

ACI 08 / ASCE 7-10 / 2012 IBC

CONCRETE SHEARWALL ANALYSIS AND DESIGN

RCWALLPRO by STRUCTECH

Your company name
Your company address
Your company address

Project :Your project
Building :Your building
Wall ID :WALL # 1

REQUIRED INPUT ARE INDICATED BY BLUE COLOR NUMBERS OR WITH BLUE SHADING

INPUT

Concrete Strength, f'c:	4	ksi	Conc E, Econc:	3605	ksi
Rebar Yield Strength, fy:	60	ksi	Steel E, Es:	29000	ksi
Total Wall Length, Ltot:	360	in	< includes end sections >		
End 1 Length, L_1:	32	in	< length of left end section >		
End 2 Length, L_2:	32	in	< length of right end section >		
Wall Thickness, T_0:	20	in	< thickness between end sects >		
End 1 Thickness, T_1:	32	in	< thickness @ left end section >		
End 2 Thickness, T_2:	32	in	< thickness @ right end section >		
Wall Vert. Steel, As_0:	2	layers - #	7	@	12 in, o.c.
Wall Horiz. Steel, As_h:	2	layers - #	7	@	12 in, o.c.
End 1 Rebar, As_1:	28	- #	11	< total x pieces #y bar >	
End 2 Rebar, As_2:	28	- #	11	< total x pieces #y bar >	
Wall Dead Load, P_DL:	320	kips	< NOT including wall self wt >		
Wall Live Load, P_LL:	235	kips			
Wall Seismic Load, P_EQ:	455	kips	< Seismic axial load @ wall center >		
Wall Selfweight, P_SW	614	kips			
Total Wall Height, H_TOT	74	feet			

Gross Section Total Elastic Deflection At Top of Wall	0.446	inch
Factored Overturning Moment at Critical Section, MOM_EQ	51684	kips-ft
Factored Shear Force at Critical Section, V	763	kips
Design Spectral Acceleration Parameter, SDs ASCE Chapter 16	1.5	g
Building Importance Factor, I - ASCE 7 Table 11.5-1	1.5	ndim

Deflection Amplification Factor, Cd - ASCE 7 Table 12.2-1	5	ndim
Cracked Section Modification Factor for Ig, Kcr	0.5	ndim
Shear Distribution Coefficient, Wv	1.33	ndim

WALL SECTION PROPERTIES

Int. Wall Length, L_0:	296	in	< wall length betw end sects >			
	Area	Centrd	A*y	Naxis	A*d^2	Ipart
		Dist		Dist		bh^3/12
	in^2	in	in^3	in	in^4	in^4
					1000's	1000's
Int. Wall:	5920	180	1065600	0	0	43224
End 1:	1024	16	16384	164	27542	87
End 2:	1024	344	352256	-164	27542	87
Total:	7968		1434240		55083	43399

Centroid Dist. To End 1, NAXIS:	180.00	in	I_gross:	98482	10^3in^4
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WALL LOADING AND AXIAL LOAD LIMIT - ACI

Wall Geometry SYMMETRIC
Factored Shear, Vu: 763 kips

COMBINED BENDING WITH MAXIMUM AXIAL LOAD

Wall Axial Load, P'u: 2091 kips < P'u = 1.2D + L + Ev + Eh
Factored Moment, Mu: 51684 kip-ft
Factored Axial Force 0.07 Ag.fc'
Compressive Strength, Po 26969 kips
Ratio of Pu /Po = 0.078 OK, CAN BE USED AS SHEARWALL

COMBINED BENDING WITH MINIMUM AXIAL LOAD

Wall Axial Load, P'u min: 105 kips < P'u = 0.9D -Ev -Eh>
Factored EQ Moment, Mu: 51684 kip-ft
Factored Axial Force 0.00 Ag.fc'

NOMINAL FLEXURAL CAPACITY M'N @ P'u

Wall Vert Steel, Rhov: 0.00500 ndim
Wall Horiz Steel, Rhoh: 0.00500 ndim
End 1 Steel, As_1: 43.68 in^2
End 2 Steel, As_2: 43.68 in^2
Betal: 0.85 ndim
Conc Yld Strain, eecy: 0.00300 ndim
Steel Yld Strain, eesy: 0.002069 ndim

UNDER MAXIMUM AXIAL LOAD

Compr Zone Length, c: 44.58 in Iterate C until Sum of Forces = 0
Sum of Forces, ftot: 0 kips OK M'n: 123410 k-ft
Maximum Steel Strain, Et_max 0.021 ndim
Strength Red. Factor, Phi 0.77
Phi M'n: 94876 kip-ft OK > Mu at P'u

