

CHAPTER A3

PRESCRIPTIVE PROVISIONS FOR SEISMIC STRENGTHENING OF CRIPPLE WALLS AND SILL PLATE ANCHORAGE OF LIGHT, WOOD-FRAME RESIDENTIAL BUILDINGS

SECTION A301 GENERAL

[BS] A301.1 Purpose. The provisions of this chapter are intended to promote public safety and welfare by reducing the risk of earthquake-induced damage to existing wood-frame residential buildings. The requirements contained in this chapter are prescriptive minimum standards intended to improve the seismic performance of residential buildings; however, they will not necessarily prevent earthquake damage.

This chapter sets standards for strengthening that may be approved by the code official without requiring plans or calculations prepared by a registered design professional. The provisions of this chapter are not intended to prevent the use of any material or method of construction not prescribed herein. The code official may require that construction documents for strengthening using alternative materials or methods be prepared by a registered design professional.

[BS] A301.2 Scope. The provisions of this chapter apply to residential buildings of light-frame wood construction containing one or more of the structural weaknesses specified in Section A303.

Exception: The provisions of this chapter do not apply to the buildings, or elements thereof, listed as follows. These buildings or elements require analysis by a registered design professional in accordance with Section A301.3 to determine appropriate strengthening:

1. Group R-1.
2. Group R with more than four dwelling units.
3. Buildings with a lateral force-resisting system using poles or columns embedded in the ground.
4. Cripple walls that exceed 4 feet (1219 mm) in height.
5. Buildings exceeding three stories in height and any three-story building with cripple wall studs exceeding 14 inches (356 mm) in height.
6. Buildings where the code official determines that conditions exist that are beyond the scope of the prescriptive requirements of this chapter.
7. Buildings or portions thereof constructed on concrete slabs on grade.

[BS] A301.3 Alternative design procedures. The details and prescriptive provisions herein are not intended to be the only acceptable strengthening methods permitted. Alternative details and methods shall be permitted to be used where approved by the code official. Approval of alternatives shall be based on a demonstration that the method or material used

is at least equivalent in terms of strength, deflection and capacity to that provided by the prescriptive methods and materials.

Where analysis by a registered design professional is required, such analysis shall be in accordance with all requirements of the building code, except that the seismic forces may be taken as 75 percent of those specified in the *California Building Code*.

SECTION A302 DEFINITIONS

[BS] A302.1 Definitions. For the purpose of this chapter, in addition to the applicable definitions in the building code, certain additional terms are defined as follows:

[BS] ADHESIVE ANCHOR. An assembly consisting of a threaded rod, washer, nut, and chemical adhesive approved by the code official for installation in existing concrete or masonry.

CODE OFFICIAL. “Code Official” shall have the same meaning as Enforcing Agency.

[BS] CRIPPLE WALL. A wood-frame stud wall extending from the top of the foundation to the underside of the lowest floor framing.

ENFORCING AGENCY. The designated department or agency as specified by statute or regulation.

[BS] EXPANSION ANCHOR. An approved post-installed anchor, inserted into a predrilled hole in existing concrete or masonry, that transfers loads to or from the concrete or masonry by direct bearing or friction or both.

[BS] PERIMETER FOUNDATION. A foundation system that is located under the exterior walls of a building.

[BS] SNUGTIGHT. As tight as an individual can torque a nut on a bolt by hand, using a wrench with a 10-inch-long (254 mm) handle, and the point at which the full surface of the plate washer is contacting the wood member and slightly indenting the wood surface.

[BS] WOOD STRUCTURAL PANEL. A panel manufactured from veneers, wood strands or wafers or a combination of veneer and wood strands or wafers bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are:

Composite panels. A wood structural panel that is comprised of wood veneer and reconstituted wood-based material and bonded together with waterproof adhesive.

Oriented strand board (OSB). A mat-formed wood structural panel comprised of thin rectangular wood

APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

strands arranged in cross-aligned layers with surface layers normally arranged in the long panel direction and bonded with waterproof adhesive.

Plywood. A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers. The plies are bonded with waterproof adhesive that cures on application of heat and pressure.

SECTION A303 STRUCTURAL WEAKNESSES

[BS] A303.1 General. For the purposes of this chapter, any of the following conditions shall be deemed a structural weakness:

1. Sill plates or floor framing that are supported directly on the ground without a foundation system that conforms to the building code.
2. A perimeter foundation system that is constructed only of wood posts supported on isolated pad footings.
3. Perimeter foundation systems that are not continuous.

Exceptions:

1. Existing single-story exterior walls not exceeding 10 feet (3048 mm) in length, forming an extension of floor area beyond the line of an existing continuous perimeter foundation.
2. Porches, storage rooms and similar spaces not containing fuel-burning appliances.
4. A perimeter foundation system that is constructed of unreinforced masonry or stone.
5. Sill plates that are not connected to the foundation or that are connected with less than what is required by the building code.

Exception: Where approved by the code official, connections of a sill plate to the foundation made with other than sill bolts shall be accepted if the capacity of the connection is equivalent to that required by the building code.

6. Cripple walls that are not braced in accordance with the requirements of Section A304.4 and Table A304.3.1, or cripple walls not braced with diagonal sheathing or wood structural panels in accordance with the building code.

SECTION A304 STRENGTHENING REQUIREMENTS

[BS] A304.1 General.

[BS] A304.1.1 Scope. The structural weaknesses noted in Section A303 shall be strengthened in accordance with the requirements of this section. Strengthening work may include both new construction and alteration of existing construction. Except as provided herein, all strengthening work and materials shall comply with the applicable provisions of the *California Building Code*.

[BS] A304.1.2 Condition of existing wood materials.

Existing wood materials that will be a part of the strengthening work (such as sills, studs and sheathing) shall be in a sound condition and free from defects that substantially reduce the capacity of the member. Any wood material found to contain fungus infection shall be removed and replaced with new material. Any wood material found to be infested with insects or to have been infested with insects shall be strengthened or replaced with new materials to provide a net dimension of sound wood equal to or greater than its undamaged original dimension.

[BS] A304.1.3 Floor joists not parallel to foundations.

Floor joists framed perpendicular or at an angle to perimeter foundations shall be restrained either by an existing nominal 2-inch-wide (51 mm) continuous rim joist or by a nominal 2-inch-wide (51 mm) full-depth block between alternate joists in one- and two-story buildings, and between each joist in three-story buildings. Existing blocking for multiple-story buildings must occur at each joist space above a braced cripple wall panel.

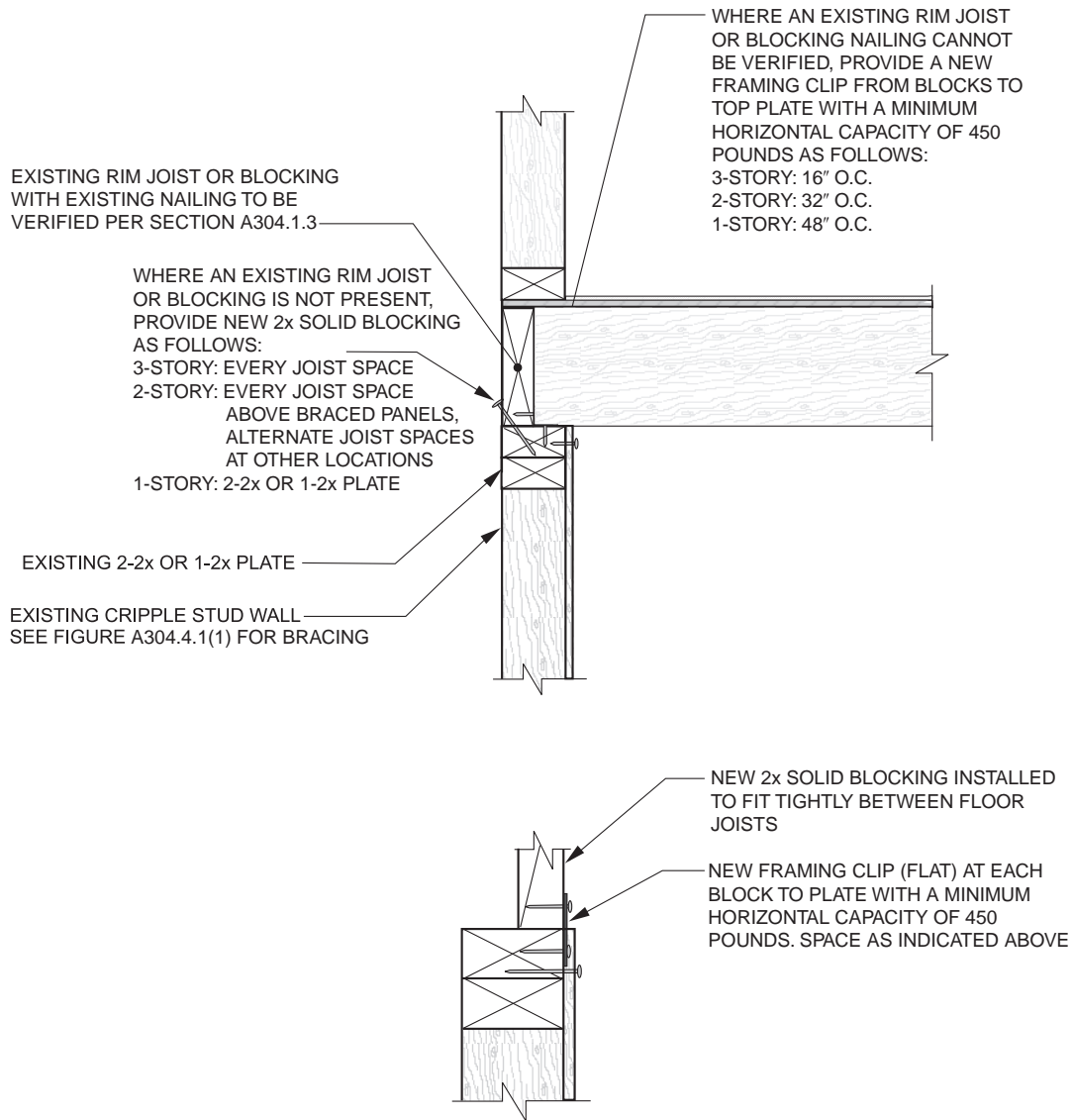
Existing connections at the top and bottom edges of an existing rim joist or blocking need not be verified in one story buildings. In multiple-story buildings, the existing top edge connection need not be verified; however, the bottom edge connection to either the foundation sill plate or the top plate of a cripple wall shall be verified. The minimum existing bottom edge connection shall consist of 8d toenails spaced 6 inches (152 mm) apart for a continuous rim joist, or three 8d toenails per block. Where this minimum bottom edge-connection is not present or cannot be verified, a supplemental connection installed as shown in Figure A304.1.3 or A304.1.4(2) shall be provided.

