGS

SCALE: NOT TO SCALE

Seismic Reinforcing

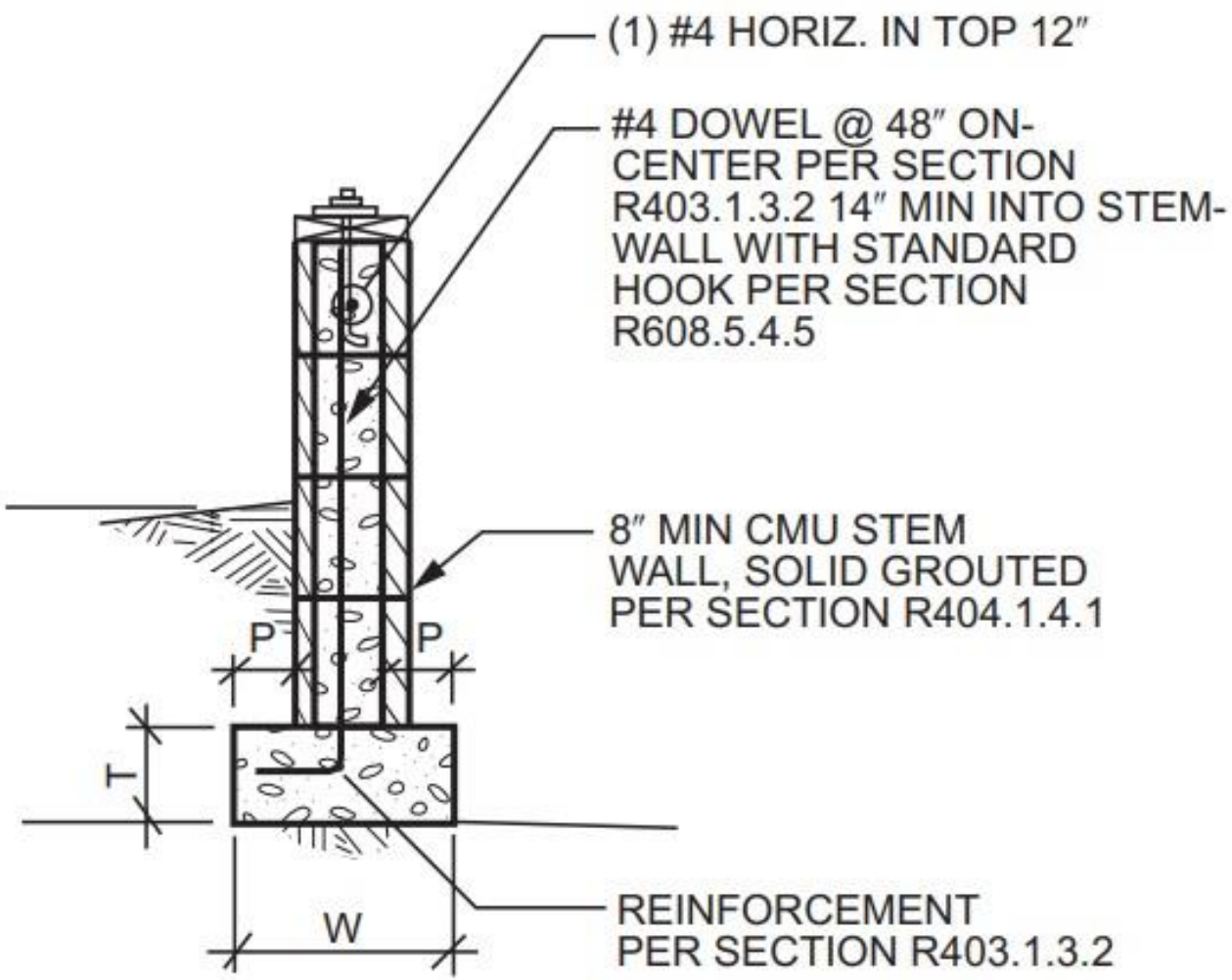
R403.1.3.1 Concrete stem walls with concrete footings. In Seismic Design Categories D_0, D_1 and D_2 where a construction joint is created between a concrete footing and a concrete stem wall, a minimum of one No. 4 vertical bar shall be installed at not more than 4 feet on center. "The vertical bar shall have a standard hook and extend to the bottom of the footing and shall have support and cover as specified in Section R403.1.3.5.3 and extend a minimum of 14 inches into the stem wall." (2015)

"The vertical bar shall extend to 3 inches clear of the bottom of the footing, have a standard hook and extend to the bottom of the footing and extend a minimum of 14 inches into the stem wall." (2006-2012)

