6.6 Design Examples

EXAMPLE 6.1 *Segmented Shear Wall Design*

Given

The segmented shear wall line, as shown in the figure below, has the following dimensions:

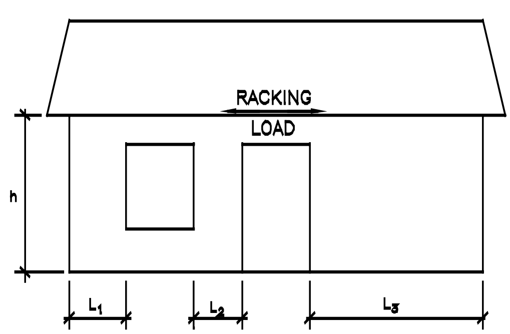
h = 8 ft
L_1 = 3 ft
L_2 = 2 ft
L_3 = 8 ft

Wall construction:

- Exterior sheathing is 7/16-inch-thick OSB with 8d pneumatic nails (0.113 inch diameter by 2 3/8 inches long) spaced 6 inches on center on panel edges and 12 inches on center in panel field
- Interior sheathing is 1/2-inch-thick gypsum wall board with #6 screws at 12 inches on center
- Framing lumber is Spruce-Pine-Fir, Stud grade (specific gravity, G = 0.42); studs are spaced at 16 inches on center.

Loading condition (assumed for illustration)

Wind shear load on wall line = 3,000 lb
Seismic shear load on wall line = 1,000 lb



Find

1. Design capacity of the segmented shear wall line for wind and seismic shear resistance.
2. Base shear connection requirements.
3. Chord tension and compression forces.
4. Load-drift behavior of the segmented shear wall line and estimated drift at design load conditions.

Solution

1. Determine the factored and adjusted (design) shear capacities for the wall segments and the total wall line (Section 6.5.2).

$F_{s,ext}$ = 905 plf OSB sheathing (Table 6.1)
$F_{s,int}$ = 80 plf GWB sheathing (Table 6.3)

The design shear capacity of the wall construction is determined as follows for each segment (Sections 6.5.2.1 and 6.5.2.2):

$F'_s = F'_{s,ext} + F'_{s,int}$
$F'_s = F_{s,ext} C_{sp} C_{ns} C_{ar} [1/SF] + F_{s,int} C_{ar} [1/SF]$

C_{sp} = [1-(0.5-0.42)] = 0.92 (Section 6.5.2.3)
C_{ns} = 0.75 (Table 6.7)
SF = 2.0 (wind) or 2.5 (seismic) (Table 6.5)

<u>Segment 1</u>

a = h/L_1 = (8 ft)/(3 ft) = 2.67 (segment aspect ratio)
C_{ar} = 1/sqrt(0.5(a)) = 0.87 (Section 6.5.2.3)

For wind design

$F'_{s,1,wind}$ = (905 plf)(0.92)(0.75)(0.87)(1/2.0) + (80 plf)(0.87)(1/2.0)
= 272 plf + 35 plf = 307 plf
$F_{ssw,1,wind}$ = $F'_s(L_1)$ = (307 plf)(3 ft) = 921 lb

For seismic design

$F'_{s,1,seismic}$ = (905 plf)(0.92)(0.75)(0.87)(1/2.5) + 0 = 218 plf
$F_{ssw,1,seismic}$ = (218 plf)(3 ft) = 654 lb

<u>Segment 2</u>

a = h/L_2 = (8 ft)/(2 ft) = 4
C_{ar} = 1/sqrt(0.5(a)) = 0.71

For wind design

$F'_{s,2,wind}$ = (905 plf)(0.92)(0.75)(0.71)(1/2.0) + (80 plf)(0.71)(1/2.0)
= 222 plf + 28 plf = 250 plf
$F_{ssw,2,wind}$ = (250 plf)(2 ft) = 500 lb

For seismic design

$F'_{s,2,seismic}$ = (905 plf)(0.92)(0.75)(0.71)(1/2.5) + 0 = 178 plf
$F_{ssw,2,seismic}$ = (178 plf)(2 ft) = 356 lb