

Masonry Wall 6.0 - MASONRY WALL ANALYSIS AND DESIGN

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 Job ID :  
 Job Description : Designed By :  
 =====

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

MASONRY WALL DATA:  
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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:  
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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:  
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Site Class (A to F) = Class A  
 Seismic Use Group = II  
 Short Period Spectral Acceleration,  $S_s$  = 78.00 %  
 One Second Spectral Acceleration,  $S_1$  = < 0.75 g  
 (Computed) Design Category, = Category C  
 Parapet Component Importance Factor,  $I_p$  = 1  
 Parapet Height/Roof Height Ratio  $z/h$  = 0  
 Veneer Weight = 24.00 psf.  
 Seismic Load on Main Wall = 15.39 psf.  
 Seismic Load on Parapet Wall = 12.31 psf.

WIND LOADS:

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	Load W or H	Magnitude (plf, lb)	Distance From	
			Base of Wall (ft) Start	End
1	W	-20.00	0.00	18.00
2				
3				
4				
5				

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

MASONRY DATA:

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Masonry Unit Strength = 1900.00 psi.

Masonry Compressive Strength,  $f'm$  = 1500.00 psi.  
Allowable Flexural Stress,  $F_b$  = 500.00 psi.  
Allowable Shear Stress,  $F_v$  = 38.73 psi.  
Allowable Tension: No Grout,  $F_t$  = 25.00 psi.  
Solid Grout,  $F_t$  = 68.00 psi.

Modulus of Elasticity,  $E_m$  = 1,350 ksi.  
Modular Ratio,  $E_s/E_m = n$  = 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:

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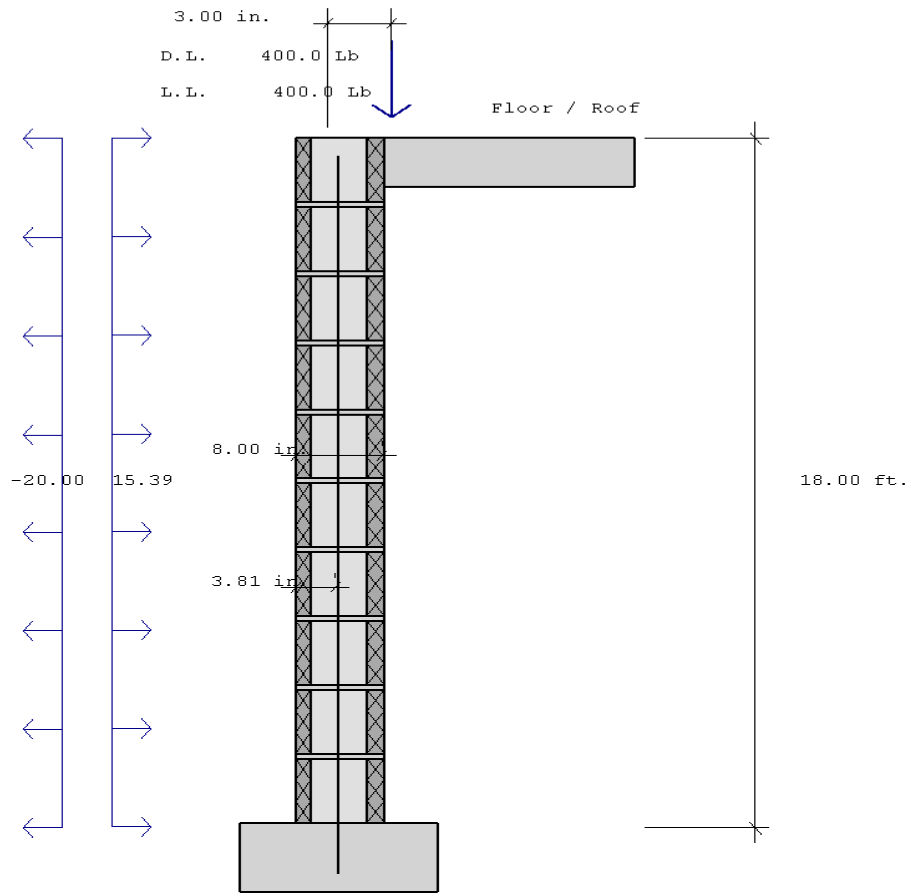
Steel Yield Strength,  $F_y$  = 60.00 ksi.  
Allowable Steel Stress,  $F_s$  = 24.00 ksi.  
Modulus of Elasticity,  $E_s$  = 29,000 ksi.

