DESIGN METHOD: ACI 530-99: Working Stress Design
MASTERY MATERIAL: Hollow Core Concrete Masonry Units
MORTAR TYPE: Type S
MORTAR MATERIAL: Portland Cement Lime Mortar
BLOCK PLACEMENT: Running Bond

MASTERY WALL DATA:
---------------------------------------------------------------
Wall Height = 18.00 ft.
Nominal Wall Thickness = 8.00 in.
Depth to c.g. Steel, Wall = 3.81 in.
Parapet Height = 0.00 ft.
Nominal Parapet Thickness = 0.00 in.
Depth to c.g. Steel, Parapet = 0.00 in.
Design Strip Width = 12.00 in.
Main Wall Reinf. Layers = One Layer
Wall Grout Spacing = Partially Grouted
Support Type at Base = Pinned Support
Span Type = Supported Top and Bottom

WALL LOADS:
-----------------------------------------------
Wall Weight = 50.00 psf.
Floor or Roof Load:
    Dead = 400.0 Lb
    Live = 400.0 Lb
    Eccentricity = 3.00 in.
Additional Vertical Load:
    Dead = 0.0 Lb
    Live = 0.0 Lb
    Eccentricity = 0.00 in.
    Vertical Distance (y) = 18.00 ft.
Equivalent Fluid Pressure = 0.00 pcf.
    Vertical Distance (x) = 0.00 ft.

SEISMIC LOADS:
-----------------------------------------------
Site Class (A to F) = Class A
Seismic Use Group = I
Short Period Spectral Acceleration, Ss = 0.00 %
One Second Spectral Acceleration, S1 = < 0.75 g
(Computed) Design Category, = Category A
Parapet Component Importance Factor, Ip = 1
Parapet Height/Roof Height Ratio z/h = 0
Veneer Weight = 0.00 psf.
Seismic Load on Main Wall = 5.00 psf.
Seismic Load on Parapet Wall = 0.00 psf.
WIND LOADS:

<table>
<thead>
<tr>
<th>Load</th>
<th>Distance From Base of Wall (ft)</th>
<th>Magnitude (plf, lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>-20.00</td>
<td>0.00</td>
</tr>
<tr>
<td>1</td>
<td>18.00</td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1. "W" designates a uniform distributed wind load.
2. "H" designates a concentrated horizontal wind load.
3. Horizontal loads are positive to the right.

MASONRY DATA:

Masonry Unit Strength = 1900.00 psi.
Masonry Compressive Strength, f'm = 1500.00 psi.
Allowable Flexural Stress, Fb = 500.00 psi.
Allowable Shear Stress, Fv = 38.73 psi.
Allowable Tension: No Grout, Ft = 25.00 psi.
Solid Grout, Ft = 68.00 psi.

Modulus of Elasticity, Em = 1,350 ksi.
Modular Ratio, Es/Em = n = 21.48
Single Grouted Cell + Web Width = 8.30 in.
Nominal Length of Masonry Unit = 16.00 in.
Block Face Shell Thickness = 1.25 in.
Nominal Minus Actual Thickness = 0.38 in.

MATERIAL DATA:

Steel Yield Strength, Fy = 60.00 ksi.
Allowable Steel Stress, Fs = 24.00 ksi.
Modulus of Elasticity, Es = 29,000 ksi.

REINFORCED WALL DATA:

Minimum Steel Ratio, As/bt = 0.0007
GRAPHIC SUMMARY OF MASONRY WALL DATA

- 3.00 in.
- D.L. 400.0 Lb
- L.L. 400.0 Lb

- 8.00 in.

- 3.81 in.

Floor / Roof

Floor

18.00 ft.

-20.00  5.00
MASONRY WALL ANALYSIS AND DESIGN

===============================================================================================
Project: LOCALIZATION
Location: By:
===============================================================================================
TIME: 10:47 AM  PAGE: 4
DATE: 11-01-2002

===============================================
SUMMARY OF RESULTS FOR MAIN WALL
===============================================

DESIGN LOADS:

Moment, Ms = -860.0 ft-lb / 12.00 in.
Axial Load, Ps = 850.0 Lb / 12.00 in.
Load Combination = 1*DL+1*WL
Eccentricity at Moment, e = M/P = 12.14 in.

