Michael Butler Civil Engineer
PO Box 1520 Fort Bragg, CA 95437 (707) 961-1891

March 30, 2009

Michael Oliphant, Head Building Inspector
Mendocino County Planning and Building Services
790 South Franklin Street
Fort Bragg, CA 95437

RE: City of Fort Bragg Cottages
Engineering for pre-approved second-unit dwelling designs

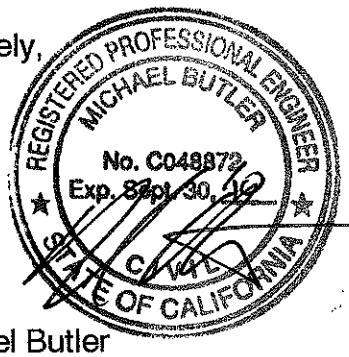
Dear Mr. Oliphant:

In agreement with the City of Fort Bragg, it is permissible for construction drawings of the 2 pre-approved dwelling designs, and related structural engineering calculations, to be reproduced with my engineering seal, for projects within the City of Fort Bragg. Of course these projects must also meet your approval and that of the City Planning Department.

The site conditions for any such pre-engineered cottage design should be the minimum soil capacity of 1000 psf at the footing depths, and that the unit not be placed in a flood zone. The slab-on-grade foundation should not be used at a wet site, unless thorough moisture mitigation measures are taken. In any case the site must be graded to maintain drainage away from the structure. The wind and seismic engineering design covers all of Fort Bragg City, except at exposed coastal headlands within ¼ mile of the Pacific Ocean, or even some of the bluff top above Noyo Harbor, where the wind design is required to be of exposure "D".

Of course the cottage placement and all related site development must meet all local zoning and setback requirements. Please contact me anytime if you have any questions or concerns about this allowable reuse of my engineering seal.

Sincerely,



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COMPUTER CALCULATIONS:

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BUTLER DESIGN ENGINEERING            BEAMS WITH UNIFORM LOAD & LATERAL SUPPORT  Sheet  WU    1
Engineer: MB                                                                    File    0817 WU
FB UNIT 1                            WOOD BEAM DESIGN                           25-Nov  2008
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LUMBER VALUES PER 2007 CBC:			Fb	Fv	Fc	FcPER	Ft	E	
Douglas Fir: 2x & 4x	Select Str		1500	180	1700	625	1000	1900	
	No. 1		1000	180	1500	625	675	1700	Cf increases per 1991 NDS
	No. 2		900	180	1350	625	575	1600	table 4A for 2x & 4x used
6x Beams & Stringers	No. 1		1350	170	925	625	675	1600	
	No. 2		875	170	600	625	425	1300	
6x Posts & Timbers	No. 1		1200	170	1000	625	825	1600	
	No. 2		700	170	475	625	475	1300	
Redwood: 2x & 4x	No. 1	Open Grain	775	160	900	425	450	1100	Cf increases per 1991 NDS
	No. 2	Open Grain	725	160	700	425	425	1000	table 4A for 2x & 4x used
6x:	No. 1		1200	145	1050	650	800	1300	
	No. 2		975	145	900	650	650	1100	
Versalam or Microlam:			3080	285	3000	900	2100	2000	
Glulam:	24F-V4 DF/DF		2400	265	1650	650	1100	1700	
Glulam for cantilevers:	24F-V8 DF/DF		2400	265	1650	650	1100	1600	

RAFTERS

L	DUR	yTL	yLL	MOIS	REP M	SIZE	NSIZE	Fv	Fb	Fb'	E	Fcp
ft	FAC	LIM	LIM	FAC	FAC	FAC	FAC	psi	psi	psi	ksi	psi
10.8	1.25	240	360	0.86	1.15	1.00	1.20	180	900	1068	1600	625

LOADS	TW ft	DL psf	LL psf	TL psf	w plf	V' lb	MOM ft-lb	fv psi	fb psi	yTL in	yLL in	yDL in
ROOF	2.00	14	20	34	68	326	991	45	905	0.27	0.16	0.11
WALL	0	8	0	8	0							
BEAM	0	15	0	15	0							

STRESS AND DEFLECTION RATIOS:

	fv/Fv	fb/Fb	TL L/	LL L/
TOTAL (LB) 28 40 68 68	0.25 OK	0.85 OK	475 OK	807 OK

Bearing: in^2 in

USE: 1.50 " x 7.25 "net D.F. Grade 2 R = 367 lb 0.47 0.31 ERR

RIDGE LONG SPAN

L	DUR	yTL	yLL	MOIS	REP M	SIZE	NSIZE	Fv	Fb	Fb'	E	Fcp
ft	FAC	LIM	LIM	FAC	FAC	FAC	FAC	psi	psi	psi	ksi	psi
12.2	1.25	240	360	1.00	1.00	1.00	1.20	180	1000	1200	1700	625

LOADS	TW ft	DL psf	LL psf	TL psf	w plf	V' lb	MOM ft-lb	fv psi	fb psi	yTL in	yLL in	yDL in
ROOF	10.8	14	16	30	324	1800	6307	81	1438	0.40	0.20	0.19
WALL	0	8	0	8	0							
BEAM	1	15	0	15	15							