REINFORCED WALL DATA:

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Minimum Steel Ratio,  $A_s/bt$  = 0.0007

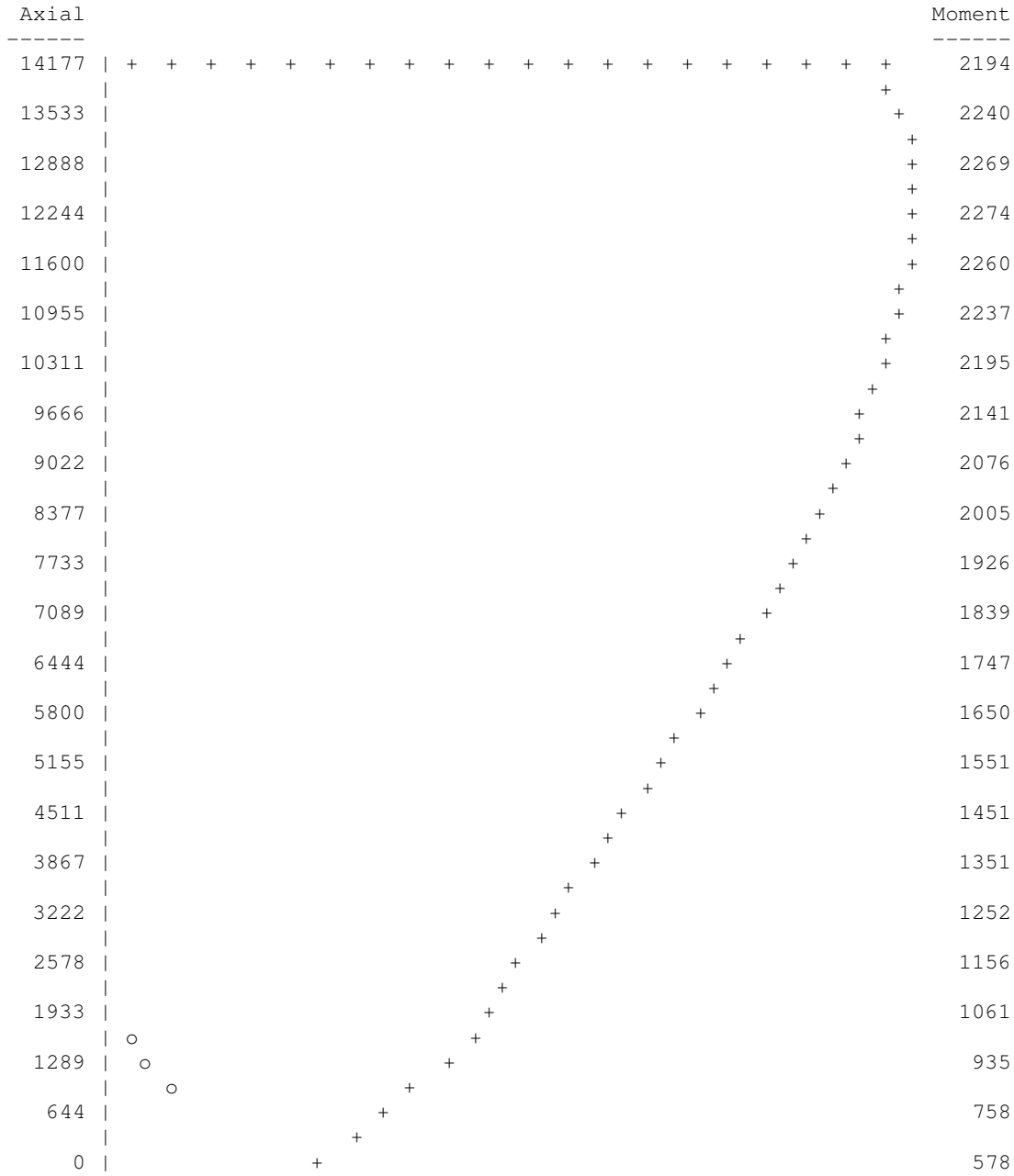
GRAPHIC SUMMARY OF MASONRY WALL DATA





MASONRY WALL INTERACTION DIAGRAM: (DEAD + LIVE LOAD ONLY)

Effective Wall Height = 18.00 ft. Solid Masonry Area,  $A_e = 61.90 \text{ in}^2$   
 Actual Wall Thickness = 7.63 in. All. Axial Stress,  $F_a = 229.02 \text{ psi}$ .  
 Depth to c.g. Steel = 3.81 in. All. Bending Stress,  $F_b = 500.00 \text{ psi}$ .  
 Design Width = 12.00 in. All. Steel Stress,  $F_s = 24.00 \text{ ksi}$ .  
 Reinforcing Design = #3 @16 in. o.c.

