

Residential Seismic Code Review

- The purpose of this code (InRC) is to provide minimum requirements for safety and to safeguard property, public safety, and general welfare through affordability, by regulating and controlling the design, construction, installation, and quality of materials of residential structures as regulated by this code.

- The following text of amendments for chapters 3 and 4 are to address the concerns of local home builders and building officials concerning the placement of Vanderburgh, Warrick, Posey, and Gibson Counties in a Seismic Design Category D₀.

Fiscal Impact:

Increased requirements for meeting these new proposed regulations will greatly impact the residential construction industry.

The following sections are some examples of the 2009 International Residential Code's increased requirements over what is now practiced in home construction for this area:

- 301.2
- 401.1
- 403.1
- 404.1
- 502.3
- 502.7
- 602.3
- 602.10
- 602.11
- 602.12
- 702.3.7
- 1001.3
- 1001.4
- 1002.4
- 1003.3
- 1003.4
- 2801.7

The changes in these requirements include:

- Increased wall bracing requirements
- Increased stem wall requirements
- Increased height limitations
- Increased steel reinforcement requirements
- Increased concrete compressive strength requirements
- Increased framing and bracing requirements
- Increased requirements for hiring Design Professionals
- Increased wall anchorage requirements

- Increased interior braced wall line requirements
- Increased exterior braced wall line requirements
- Increased veneer anchorage
- Increased veneer limitations

These costs easily add up to over \$2,000.00 per home on a very conservative 1,000 sq ft one story dwelling.

As a coalition of home builders and building officials we are addressing the current threat of seismic activity by continuing with the C₁ SDC.

Under these amendments home construction and applicable remodeling are required to have:

- Steel reinforcement in the footings
- Masonry chimney anchorage
- Ruble stone foundations are not allowed
- Water heaters, both gas and electric, are required to be restrained.

As this seismic package is parallel to existing standards, no impact is expected.

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

Change the SDC:

No. County	Wind	Speed1	(MPH)	Seismic	Zone2	Ground	Snow	(PSF)	Foundation3	Winter	Design	Temp Decay Termite Weathering4
87 Warrick				C ₁								
82 Vanderburgh				C ₁								
65 Posey				C ₁								
26 Gibson				C ₁								

R301.2.2 Seismic provisions.

Add to read as follows:

The seismic provisions of this code shall apply to buildings constructed in Seismic Design Categories C, C₁, D₀, D₁ and D₂, as determined in accordance with this section.

R301.2.2.1 Determination of seismic design category.

Delete without substitution:

~~Buildings shall be assigned a seismic design category in accordance with Figure R301.2(2).~~

R301.2.2.1.1 Alternate determination of seismic design category.

Delete and substitute as follows:

~~The Seismic Design Categories and corresponding Short Period Design Spectral Response Accelerations, SDS shown in Figure R301.2(2) are based on soil Site Class D, as defined in Section 1613.5.2 of the International Building Code. If soil conditions are other than Site Class D, the Short Period Design Spectral Response Accelerations, SDS, for a site can be determined according to Section 1613.5 of the International Building Code. The value of SDS determined according to Section 1613.5 of~~

the International Building Code is permitted to be used to set the seismic design category according to Table R301.2.2.1.1, and to interpolate between values in Tables R602.10.1, R603.7 and other seismic design requirements of this code.

Change SECTION R301.2.2.1.1 as follows:

(a) Change the first sentence to read as follows: The Seismic Design Categories and corresponding Short Period Design Spectral Response Accelerations, S_{DS} , are based on soil Site Class D, as defined in the Indiana Building Code, 675 IAC 13.

(b) Change the second sentence to read as follows: If soil conditions are other than Site Class D, the Short Period Design Spectral Response Acceleration, S_{DS} , for a site can be determined according to the Indiana Building Code, 675 IAC 13.

(c) Change the third sentence to read as follows: The value of S_{DS} determined according to the Indiana Building Code, 675 IAC 13, is permitted to be used to set the Seismic Design Category according to TABLE R301.2.2.1.1, and to interpolate between values in TABLES R602.10.3 and R603.7 and other seismic design requirements of this code.

R301.2.2.2 Seismic Design Category C.

