Masonry Design
Spring 2005

Wall Design: Shear, In-Plane Axial & Flexure

Exam 2 Preview

Height of Wall = 20’ Length of Wall = 14’

12” CMU, unit weight of block = 110 pcf Type M Masonry Cement Mortar, running bond f’m = 2000 psi, grade 60 reinforcement

Gravity Loads:
Super-imposed DL = 20 psf
Roof Live Load = 15 psf
Tributary width of roof loads supported by wall = 30’
Eccentricity of gravity loads = 4” at top of wall

Wind Loads
Wind Load normal to wall = 20 psf (check flexure at mid-height)
Wind parallel to wall causes shear at top of wall = 22,000 lb

1. Check the masonry wall described above for out-of-plane shear using ASD. Assume the wall has flexural reinforcement of #5 @ 48”. (see pg 2/9 of HW #5 Soln for worked-out solution). (~1 page hand-calc)

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. (see pg 5/9 of HW #5 Soln.) (~ ½ pg calc)

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. (~ 1 pg calc)

Assume:
- the wall has the out-of-plane flexure reinforcement described in Problem 1 when calculating the self weight of the wall
- 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 (ε_m_sup) = -.000316 and depth of neutral axis (x) = 52.1”.

4. Check if the wall you checked for Problem 3 above needs shear reinforcement of in-plane shear, ASD. If it does, design the shear reinforcement. (see pg 7/9 of HW #5 Soln). (~3/4 pg calc)

5. Check the wall for axial and in-plane flexure with reinforcement, SD. (see pg 8/9 of HW #5 Soln). (~ 1 pg calc)
   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 equal.

Assume:
- the wall has the out-of-plane flexure reinforcement of #4 @ 48” (for self wt)
- the wall has in-plane flexure reinforcement of 2 #6 in the two end cells
- the compression zone consists of the face shells only (b = 2 t_f)
- the depth to neutral axis = 20.7”