Seismic Reinforcing

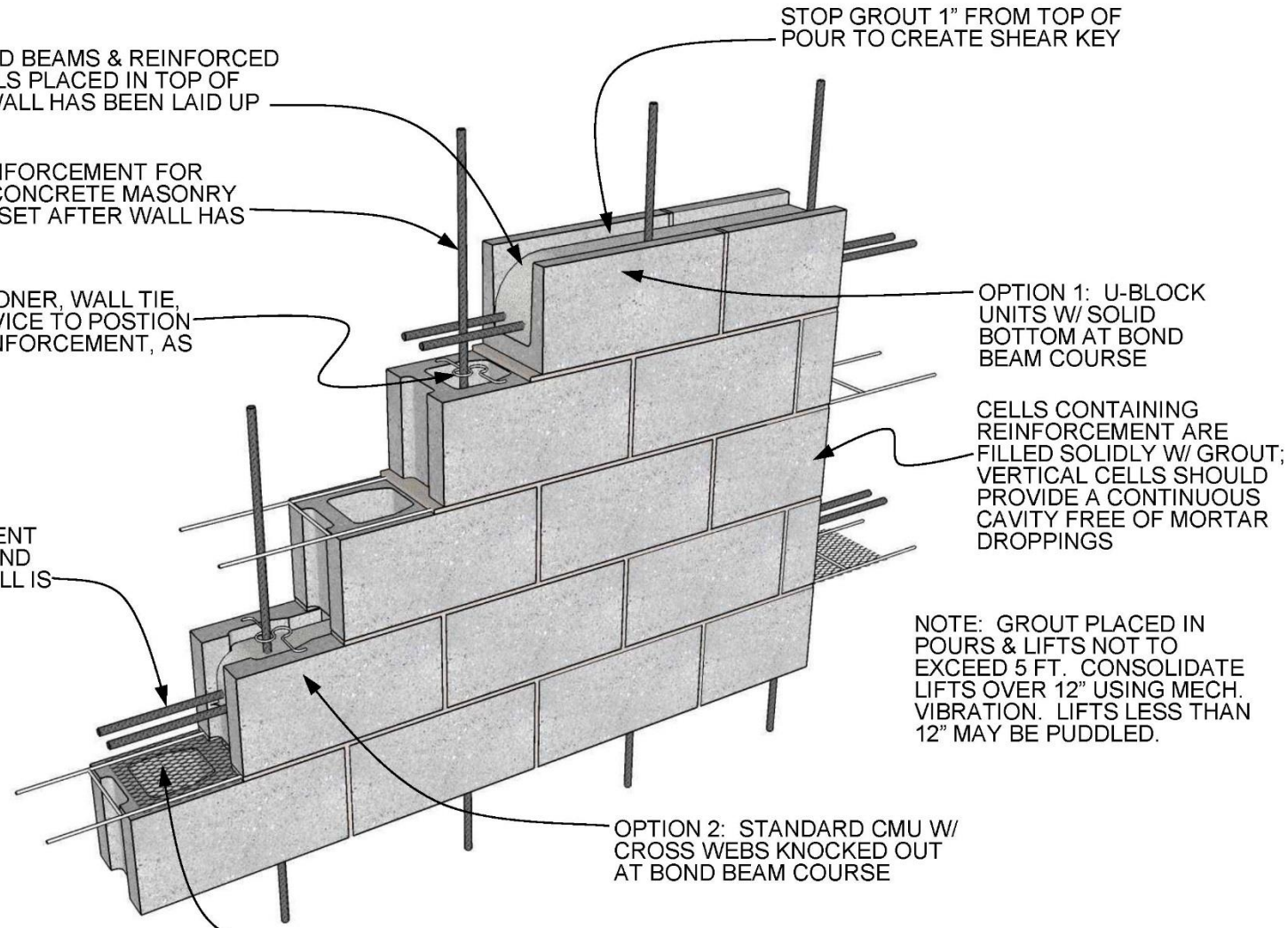
R403.1.3.2 Masonry stem walls with concrete footings.
… where a masonry stem wall is supported on a concrete footing, a minimum of one No. 4 vertical bar shall be installed at not more than 4 feet on center. The vertical bar shall have a standard hook and extend to the bottom of the footing and shall have support and cover as specified in Section R403.1.3.5.3 and extend a minimum of 14 inches into the stem wall. Standard hooks shall comply with Section R608.5.4.5. A minimum of one No. 4 horizontal bar shall be installed within 12 inches of the top of the wall and one No. 4 horizontal bar shall be located 3 to 4 inches from the bottom of the footing. Masonry stem walls shall be solid grouted. (2015)

Figure R403.1.3 (2015 IRC)