Where an existing continuous rim joist or the minimum existing blocking does not occur, new $\frac{3}{4}$ -inch (19.1 mm) or $\frac{23}{32}$ -inch (18 mm) wood structural panel blocking installed tightly between floor joists and nailed as shown in Figure A304.1.4(3) shall be provided at the inside face of the cripple wall. In lieu of wood structural panel blocking, tight fitting, full-depth 2-inch (51 mm) blocking may be used. New blocking may be omitted where it will interfere with vents or plumbing that penetrates the wall.

[BS] A304.1.4 Floor joists parallel to foundations.

Where existing floor joists are parallel to the perimeter foundations, the end joist shall be located over the foundation and, except for required ventilation openings, shall be continuous and in continuous contact with the foundation sill plate or the top plate of the cripple wall. Existing connections at the top and bottom edges of the end joist need not be verified in one-story buildings. In multiple-story buildings, the existing top edge connection of the end joist need not be verified; however, the bottom edge connection to either the foundation sill plate or the top plate of a cripple wall shall be verified. The minimum bottom edge connection shall be 8d toenails spaced 6 inches (152 mm) apart. If this minimum bottom edge connection is not present or cannot be verified, a supplemental connection installed as shown in Figure A304.1.4(1), A304.1.4(2) or A304.1.4(3) shall be provided.

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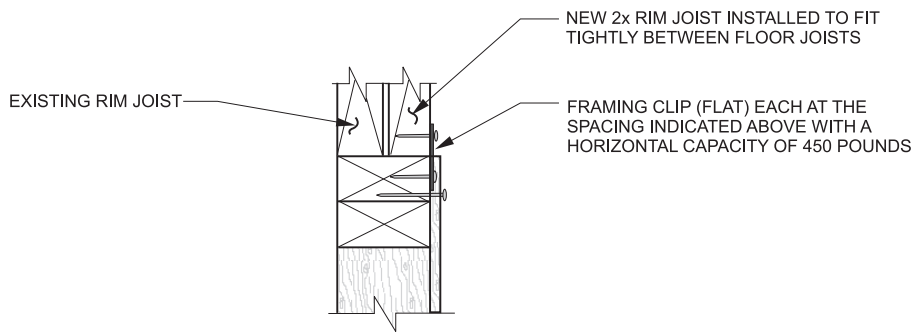
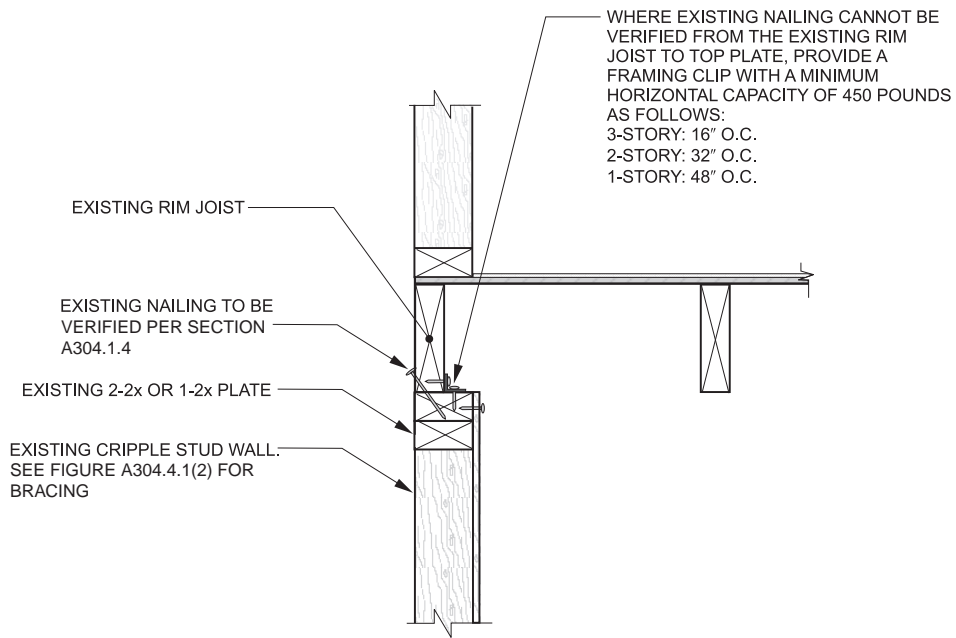
ALTERNATE CONNECTION FOR FLUSH CONNECTION

For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.

NOTE: See manufacturing instructions for nail sizes associated with metal framing clips.

**[BS] FIGURE A304.1.3
 TYPICAL FLOOR TO CRIPPLE WALL CONNECTION (FLOOR JOISTS NOT PARALLEL TO FOUNDATIONS)**

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ALTERNATE CONNECTION FOR FLUSH CONNECTION

For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.

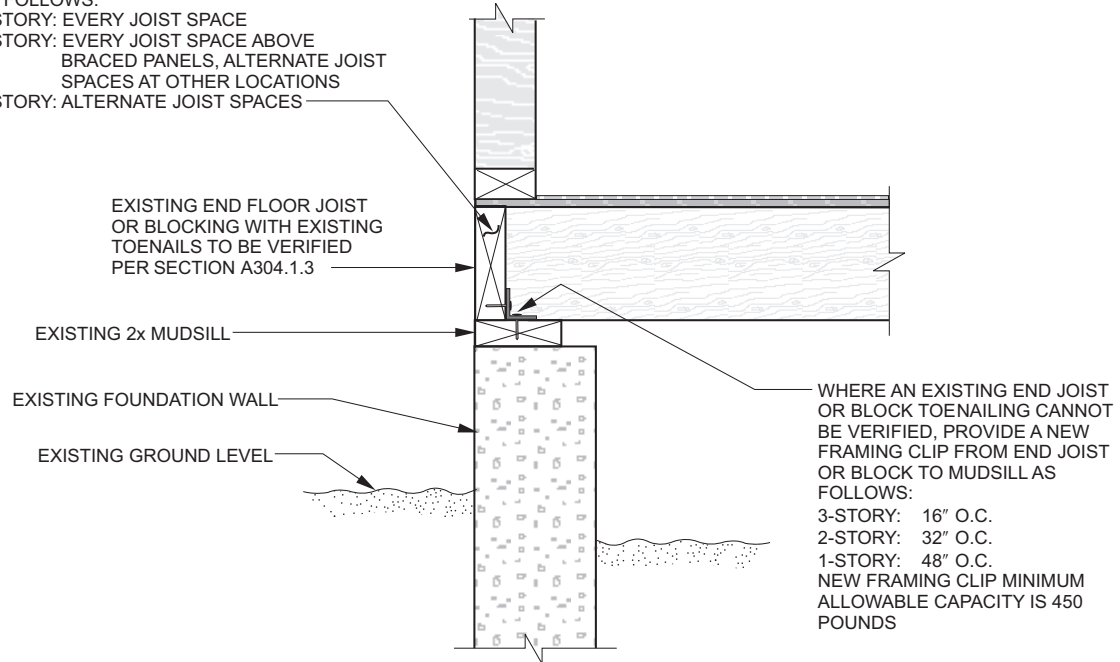
NOTE: See manufacturing instructions for nail sizes associated with metal framing clips.