STRESS AND DEFLECTION RATIOS:

	fv/Fv	fb/Fb	TL L/	LL L/
TOTAL (LB) 166 173 339 339	0.45 OK	1.20 OK	368 OK	723 OK

Bearing: in^2 in

USE: 3.50 " x 9.50 "net D.F. Grade 1 R = 2068 lb 2.65 0.76

LOFT JOISTS

L ft	DUR FAC	yTL LIM	yLL LIM	MOIS FAC	REP M FAC	SIZE FAC	NSIZE FAC	Fv psi	Fb psi	Fb' psi	E ksi	Fcp psi
10.2	1.00	240	360	1.00	1.15	1.00	1.30	180	900	1346	1600	625

LOADS	TW ft	DL psf	LL psf	TL psf	w plf	V' lb	MOM ft-lb	fv psi	fb psi	yTL in	yLL in	yDL in
LOFT	1.3	14	30	44	59	272	761	49	1208	0.43	0.29	0.14
WALL	0	10	0	10	0							
BEAM	0	15	0	15	0							
FLOOR	0.0	20	40	60	0							

STRESS AND DEFLECTION RATIOS:

	fv/Fv	fb/Fb	TL L/	LL L/
TOTAL (LB)	19	40	59	59
	0.27 OK	0.90 OK	286 OK	419 OK

Bearing: in^2 in

USE: 1.50 " x 5.50 "net D.F. Grade 2 R = 298 lb 0.48 0.32

LOFT RIM BEAM

L ft	DUR FAC	yTL LIM	yLL LIM	MOIS FAC	REP M FAC	SIZE FAC	NSIZE FAC	Fv psi	Fb psi	Fb' psi	E ksi	Fcp psi
11.0	1.00	240	360	1.00	1.00	1.00	1.00	170	1200	1200	1600	625

LOADS	TW ft	DL psf	LL psf	TL psf	w plf	V' lb	MOM ft-lb	fv psi	fb psi	yTL in	yLL in	yDL in
LOFT	3.0	14	30	44	132	691	2072	34	897	0.37	0.24	0.13
WALL	0	10	0	10	0							
BEAM	1	5	0	5	5							
FLOOR	0.0	20	40	60	0							

STRESS AND DEFLECTION RATIOS:

	fv/Fv	fb/Fb	TL L/	LL L/
TOTAL (LB)	47	90	137	137
	0.20 OK	0.75 OK	357 OK	543 OK

Bearing: in^2 in

USE: 5.50 " x 5.50 "net D.F. Grade 1 R = 754 lb 1.21 0.22

WORST HEADER

L ft	DUR FAC	yTL LIM	yLL LIM	MOIS FAC	REP M FAC	SIZE FAC	NSIZE FAC	Fv psi	Fb psi	Fb' psi	E ksi	Fcp psi
4.4	1.25	240	360	0.86	1.00	1.00	1.00	170	1200	1032	1600	625

LOADS	TW ft	DL psf	LL psf	TL psf	w plf	V' lb	MOM ft-lb	fv psi	fb psi	yTL in	yLL in	yDL in
ROOF	6.0	14	20	34	204	876	1111	68	1187	0.12	0.07	0.05
WALL	2	10	0	10	20							
BEAM	1	15	0	15	15							
LOFT	5.0	14	30	44	220							

STRESS AND DEFLECTION RATIOS:

	fv/Fv	fb/Fb	TL L/	LL L/
TOTAL (LB)	189	270	459	459
	0.40 OK	1.15 OK	429 OK	729 OK

Bearing: in^2 in

USE: 5.50 " x 3.50 "net D.F. Grade 1 R = 1010 lb 1.29 0.24

ERR

WORST HEADER IF 2X

L ft	DUR FAC	yTL LIM	yLL LIM	MOIS FAC	REP M FAC	SIZE FAC	NSIZE FAC	Fv psi	Fb psi	Fb' psi	E ksi	Fcp psi
4.4	1.25	240	360	0.86	1.00	1.00	1.20	180	900	929	1600	625

LOADS	TW ft	DL psf	LL psf	TL psf	w plf	V' lb	MOM ft-lb	fv psi	fb psi	yTL in	yLL in	yDL in
ROOF	6.0	14	20	34	204	732	1111	101	1014	0.05	0.03	0.02
WALL	2	10	0	10	20							
BEAM	1	15	0	15	15							
LOFT	5.0	14	30	44	220							

	fv/Fv	fb/Fb	TL L/	LL L/
TOTAL (LB)	189	270	459	459	0.56 OK	1.09 OK	1040 OK	1767 OK

STRESS AND DEFLECTION RATIOS:

Bearing: in^2 in

USE: 1.50 " x 7.25 "net D.F. Grade 2 R = 1010 lb 1.29 0.86

ERR

GIRDER TAKING LOFT LOAD

L ft	DUR FAC	yTL LIM	yLL LIM	MOIS FAC	REP M FAC	SIZE FAC	NSIZE FAC	Fv psi	Fb psi	Fb' psi	E ksi	Fcp psi
5.7	1.00	240	360	0.86	1.00	1.00	1.30	180	900	1006	1600	625

