

Appendix C

EARTHQUAKE PROVISIONS CHECKLIST FOR DESIGNERS AND PLAN CHECKERS

General Earthquake-Resistance Requirements

General Earthquake Limitations

C NC N/A

- Seismic Design Category. Buildings in SDCs A through D₂ may be designed per the *IRC*; buildings in SDC E require engineered design unless the alternate determination of Seismic Design Category provisions of *IRC* Sections R301.2.2.1.1 or R301.2.2.1.2 are met. (*IRC* Section R301.2.2)
- Assembly weight. Weight of roof plus ceiling, floor, interior wall and exterior wall assemblies are limited in SDCs D₁ and D₂ and townhouses in SDC C (*IRC* Section R301.2.2.2.1).
- Number of stories. Wood light-frame buildings are limited to two stories plus cripple walls in SDC D₂ (*IRC* Section R301.2.2.4.1 and Table R602.10.1). Cold-formed steel framed buildings are limited to two stories above grade in SDCs D₁ and D₂ (Section R301.2.2.41). Masonry walls are limited to one story and 9 feet between lateral supports in SDCs D₁ and D₂ (*IRC* Section R606.11.3.1 and R606.11.4).
- Story height. All SDCs. Building story height is limited by the following limits on bearing wall clear height plus a maximum of 16 inches for the floor framing depth:
- | | |
|-------------------|--|
| Wood light frame | 12 ft (<i>IRC</i> Section R301.3, Item 1 Exception) |
| Cold-formed steel | 10 ft (<i>IRC</i> Section R301.3, Item 2) |
| Masonry | 12 ft plus 8 ft at gable ends (<i>IRC</i> Section R301.3, Item 3) |
| ICF | 10 ft (<i>IRC</i> Section R301.3, Item 4, and Section 611) |

Load Path

C NC N/A

- Minimum wood light frame fastening. All SDCs. (*IRC* Table R602.3)
- Anchor bolts and plate washers. *IRC* Section R403.1.6 for all SDCs. *IRC* Sections R403.1.6.1 and 602.11.1 for SDCs D₁ and D₂ and townhouses in SDC C.
- Overturning Anchorage. *IRC* Section R602.10.6 for alternate braced wall panels, all SDCs. *IRC* Section R602.10.11 Exception 2, where braced wall panels are not located at corners for SDCs D₁ and D₂. *IRC* Section R703.7, Exceptions 3 and 4, when veneer is used for SDCs D₁ and D₂.

Designed collector members aligned with and connected to the top plate of braced walls (continuous from the end of a braced wall line to the end of the braced wall panel closest to the end of the wall line). In all SDCs *IRC* Section R602.10.1. In SDC D₁ and D₂, *IRC* Section R602.10.11 last paragraph. *IRC* Section R301.2.2.2.2 for SDCs D₁ and D₂ and townhouses in SDC C.

Irregularities

C NC N/A

- | | | | |
|--------------------------|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Irregularity 1: Exterior braced wall panels not in one plane (stacked) from foundation to top most story in which they are required. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Irregularity 2: Section of floor or roof not supported by braced wall lines on all edges. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Irregularity 3: End of braced wall panel occurs over opening in wall below, and extends more than one foot beyond the edge of the opening. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Irregularity 4: Opening in floor or roof exceeds lesser of 12 feet or 50% of least floor or roof dimension. Figure 2-x. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Irregularity 5: Portions of floor level are vertically offset (split level). |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Irregularity 6: Braced wall lines do not occur in two perpendicular directions. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Irregularity 7: Stories braced by light-frame walls include concrete or masonry construction. |

Above-code Recommendations:

- **Apply irregularities to all SDCs because they are also applicable for wind load.**
- **Increase first-story strength and stiffness to mitigate weak-story irregularity.**
- **Increase cripple wall strength and stiffness to mitigate weak-story irregularity.**

Foundations and Foundation Walls

General

C NC N/A

- | | | | |
|--------------------------|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Continuous perimeter foundations. All exterior walls are to be supported on continuous perimeter foundations. All SDCs. (<i>IRC</i> Section R403.1) |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Continuous interior foundations. At interior braced wall lines in buildings with plan dimensions greater than 50 ft. SDCs D ₁ and D ₂ . (<i>IRC</i> Section R403.1.2). |

Special Soils Conditions

C NC N/A

- Low bearing capacity. Soils investigation required when building official determines that soil bearing capacities of less than 1500 psf might be present at site. All SDCs. (*IRC* Table R401.4.1, footnote b)
- Soil testing when expansive, compressible, or shifting soils are encountered or are likely. (*IRC* Section R401.4)
- Frost protection. Footings are to be below the frost line or adequate frost protection should be provided. (*IRC* Section R403.1.4.1)

