4.3.3.4.1 Shear distribution to individual shear walls in a shear wall line shall provide the same calculated deflection, δ_{sw}, in each shear wall.

Exceptions:

1. Where nominal shear capacities of all wood structural panel shear walls with aspect ratios (h/b_s) greater than 2:1 are multiplied by $2b_s/h$ for design, shear distribution to individual full-height wall segments shall be permitted to be taken as proportional to the shear capacities of individual full height wall segments used in design. Where multiplied by $2b_s/h$, the nominal shear capacities need not be reduced by the adjustment in 4.3.4.2.

2. Where nominal shear capacities of all structural fiberboard shear walls with aspect ratios (h/b_s) greater than 1:1 are multiplied by $0.1 + 0.9b_s/h$ for design, shear distribution to individual full-height wall segments shall be permitted to be taken as proportional to the shear capacities of individual full height wall segments used in design. Where multiplied by $0.1 + 0.9b_s/h$, the nominal shear capacities need not be reduced by the adjustment in 4.3.4.2.

4.3.3.5 Shear Capacity of Perforated Shear Walls: The nominal shear capacity of a perforated shear wall shall be taken as the tabulated nominal unit shear capacity multiplied by the sum of the shear wall segment lengths, ΣL_i, and the appropriate shear capacity adjustment factor, C_o, from Table 4.3.3.5 or calculated using the following equation:

$$C_O = \left(\frac{r}{3 - 2r}\right)\left(\frac{L_{tot}}{\sum L_i}\right) \qquad (4.3\text{-}5)$$

$$r = \frac{1}{1 + \frac{A_o}{h\sum L_i}} \qquad (4.3\text{-}6)$$

where:

r = sheathing area ratio

L_{tot} = total length of a perforated shear wall including the lengths of perforated shear wall segments and the lengths of segments containing openings, ft

A_o = total area of openings in the perforated shear wall where individual opening areas are calculated as the opening width times the clear opening height, ft^2. Where sheathing is not applied to framing above or below the opening, these areas shall be included in the total area of openings. Where the opening height is less than h/3, an opening height of h/3 shall be used

h = height of the perforated shear wall, ft

ΣL_i = sum of perforated shear wall segment lengths L_i, ft. Lengths of perforated shear wall segments with aspect ratios greater than 2:1 shall be adjusted in accordance with 4.3.4.3.

4.3.4 Shear Wall Aspect Ratios and Capacity Adjustments

4.3.4.1 The size and shape of shear walls shall be limited to the aspect ratios in Table 4.3.4.

4.3.4.2 For wood structural panel shear walls with aspect ratios (h/b_s) greater than 2:1, the nominal shear capacity shall be multiplied by the Aspect Ratio Factor (WSP) = $1.25 - 0.125h/b_s$. For structural fiberboard shear walls with aspect ratios (h/b_s) greater than 1:1, the nominal shear capacity shall be multiplied by the Aspect Ratio Factor (fiberboard) = $1.09 - 0.09\ h/b_s$.

4.3.4.3 Aspect Ratio of Perforated Shear Wall Segments: The aspect ratio limitations of Table 4.3.4 shall apply to perforated shear wall segments within a perforated shear wall as illustrated in Figure 4C. Portions of walls with aspect ratios exceeding 3.5:1 shall not be considered in the sum of shear wall segments. In the design of perforated shear walls, the length of each perforated shear wall segment with an aspect ratio greater than 2:1 shall be multiplied by $2b_s/h$ for the purposes of determining L_i and ΣL_i. The provisions of Section 4.3.4.2 and the exceptions to Section 4.3.3.4.1 shall not apply to perforated shear wall segments.