**[BS] FIGURE A304.1.4(1)
TYPICAL FLOOR TO CRIPPLE WALL CONNECTION (FLOOR JOISTS PARALLEL TO FOUNDATIONS)**

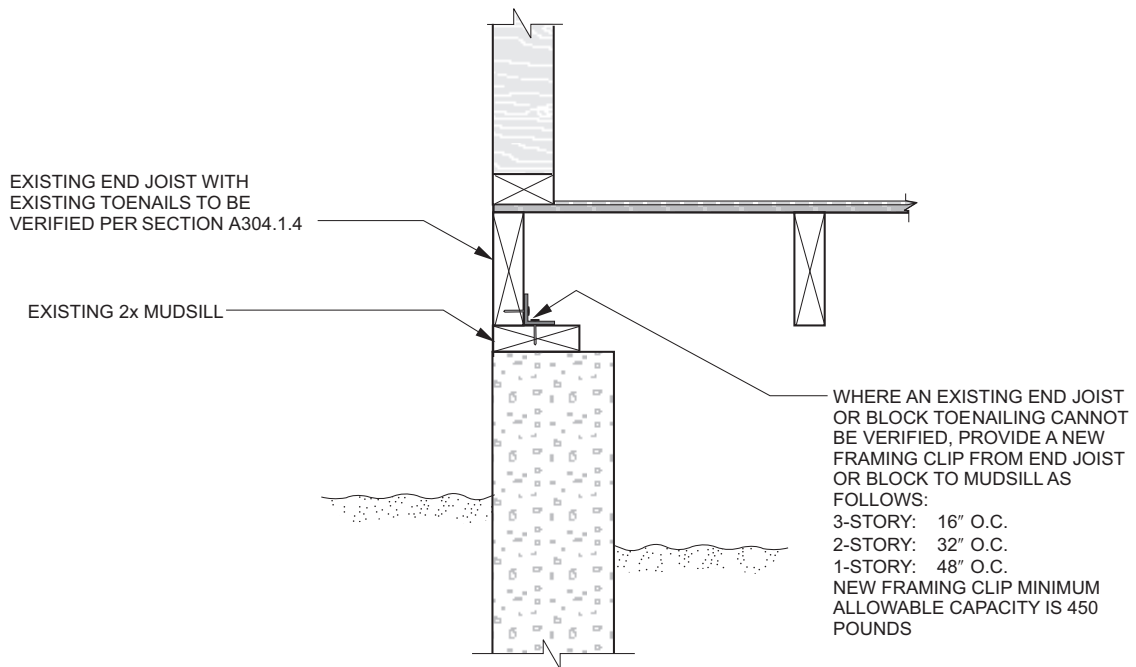
APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

WHERE AN EXISTING RIM JOIST OR BLOCKING IS NOT PRESENT, PROVIDE NEW 2x SOLID BLOCKING AS FOLLOWS:

- 3-STORY: EVERY JOIST SPACE
 2-STORY: EVERY JOIST SPACE ABOVE BRACED PANELS, ALTERNATE JOIST SPACES AT OTHER LOCATIONS
 1-STORY: ALTERNATE JOIST SPACES



FLOOR JOISTS NOT PARALLEL TO FOUNDATIONS



FLOOR JOISTS PARALLEL TO FOUNDATIONS

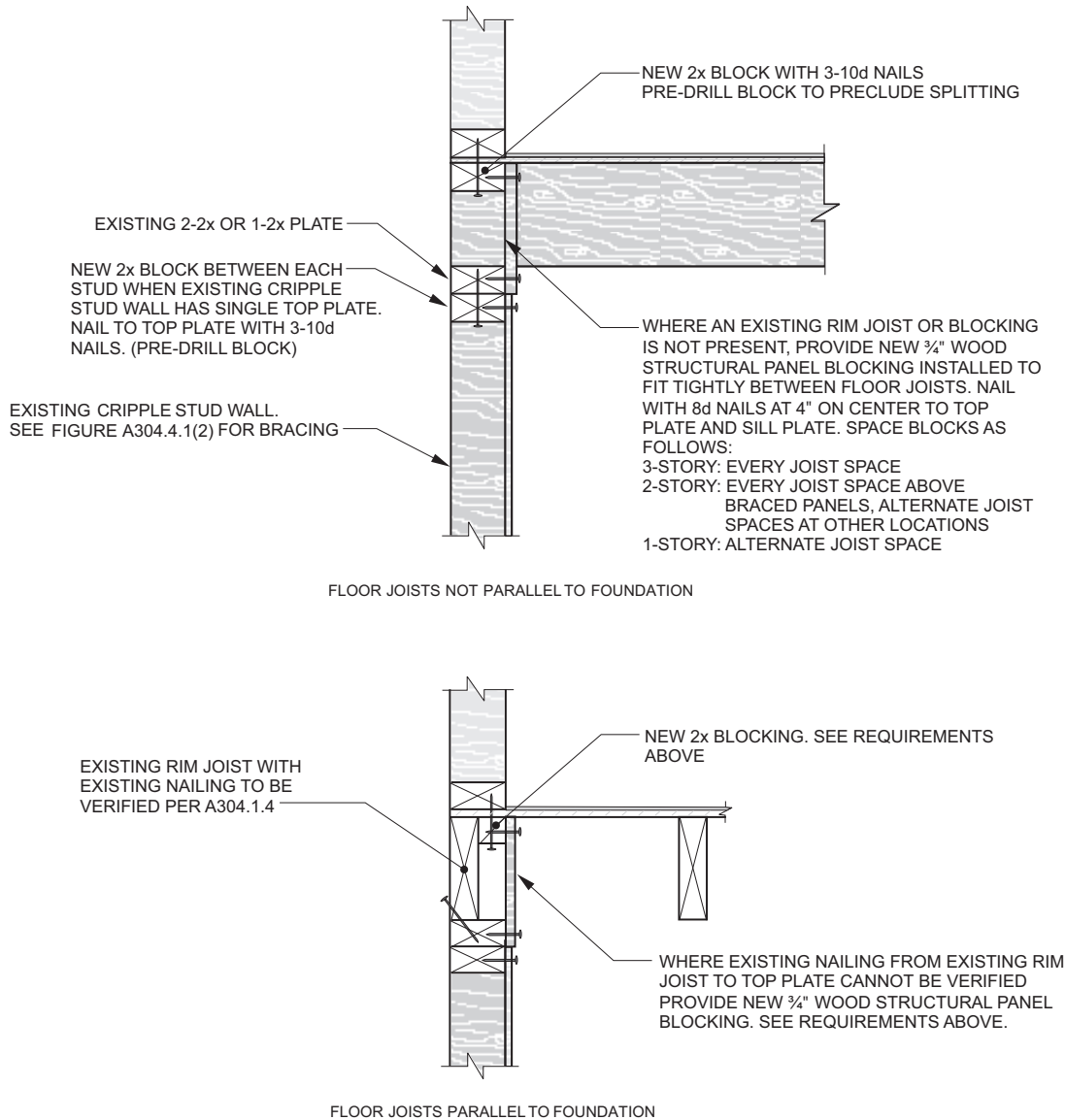
For SI: 1 inch = 25.4 mm.

NOTES:

1. See Section A304.3 for sill plate anchorage.
2. See manufacturing instructions for nail sizes associated with metal framing clips.

**[BS] FIGURE A304.1.4(2)
 TYPICAL FLOOR TO MUDSILL CONNECTIONS**

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For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.

NOTE: See Section A304.4 for cripple wall bracing.

[BS] FIGURE A304.1.4(3)
ALTERNATIVE FLOOR FRAMING TO CRIPPLE WALL CONNECTION

[BS] A304.2 Foundations.

[BS] A304.2.1 New perimeter foundations. New perimeter foundations shall be provided for structures with the structural weaknesses noted in Items 1 and 2 of Section A303. Soil investigations or geotechnical studies are not required for this work unless the building is located in a special study zone as designated by the code official or other authority having jurisdiction.

[BS] A304.2.2 Evaluation of existing foundations. Partial perimeter foundations or unreinforced masonry foundations shall be evaluated by a registered design professional for the force levels specified in Section A301.3. Test reports or other substantiating data to deter-

mine existing foundation material strengths shall be submitted to the code official. Where approved by the code official, these existing foundation systems shall be strengthened in accordance with the recommendations included with the evaluation in lieu of being replaced.

Exception: In lieu of testing existing foundations to determine material strengths, and where approved by the code official, a new nonperimeter foundation system designed for the forces specified in Section A301.3 shall be used to resist lateral forces from perimeter walls. A registered design professional shall confirm the ability of the existing diaphragm to transfer seismic forces to the new nonperimeter foundations.

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[BS] A304.2.3 Details for new perimeter foundations.

All new perimeter foundations shall be continuous and constructed according to Figure A304.2.3(1) and Table A304.2.3(1) or Figure A304.2.3(2) and Table A304.2.3(2). New construction materials shall comply with the requirements of building code. Where approved by the code official, the existing clearance between existing floor joists or girders and existing grade below the floor need not comply with the building code.