4 BASEMENT OR CRAWL SPACE WITH MASONRY STEM WALL AND SPREAD FOOTING

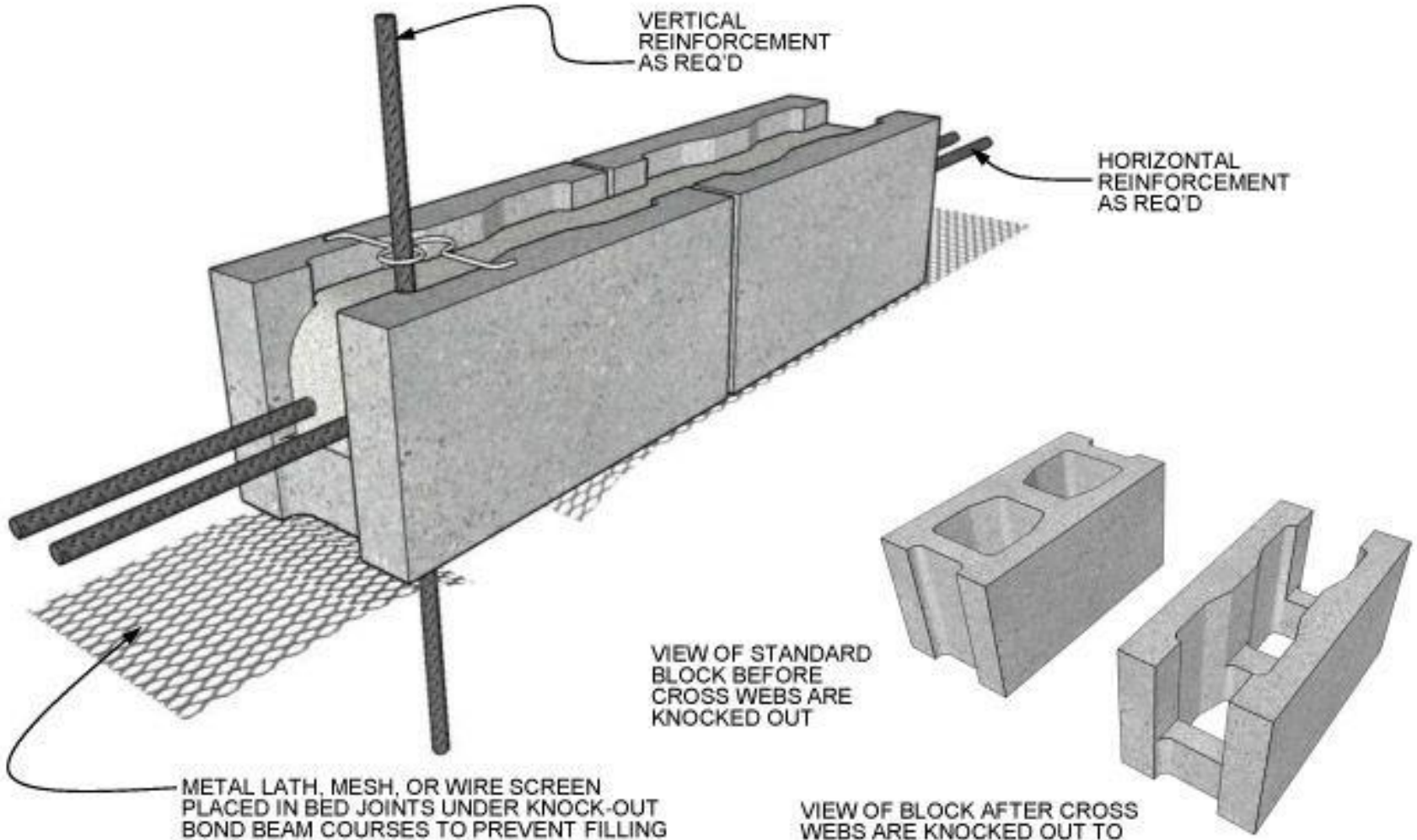
SCALE: NOT TO SCALE



LOW LIFT GROUTING PROCEDURES

DETAIL 02.410.0131 REV. 06/30/10

International Masonry Institute
team MASONRY DETAILING SERIES
800-IMI-0988 www.imiweb.org