Delete without substitution:

~~Structures assigned to Seismic Design Category C shall conform to the requirements of this section.~~

~~R301.2.2.2.1 Weights of materials.~~

~~Average dead loads shall not exceed 15 pounds per square foot (720 Pa) for the combined roof and ceiling assemblies (on a horizontal projection) or 10 pounds per square foot (480 Pa) for floor assemblies, except as further limited by Section R301.2.2. Dead loads for walls above grade shall not exceed:~~

- ~~1. Fifteen pounds per square foot (720 Pa) for exterior light frame wood walls.~~
- ~~2. Fourteen pounds per square foot (670 Pa) for exterior light frame cold formed steel walls.~~
- ~~3. Ten pounds per square foot (480 Pa) for interior light frame wood walls.~~
- ~~4. Five pounds per square foot (240 Pa) for interior light frame cold formed steel walls.~~
- ~~5. Eighty pounds per square foot (3830 Pa) for 8-inch-thick (203 mm) masonry walls.~~
- ~~6. Eighty five pounds per square foot (4070 Pa) for 6-inch-thick (152 mm) concrete walls.~~
- ~~7. Ten pounds per square foot (480 Pa) for SIP walls.~~

~~Exceptions:~~

- ~~1. Roof and ceiling dead loads not exceeding 25 pounds per square foot (1190 Pa) shall be permitted provided the wall bracing amounts in Chapter 6 are increased in accordance with Table R301.2.2.2.1.~~
- ~~2. Light frame walls with stone or masonry veneer shall be permitted in accordance with the provisions of Sections R702.1 and R703.~~
- ~~3. Fireplaces and chimneys shall be permitted in accordance with Chapter 10.~~

~~TABLE R301.2.2.2.1
WALL BRACING ADJUSTMENT FACTORS BY
ROOF COVERING DEAD LOAD_a~~

~~WALL SUPPORTING — ROOF/CEILING
DEAD LOAD —
15 psf or less — 25 psf —~~

Roof only — 1.0 — 1.2 —
Roof plus one or two stories — 1.0 — 1.1 —

For SI: 1 pound per square foot = 0.0479 kPa.

a. — Linear interpolation shall be permitted.

R301.2.2.2.2 Stone and masonry veneer.

Anchored stone and masonry veneer shall comply with the requirements of Sections R702.1 and R703.

R301.2.2.2.3 Masonry construction.

Masonry construction shall comply with the requirements of Section R606.11.2.

R301.2.2.2.4 Concrete construction.

Detached one- and two-family dwellings with exterior above-grade concrete walls shall comply with the requirements of Section R611, PCA 100 or shall be designed in accordance with ACI 318. Townhouses with above-grade exterior concrete walls shall comply with the requirements of PCA 100 or shall be designed in accordance with ACI 318.

R301.2.2.2.5 Irregular buildings.

Prescriptive construction as regulated by this code shall not be used for irregular structures located in Seismic Design Categories C, D0, D1 and D2. Irregular portions of structures shall be designed in accordance with accepted engineering practice to the extent the irregular features affect the performance of the remaining structural system. When the forces associated with the irregularity are resisted by a structural system designed in accordance with accepted engineering practice, design of the remainder of the building shall be permitted using the provisions of this code. A building or portion of a building shall be considered to be irregular when one or more of the following conditions occur:

1. — When exterior shear wall lines or braced wall panels are not in one plane vertically from the foundation to the uppermost story in which they are required.

Exception: For wood light frame construction, floors with cantilevers or setbacks not exceeding four times the nominal depth of the wood floor joists are permitted to support braced wall panels that are out of plane with braced wall panels below provided that:

1. — Floor joists are nominal 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.

2. — The ratio of the back span to the cantilever is at least 2 to 1.

3. — Floor joists at ends of braced wall panels are doubled.

4. — For wood frame construction, a continuous rim joist is connected to ends of all cantilever joists. When spliced, the rim joists shall be spliced using a galvanized metal tie not less than 0.058 inch (1.5 mm) (16-gage) and 1 1/2 inches (38 mm) wide fastened with six 16d nails on each side of the splice or a block of the same size as the rim joist of sufficient length to fit securely between the joist space at which the splice occurs fastened with eight 16d nails on each side of the splice; and

5. — Gravity loads carried at the end of cantilevered joists are limited to uniform wall and roof loads and the reactions from headers having a span of 8 feet (2438 mm) or less.