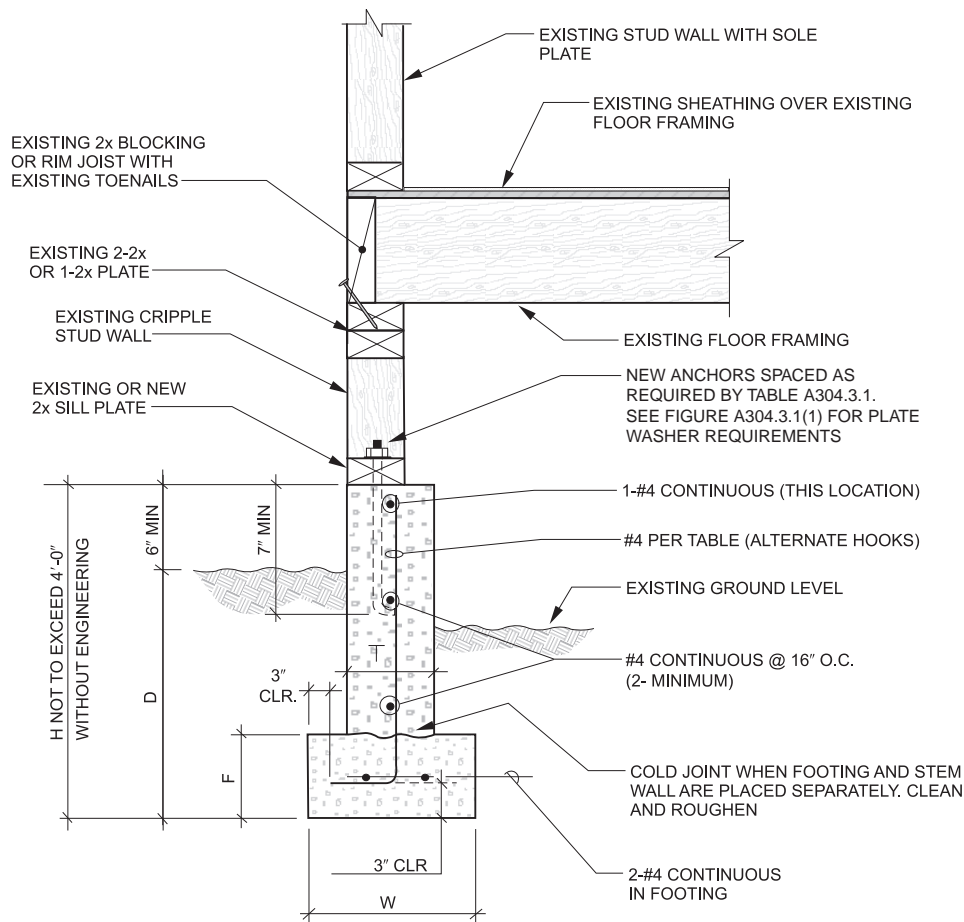
Exception: Where designed by a registered design professional and approved by the code official, partial perimeter foundations shall be used in lieu of a continuous perimeter foundation.

[BS] A304.2.4 New concrete foundations. New concrete foundations shall have a minimum compressive strength of 2,500 pounds per square inch (17.24 MPa) at 28 days.

[BS] A304.2.5 New hollow-unit masonry foundations. New hollow-unit masonry foundations shall be solidly

grouted. The grout shall have minimum compressive strength of 2,000 pounds per square inch (13.79 MPa). Mortar shall be Type M or S.

[BS] A304.2.6 New sill plates. Where new sill plates are used in conjunction with new foundations, they shall be minimum two times nominal thickness and shall be preservative-treated wood or naturally durable wood permitted by the building code for similar applications, and shall be marked or branded by an approved agency. Fasteners in contact with preservative-treated wood shall be hot-dip galvanized or other material permitted by the building code for similar applications. Anchors, that attach a preservative-treated sill plate to the foundation, shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum. Metal framing anchors in contact with preservative-treated wood shall be galvanized in accordance with ASTM A653 with a G185 coating.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**[BS] FIGURE A304.2.3(1)
NEW REINFORCED CONCRETE FOUNDATION SYSTEM**

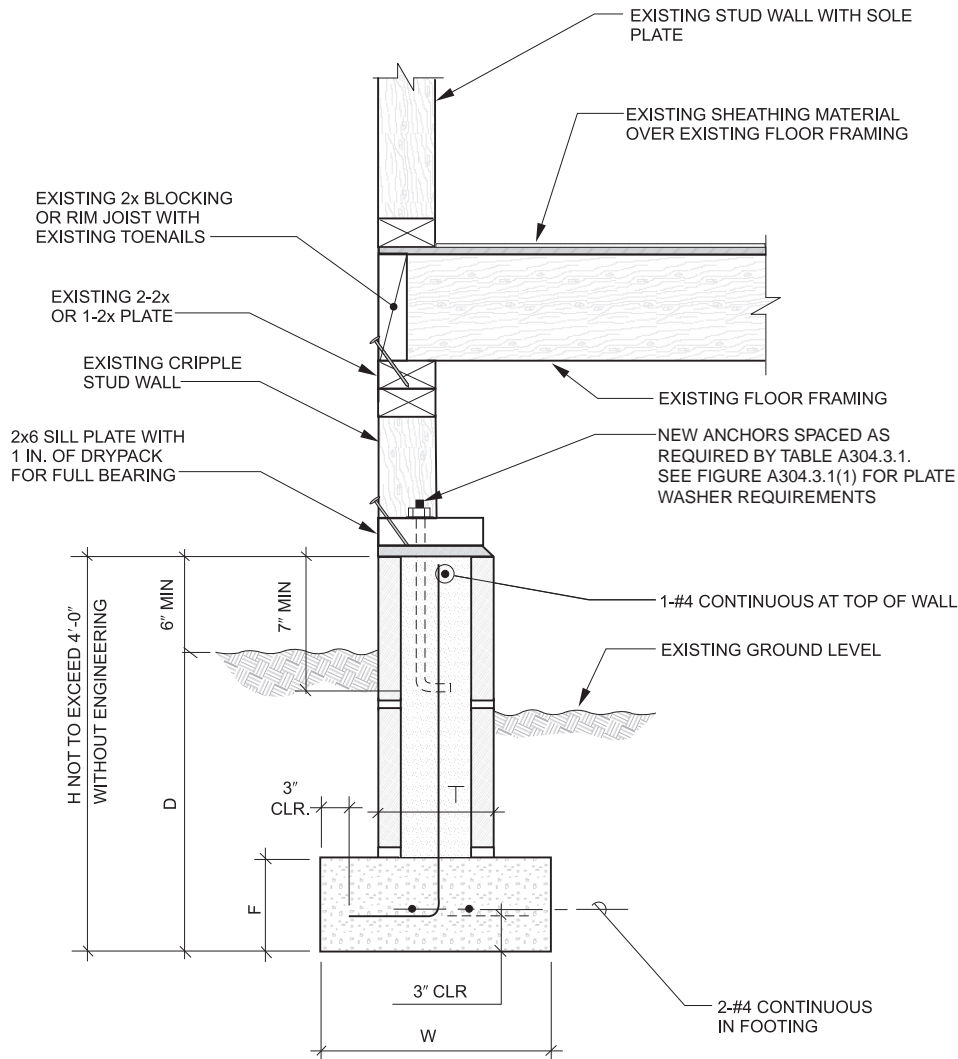
APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

[BS] TABLE A304.2.3(1)
NEW REINFORCED CONCRETE FOUNDATION SYSTEM

NUMBER OF STORIES	MINIMUM FOUNDATION DIMENSIONS					MINIMUM FOUNDATION REINFORCING	
	W	F	D ^{a, b, c}	T	H	VERTICAL REINFORCING	
						Single-pour wall and footing	Footing placed separate from wall
1	12 inches	6 inches	12 inches	6 inches	≤ 24 inches	#4 @ 48 inches on center	#4 @ 32 inches on center
2	15 inches	7 inches	18 inches	8 inches	≥ 36 inches	#4 @ 48 inches on center	#4 @ 32 inches on center
3	18 inches	8 inches	24 inches	10 inches	≥ 36 inches	#4 @ 48 inches on center	#4 @ 18 inches on center

For SI: 1 inch = 25.4 mm.

- a. Where frost conditions occur, the minimum depth shall extend below the frost line.
- b. The ground surface along the interior side of the foundation may be excavated to the elevation of the top of the footing.
- c. Where the soil is designated as expansive, the foundation depth and reinforcement shall be approved by the code official.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

[BS] FIGURE A304.2.3(2)
NEW MASONRY CONCRETE FOUNDATION

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[BS] TABLE A304.2.3(2)
NEW MASONRY CONCRETE FOUNDATION

MINIMUM FOUNDATION DIMENSIONS						MINIMUM FOUNDATION REINFORCING	
NUMBER OF STORIES	W	F	D ^{a, b, c}	T	H	VERTICAL REINFORCING	HORIZONTAL REINFORCING
1	12 inches	6 inches	12 inches	6 inches	≤ 24 inches	#4 @ 24 inches on center	#4 continuous at top of stem wall
2	15 inches	7 inches	18 inches	8 inches	≥ 24 inches	#4 @ 24 inches on center	#4 @ 16 inches on center
3	18 inches	8 inches	24 inches	10 inches	≥ 36 inches	#4 @ 24 inches on center	#4 @ 16 inches on center

For SI: 1 inch = 25.4 mm.

- Where frost conditions occur, the minimum depth shall extend below the frost line.
- The ground surface along the interior side of the foundation may be excavated to the elevation of the top of the footing.
- Where the soil is designated as expansive, the foundation depth and reinforcement shall be approved by the code official.

[BS] A304.3 Foundation sill plate anchorage.