ERR

LOADS	TW ft	DL psf	LL psf	TL psf	w plf	V' lb	MOM ft-lb	fv psi	fb psi	yTL in	yLL in	yDL in
FLOOR	5.5	20	40	60	330	1318	2384	78	933	0.08	0.05	0.03
WALL	1	8	0	8	8							
LOFT	5	15	30	45	234							
BEAM	1	15	0	15	15							

	fv/Fv	fb/Fb	TL L/	LL L/
TOTAL (LB)	211	376	587	587	0.43 OK	0.93 OK	872 OK	1362 OK

STRESS AND DEFLECTION RATIOS:

Bearing: in^2 in

USE: 3.50 " x 7.25 "net D.F. Grade 2 R = 1673 lb 2.68 0.76

TYP GIRDER

L ft	DUR FAC	yTL LIM	yLL LIM	MOIS FAC	REP M FAC	SIZE FAC	NSIZE FAC	Fv psi	Fb psi	Fb' psi	E ksi	Fcp psi
5.7	1.00	240	360	0.86	1.00	1.00	1.30	180	900	1006	1600	625

ERR

LOADS	TW ft	DL psf	LL psf	TL psf	w plf	V' lb	MOM ft-lb	fv psi	fb psi	yTL in	yLL in	yDL in
FLOOR	5.5	20	40	60	330	844	1434	66	975	0.11	0.07	0.04
WALL	1	8	0	8	8							
LOFT	0	15	30	45	0							
BEAM	1	15	0	15	15							

	fv/Fv	fb/Fb	TL L/	LL L/
TOTAL (LB)	133	220	353	353	0.37 OK	0.97 OK	633 OK	1016 OK

STRESS AND DEFLECTION RATIOS:

Bearing: in^2 in

USE: 3.50 " x 5.50 "net D.F. Grade 2 R = 1006 lb 1.61 0.46

BUTLER DESIGN ENGINEERING — BEAMS WITH UNIFORM & CONCENTRATED LOADS — Sheet WC 1
Engineer: MB — File 0817 WC
FB UNIT 1 — WOOD BEAM DESIGN — 25-Nov 2008

LUMBER VALUES PER 2007 CBC:			Fb	Fv	Fc	FcPERP	Ft	E	
Douglas Fir: 2x & 4x	Select Str		1500	180	1700	625	1000	1900	
Douglas Fir: 2x & 4x	No. 1		1000	180	1500	625	675	1700	Cf increases per 1991 NDS
	No. 2		900	180	1350	625	575	1600	table 4A for 2x & 4x used
6x Beams & Stringers	No. 1		1350	170	925	625	675	1600	
	No. 2		875	170	600	625	425	1300	
6x Posts & Timbers	No. 1		1200	170	1000	625	825	1600	
	No. 2		700	170	475	625	475	1300	
Redwood: 2x & 4x	No. 1	Open Grain	775	160	900	425	450	1100	Cf increases per 1991 NDS
	No. 2	Open Grain	725	160	700	425	425	1000	table 4A for 2x & 4x used
6x:	No. 1		1200	145	1050	650	800	1300	
	No. 2		975	145	900	650	650	1100	
Versalam or Microlam:			3080	285	3000	900	2100	2000	
Glulam:	24F-V4 DF/DF		2400	265	1650	650	1100	1700	
Glulam for cantilevers:	24F-V8 DF/DF		2400	265	1650	650	1100	1600	

Calculations begin on the next page.

L ft	lu ft	x ft	DUR FAC	yTL LIM	yLL LIM	MOIS FAC	REP M FAC	SIZE FAC	NSIZE FAC	Fv psi	Fb psi	Fb'' psi	Fb''' psi	E ksi	I in^4	Fcp PSI
13.5	14	2.8	1.25	240	480	1.00	1.00 * 1.15	1.00	1.20	180	1000	1000	1200	1700	231	625

le in	Cs	Ck	Fb''': Cs<10 psi	Cs<Ck psi	Cs>Ck psi	Cs>50 psi	Fb'lu psi	Fb'sz psi	Fb' psi
311	15.3	29.9	0	1172	0	0	1172	1200	1172

======CONCENTRATED LOAD #1

LOADS:	TA sf	DL psf	LL psf	TL lb	a1 ft	bi ft	Vmax lb	MOM@a ft*lb	MOM@x ft*lb	fv psi	fb@x psi	y@xTL IFx<a	y@xTL IFx>a	y@xTL in	y@xLL in	y@xDL in
ROOF	74	14	16	2205	2.8	10.8	1756	4829	4806	81	1156	0.21	0.21	0.21	0.11	0.10
WALL	0	20	0	0												
TOTAL (lb):				1029	1176	2205										

======CONCENTRATED LOAD #2

LOADS:	TA sf	DL psf	LL psf	TL lb	a2 ft	b2 ft	Vmax lb	MOM@a ft*lb	MOM@x ft*lb	fv psi	fb@x psi	y@xTL IFx<a	y@xTL IFx>a	y@xTL in	y@xLL in	y@xDL in
ROOF	21	14	16	630	6.8	6.8	315	2126	882	15	212	0.08	0.05	0.08	0.04	0.04
WALL	0	9	0	0												
TOTAL (lb):				294	336	630										