2. — When a section of floor or roof is not laterally supported by shear walls or braced wall lines on all edges.

Exception: Portions of floors that do not support shear walls or braced wall panels above, or roofs, shall be permitted to extend no more than 6 feet (1829 mm) beyond a shear wall or braced wall line.

3. — When the end of a braced wall panel occurs over an opening in the wall below and ends at a horizontal distance greater than 1 foot (305 mm) from the edge of the opening. This provision is applicable to shear walls and braced wall panels offset in plane and to braced wall panels offset out of plane as permitted by the exception to Item 1 above.

Exception: For wood light frame wall construction, one end of a braced wall panel shall be permitted to extend more than 1 foot (305 mm) over an opening not more than 8 feet (2438 mm) wide in the wall below provided that the opening includes a header in accordance with the following:

1. ~~The building width, loading condition and framing member species limitations of Table R502.5(1) shall apply; and~~
2. ~~Not less than one 2 × 12 or two 2 × 10 for an opening not more than 4 feet (1219 mm) wide; or~~
3. ~~Not less than two 2 × 12 or three 2 × 10 for an opening not more than 6 feet (1829 mm) wide; or~~
4. ~~Not less than three 2 × 12 or four 2 × 10 for an opening not more than 8 feet (2438 mm) wide; and~~
5. ~~The entire length of the braced wall panel does not occur over an opening in the wall below.~~
4. ~~When an opening in a floor or roof exceeds the lesser of 12 feet (3658 mm) or 50 percent of the least floor or roof dimension.~~
5. ~~When portions of a floor level are vertically offset.~~

Exceptions:

1. ~~Framing supported directly by continuous foundations at the perimeter of the building.~~
2. ~~For wood light frame construction, floors shall be permitted to be vertically offset when the floor framing is lapped or tied together as required by Section R502.6.1.~~
6. ~~When shear walls and braced wall lines do not occur in two perpendicular directions.~~
7. ~~When stories above grade partially or completely braced by wood wall framing in accordance with Section R602 or steel wall framing in accordance with Section R603 include masonry or concrete construction.~~

~~Exception: Fireplaces, chimneys and masonry veneer as permitted by this code. When this irregularity applies, the entire story shall be designed in accordance with accepted engineering practice.~~

R301.2.2.3 Seismic Design Categories D0, D1 and D2.

Delete and substitute as follows:

~~Structures assigned to Seismic Design Categories D0, D1 and D2 shall conform to the requirements for Seismic Design Category C and the additional requirements of this section.~~

Structures assigned to SDC C₁ shall conform to sections that are specifically denoted as required for SDC C₁, and R301.2.2.3.6 (Masonry Chimneys) and R301.2.2.3.7 (Anchorage of Water Heaters)

R403.1.1 Minimum size / Table 403.1 Minimum Width of Concrete, Precast or masonry footings

Delete and substitute as follows:

R403.1.1 Minimum size.

Minimum sizes for concrete and masonry footings shall be as set forth in Table R403.1 and Figure R403.1(1). The footing width, W, shall be based on the load-bearing value of the soil in accordance with Table R401.4.1. Spread footings shall be at least 6 inches (152 mm) in thickness, T. Footing projections, P, shall be at least 2 inches (51 mm) and shall not exceed the thickness of the footing. The size of footings supporting piers and columns shall be based on the tributary load and allowable soil pressure in accordance with Table R401.4.1. ~~Footings for wood foundations shall be in accordance with the details set forth in Section R403.2, and Figures R403.1(2) and R403.1(3).~~

(a) In SECTION R403.1.1, delete the fifth sentence and substitute to read as follows: The minimum size of footings supporting piers and columns shall be in accordance with TABLE R403.1.

(b) Change TABLE R403.1 as follows:

(1) In the title add a reference to footnote "b" after the reference to footnote "a".

(2) Add footnote "b" to read as follows: ^bA basement shall not be considered a story for the purpose of this table.