[BS] A304.3.1 Existing perimeter foundations. Where the building has an existing continuous perimeter foundation, all perimeter wall sill plates shall be anchored to the foundation with adhesive anchors or expansion anchors in accordance with Table A304.3.1.

Anchors shall be installed in accordance with Figure A304.3.1(1), with the plate washer installed between the nut and the sill plate. The nut shall be tightened to a snug-tight condition after curing is complete for adhesive anchors and after expansion wedge engagement for expansion anchors. Anchors shall be installed in accordance with manufacturer's recommendations. Expansion anchors shall not be used where the installation causes surface cracking of the foundation wall at the locations of the anchor.

Where existing conditions prevent anchor installations through the top of the sill plate, this connection shall be made in accordance with Figure A304.3.1(2), A304.3.1(3) or A304.3.1(4). Alternative anchorage methods having a

minimum shear capacity of 900 pounds (4003 N) per connection parallel to the wall shall be permitted. The spacing of these alternative connections shall comply with the maximum spacing requirements of Table A304.3.1 for 1/2-inch (12.7 mm) bolts.

[BS] A304.3.2 Placement of anchors. Anchors shall be placed within 12 inches (305 mm), but not less than 9 inches (229 mm), from the ends of sill plates and shall be placed in the center of the stud space closest to the required spacing. New sill plates may be installed in pieces where necessary because of existing conditions. For lengths of sill plates 12 feet (3658 mm) or greater, anchors shall be spaced along the sill plate as specified in Table A304.3.1. For other lengths of sill plate, anchor placement shall be in accordance with Table A304.3.2.

Exception: Where physical obstructions such as fireplaces, plumbing or heating ducts interfere with the placement of an anchor, the anchor shall be placed as close to the obstruction as possible, but not less than 9

[BS] TABLE A304.3.1
SILL PLATE ANCHORAGE AND CRIPPLE WALL BRACING

NUMBER OF STORIES ABOVE CRIPPLE WALLS	MINIMUM SILL PLATE CONNECTION AND MAXIMUM SPACING ^{a, b, c}	AMOUNT OF BRACING FOR EACH WALL LINE ^{d, e, f}	
		A Combination of Exterior Walls Finished with Portland Cement Plaster and Roofing Using Clay Tile or Concrete Tile Weighing More than 6 psf (287 N/m ²)	All Other Conditions
One story	1/2 inch spaced 6 feet, 0 inch center-to-center with washer plate	Each end and not less than 50 percent of the wall length	Each end and not less than 40 percent of the wall length
Two stories	1/2 inch spaced 4 feet, 0 inch center-to-center with washer plate; or 5/8 inch spaced 6 feet, 0 inch center-to-center with washer plate	Each end and not less than 70 percent of the wall length	Each end and not less than 50 percent of the wall length
Three stories	5/8 inch spaced 4 feet, 0 inch center-to-center with washer plate	100 percent of the wall length ^g	Each end and not less than 80 percent of the wall length ^g

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.88 N/m².

- Sill plate anchors shall be adhesive anchors or expansion anchors in accordance with Section A304.3.1.
- All washer plates shall be 3 inches by 3 inches by 0.229 inch minimum. The hole in the plate washer is permitted to be diagonally slotted with a width of up to 3/16 inch larger than the bolt diameter and a slot length not to exceed 1 3/4 inches, provided that a standard cut washer is placed between the plate washer and the nut.
- This table shall also be permitted for the spacing of the alternative connections specified in Section A304.3.1.
- See Figure A304.4.2 for braced panel layout.
- Braced panels at ends of walls shall be located as near to the end as possible.
- All panels along a wall shall be nearly equal in length and shall be nearly equal in spacing along the length of the wall.
- The minimum required underfloor ventilation openings are permitted in accordance with Section A304.4.4.

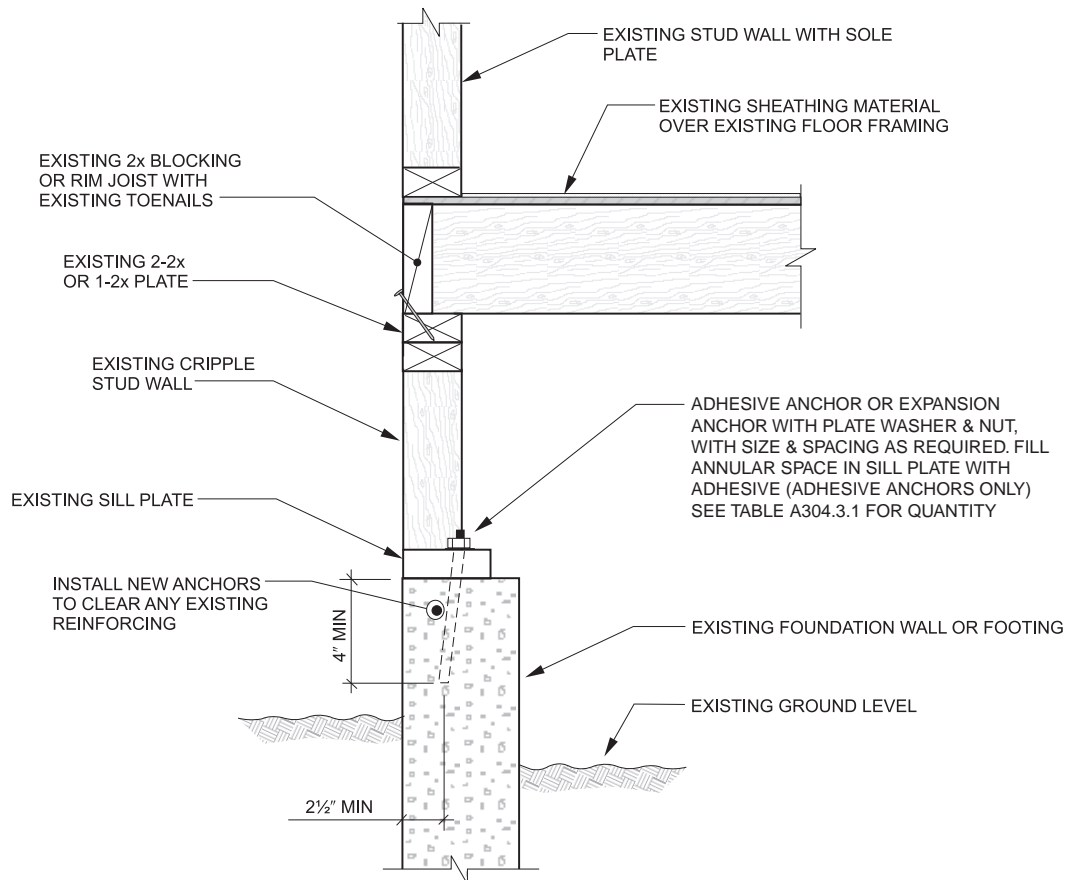
APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

inches (229 mm) from the end of the plate. Center-to-center spacing of the anchors shall be reduced as necessary to provide the minimum total number of anchors required based on the full length of the wall. Center-to-center spacing shall be not less than 12 inches (305 mm).

[BS] A304.3.3 New perimeter foundations. Sill plates for new perimeter foundations shall be anchored in accordance with Table A304.3.1 and Figure A304.2.3(1) and Table A304.2.3(1) or Figure A304.2.3(2) and Table A304.2.3(2).

[BS] A304.4 Cripple wall bracing.

[BS] A304.4.1 General. Exterior cripple walls not exceeding 4 feet (1219 mm) in height shall be permitted to be specified by the prescriptive bracing method in Section A304.4. Cripple walls over 4 feet (1219 mm) in height require analysis by a registered design professional in accordance with Section A301.3.



For SI: 1 inch = 25.4 mm.

a. Plate washers shall comply with the following:

$\frac{1}{2}$ -inch anchor or bolt—3 inches \times 3 inches \times 0.229 inch minimum.

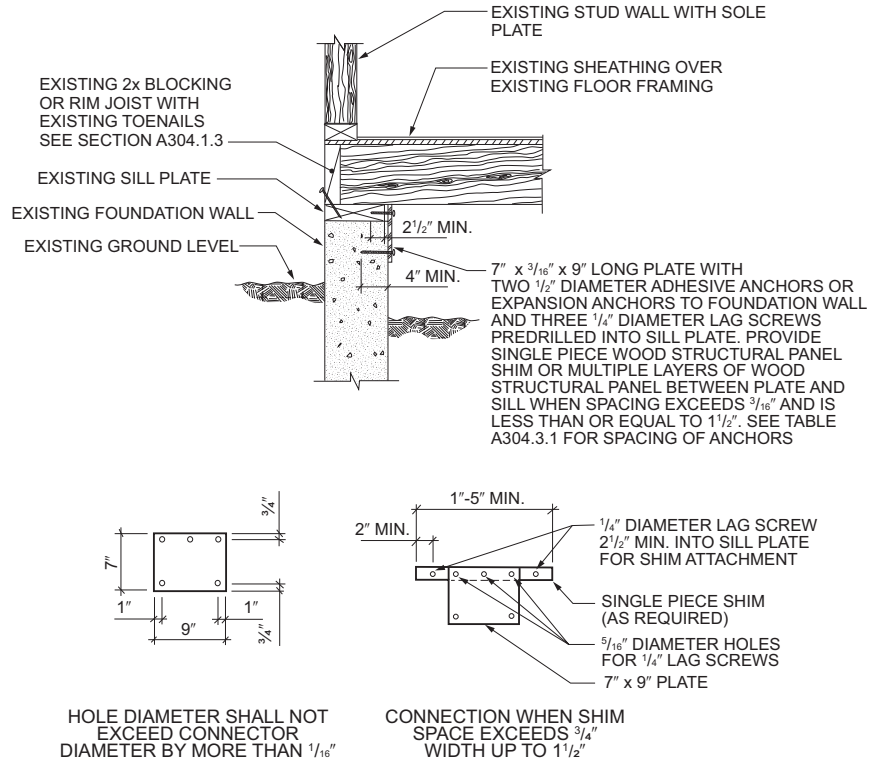
$\frac{5}{8}$ -inch anchor or bolt—3 inches \times 3 inches \times 0.229 inch minimum.

