Segment 3

a = h/L_3 = (8 ft)/(8 ft) = 1
C_{ar} = 1.0 (for a < 2)

For wind design

$F'_{s,3,wind}$ = (905 plf)(0.92)(0.75)(1.0)(1/2.0) + (80 plf)(1.0)(1/2.0)
= 312 plf + 40 plf = 352 plf
$F_{ssw,3,wind}$ = (352 plf)(8 ft) = 2,816 lb

For seismic design

$F'_{s,3,seismic}$ = (905 plf)(0.92)(0.75)(1.0)(1/2.5) + 0 = 250 plf
$F_{ssw,3,seismic}$ = (250 plf)(8 ft) = 2,000 lb

Total for wall line

$F_{ssw,total,wind}$ = 921 lb + 500 lb + 2,816 lb = 4,237 lb
$F_{ssw,total,seismic}$ = 654 lb + 356 lb + 2,000 lb = 3,010 lb

2. Determine base shear connection requirements to transfer shear load to the foundation or floor construction below the wall

The wall bottom plate to the left of the door opening is considered to be continuous and therefore acts as a distributor of the shear load resisted by Segments 1 and 2. The uniform shear connection load on the bottom plate to the left of the opening is determined as follows:

Bottom plate length = 3 ft + 3 ft + 2 ft = 8 ft

Base shear resistance required (wind) = ($F_{ssw,1,wind}$ + $F_{ssw,2,wind}$)/(plate length)
= (921 lb + 500 lb)/(8 ft) = 178 plf

Base shear resistance required (seismic) = ($F_{ssw,1,seismic}$ + $F_{ssw,2,seismic}$)/(plate length)
= (654 lb + 356 lb)/(8 ft) = 127 plf

For the wall bottom plate to the right of the door opening, the base shear connection is equivalent to $F'_{s,3,wind}$ = 352 plf or $F'_{s,3,seismic}$ = 250 plf for wind and seismic design respectively.

Normally, this connection is achieved by use of nailed or bolted bottom plate fastenings. Refer to Chapter 7 and Section 7.3.6 for information on designing these connections.

Notes:

1. While the above example shows that variable bottom plate connections may be specified based on differing shear transfer requirements for portions of the wall, it is acceptable practice to use a constant (i.e., worst-case) base shear connection to simplify construction. However, this can result in excessive fastening requirements for certain loading conditions and shear wall configurations.
2. For the assumed wind loading of 3,000 lb, the wall has excess design capacity (i.e., 4,237 lb). The design wind load may be distributed to the shear wall segments in proportion to their design capacity (as shown in the next step for hold-down design) to reduce the shear connection loads accordingly. For seismic design, this should not be done and the base shear connection design should be based on the design capacity of the shear walls to ensure that a "balanced design" is achieved (i.e., the base connection capacity meets or exceeds that of the shear wall). This approach is necessary in seismic design because the actual shear force realized in the connections may be substantially higher than anticipated by the design seismic load calculated using an R factor in accordance with Equation 3.8-1 of Chapter 3. Refer also to the discussion on R factors and overstrength in Section 3.8.4 of Chapter 3. It should be realized that the GWB interior finish design shear capacity was not included in determining the design shear wall capacity for seismic loading. While this is representative of current building code practice, it can create a situation where the actual shear wall capacity and connection forces experienced are higher than those used for design purposes. This condition (i.e., underestimating of the design shear wall capacity) should also be considered in providing sufficiently strong overturning connections (i.e., hold-downs) as covered in the next step.

3. Determine the chord tension and compression (i.e., overturning) forces in the shear wall segments (Section 6.5.2.4)

Basic equation for overturning (Equation 6.5-7c)

$T = C = (d/x)(F'_s)(h)$

<u>Segment 1</u>

h = 8 ft
d = 3 ft
x = d – (width of end studs + offset to center of hold-down anchor bolt)*
= 3 ft – (4.5 in + 1.5 in)(1ft/12 in) = 2.5 ft

*If an anchor strap is used, the offset dimension may be reduced from that determined above assuming a side-mounted hold-down bracket. Also, depending on the number of studs at the end of the wall segment and the type of bracket used, the offset dimension will vary and must be verified by the designer.

$F'_{s,1,wind}$ = 307 plf
$F'_{s,1,seismic}$ = 218 plf

T = C = (3 ft / 2.5 ft)(307 plf)(8 ft) = 2,947 lb (wind)
T = C = (3 ft / 2.5 ft)(218 plf)(8 ft) = 2,093 lb (seismic)