Table 4.3.3.5 Shear Capacity Adjustment Factor, C_o

Wall Height, h	Maximum Opening Height[1]				
	h/3	h/2	2h/3	5h/6	h
8' Wall	2'-8"	4'-0"	5'-4"	6'-8"	8'-0"
10' Wall	3'-4"	5'-0"	6'-8"	8'-4"	10'-0"
Percent Full-Height Sheathing [2]	**Effective Shear Capacity Ratio**				
10%	1.00	0.69	0.53	0.43	0.36
20%	1.00	0.71	0.56	0.45	0.38
30%	1.00	0.74	0.59	0.49	0.42
40%	1.00	0.77	0.63	0.53	0.45
50%	1.00	0.80	0.67	0.57	0.50
60%	1.00	0.83	0.71	0.63	0.56
70%	1.00	0.87	0.77	0.69	0.63
80%	1.00	0.91	0.83	0.77	0.71
90%	1.00	0.95	0.91	0.87	0.83
100%	1.00	1.00	1.00	1.00	1.00

1 The maximum opening height shall be taken as the maximum opening clear height in a perforated shear wall. Where areas above and/or below an opening remain unsheathed, the height of each opening shall be defined as the clear height of the opening plus the unsheathed areas.

2 The sum of the perforated shear wall segment lengths, $\sum L_i$, divided by the total length of the perforated shear wall, L_{tot}. Lengths of perforated shear wall segments with aspect ratios greater than 2:1 shall be adjusted in accordance with Section 4.3.4.3.

4.3.4.4 Aspect Ratio of Force-transfer Shear Walls: The aspect ratio limitations of Table 4.3.4 shall apply to the overall shear wall including openings and to each wall pier at the sides of openings. The height of a wall pier with an opening on one side shall be defined as the clear height of the pier at the side of the opening. The height of a wall pier with an opening on each side shall be defined as the larger of the clear heights of the pier at the sides of the openings. The length of a wall pier shall be defined as the sheathed length of the pier. Wall piers with aspect ratios exceeding 3.5:1 shall not be considered as portions of force-transfer shear walls.

Table 4.3.4 Maximum Shear Wall Aspect Ratios

Shear Wall Sheathing Type	Maximum h/b_s Ratio
Wood structural panels, unblocked	2:1
Wood structural panels, blocked	3.5:1
Particleboard, blocked	2:1
Diagonal sheathing, conventional	2:1
Gypsum wallboard	2:1[1]
Portland cement plaster	2:1[1]
Structural Fiberboard	3.5:1

1 Walls having aspect ratios exceeding 1.5:1 shall be blocked shear walls.

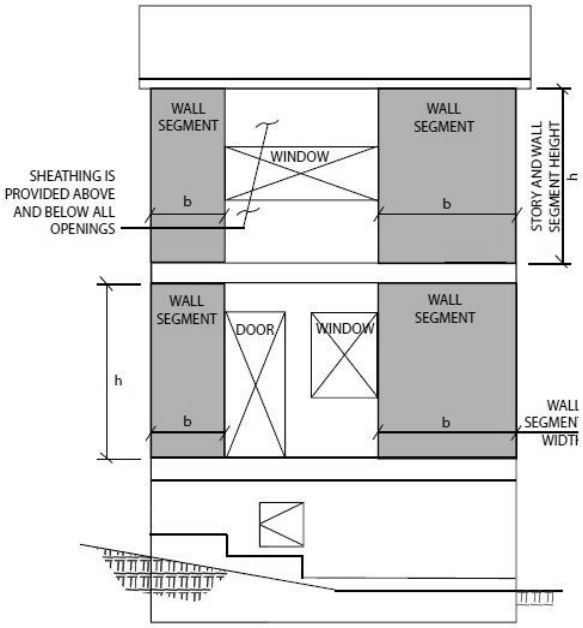
4.3.5 Shear Wall Types

Where individual full-height wall segments are designed as shear walls, the provisions of 4.3.5.1 shall apply. For shear walls with openings, where framing members, blocking, and connections around the openings are designed for force transfer around the openings (force-transfer shear walls) the provisions of 4.3.5.2 shall apply. For shear walls with openings, where framing members, blocking, and connections around the opening are not designed for force transfer around the openings (perforated shear walls) the provisions of 4.3.5.3 shall apply or individual full-height wall segments shall be designed per 4.3.5.1