======UNIFORM LOAD

LOADS:	TW ft	DL psf	LL psf	TL psf	w plf	V' lb	MOM@CL ft*lb	MOM@x ft*lb	fv psi	fb@x psi	y@cTL psi	y@xTL in	y@xLL in	y@xDL in
CEIL	0.00	15	20	35	0	60	228	150	3	36	0.02	0.01	0.00	0.01
WALL		0	8	0	8	0								
BEAM		1	10	0	10	10								
TOTAL (plf):				10	0	10	10								
AREA:		0												
TOTAL:		95												

DEFLECTION TOTALS:

y@xTL in	y@xLL in	y@xDL in
0.31	0.16	0.15

TOTAL STRESS AND DEFLECTION RATIOS:

fv/Fv	fb/Fb'	TL L/	LL L/
0.55 OK	1.20 OK	527 OK	1027 OK

USE: D.F. Grade 1 Ra= 1823 lb BEARING: 3.6 in^2 3.5 in x 1.0 in
Net : 3.50 " x 9.25 " Rb= 517 lb BEARING: 1.0 in^2 3.5 in x 0.3 in

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Butler Engineering                LATERAL DESIGN   LONGITUDINAL DIRECTION          Sheet  LL       1
Engineer: MB                                                                       File     0817 LL
FB UNIT 1                         FLEXIBLE DIAPHRAGM SHEARWALL ANALYSIS            01-Dec   2008
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Loads per 2007 CBC. FLOOR DIAPHRAGM See lateral resistance diagram for this job.

This calculation checks Allowable Load Combinations controling stability and lateral strength per 1605.3
16-17: D + L + wW
16-18: D + L + wW + S/2 (E is factored at p*Cs/1.4 during calc to compare seismic with wind)
16-20: D + L + S + E/1.4 (For footing strength check, W and E/1.4 are multiplied by 1.7)
16-21: D + E/1.4

Allowable loads for materials and hardware: Materials allowable stress increase factor: 1.33

Stress Values:			Allowable Loads (for DF-L N):	
#2 DF:	Ft=	575 psi	(at 1.33 increase)	
	Fcp=	625 psi	A35	450 lb
A36 steel:	Fa=	21.6 ksi	L90	650 lb
Concrete:	fc'=	2500 psi	CS150	1685 lb
Rebar:primary	Fy=	40 ksi		
secondary	Fy=	40 ksi		
Soil:	q'=	1500 psf @ ftg depth		
	alpha	0.3 (friction)		
	Kp=	300 pcf		

Anchor Bolts:	p	q	Nails in 2x DF-L (N):	Sinker	Com
5/8" in 2x4 sill:	780	275 lb			
3/4" in 2x6 sill:	1080	409 lb	16d=	116	139
5/8" in 3x4 sill:	957	348 lb			
3/4" in 3x6 sill:	1290	600 lb			

WIND per ASCE7-05 Method 2: SEISMIC per ASCE7-05 12.8 (Equivalent Force Method)
(Mod for horiz and vert compnts) Wood Frame Construction, I=1, Ct=0.02, x=0.75
Vel Pres q=0.00256*Kz*Kzt*Kd*V^2 Ss and S1 Determined from NEHRP Data (ASCE7-05)
Wind Velocity: 85 mph ACCELLERATION: Cs=Sds/R (And if S1>0.6g: Min Cs=0.5S1/r)

Site Exposure:	C	Bldg Ht:	17 ft.	Ss:	1.500	This valid only for site classes B-E.	
Enclosure GCp+/- :	0.18 Roof Only	SiteClass:	D	S1:	0.660	This Sds calc is not valid for Ss<1.0	
Topo Factor Kzt:	1.00	R:	6.5			This Sd1 calc is not valid for S1<0.4	
Directn Fact Kd:	0.85	(Sds)SDC=	D	Sds=	1.000	(At site D w Ss<1.25, Sds can be lower	
Exposure Fact Kz=	0.85	(Sd1)SDC=	D	Sd1=	0.660	(At site D w S1<0.5, Sd1 can be lower)	
Load Combo Fact, w:	1.30	Ta=	0.167			(At site C w S1<0.5, Sd1 can be lower)	
		(Sds) Cs=	0.154	(SD1) Cs =	0.051		
		Cs max=	0.606	Cs =	0.154	(Controlling)	
Velocity Press=	17.37 psf	Cs min=	0.100	Cs/1.4 =	0.110	(E/1.4, to compare with wind loads)	
				p =	1.3	(Inc "p", Rho, factor here. Reduce	
WIND LOAD DISTRIBUTION	Bldg Dims: Max	Perp		p*Cs/1.4 =	0.143	it at shear walls later if allowed)	
Determination of Load Components:	30	22	Pressures adjusted to ave values inc edge zones etc.				