UNDER MINIMUM AXIAL LOAD

Compr Zone Length, c_min: 29.79 in Iterate C until Sum of Forces = 0
Sum of Forces, ftot: -61 kips RETRY.. M'n: 97941 k-ft
Maximum Steel Strain, Et_min 0.033 ndim
Strength Red. Factor, Phi 0.90 ndim
Phi M'n: 88147 kip-ft OK > Mu at P'u

BOUNDARY ELEMENT REQUIREMENT PER ACI SECTION 21.6.6

Total Elastic Displacement at Top of Wall, $d_{e\ tot}$:	0.45	inches
Approximate Design/Expected Inelastic Displacement, d_u	2.97	inches
Design Displacement/Height Ratio	0.003	ndim
Maximum Compr Zone Length, C_{max} Per Eq. (21-8)	85.71	inches
Minimum Boundary Zone Length, L_{BZ_ACI} :	0.00	inches
Maximum Height Above The Base, H_{BZ_ACI}	0.00	inches
Hoop Spacing S_o Per Eq. (21-5)	4.00	inches
Max. Horizontal Spacing of Hoop/Crossties, h_x	14.00	inches
Thickness, T_{BZ_ACI}	32.00	in
Hoops Vertical Spacing, S_{v_ACI}	6.00	in
Dist. from Face of Concrete to Center of Hoops, D_{c_ACI}	1.50	in
Req. Area of Hoops in Longitudinal Dir., A_{sh_x} :	0.00	in ²
Req. Area of Hoops in Transverse Dir., A_{sh_y} :	0.00	in ²
Max. Hoops Vertical Spacing If Boundary Element is Not Required :	8.00	inches

BOUNDARY ELEMENT IS NOT REQUIRED; SEE SECTION 21.9.6.5 FOR OTHER REQUIREMENT

SHEAR DEMAND AND CAPACITY

Wall's Height to Length Ratio	2.5
Coefficient $ALFA_C$	2.0

SHEAR STRENGTH REDUCTION FACTOR FOR SPECIAL CONCRETE WALL PER ACI SEC. 9.3.4

Approximate Shear Demand Corresponding to Maximum M_n , V_f	2218	kips
Nominal Shear Strength, V_n	3071	kips
Ratio of V_p/V_n	0.72	ndim
Shear Strength Reduction Factor, Φ_{v_v}	0.75	ndim

Shear Capacity, $\Phi_{v_v} V_n$:	2303	kips
Maximum Usable Shear Capacity, $\Phi_{v_v} V_n$ max:	3415	kips OK
Shear Demand/Capacity, $V_u/(\Phi_{v_v} V_n)$	0.33	ndim OK

END OF CALCULATIONS

To report any 'bug' in the spreadsheet, please contact structech@gmail.com
www.structech.us

INTERMEDIATE CALCULATIONS

STRESS - STRAIN COMPATIBILITY ANALYSIS AND SECTION EQUILIBRIUM

UNDER MAXIMUM AXIAL LOAD

Stress Block Length, a : 37.90 in (c/dt)= 0.12960
 Steel Strain @ End 2: 0.02122 ndim

Vertical Forces Acting on Wall Critical Section	Magnitude kips	Distance to Comp. End of Wall in	Moment on the Critical Section k-ft
Compr Conc End 1, C1c:	-3481.6	16.00	-4642
Compr Conc Wall, C0c:	-400.9	34.95	-1168
Compr Steel End 1, C1s:	-2436.3	16.00	-3248
Compr Steel Wall, C0sa:	0.0	32.00	0
Compr Steel Wall, C0sb:	-1.2	36.19	-4
Wall Load P'u:	2091.0	180.00	31365
Tens Steel Wall, T0sa:	1516.0	201.66	25477
Tens Steel Wall, T0sb:	92.2	65.08	500
Tens Steel End 2, T2s:	2620.8	344.00	75130

$M'n = 123410$

UNDER MINIMUM AXIAL LOAD

Stress Block Length, A_{min} : 25.32 in (c/dt) min = 0.0866
 Steel Strain @ End 2: 0.03325 ndim

Vertical Forces Acting on Wall Critical Section	Magnitude kips	Distance to Comp. End of Wall in	Moment on the Critical Section k-ft
Compr Conc End 1, C1c:	-2755.2	12.66	-2907
Compr Conc Wall, C0c:	0.0	32.00	0
Compr Steel End 1, C1s:	-1759.3	16.00	-2346
Compr Steel Wall, C0sa:	0.0	32.00	0
Compr Steel Wall, C0sb:	0.0	31.26	0
Wall Axial Load, P'u:	105.4	180.00	1581
Tens Steel Wall, T0sa:	1666.0	189.17	26262
Tens Steel Wall, T0sb:	60.9	43.52	221
Tens Steel End 2, T2s:	2620.8	344.00	75130

-61.39998

$M'n = 97941$

To print intermediate calculations, extend the print area.