R403.1.3 Seismic reinforcing.

Delete and substitute as follows:

~~Concrete footings located in Seismic Design Categories D0, D1 and D2, as established in Table R301.2(1), shall have minimum reinforcement. Bottom reinforcement shall be located a minimum of 3 inches (76 mm) clear from the bottom of the footing.~~

~~In Seismic Design Categories D0, D1 and D2 where a construction joint is created between a concrete footing and a stem wall, a minimum of one No. 4 bar shall be installed at not more than 4 feet (1219 mm) on center. The vertical bar shall extend to 3 inches (76 mm) clear of the bottom of the footing, have a standard hook and extend a minimum of 14 inches (357 mm) into the stem wall.~~

~~In Seismic Design Categories D0, D1 and D2 where a grouted masonry stem wall is supported on a concrete footing and stem wall, a minimum of one No. 4 bar shall be installed at not more than 4 feet (1219 mm) on center. The vertical bar shall extend to 3 inches (76 mm) clear of the bottom of the footing and have a standard hook.~~

~~In Seismic Design Categories D0, D1 and D2 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.~~

R 403.1.3 Footings in Seismic Design Category C₁.

(a) In Seismic Design Category C₁, as a minimum requirement, 2 #4 bars shall be placed longitudinally in the bottom of the exterior footings.

(b) Add a sentence at the end of SECTION R403.1.3 to read as follows: The required bars shall be placed in the bottom half of the footing, at least 6 inches (152.4 mm) apart and not less than 3 inches (76.2 mm) from the bottom and the sides of the footing.

R403.1.4.2 Seismic conditions.

Delete and substitute as follows:

~~In Seismic Design Categories D0, D1 and D2, interior footings supporting bearing or bracing walls and cast monolithically with a slab on grade shall extend to a depth of not less than 12 inches (305 mm) below the top of the slab.~~

In Seismic Design Category C₁, interior footings cast monolithically with a slab on grade shall extend to a depth of not less than 8 inches below the top of the slab or to the undisturbed ground or engineered fill, whichever is greater.

R403.4.1 Crushed stone footings.

Add to read as follows:

Clean crushed stone shall be free from organic, clayey or silty soils. Crushed stone shall be angular in nature and meet ASTM C 33, with the maximum size stone not to exceed 1/2 inch (12.7 mm) and the minimum stone size not to be smaller than 1/16-inch (1.6 mm). Crushed stone footings for precast foundations shall be installed in accordance with Figure R403.4(1) and Table R403.4. Crushed stone footings shall be consolidated using a vibratory plate in a maximum of 8-inch lifts. Crushed stone footings shall be limited to Seismic Design Categories A, B, C and C₁.

R404.1.1 Design of masonry foundation walls.

Delete and substitute as follows:

~~Masonry foundation walls shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of ACI530/ASCE 5/TMS 402 or NCMA TR68 A. When ACI530/ASCE 5/TMS 402, NCMA TR68 A or the provisions of this section are used to design masonry foundation walls, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.~~

Concrete masonry and clay foundation walls shall be constructed as set forth in TABLES R404.1.1(1), R404.1.1(2), R404.1.1(3), and R404.1.1(4) and shall comply with the provisions of this section and the applicable provisions of SECTIONS R606.1 through R606.10, R607, R608, R609, and R610. Rubble masonry foundation walls shall be constructed in accordance with SECTIONS R404.1.8 and R606.2.2.

EXCEPTION: In Seismic Design Category C₁, TABLE R404.1.1(1) may be used only when the unbalanced fill is 4 feet (1,219 mm) or less. Rubble stone masonry walls shall not be used in Seismic Design Category C₁.

R404.1.8 Rubble stone masonry.

Delete and substitute as follows:

Rubble stone masonry foundation walls shall have a minimum thickness of 16 inches (406 mm), shall not support an unbalanced backfill exceeding 8 feet (2438 mm) in height, shall not support a soil pressure greater than 30 pounds per square foot per foot (4.71 kPa/m), and shall not be constructed in Seismic Design Categories ~~D0, D1, D2~~ SDC C₁ or townhouses in Seismic Design Category C, as established in Figure R301.2(2).