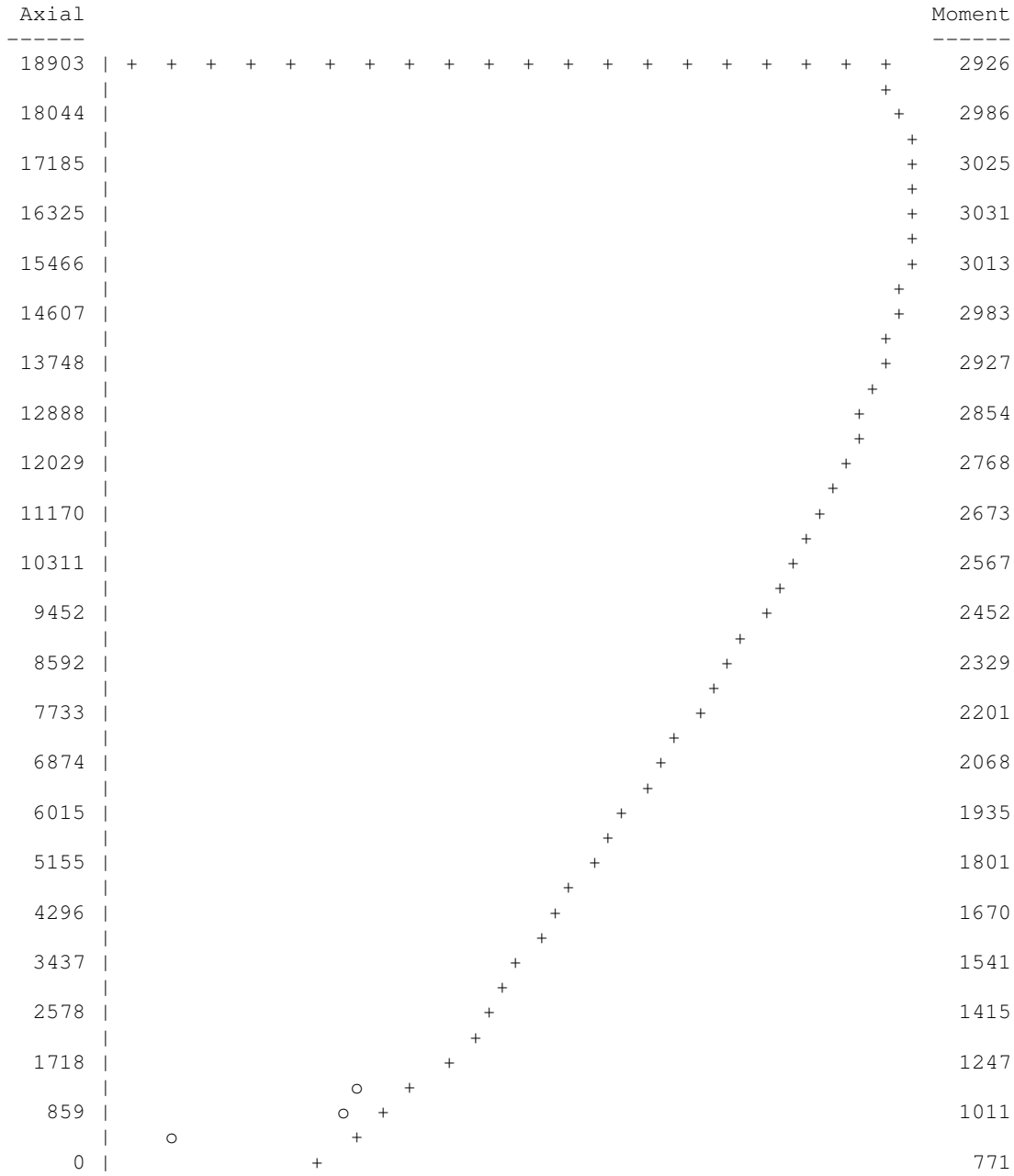


NOTES: Axial Load = Lb, Moment = ft-lb  
 + = Moment Capacity  
 o = Applied Moment