(This is for roof slopes to 45 degs)

		Wall Ave	Roof Rise	# Perp Edges	Load Width ft	Diaph Depth ft	Roof Ohng ft	"a" dist ft	Roof Slope tan	Averaged Wind Load Factors: (Roof loads are out unless neg) 1	2	3	4	1E	2E	3E	4E
Load	Line	Ht ft	ft														
WA	A B	13.0	0.0	2	22	24	1.0	3.0	0.00	0.40	0.87	0.55	0.29	0.61	1.25	0.71	0.43

WIND LOADS, Continued:

Load	1=Roof 0=Floor	LATERAL LOAD: Wall Roof Ajst Horz Pres Pres Sum Sum psf psf	Total Horiz Load plf	UPLIFT LOAD: Windward Roof Vert psf	0.6 DL (seis)	Net Vert plf	Leeward Roof Vert psf	0.6 DL (seis)	Net Vert plf	Total Up plf (negative is down)
WA	1	15.30 0.00	99	18.7	10.8	103	11.1	10.8	4	106
0	1	0.00 0.00	0	0.0	9.0	0	0.0	9.0	0	0
0	1	0.00 0.00	0	0.0	10.8	0	0.0	10.8	0	0
0	1	0.00 0.00	0	0.0	10.8	0	0.0	10.8	0	0

SEISMIC LOADS p*Cs/1.4 for this level = 0.143 Loads not constant over entire width are averaged.

WA	Item	psf	x	Depth	=	Weight		
	ROOF	18		34		612		
	EXTW	10		13		130		
	INTW	8		12		96		
	LOFT	20		13		260		
	TOTAL=					1098	V=	157 plf

0	Item	psf	x	Depth	=	Weight		
	ROOF	15		0		0		
	EXTWL	20		0		0		
	INTWL	8		3		24		
		0		0		0		
	TOTAL=					24	V=	3 plf

0	Item	psf	x	Depth	=	Weight		
	ROOF	18		0		0		
	EXTW	10		0		0		
	INTW	8		0		0		
		0		0		0		
	TOTAL=					0	V=	0 plf

0	Item	psf	x	Depth	=	Weight		
	ROOF	18		0		0		
	EXTWL	10		0		0		
	INTW	8		10		80		
		0		0		0		
	TOTAL=					80	V=	11 plf

Horizontal diaphragm stress calculation: Diaphragm depths may be understated to be safe.

Load	No. Rea	Widt ft	Depth ft	WIND: V wPLF	lb	v PLF	Up lb	SEIS: V wPLF	lb	v PLF	CONTROL:	V lb	v PLF
WA	2	22.0	24	99	1094	46	1171	157	1725	72	SEIS	1725	72
0	2	0.0	0	0	0	0	0	0	0	0	SEIS	0	0
0	2	0.0	0	0	0	0	0	0	0	0	SEIS	0	0
0	2	0.0	0	0	0	0	0	0	0	0	SEIS	0	0

Load	From	To	Chord stress calculation: Control	wPLF	F lb	Area Req'd: Fir	Steel	Total # 16d Sinker Req'd at splices- half ea side.			See drag force calcs also Plate Splice Class:
WA	A	B	SEIS	157	395	0.51	0.01	2.6	Use:	16 -16d	I
0	0	0	SEIS	0	0	0	0.00	0.0	Use:	16 -16d	I
0	0	0	SEIS	0	0	0	0.00	0.0	Use:	16 -16d	I
0	0	0	SEIS	0	0	0	0.00	0.0	Use:	16 -16d	I

CALCULATIONS FOR SHEARWALLS Line A Sheet LL 3

Drag force calculation: Seis p is set at 1.3 (above); Assumes a missing element reduces strength by > 33%

With 3.0 Overstrength Factor for Seis Load

Reactions: p corr: 1.0	SEIS	WIND	ROOF WIND UP	Line:	Wall ft	Open ft	Wall Sum	Begin at	End at	Drag-force Beg	Drag-force End	Area req'd: Fir:	Area req'd: Steel:	#16d Req	#16d Use:	Splice Class
WA	1725	1094	1171	1	3.5		3.5	0	3.5	0	1410	1.84	0.05	9	16	I
						4	3.5	3.5	7.5	1410	747	1.84	0.05	9	16	I
ADDL			Net UP			4	3.5	7.5	11.5	747	83	0.98	0.03	5	16	I
W sum =	1725	1094	1171			9	3.5	11.5	20.5	83	1410	1.84	0.05	9	16	I
R' A					3.5		7	20.5	24	1410	0	1.84	0.05	9	16	I
							7	24	24	0	0	0.00	0.00	0	16	I
V=	1725	1094					7	24	24	0	0	0.00	0.00	0	16	I
Control=	1725	SEIS					7	24	24	0	0	0.00	0.00	0	16	I
Drag Overstrength=	2.307		2				7	24	24	0	0	0.00	0.00	0	16	I

SHEAR WALL STRESS vWIND= 156 plf Drag Length= 24 ft
TotalSW= 7 ft vSEIS= 246 plf vDRAG= 72 plf

Plate Nails: Drag L = 24 FT Sill= 2 x SPACING 16d 26 " oc max or 5/8AB@ 173 " o.c. max
Wall trib w = 4.5 FT w= 68.9 plf 16d 27 " oc max or 5/8AB@ 64 " o.c. max
USE: 16d 16 " oc max or 5/8AB@ 64 " o.c. max