NOTE: Max. moment is located in Zone C, (e > 2d/3)
Wall is cracked, steel is stressed in tension.

Max. Shear, Vs = 191.1 Lb / 12.00 in.
Load Combination = 1*DL+1*LL+1*WL

ANALYSIS RESULTS:

Design Strip Width = 12.00 in.
Actual Wall Thickness, t = 7.63 in.
Effective Height, h' = 18.00 ft.
Seismic Force, (IBC 2000 1620.1.7) Fp = 5.00 plf. / 12.00 in.

Minimum Area of Steel, Vertical Reinf. = 0.064 in.² / 12.00 in.
Minimum Area of Steel, Horiz. Reinf. = Not Required

Ref. ACI 99 1.11/IBC 2000 2109.6.5

DESIGN RESULTS:

<table>
<thead>
<tr>
<th>Bar</th>
<th>Fa, psi</th>
<th>fv, psi</th>
<th>All. Moment @ Axial Load</th>
<th>Bar Spa. (in. o.c.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(4/3*.25<em>f'm</em>R)</td>
<td>(V/b'd)</td>
<td>(P=850.0 lb)</td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td>305.36</td>
<td>8.05</td>
<td>1,008.0</td>
<td>16.00</td>
</tr>
<tr>
<td>#4</td>
<td>340.84</td>
<td>16.10</td>
<td>941.5</td>
<td>32.00</td>
</tr>
<tr>
<td>#5</td>
<td>354.32</td>
<td>24.15</td>
<td>963.7</td>
<td>48.00</td>
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<tr>
<td>#6</td>
<td>354.32</td>
<td>36.23</td>
<td>899.0</td>
<td>72.00</td>
</tr>
<tr>
<td>#7</td>
<td>354.32</td>
<td>36.23</td>
<td>992.3</td>
<td>72.00</td>
</tr>
<tr>
<td>#8</td>
<td>354.32</td>
<td>36.23</td>
<td>1,071.2</td>
<td>72.00</td>
</tr>
<tr>
<td>#9</td>
<td>354.32</td>
<td>36.23</td>
<td>1,136.0</td>
<td>72.00</td>
</tr>
</tbody>
</table>

Max. vertical bar spacing is 72 inch per ACI 99 2.3.3.3 (commentary)
MASONRY WALL INTERACTION DIAGRAM: (DEAD + LIVE LOAD ONLY)

Effective Wall Height = 18.00 ft. All. Axial Stress, Fa = 255.63 psi.
Actual Wall Thickness = 7.63 in. All. Bending Stress, Fb = 500.00 psi.
Depth to c.g. Steel = 3.81 in. All. Steel Stress, Fs = 24.00 ksi.
Design Width = 12.00 in.
Reinforcing Design = #4 @ 32 in. o.c.

Axial Load (lb) | Moment (ft-lb)
--- | ---
11747 | 1835
10908 | 1957
10068 | 2031
9229 | 2024
8390 | 1967
7551 | 1871
6712 | 1763
5873 | 1642
5034 | 1513
4195 | 1382
3356 | 1252
2517 | 1124
1678 | 989
839 | 762
0 | 528

NOTES: Axial Load = Lb, Moment = ft-lb
Positive moment is defined as moment which causes compression on the outside face of wall.
MASONRY WALL INTERACTION DIAGRAM: (WIND / SEISMIC LOADS)

Effective Wall Height = 18.00 ft. All. Axial Stress, Fa = 340.84 psi.
Actual Wall Thickness = 7.63 in. All. Bending Stress, Fb = 666.67 psi.
Depth to c.g. Steel = 3.81 in. All. Steel Stress, Fs = 32.00 ksi.
Design Width = 12.00 in.
Reinforcing Design = #4 @ 32 in. o.c.

