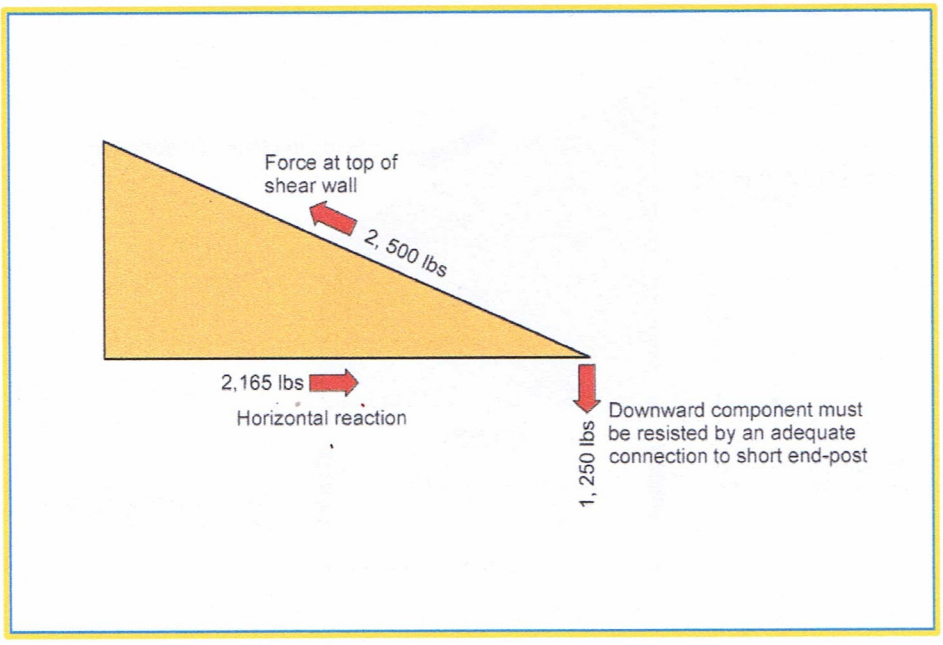

Figure 153

Free-body diagram of triangular portion of wall. The lines of action of all three forces must pass through the low point of the triangle.

If we consider only the rectangular portion of the wall, we can then add the vertical reaction from the triangular portion to find the overall tie-down forces. Using the shear wall from the previous example, the horizontal component acting at the top of the rectangular portion of the wall would require a tie-down force of (2,165 pounds) 8 feet/12 feet = 1,443 pounds. This is the same force we found for the tall end-post as determined in Figure 152. If we add the 1,250-pound vertical component shown in Figure 153 to 1,443 pounds, we get 2,693 pounds. This is the same force determined in Figure 152 as the tie-down force at the short end-post.

The preceding gives us another method to find the tie-down force at the short end-post: The horizontal component of the diaphragm force (typically determined in a lateral analysis) multiplied by the tangent of the roof angle gives the vertical force required to tie the triangular wall segment to the short end-post. Figure 154 illustrates how we can add the forces determined in the "standard" rectangular wall and the triangular segment to get the overall forces on the wall.

Note that this is a theoretical analysis and does not account for the deformation of the wall segments, added strength from sloped rafters that may be present at the top of the wall, bending in the nails, panel buckling, dead load of the wall and any tributary roof area, and so forth. Full scale testing of mono-sloped wall segments could verify or disprove the assumptions stated above. Until such testing is undertaken, this author recommends the preceding approach. Once you get used to the process, it is just as easy as the more common approach of finding the overturning moment due to a horizontal load applied at the average wall height. Calculating the vertical component of force in the short end-post involves no more effort than finding the average wall height.