A diagonal slot in the plate washer is permitted in accordance with Table A304.3.1, Note b.

b. See Figure A304.4.1(1) or A304.4.1(2) for cripple wall bracing.

[BS] FIGURE A304.3.1(1)
SILL PLATE ANCHORING TO EXISTING FOUNDATION^{a, b}

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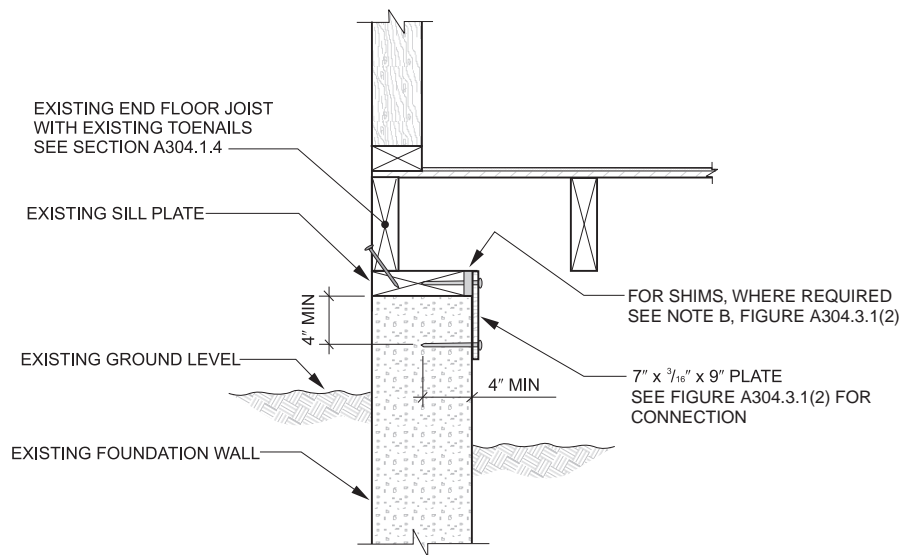


For SI: 1 inch = 25.4 mm.

NOTES:

- a. If shim space exceeds 1 1/2 inches, alternative details will be required.
- b. Where required, single piece shim shall be naturally durable wood or preservative-treated wood. If preservative-treated wood is used, it shall be isolated from the foundation system with a moisture barrier.

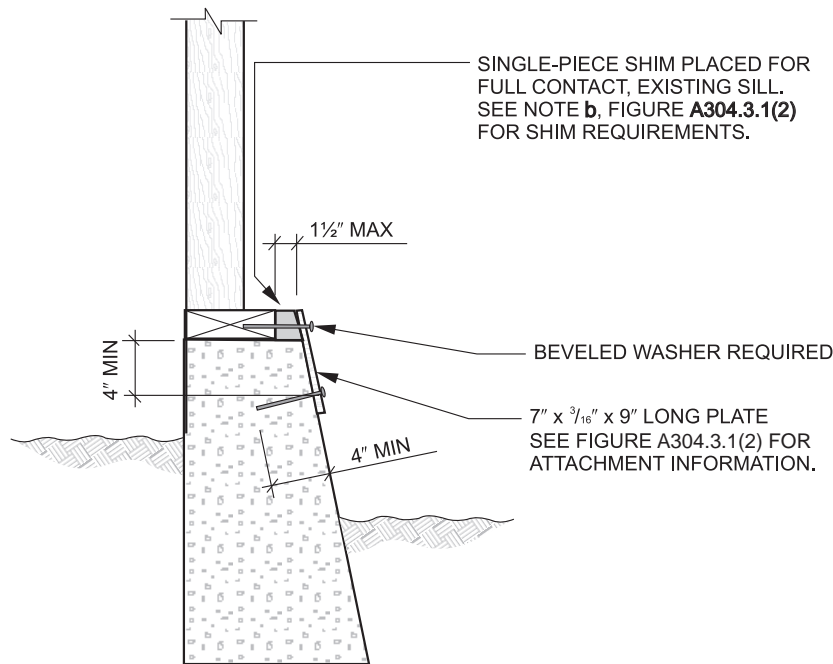
[BS] FIGURE A304.3.1(2)
ALTERNATIVE SILL PLATE ANCHORING IN EXISTING FOUNDATION—WITHOUT CRIPPLE WALLS AND FLOOR FRAMING NOT PARALLEL TO FOUNDATIONS^{a, b}



For SI: 1 inch = 25.4 mm.

[BS] FIGURE A304.3.1(3)
ALTERNATIVE SILL PLATE ANCHOR TO EXISTING FOUNDATION WITHOUT CRIPPLE WALL AND FLOOR FRAMING PARALLEL TO FOUNDATIONS

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For SI: 1 inch = 25.4 mm.

[BS] FIGURE A304.3.1(4)
SILL PLATE ANCHORING TO EXISTING FOUNDATION—ALTERNATIVE CONNECTION FOR BATTERED FOOTING

[BS] TABLE A304.3.2
SILL PLATE ANCHORAGE FOR VARIOUS LENGTHS OF SILL PLATE^{a, b}

NUMBER OF STORIES	LENGTHS OF SILL PLATE		
	Less than 12 feet to 6 feet	Less than 6 feet to 30 inches	Less than 30 inches ^c
One story	Three connections	Two connections	One connection
Two stories	Four connections for 1/2-inch anchors or bolts or three connections for 5/8-inch anchors or bolts	Two connections	One connection
Three stories	Four connections	Two connections	One connection

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Connections shall be either adhesive anchors or expansion anchors.
- b. See Section A304.3.2 for minimum end distances.
- c. Connections shall be placed as near to the center of the length of plate as possible.

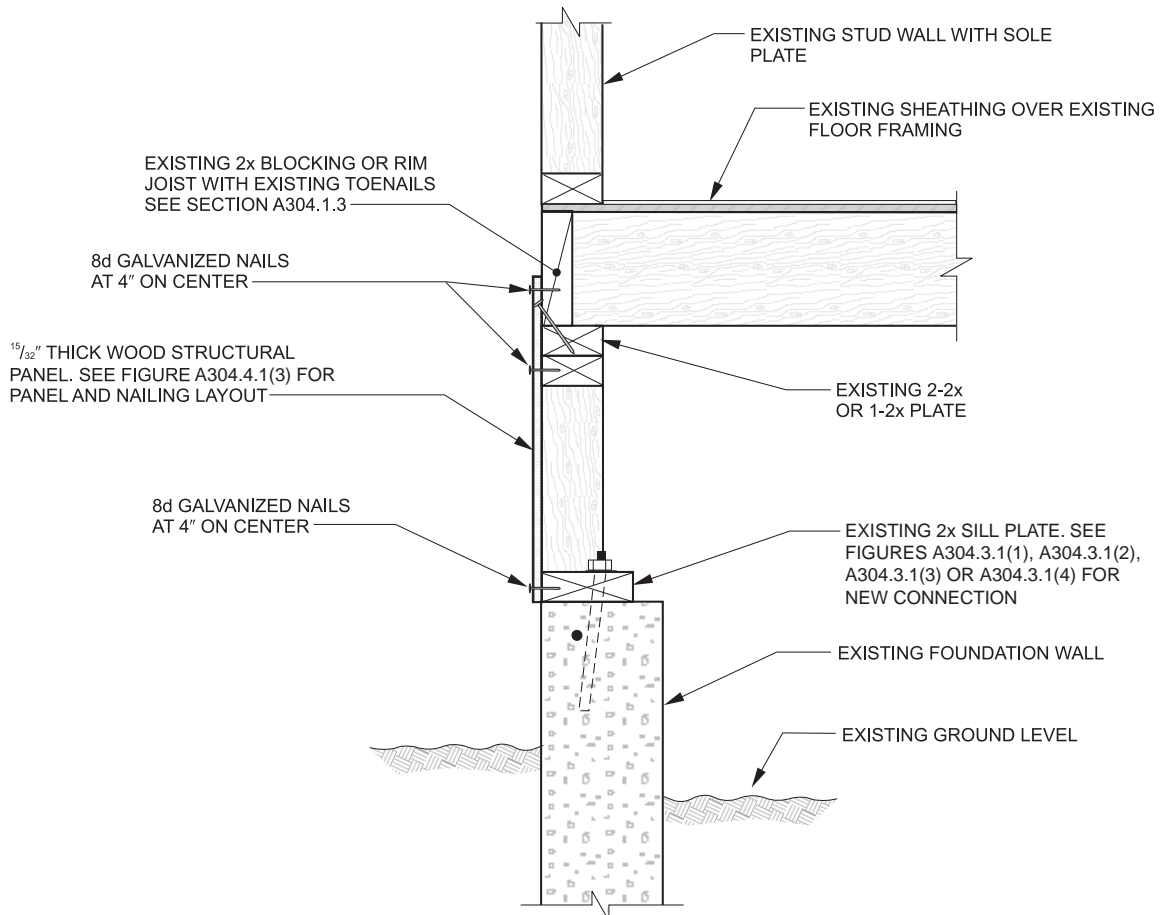
APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