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. Solid Masonry Area,  $A_e = 61.90 \text{ in}^2$   
 Actual Wall Thickness = 7.63 in. All. Axial Stress,  $F_a = 305.36 \text{ psi}$ .  
 Depth to c.g. Steel = 3.81 in. All. Bending Stress,  $F_b = 666.67 \text{ psi}$ .  
 Design Width = 12.00 in. All. Steel Stress,  $F_s = 32.00 \text{ ksi}$ .  
 Reinforcing Design = #3 @16 in. o.c.



NOTES: Axial Load = Lb, Moment = ft-lb  
 + = Moment Capacity  
 o = Applied Moment

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 : #3 @16 in. o.c.  
 FURNISHED AREA OF STEEL : 0.082 in<sup>2</sup> / 12.00 in.  
 MINIMUM AREA OF STEEL : 0.064 in<sup>2</sup> / 12.00 in.

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

WALL PROPERTIES:

-----  
 Effective Flange Width                   bf = 12.00 in. / 12.00 in.  
 Effective Grouted Core Width,         b' = 6.23 in. / 12.00 in.  
  
 Solid Masonry Area,                     Ae = 61.90 in.<sup>2</sup> / 12.00 in.  
 Gross Moment of Inertia,             Ig = 378.54 in.<sup>4</sup> / 12.00 in.  
 Section Modulus,                       S = 2\*Ig/t = 99.29 in.<sup>3</sup> / 12.00 in.  
 Radius of Gyration,                    r = 2.473 in. / 12.00 in.  
 Slenderness Factor,                    h'/r = 87.35

ALLOWABLE STRESSES:

-----  
 Allowable Axial Stress,                Fa = 229.02 psi.  
 Allowable Bending Stress,              Fb = 500.00 psi.  
 Allowable Shear Stress,                Fv = 38.73 psi.  
 Allowable Steel Stress,                 Fs = 24000.00 psi.

DETAILED RESULTS FOR MAIN WALL:

-----  
 LOAD COMBINATION : 1\*DL+1\*LL+1\*WL  
 REBAR DESIGN : #3 @16 in. o.c.  
 FURNISHED AREA OF STEEL : 0.082 in<sup>2</sup> / 12.00 in.  
 MINIMUM AREA OF STEEL : 0.064 in<sup>2</sup> / 12.00 in.

No.	Dist From Bot (ft)	Mom. (ft-lb)	Axial (lbs)	Shear (lbs)
0	18.00	-200.0	800.0	168.9
1	16.20	-471.6	890.0	132.9
2	14.40	-678.4	980.0	96.9
3	12.60	-820.4	1,070.0	60.9
4	10.80	-897.6	1,160.0	24.9
5	9.00	-910.0	1,250.0	-11.1
6	7.20	-857.6	1,340.0	-47.1
7	5.40	-740.4	1,430.0	-83.1
8	3.60	-558.4	1,520.0	-119.1
9	1.80	-311.6	1,610.0	-155.1
10	0.00	0.0	1,700.0	-191.1

WALL PROPERTIES:

-----  
 Effective Flange Width                   bf = 12.00 in. / 12.00 in.  
 Effective Grouted Core Width,           b' = 6.23 in. / 12.00 in.  
  
 Solid Masonry Area,                       Ae = 61.90 in.<sup>2</sup> / 12.00 in.  
 Gross Moment of Inertia,                Ig = 378.54 in.<sup>4</sup> / 12.00 in.  
 Section Modulus,                         S = 2\*Ig/t = 99.29 in.<sup>3</sup> / 12.00 in.  
 Radius of Gyration,                      r = 2.473 in. / 12.00 in.  
 Slenderness Factor,                      h'/r = 87.35

ALLOWABLE STRESSES:

-----  
 Allowable Axial Stress,                 Fa = 305.36 psi.  
 Allowable Bending Stress,               Fb = 666.67 psi.  
 Allowable Shear Stress,                 Fv = 51.64 psi.  
 Allowable Steel Stress,                 Fs = 32000.00 psi.