KNOCK-OUT CMU BOND BEAMS

DIAGRAM 02.410.0141 REV. 11/30/10

International Masonry Institute

team IMI MASONRY DETAILING SERIES

800-IMI-0988 www.imiweb.org

Seismic Reinforcing

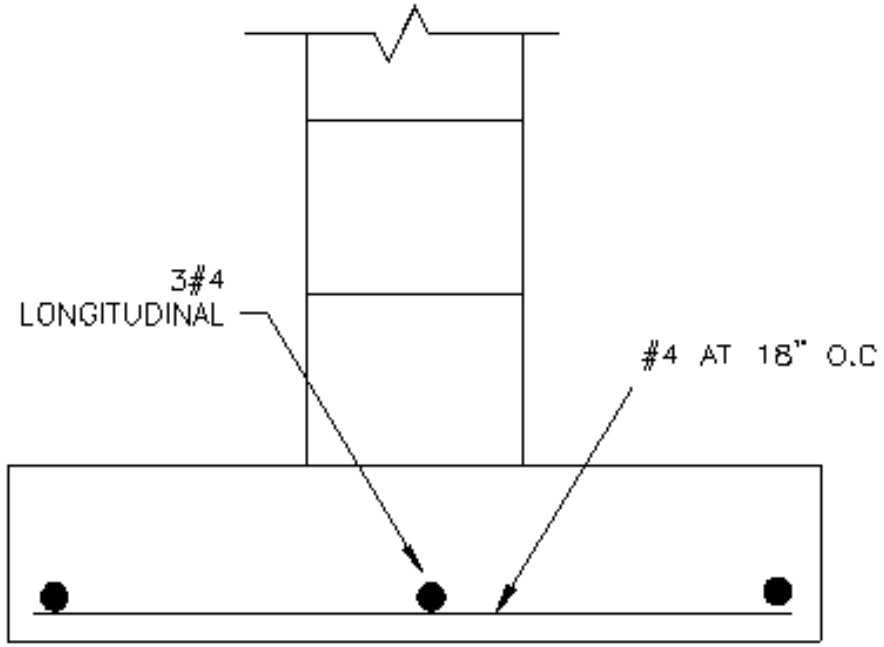
2006-2009

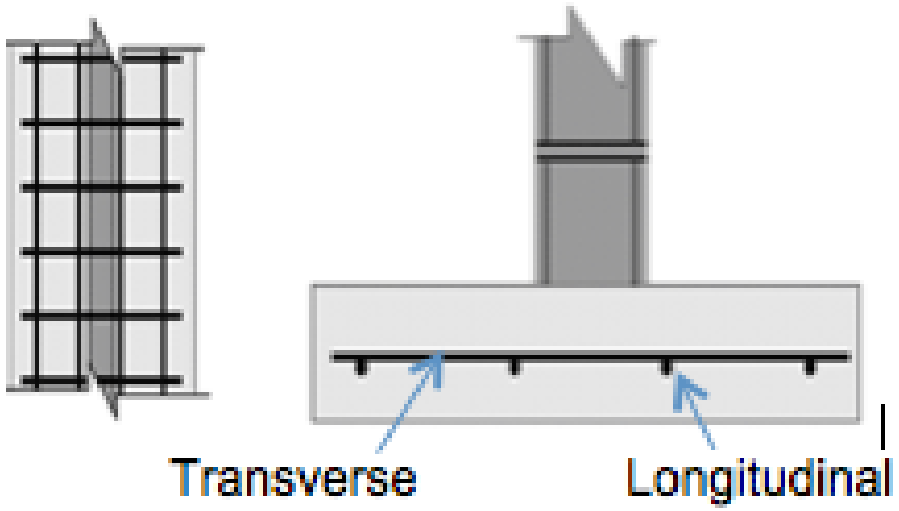
"… masonry stem walls without solid grout and vertical reinforcing are not permitted."

Exception: In detached one-and two-family dwellings which are three stories or less in height and constructed with stud bearing walls, plain concrete footings without longitudinal reinforcement supporting walls and isolated plain concrete footings supporting columns or pedestals are permitted.

This exception changed in 2012 & deleted in 2015

Longitudinal Reinforcing





Seismic Reinforcing

R403.1.3.6 Isolated concrete footings. In detached one- and two-family dwellings that are three stories or less in height and constructed with stud bearing walls, isolated plain concrete footings supporting columns or pedestals are permitted. (added 2015)

Summary Seismic Reinforcing in Category “D” IRC

2003-2015

Continuous footings required

Masonry block with solid grout

Vertical bars no more than 4 feet apart (unless single pour)

Townhouses & more than 3 story longitudinal reinforcement

Horizontal bar within 12 inches of top of stem walls

#4 minimum size bar, 3” from bottom, 14” into stem wall w/hook

Summary Seismic Reinforcing in Category “D” IRC

2012-2015

Continuous footings required

Masonry block with solid grout

Vertical bars no more than 4 feet apart (unless single pour)

Longitudinal reinforcement, no plain concrete footings

Horizontal bar within 12 inches of the top of stem walls

#4 minimum size bar, 3” from bottom, 14” into stem wall w/hook

Summary Seismic Reinforcing in Category “D” IRC

2003-2009

Plain concrete footings allowed by exception for 1 & 2 family detached which are 3 stories or less, stud bearing walls without stem walls (longitudinal reinforcement required when stem walls exists)