4.3.5.1 Individual Full-Height Wall Segments: Where individual full-height wall segments are designed as shear walls without openings, the aspect ratio limitations of 4.3.4 shall apply to each full-height wall segment as illustrated in Figure 4D. The following limitations shall apply:

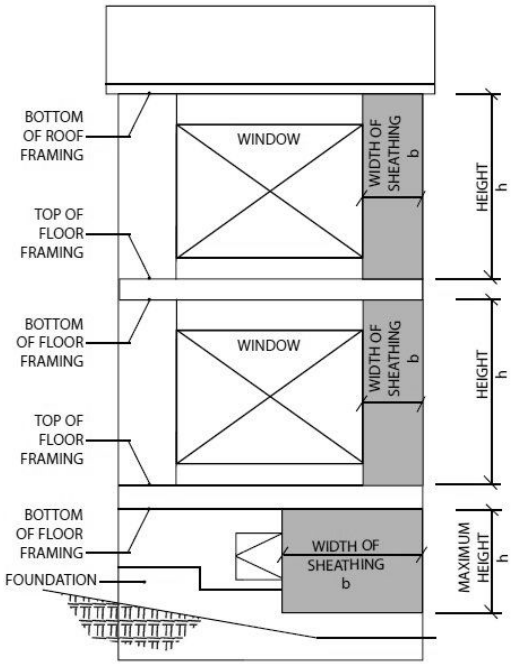
1. Openings shall be permitted to occur beyond the ends of a shear wall. The length of such openings shall not be included in the length of the shear walls.
2. Where out-of-plane offsets occur, portions of the wall on each side of the offset shall be considered as separate shear walls.
3. Collectors for shear transfer to individual full-height wall segments shall be provided.

Figure 4C Typical Shear Wall Height-to-Width Ratio for Perforated Shear Walls



Note: b_s is the minimum shear wall segment length, b, in the perforated shear wall.

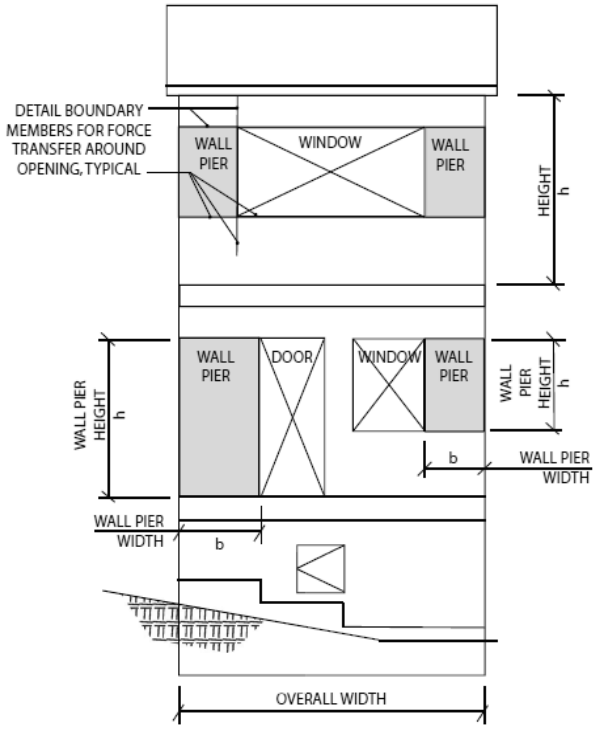
Figure 4D Typical Individual Full-Height Wall Segments Height-to-Width Ratio



4.3.5.2 Force-transfer Shear Walls: Where shear walls with openings are designed for force transfer around the openings, the aspect ratio limitations of 4.3.4.4 shall apply as illustrated in Figure 4E. Design for force transfer shall be based on a rational analysis. The following limitations shall apply:

1. The length of each wall pier shall not be less than 2'.
2. A full-height wall segment shall be located at each end of a force-transfer shear wall.
3. Where out-of-plane offsets occur, portions of the wall on each side of the offset shall be considered as separate force-transfer shear walls.
4. Collectors for shear transfer shall be provided through the full length of the force-transfer shear wall.