DETAILED RESULTS FOR MAIN WALL:

-----  
 LOAD COMBINATION : 1\*DL+1\*LL+1\*E  
 REBAR DESIGN : #3 @16 in. o.c.  
 FURNISHED AREA OF STEEL : 0.082 in<sup>2</sup> / 12.00 in.  
 MINIMUM AREA OF STEEL : 0.064 in<sup>2</sup> / 12.00 in.

No.	Dist From Bot (ft)	Mom. (ft-lb)	Axial (lbs)	Shear (lbs)
0	18.00	-200.0	800.0	-149.6
1	16.20	44.4	890.0	-121.9
2	14.40	239.0	980.0	-94.2
3	12.60	383.6	1,070.0	-66.5
4	10.80	478.4	1,160.0	-38.8
5	9.00	523.4	1,250.0	-11.1
6	7.20	518.4	1,340.0	16.6
7	5.40	463.6	1,430.0	44.3
8	3.60	359.0	1,520.0	72.0
9	1.80	204.4	1,610.0	99.7
10	0.00	0.0	1,700.0	127.4

WALL PROPERTIES:

-----  
 Effective Flange Width                   bf = 12.00 in. / 12.00 in.  
 Effective Grouted Core Width,         b' = 6.23 in. / 12.00 in.  
  
 Solid Masonry Area,                     Ae = 61.90 in.<sup>2</sup> / 12.00 in.  
 Gross Moment of Inertia,               I<sub>g</sub> = 378.54 in.<sup>4</sup> / 12.00 in.  
 Section Modulus,                        S = 2\*I<sub>g</sub>/t = 99.29 in.<sup>3</sup> / 12.00 in.  
 Radius of Gyration,                     r = 2.473 in. / 12.00 in.  
 Slenderness Factor,                     h'/r = 87.35

ALLOWABLE STRESSES:

-----  
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 Allowable Shear Stress,                 Fv = 51.64 psi.  
 Allowable Steel Stress,                 Fs = 32000.00 psi.

DETAILED RESULTS FOR MAIN WALL:

LOAD COMBINATION : 1\*DL+1\*WL  
 REBAR DESIGN : #3 @16 in. o.c.  
 FURNISHED AREA OF STEEL : 0.082 in<sup>2</sup> / 12.00 in.  
 MINIMUM AREA OF STEEL : 0.064 in<sup>2</sup> / 12.00 in.

No.	Dist From Bot (ft)	Mom. (ft-lb)	Axial (lbs)	Shear (lbs)
0	18.00	-100.0	400.0	174.4
1	16.20	-381.6	490.0	138.4
2	14.40	-598.4	580.0	102.4
3	12.60	-750.4	670.0	66.4
4	10.80	-837.6	760.0	30.4
5	9.00	-860.0	850.0	-5.6
6	7.20	-817.6	940.0	-41.6
7	5.40	-710.4	1,030.0	-77.6
8	3.60	-538.4	1,120.0	-113.6
9	1.80	-301.6	1,210.0	-149.6
10	0.00	0.0	1,300.0	-185.6

WALL PROPERTIES:

Effective Flange Width, bf = 12.00 in. / 12.00 in.  
 Effective Grouted Core Width, b' = 6.23 in. / 12.00 in.  
 Solid Masonry Area, Ae = 61.90 in.<sup>2</sup> / 12.00 in.  
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 Allowable Steel Stress, Fs = 32000.00 psi.

DETAILED RESULTS FOR MAIN WALL:

-----  
 LOAD COMBINATION : 0.9\*DL+1\*E  
 REBAR DESIGN : #3 @16 in. o.c.  
 FURNISHED AREA OF STEEL : 0.082 in<sup>2</sup> / 12.00 in.  
 MINIMUM AREA OF STEEL : 0.064 in<sup>2</sup> / 12.00 in.

No.	Dist From Bot (ft)	Mom. (ft-lb)	Axial (lbs)	Shear (lbs)
0	18.00	-90.0	360.0	-143.5
1	16.20	143.4	441.0	-115.8
2	14.40	327.0	522.0	-88.1
3	12.60	460.6	603.0	-60.4
4	10.80	544.4	684.0	-32.7
5	9.00	578.4	765.0	-5.0
6	7.20	562.4	846.0	22.7
7	5.40	496.6	927.0	50.4
8	3.60	381.0	1,008.0	78.1
9	1.80	215.4	1,089.0	105.8
10	0.00	0.0	1,170.0	133.5

WALL PROPERTIES:

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