Shear Wall Overturning: Line A WIND: V lb OT Mom SEIS: V lb OT Mom

H: 9 ft L= 3.5 ft

Weight:psf		T.W.	plf	Net DL R MOM	lb	lb*ft	LATERAL= 1094	9848	TOTAL= 1725	15529
WALL	10	9	90							
ROOF	14	6	84							
FLOOR			0	.6DL>	365	639	SEIS			
					18	32	WIND	Line length 24 FT	Wall 237	1068
TOTAL:			174	plf						

For entire line: Total= WIND: 1094 9848 lb*ft SEIS: 1963 16597 lb*ft
WIND SEIS
For this wall only: OT Mom - R Mom = 4892 lb*ft 7659 lb*ft
" Net Uplift = 1398 lb 2188 lb
" Add uplift above: lb lb
" Total Net Uplift = 1398 lb 2188 lb

GRADE BEAM: Line A Use 100% Seis (inc p) at soil per 1605.3.2. qALL= 1995 psf @ footing depth

Leq: 24 ft + 0 ft = 24 ft	Lateral:	Overturning:	Pressure:	Sliding:		
Have 9 ft + 1.5 ft = 10.5 ft	Vdia= 1725 LB	Mdia= 18117 lb*ft	AREA= 24 ft^2	P= 10606 lb		
@CG wall: 6 ft = 6 ft	Vwal= 237 LB	Mwal= 1424 lb*ft	qDL= 442 psf	alpha= 0.3		
Weight to Grade Beam:	V= 1963 LB	Mseis=19541 lb*ft	qLAT= 204 psf	Kp= 300 lb		
DL lowest flr & ponywl: 450 plf	v= 82 PLF	0.6DL=10606 lb (inc. wall wt.)	Passive h= 1.5 ft			
FTG:Depth: Width:	v= 1.135 PSI	Resultant eccentricity & F.S.	x W= 15 ft			
Stem 6 " x 6 " = 38 plf	OK	Leq/6= 4.0 ft	F.S. = 3.0	Max Reaction= 8244 lb		
Foot 6 " x 12 " = 75 plf		Leq/4= 6.0 ft	F.S. = 2.0	V Control 1963 lb		
Dept 12 " Total = 563 plf		Leq/3= 8 ft	F.S. = 1.5	(SEIS) OK		

Net Uplift= 2188 lb Use: e< 8.0 ft e= 1.8 ft OK qMAX= 645 psf OK
Add Uplift lb
Total = 2188 lb Fc'= 2500 psi Fv= 100.0 psi Fy= 40 ksi

---- 0.75 Factored Loads to Concrete Footing:

Gr Beam 2 Side(s):	Lreq= 1.9 ft	No. Moments 2	Shear:Vup= 1094 lb	Smax= 4 in					
Bar size 4	d= 8.5 in	Beam Moment= 1.1 k*ft	Ac= 51 in^2	Av min= 0.03 in^2					
No. Bars 1 T&B	b= 6 in	0.75 Mu= 1.4 k*ft	vu= 36.47 psi	Use#3 @ 0 "oc					
As= 0.19 IN^2	a= 0.61 in	Mn x phi= 4.8 k*ft OK	fv*phi= 100 psi	Over L= 0.0 ft					

CALCULATIONS FOR SHEARWALLS Line B Sheet LL 4

Drag force calculation: Seis p is set at 1.3 (above); Assumes a missing element reduces strength by > 33%

With 3.0 Overstrength Factor for Seis Load

Reactions: p corr: 1.0	SEIS	WIND	ROOF WIND UP	Line:	Wall ft	Open ft	Wall Sum	Begin at	End at	Drag-force Beg	Drag-force End	Area req'd: Fir:	Area req'd: Steel:	#16d Req	#16d Use:	Splice Class
WA	1725	1094	1171	1	3.5	0	0	3.5	0	465	0.61	0.02	3	16	I
0	0	0	0		4	0	3.5	7.5	465	995	1.30	0.03	6	16	I
ADDL			Net UP		5.5	5.5	7.5	13	995	2256	2.95	0.08	15	16	I
W sum =	1725	1094	1171		17	5.5	13	30	2256	0	2.95	0.08	15	16	I
R' B						5.5	30	30	0	0	0.00	0.00	0	16	I
						5.5	30	30	0	0	0.00	0.00	0	16	I
V=	1725	1094				5.5	30	30	0	0	0.00	0.00	0	16	I
Control=	1725	SEIS				5.5	30	30	0	0	0.00	0.00	0	16	I
Drag Overstrength=	2.307		2			5.5	30	30	0	0	0.00	0.00	0	16	I

SHEAR WALL STRESS vWIND= 199 plf Drag Length= 30 ft
TotalSW= 5.5 ft vSEIS= 314 plf vDRAG= 58 plf

Plate Nails: Drag L = 30 FT Sill= 2 x SPACING 16d 32 " oc max or 5/8AB@ 216 " o.c. max
Wall trib w = 5 FT w= 76.5 plf 16d 24 " oc max or 5/8AB@ 57 " o.c. max
USE: 16d 16 " oc max or 5/8AB@ 57 " o.c. max