Axial Load | Moment
--- | ---
15662 | 2447
14543 | 2609
13425 | 2708
12306 | 2698
11187 | 2623
10068 | 2494
8950 | 2351
7831 | 2189
6712 | 2017
5594 | 1843
4475 | 1670
3356 | 1499
2237 | 1319
1119 | 1016
0 | 704

NOTES: Axial Load = Lb, Moment = ft-lb
Positive moment is defined as moment which causes compression on the outside face of wall.
### Detailed Results for Main Wall:

**Load Combination:** 1*DL+1*LL  
**Rebar Design:** #4 @ 32 in. o.c.  
**Furnished Area of Steel:** 0.075 in^2 / 12.00 in.  
**Minimum Area of Steel:** 0.064 in^2 / 12.00 in.

<table>
<thead>
<tr>
<th>No.</th>
<th>Dist From Bot (ft)</th>
<th>Mom. (ft-lb)</th>
<th>Axial (lbs)</th>
<th>Shear (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>18.00</td>
<td>-200.0</td>
<td>800.0</td>
<td>-11.1</td>
</tr>
<tr>
<td>1</td>
<td>16.20</td>
<td>-180.0</td>
<td>890.0</td>
<td>-11.1</td>
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<tr>
<td>2</td>
<td>14.40</td>
<td>-160.0</td>
<td>980.0</td>
<td>-11.1</td>
</tr>
<tr>
<td>3</td>
<td>12.60</td>
<td>-140.0</td>
<td>1,070.0</td>
<td>-11.1</td>
</tr>
<tr>
<td>4</td>
<td>10.80</td>
<td>-120.0</td>
<td>1,160.0</td>
<td>-11.1</td>
</tr>
<tr>
<td>5</td>
<td>9.00</td>
<td>-100.0</td>
<td>1,250.0</td>
<td>-11.1</td>
</tr>
<tr>
<td>6</td>
<td>7.20</td>
<td>-80.0</td>
<td>1,340.0</td>
<td>-11.1</td>
</tr>
<tr>
<td>7</td>
<td>5.40</td>
<td>-60.0</td>
<td>1,430.0</td>
<td>-11.1</td>
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<tr>
<td>8</td>
<td>3.60</td>
<td>-40.0</td>
<td>1,520.0</td>
<td>-11.1</td>
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<tr>
<td>9</td>
<td>1.80</td>
<td>-20.0</td>
<td>1,610.0</td>
<td>-11.1</td>
</tr>
<tr>
<td>10</td>
<td>0.00</td>
<td>0.0</td>
<td>1,700.0</td>
<td>-11.1</td>
</tr>
</tbody>
</table>

**Wall Properties:**

- **Effective Flange Width:** \( bf = 12.00 \text{ in.} / 12.00 \text{ in.} \)
- **Effective Grouted Core Width:** \( b' = 3.11 \text{ in.} / 12.00 \text{ in.} \)
- **Solid Masonry Area:** \( Ae = 45.95 \text{ in.}^2 / 12.00 \text{ in.} \)
- **Gross Moment of Inertia:** \( Ig = 343.63 \text{ in.}^4 / 12.00 \text{ in.} \)
- **Section Modulus:** \( S = 2*Ig/t = 90.13 \text{ in.}^3 / 12.00 \text{ in.} \)
- **Radius of Gyration:** \( r = 2.735 \text{ in.} / 12.00 \text{ in.} \)
- **Slenderness Factor:** \( h'/r = 78.99 \)

**Allowable Stresses:**

- **Allowable Axial Stress:** \( Fa = 255.63 \text{ psi.} \)
- **Allowable Bending Stress:** \( Fb = 500.00 \text{ psi.} \)
- **Allowable Shear Stress:** \( Fv = 38.73 \text{ psi.} \)
- **Allowable Steel Stress:** \( Fs = 24000.00 \text{ psi.} \)
DETAILED RESULTS FOR MAIN WALL:

<table>
<thead>
<tr>
<th>No.</th>
<th>Dist From Bot (ft)</th>
<th>Mom. (ft-lb)</th>
<th>Axial (lbs)</th>
<th>Shear (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>18.00</td>
<td>-200.0</td>
<td>800.0</td>
<td>168.9</td>
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<td>16.20</td>
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<td>2</td>
<td>14.40</td>
<td>-678.4</td>
<td>980.0</td>
<td>96.9</td>
</tr>
<tr>
<td>3</td>
<td>12.60</td>
<td>-820.4</td>
<td>1,070.0</td>
<td>60.9</td>
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<tr>
<td>4</td>
<td>10.80</td>
<td>-897.6</td>
<td>1,160.0</td>
<td>24.9</td>
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<tr>
<td>5</td>
<td>9.00</td>
<td>-910.0</td>
<td>1,250.0</td>
<td>-11.1</td>
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<tr>
<td>6</td>
<td>7.20</td>
<td>-857.6</td>
<td>1,340.0</td>
<td>-47.1</td>
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<td>0.00</td>
<td>0.0</td>
<td>1,700.0</td>
<td>-191.1</td>
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WALL PROPERTIES:

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<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Effective Flange Width</td>
<td>bf = 12.00 in. / 12.00 in.</td>
</tr>
<tr>
<td>Effective Grouted Core Width</td>
<td>b' = 3.11 in. / 12.00 in.</td>
</tr>
<tr>
<td>Solid Masonry Area</td>
<td>Ae = 45.95 in.^2 / 12.00 in.</td>
</tr>
<tr>
<td>Gross Moment of Inertia</td>
<td>Ig = 343.63 in.^4 / 12.00 in.</td>
</tr>
<tr>
<td>Section Modulus</td>
<td>S = 2*Ig/t = 90.13 in.^3 / 12.00 in.</td>
</tr>
<tr>
<td>Radius of Gyration</td>
<td>r = 2.735 in. / 12.00 in.</td>
</tr>
<tr>
<td>Slenderness Factor</td>
<td>h'/r = 78.99</td>
</tr>
</tbody>
</table>

ALLOWABLE STRESSES:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
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<tbody>
<tr>
<td>Allowable Axial Stress</td>
<td>Fa = 340.84 psi.</td>
</tr>
<tr>
<td>Allowable Bending Stress</td>
<td>Fb = 666.67 psi.</td>
</tr>
<tr>
<td>Allowable Shear Stress</td>
<td>Fs = 51.64 psi.</td>
</tr>
<tr>
<td>Allowable Steel Stress</td>
<td>Fs = 32000.00 psi.</td>
</tr>
</tbody>
</table>
DETAILED RESULTS FOR MAIN WALL:
------------------------------------

LOAD COMBINATION :  1*DL+1*WL
REBAR DESIGN :  #4 @ 32 in. o.c.
FURNISHED AREA OF STEEL :  0.075 in^2 / 12.00 in.
MINIMUM AREA OF STEEL :  0.064 in^2 / 12.00 in.

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<th>Axial (lbs)</th>
<th>Shear (lbs)</th>
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<tbody>
<tr>
<td>0</td>
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<td>1,300.0</td>
<td>-185.6</td>
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</tbody>
</table>

WALL PROPERTIES:
------------------------------------

Effective Flange Width, $b_f = 12.00$ in. / 12.00 in.
Effective Grouted Core Width, $b'_c = 3.11$ in. / 12.00 in.
Solid Masonry Area, $A_e = 45.95$ in.$^2$ / 12.00 in.
Gross Moment of Inertia, $I_g = 343.63$ in.$^4$ / 12.00 in.
Section Modulus, $S = 2*I_g/t = 90.13$ in.$^3$ / 12.00 in.
Radius of Gyration, $r = 2.735$ in. / 12.00 in.
Slenderness Factor, $h'/r = 78.99$

ALLOWABLE STRESSES:
---------------------

Allowable Axial Stress, $F_a = 340.84$ psi.
Allowable Bending Stress, $F_b = 666.67$ psi.
Allowable Shear Stress, $F_v = 51.64$ psi.
Allowable Steel Stress, $F_s = 32000.00$ psi.