[BS] A304.4.1.1 Sheathing installation requirements. Wood structural panel sheathing shall be not less than $1\frac{5}{32}$ -inch (12 mm) thick and shall be installed in accordance with Figure A304.4.1(1) or A304.4.1(2). Individual pieces of wood structural panels shall be nailed with 8d common nails spaced 4 inches (102 mm) on center at all edges and 12 inches (305 mm) on center at each intermediate support with not less than two nails for each stud. Nails shall be driven so that their heads are flush with the surface of the sheathing and shall penetrate the supporting member not less than $1\frac{1}{2}$ inches (38 mm). When a nail fractures the surface, it shall be left in place and not counted as part of the required nailing. A new 8d nail shall be located within 2 inches (51 mm) of the discounted nail and be hand-driven flush with the sheathing surface. Where the installation involves horizontal joints, those joints shall occur over nominal 2-inch by 4-inch (51 mm by 102 mm) blocking installed with the nominal 4-inch (102 mm) dimension against the face of the plywood.

Vertical joints at adjoining pieces of wood structural panels shall be centered on studs such that there is a minimum $\frac{1}{8}$ inch (3.2 mm) between the panels. Where required edge distances cannot be maintained because of the width of the existing stud, a new stud shall be added adjacent to the existing studs and connected in accordance with Figure A304.4.1(3).

[BS] A304.4.2 Distribution and amount of bracing. See Table A304.3.1 and Figure A304.4.2 for the distribution and amount of bracing required for each wall line. Each braced panel length must be not less than two times the height of the cripple stud. Where the minimum amount of bracing prescribed in Table A304.3.1 cannot be installed along any walls, the bracing must be designed in accordance with Section A301.3.

Exception: Where physical obstructions such as fireplaces, plumbing or heating ducts interfere with the placement of cripple wall bracing, the bracing shall then be placed as close to the obstruction as possible. The total amount of bracing required shall not be reduced because of obstructions.



For SI: 1 inch = 25.4 mm.

NOTE: See Figure A304.3.1(1) for sill plate anchoring.

[BS] FIGURE A304.4.1(1)
CRIPPLE WALL BRACING WITH NEW WOOD STRUCTURAL PANEL ON EXTERIOR FACE OF CRIPPLE STUDS

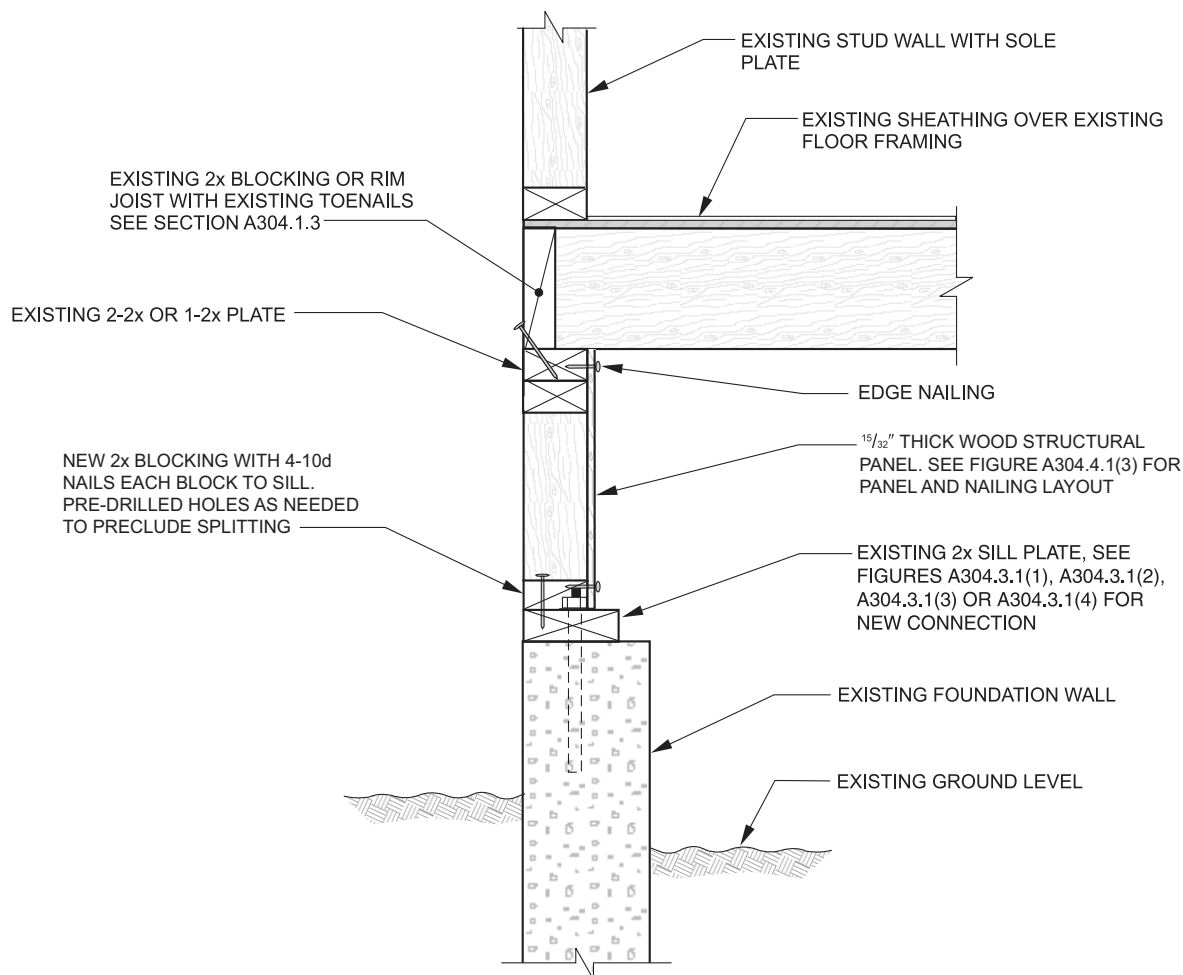
APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

[BS] A304.4.3 Stud space ventilation. Where bracing materials are installed on the interior face of studs forming an enclosed space between the new bracing and the existing exterior finish, each braced stud space must be ventilated. Adequate ventilation and access for future inspection shall be provided by drilling one 2-inch to 3-inch-diameter (51 mm to 76 mm) round hole through the sheathing, nearly centered between each stud at the top and bottom of the cripple wall. Such holes should be spaced not less than 1 inch (25 mm) clear from the sill or top plates. In stud spaces containing sill bolts, the hole shall be located on the centerline of the sill bolt but not closer than 1 inch (25 mm) from the nailing edge of the sheathing. Where existing blocking occurs within the stud space, additional ventilation holes shall be placed above and below the blocking, or the existing block shall be removed and a new nominal 2-inch by 4-inch (51 mm by 102 mm) block shall be installed with the nominal 4-inch (102 mm) dimension against the face of the plywood.

For stud heights less than 18 inches (457 mm), only one ventilation hole need be provided.

[BS] A304.4.4 Existing underfloor ventilation. Existing underfloor ventilation shall not be reduced without providing equivalent new ventilation as close to the existing ventilation as possible. Braced panels may include underfloor ventilation openings where the height of the opening, measured from the top of the foundation wall to the top of the opening, does not exceed 25 percent of the height of the cripple stud wall; however, the length of the panel shall be increased a distance equal to the length of the opening or one stud space minimum. Where an opening exceeds 25 percent of the cripple wall height, braced panels shall not be located where the opening occurs. See Figure A304.4.1(3).

Exception: For homes with a post and pier foundation system where a new continuous perimeter foundation system is being installed, new ventilation shall be provided in accordance with the building code.



For SI: 1 inch = 25.4 mm.

[BS] FIGURE A304.4.1(2)
CRIPPLE WALL BRACING WITH WOOD STRUCTURAL PANEL ON INTERIOR FACE OF CRIPPLE STUDS

APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

[BS] A304.5 Inspections. All work shall be subject to inspection by the code official including, but not limited to:

1. Placement and installation of new adhesive or expansion anchors installed in existing foundations. Special inspection *may be* required for adhesive anchors installed in existing foundations regulated by the prescriptive provisions of this chapter.
2. Installation and nailing of new cripple wall bracing.
3. Any work shall be subject to special inspection where required by the code official in accordance with the building code.

