Wall Design: Shear, In-Plane Axial & Flexure

Height of Wall = 18’, Length of Wall = 16’

8” CMU, unit weight of block = 120 pcf,
Type S Portland Cement/Lime Mortar, running bond
f’m = 1500 psi, grade 60 reinforcement

Gravity Loads:
Super-imposed DL = 30 psf
Roof Live Load = 40 psf
Tributary width of roof loads supported by wall = 28’

Wind Loads
Wind Load normal to wall = 30 psf (check flexure at mid-height)
Wind parallel to wall causes shear at top of wall = 25,000 lb

Out-of-Plane design for axial and flexure: #6 @ 24” (needed for self wt for all but Prob. 2 below)

1. Check the base of the masonry wall described above for out-of-plane shear using ASD.

2. Check the masonry wall for axial and in-plane flexure with no reinforcement, ASD.
   Assume the wall has no out-of-plane reinforcement when calculating self weight. Also assume the wall has face-shell mortar only when calculating section properties.

3. Check the wall for axial and in-plane flexure with reinforcement, ASD.
   a. Verify that the internal forces (P & M) equal (within 10%) the P & M due to loads.
   b. Check the stresses in the masonry and reinforcing steel.

   Assume:
   • the wall has in-plane flexure reinforcement of 2 #8 in the two end cells
   • the compression zone consists of the face shells only (b = 2 t_f)
   • max. compressive strain in the masonry (ɛ_m_top ) = -.000357 and depth of neutral axis (x) = 70.9”.

4. Check if the wall needs shear reinforcement for in-plane shear, ASD. If it does, design the shear reinforcement.

5. Check the wall for axial and in-plane flexure with reinforcement, SD.
   a. Check that the strength (ϕP_n, ϕM_n) exceeds the factored loads (P_u, M_u).
      • Check that the eccentricities for both sets of forces above are about equal.

   Assume:
   • the wall has in-plane flexure reinforcement of 1 #8 in the end cell
   • the compression zone consists of the face shells only (b = 2 t_f)
   • the depth to neutral axis = 33.1”