Shear Wall Overturning: Line B WIND: V lb OT Mom SEIS: V lb OT Mom

H: 10 ft L= 5.5 ft

Weight:psf		T.W.	plf
WALL	10	10	100
ROOF	14	4	56
FLOOR		0	.6DL>
TOTAL:		156	plf

Net DL R MOM lb lb*ft: 515 1416 SEIS; 115 317 WIND

LATERAL= 1094 10942 TOTAL= 1725 17254

Line length 30 FT Wall 330 1648

For entire line: Total= WIND: 1094 10942 lb*ft SEIS: 2055 18903 lb*ft
WIND SEIS

For this wall only: OT Mom - R Mom = 10625 lb*ft 17487 lb*ft
" Net Uplift = 1932 lb 3179 lb
" Add uplift above: 0 lb lb
" Total Net Uplift = 1932 lb 3179 lb

GRADE BEAM: Line B Use 100% Seis (inc p) at soil per 1605.3.2. qALL= 1995 psf @ footing depth

Leq: 30 ft + 0 ft = 30 ft
Have 10 ft + 1.5 ft = 11.5 ft
@CG wall: 6.5 ft = 6.5 ft
Weight to Grade Beam:
DL lowest flr & ponywl: 450 plf
FTG:Depth: Width:
Stem 6 " x 6 " = 38 plf
Foot 6 " x 12 " = 75 plf
Dept 12 " Total = 563 plf

Lateral:
Vdia= 1725 LB
Vwal= 330 LB
V= 2055 LB
v= 69 PLF
v= 0.951 PSI
OK

Overturning:
Mdia= 19842 lb*ft
Mwal= 2143 lb*ft
Mseis=21985 lb*ft
0.6DL=12933 lb (inc. wall wt.)
Resultant eccentricity & F.S.
Leq/6= 5.0 ft F.S. = 3.0
Leq/4= 7.5 ft F.S. = 2.0
Leq/3= 10 ft F.S. = 1.5

Pressure:
AREA= 30 ft^2
qDL= 431 psf
qLAT= 147 psf
Max Reaction= 8942 lb
V Control 2055 lb
(SEIS) OK

Sliding:
P= 12933 lb
alpha= 0.3
Kp= 300 lb
Passive h= 1.5 ft
x W= 15 ft

Net Uplift= 3179 lb Use: e< 10.0 ft e= 1.7 ft OK qMAX= 578 psf OK
Add Uplift lb
Total = 3179 lb Fc'= 2500 psi Fv= 100.0 psi Fy= 40 ksi

---- 0.75 Factored Loads to Concrete Footing: ----

Gr Beam 2 Side(s): Lreq= 2.8 ft No. Moments 2 Shear:Vup= 1590 lb Smax= 4 in
Bar size 4 d= 8.5 in Beam Moment= 2.2 k*ft Ac= 51 in^2 Av min= 0.03 in^2
No. Bars 1 T&B b= 6 in 0.75 Mu= 2.9 k*ft vu= 52.99 psi Use#3 @ 4 "oc
As= 0.19 IN^2 a= 0.61 in Mn x phi= 4.8 k*ft OK fv*phi= 100 psi Over L= 0.2 ft

```
Butler Engineering                LATERAL DESIGN   TRANSVERSE DIRECTION              Sheet  LT       1
Engineer: MB                                                                        File     0817 LT
FB UNIT 1                         FLEXIBLE DIAPHRAGM SHEARWALL ANALYSIS             25-Nov   2008
```

Loads per 2007 CBC. FLOOR DIAPHRAGM See lateral resistance diagram for this job.

This calculation checks Allowable Load Combinations controling stability and lateral strength per 1605.3
16-17: D + L + wW
16-18: D + L + wW + S/2 (E is factored at p*Cs/1.4 during calc to compare seismic with wind)
16-20: D + L + S + E/1.4 (For footing strength check, W and E/1.4 are multiplied by 1.7)
16-21: D + E/1.4

Allowable loads for materials and hardware: Materials allowable stress increase factor: 1.33

Stress Values:			Allowable Loads (for DF-L N):		
#2 DF:	Ft=	575 psi	(at 1.33 increase)		
	Fcp=	625 psi	A35	450	lb
A36 steel:	Fa=	21.6 ksi	L90	650	lb
Concrete:	fc'=	2500 psi	CS150	1685	lb
Rebar:primary	Fy=	40 ksi			
secondary	Fy=	40 ksi			
Soil:	q'=	1500 psf @ ftg depth			
	alpha	0.3 (friction)			
	Kp=	300 pcf			

Anchor Bolts:	p	q	Nails in 2x DF-L (N):	Sinker	Com
5/8" in 2x4 sill:	780	275 lb			
3/4" in 2x6 sill:	1080	409 lb	16d=	116	139
5/8" in 3x4 sill:	957	348 lb			
3/4" in 3x6 sill:	1290	600 lb			

WIND per ASCE7-05 Method 2: SEISMIC per ASCE7-05 12.8 (Equivalent Force Method)
(Mod for horiz and vert compnts) Wood Frame Construction, I=1, Ct=0.02, x=0.75
Vel Pres q=0.00256*Kz*Kzt*Kd*V^2 Ss and S1 Determined from NEHRP Data (ASCE7-05)
Wind Velocity: 85 mph ACCELLERATION: Cs=Sds/R (And if S1>0.6g: Min Cs=0.5S1/r)