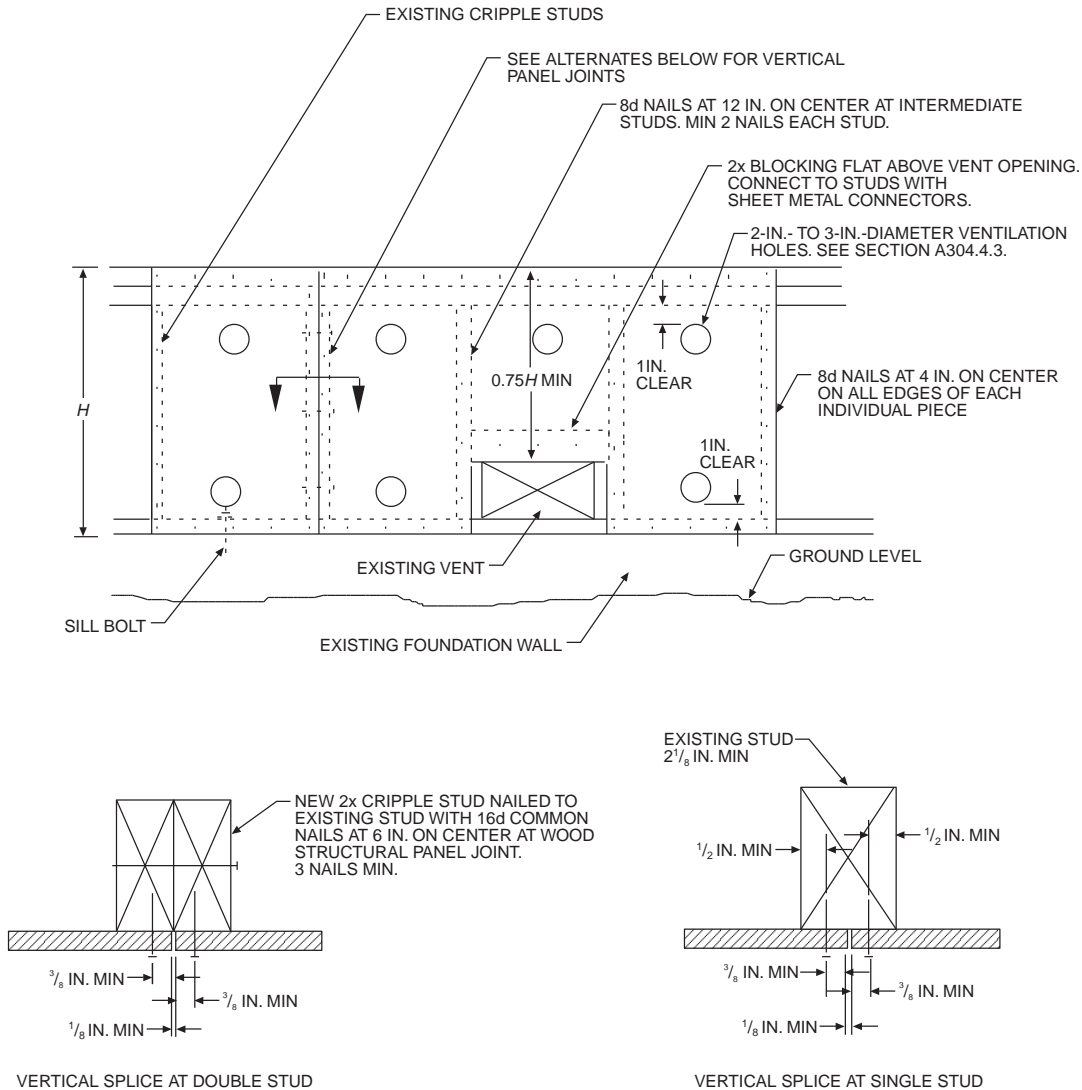
[BS] A304.5.1 Nails. All nails specified in this chapter shall be common wire nails of the following diameters and lengths:

1. 8d nails = 0.131 inch (3.3 mm) by 2½ inches (64 mm).

2. 10d nails = 0.148 inch (3.8 mm) by 3 inches (76 mm).
3. 12d nails = 0.148 inch (3.8 mm) by 3¼ inches (83 mm).
4. 16d nails = 0.162 inch (4.1 mm) by 3½ inches (89 mm).

Nails used to attach metal framing connectors directly to wood members shall be as specified by the connector manufacturer in an approved report.

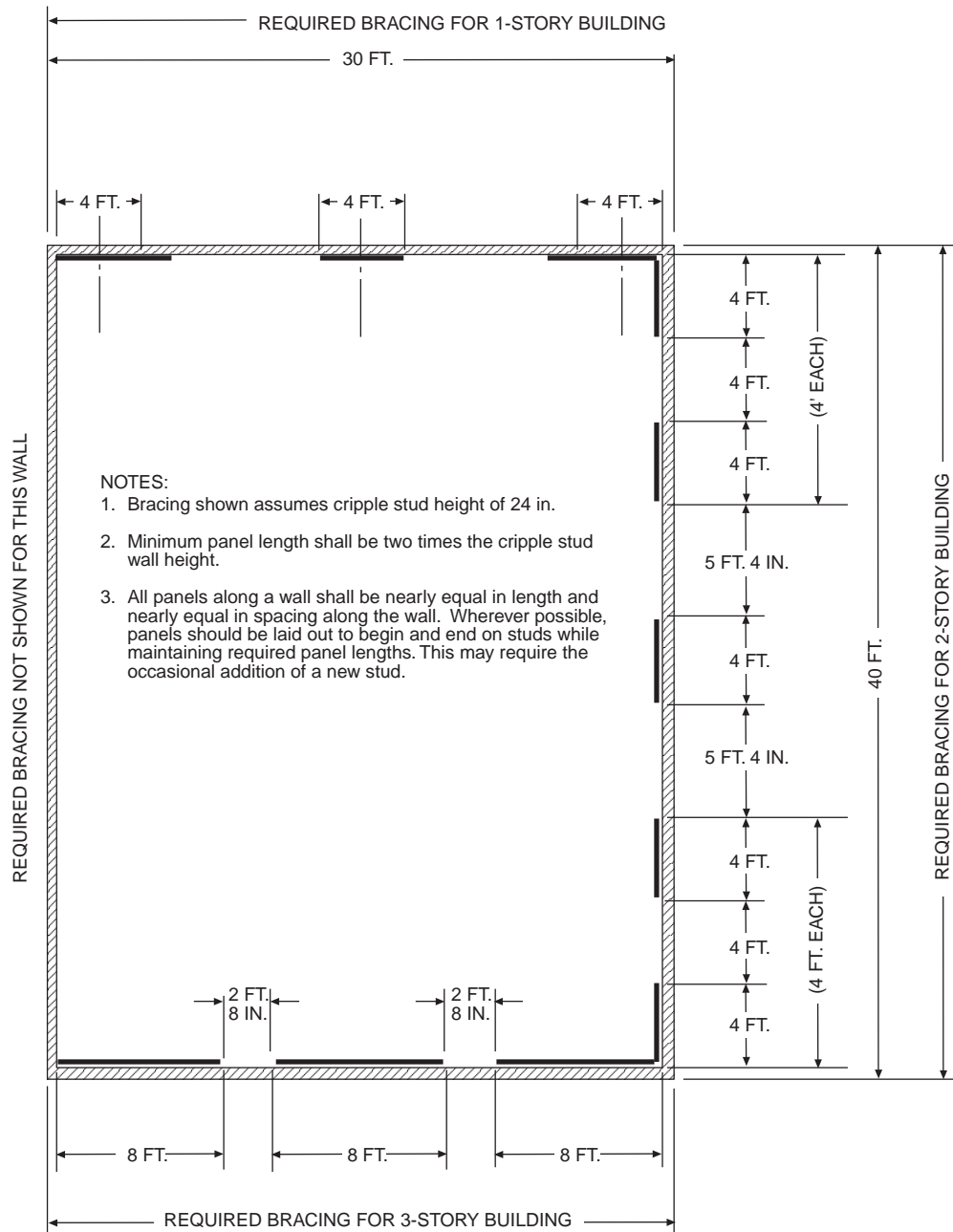
A304.6 Phasing of the strengthening work. When approved by the Enforcing Agency, the strengthening work contained in this chapter may be completed in phases.



For SI: 1 inch = 25.4 mm.

**[BS] FIGURE A304.4.1(3)
PARTIAL CRIPPLE STUD WALL ELEVATION**

APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS



Bracing determination:

- 1-story building—each end and not less than 40% of wall length.^a
 Transverse wall— $30 \text{ ft.} \times 0.40 = 12 \text{ ft.}$ minimum panel length = 4 ft. 0 in.
- 2-story building—each end and not less than 50% of wall length.^a
 Longitudinal wall— $40 \text{ ft.} \times 0.50 = 20 \text{ ft.}$ 0 in. minimum of bracing.
- 3-story building—each end and not less than 80% of wall length.^a
 Transverse wall— $30 \text{ ft.} \times 0.80 = 24 \text{ ft.}$ 0 in. minimum of bracing.

a. See Table 304.3.1 for buildings with both plaster walls and roofing exceeding 6 psf.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 42.88 N/m².

[BS] FIGURE A304.4.2
 FLOOR PLAN-CRIPPLE WALL BRACING LAYOUT