Concrete Foundations

C NC N/A

- Minimum concrete strength. 2500 psi for all SDCs. 3000 or 3500 psi in moderate or severe weathering probability areas. (*IRC* Section R402.2 and Table R402.2)
- Horizontal reinforcing. One No.4 in footing and second No. 4 in stem wall. No. 4 top and bottom in thickened slab footing with alternative of one No. 5 or two No.4 in middle third of footing height for thickened slab footings cast monolithically with slab. SDCs D₁ and D₂. (*IRC* Sections R403.1.3 and R403.1.3.2)
- Vertical reinforcing. No. 4 at 48 inches maximum spacing required where a pour joint occurs between concrete footing and concrete stem wall. SDCs D₁ and D₂. (*IRC* Section R403.1.3)

Masonry Foundations

C NC N/A

- Masonry foundation type. Solid clay masonry and fully grouted concrete masonry permitted in all SDCs (*IRC* Section R403.1). Rubble stone masonry foundation walls limited to SDCs A through C (*IRC* Section R404.1.1).
- Horizontal reinforcing. One No. 4 in footing and second No. 4 in stem wall. SDCs D₁ and D₂. (*IRC* Section R403.1.3 and R403.1.3.1)
- Vertical reinforcing. Minimum No.4 at 4 feet on center extending into footing with standard hook. SDCs D₁ and D₂. (*IRC* Section R403.1.3)

Foundation Walls

C NC N/A

- Wall thickness. Six inches minimum up to 12 inches required based on soil type at site. SDCs A through D₂. (*IRC Table R401.1.1(1)*).
- Horizontal reinforcing. Dependent upon all thickness and material. Minimum No. 4 in upper 12 inches of wall. SDCs D₁ and D₂. (*IRC Sections R404.1.4 and R606.11*).
- Vertical reinforcing. Varies depending on wall height and soil type at site. ASTM Grade 60 minimum. All SDCs. (*IRC Tables R404.1.1(2)*).

Above Code Recommendations:

Avoid construction of slab-on-grade homes on cut and fill sites where possible. Where this condition cannot be avoided, provide additional quality control for fill placement and compaction operations.

Regardless of SDC, provide not less than one continuous No. 4 reinforcing bar in concrete footings. Provide a second No. 4 in stem wall if present. This will provide tension and bending capacity to help mitigate foundation damage due to earthquake, wind, soil movement, and frost heave.

In SDCs C, D₁ and D₂, provide not less than No. 4 vertical bars at 4 feet as dowels between a concrete footing and separately cast slab-on-grade.

In concrete foundations, lap reinforcing bars not less than 24 inches. Bend radius (outer) for No. 4 bar is 2 inches and 2-1/2 inches for No. 5. Hook at corners and intersections of 8 inches for No.4 bars and 10 inches for No. 5 bars.

Regardless of SDC, provide not less than one continuous No. 4 reinforcing bar in masonry foundation stem walls.

In masonry foundation walls and stem walls, lap reinforcing bars not less than 24 inches. Bend radius (outer) for No. 4 bar is 2 inches and 2-1/2 inches for No. 5. Hook at corners and intersections of 8 inches for No. 4 and 10 inches for No. 5.

Floor Construction

C NC N/A

- Blocking or lateral restraint. Required at intermediate floor framing member supports. SDCs D₁ and D₂. (*IRC Section R502.7, Exception*).

Light-Frame Wall Construction

C NC N/A

- Braced wall length required for each 25 ft of wall length. (*IRC* Section R602.10.6)
- Sheathing attachment spacing. (Various *IRC* sections)

Cold-formed Steel Construction

C NC N/A

- Cold-formed steel framing. Buildings in SDCs D₁ and D₂ need to comply with the *AISI Standard for Cold-Formed Steel Framing – Prescriptive Method for One- and Two-Family Dwellings* in addition to the requirements of the *IRC* Section R301.2.2.4.5.

Masonry Wall Buildings

C NC N/A

- Limited to one story for SDCs D₁ and D₂. (*IRC* Section R606)
- In SDCs D₁ and D₂, 9 feet between lateral supports. (*IRC* Section R606.8)
- Light-frame restricted from supporting lateral loads from masonry. (*IRC* Section R301.2.2.2.2)
- Reinforcement detailing (*IRC* Section R606.11).

Concrete and Insulating Concrete Form Wall Buildings

C NC N/A

- Limited to two stories above grade. (*IRC* Section R611)
- Minimum wall thickness of 5.5 inches for IFC and 6 inches for solid concrete. (*IRC* Section R611.7.4)
- Maximum plan dimension of 60 feet and aspect ratio of 2:1. (*IRC* Section R611.2)
- Reinforcement detailing. (*IRC* Sections R611.3 - R611.5 and R611.7.1.2 and R611.7.1.3)

Stone and Masonry Veneer

C NC N/A

- Veneer. In SDCs D₁ and D₂, veneer is not permitted on buildings with cripple walls. (*IRC* Section R703.7, Exceptions 3 and 4)

Fireplaces and Chimneys

C NC N/A

- Vertical reinforcement requirements (four No. 4 Bars). (*IRC* Section R1003.3)
- Type N mortar prohibited in SDCs D₁ and D₂. (*IRC* Section R609)
- Anchorage requirements for SDCs D₁ and D₂. (*IRC* Section R1003.4)