Figure 4E Typical Shear Wall Height-to-Width Ratio for Shear Walls Designed for Force Transfer Around Openings



4.3.5.3 Perforated Shear Walls: Where shear walls with openings are not designed for force transfer around the openings, they shall be designed as perforated shear walls. Perforated shear walls shall be sheathed on one or both sides with wood structural panel sheathing. The combined nominal unit shear

capacity of perforated shear walls sheathed with wood structural panel sheathing on one side and gypsum wallboard on the opposite side shall be permitted to be determined in accordance with Section 4.3.3.3.2. The following limitations shall apply:

1. A perforated shear wall segment shall be located at each end of a perforated shear wall. Openings shall be permitted to occur beyond the ends of the perforated shear wall, provided the lengths of such openings are not included in the length of the perforated shear wall.
2. The aspect ratio limitations of Section 4.3.4.3 shall apply.
3. The nominal unit shear capacity for a single-sided wall shall not exceed 1,740 plf for seismic or 2,435 plf for wind as given in Table 4.3A. The nominal unit shear capacity for a double-sided wall shall not exceed 2,435 plf for wind.
4. Where out-of-plane offsets occur, portions of the wall on each side of the offset shall be considered as separate perforated shear walls.
5. Collectors for shear transfer shall be provided through the full length of the perforated shear wall.
6. A perforated shear wall shall have uniform top-of-wall and bottom-of-wall elevations. Perforated shear walls not having uniform elevations shall be designed by other methods.
7. Perforated shear wall height, h, shall not exceed 20'.

4.3.6 Construction Requirements

4.3.6.1 Framing Requirements: All framing members and blocking used for shear wall construction shall be 2" nominal or greater. Where shear walls are designed as blocked, all joints in sheathing shall occur over and be fastened to common framing members or common blocking. Shear wall boundary elements, such as end posts, shall be provided to transmit the design tension and compression forces. Shear wall sheathing shall not be used to splice boundary elements. End posts (studs or columns) shall be framed to provide full end bearing.

4.3.6.1.1 Common Framing Member: Where a common framing member is required at adjoining panel edges, two framing members that are at least 2" in nominal thickness shall be permitted provided they are fastened together with fasteners designed in accordance with the NDS to transfer the induced shear between members. When fasteners connecting the two framing members are spaced less than 4" in center, they shall be staggered.

4.3.6.1.2 Tension and Compression Chords: Tension force, T, and a compression force, C, resulting from shear wall overturning forces at each story level shall be calculated in accordance with the following:

$$T = C = \nu h \tag{4.3-7}$$

where:

C = compression force, lbs

h = shear wall height, ft

T = tension force, lbs

ν = induced unit shear, lbs/ft

4.3.6.1.3 Tension and Compression Chords of Perforated Shear Walls: Each end of each perforated shear wall shall be designed for a tension force, T, and a compression force, C. Each end of each perforated shear wall segment shall be designed for a compression force, C, in each segment. For perforated shear walls, the values for T and C resulting from shear wall overturning at each story level shall be calculated in accordance with the following:

$$T = C = \frac{Vh}{C_o \sum L_i} \tag{4.3-8}$$

where:

C_o = shear capacity adjustment factor from Table 4.3.3.5

V = induced shear force in perforated shear wall, lbs

ΣL_i = sum of perforated shear wall segment lengths L_i, ft. Lengths of perforated shear wall segments with aspect ratios greater than 2:1 shall be adjusted in accordance with 4.3.4.3.

4.3.6.2 Sheathing: Shear walls shall be sheathed with approved materials attached directly to the framing members, and blocking where required, except as permitted in 4.3.7.2. Details on sheathing types and thicknesses for commonly used shear wall assemblies are provided in 4.3.7 and Tables 4.3A, 4.3B, 4.3C, and 4.3D.