Site Exposure:	C	Bldg Ht: 17 ft.	Ss: 1.500	This valid only for site classes B-E.	
Enclosure GCp+/- :	0.18 Roof Only	SiteClass: D	S1: 0.660	This Sds calc is not valid for Ss<1.0	
Topo Factor Kzt:	1.00	R: 6.5		This Sd1 calc is not valid for S1<0.4	
Directn Fact Kd:	0.85	(Sds)SDC= D	Sds= 1.000	(At site D w Ss<1.25, Sds can be lower	
Exposure Fact Kz=	0.85	(Sd1)SDC= D	Sd1= 0.660	(At site D w S1<0.5, Sd1 can be lower)	
Load Combo Fact, w:	1.30	Ta= 0.167		(At site C w S1<0.5, Sd1 can be lower)	
		(Sds) Cs= 0.154	(SD1) Cs = 0.051		
		Cs max= 0.606	Cs = 0.154	(Controlling)	
Velocity Press=	17.37 psf	Cs min= 0.100	Cs/1.4 = 0.110	(E/1.4, to compare with wind loads)	
			p = 1.3	(Inc "p", Rho, factor here. Reduce	
WIND LOAD DISTRIBUTION	Bldg Dims: Max	Perp	p*Cs/1.4 = 0.143	it at shear walls later if allowed)	
Determination of Load Components:	30	22	Pressures adjusted to ave values inc edge zones etc.		

(This is for roof slopes to 45 degs)

Load Line	Wall Ave Ht ft	Roof Rise ft	# Perp Edges	Load Width ft	Diaph Depth ft	Roof Ohng ft	"a" dist ft	Roof Slope tan	Averaged Wind Load Factors: (Roof loads are out unless neg) 1	2	3	4	1E	2E	3E	4E
W1	1 2	9.0	10.0	2	30	22	1.0	3.0	0.91	0.56	-0.21	0.61	0.37	0.69	-0.27	0.71	0.48

WIND LOADS, Continued: Sheet LT 2

Load	1=Roof 0=Floor	LATERAL LOAD: Wall Ajst Pres Sum psf	Roof Horz Pres Sum psf	Total Horiz Load plf	UPLIFT LOAD: Windward Roof Vert psf	0.6 DL (seis)	Net Vert plf	Leeward Roof Vert psf	0.6 DL (seis)	Net Vert plf	Total Up plf (negative is down)
W1	1	17.82	13.96	220	-1.7	10.8	-150	4.7	10.8	-73	-223
0	1	0.00	0.00	0	0.0	9.0	0	0.0	9.0	0	0
0	1	0.00	0.00	0	0.0	10.8	0	0.0	10.8	0	0
0	1	0.00	0.00	0	0.0	10.8	0	0.0	10.8	0	0

SEISMIC LOADS p*Cs/1.4 for this level = 0.143 Loads not constant over entire width are averaged.

W1	Item	psf	x	Depth	=	Weight		
	ROOF	18		23		414		
	EXTW	10		9		90		
	INTW	8		12		96		
	LOFT	20		10		200		
	TOTAL=					800	V=	114 plf

0	Item	psf	x	Depth	=	Weight		
	ROOF	15		0		0		
	EXTWL	20		0		0		
	INTWL	8		3		24		
		0		0		0		
	TOTAL=					24	V=	3 plf

0	Item	psf	x	Depth	=	Weight		
	ROOF	18		0		0		
	EXTW	10		0		0		
	INTW	8		0		0		
		0		0		0		
	TOTAL=					0	V=	0 plf

0	Item	psf	x	Depth	=	Weight		
	ROOF	18		0		0		
	EXTWL	10		0		0		
	INTW	8		10		80		
		0		0		0		
	TOTAL=					80	V=	11 plf

Horizontal diaphragm stress calculation: Diaphragm depths may be understated to be safe.

Load	No. Rea	Widt ft	Depth ft	WIND: V lb	v PLF	Up lb	SEIS: V wPLF	lb	v PLF	CONTROL:	V lb	v PLF
W1	2	30.0	22	220	3297	150	-3346	114	1714	78 WIND	3297	150
0	2	0.0	0	0	0	0	0	0	0	0 SEIS	0	0
0	2	0.0	0	0	0	0	0	0	0	0 SEIS	0	0
0	2	0.0	0	0	0	0	0	0	0	0 SEIS	0	0

Load	From	To	Control	wPLF	F lb	Area Req'd: Fir	Steel	Total # 16d Sinker Req'd at splices- half ea side.			See drag force calcs also Plate Splice Class:
W1	1	2	WIND	220	1124	1.46	0.04	7.3	Use:	16 -16d	I
0	0	0	SEIS	0	0	0	0.00	0.0	Use:	16 -16d	I
0	0	0	SEIS	0	0	0	0.00	0.0	Use:	16 -16d	I
0	0	0	SEIS	0	0	0	0.00	0.0	Use:	16 -16d	I

CALCULATIONS FOR SHEARWALLS Line 1 Sheet LT 3

Drag force calculation: Seis p is set at 1.3 (above); Assumes a missing element reduces strength by > 33%

With 3.0 Overstrength Factor for Seis Load

Reactions: p corr: 1.0	SEIS	WIND	ROOF WIND UP	Line:	Wall ft	Open ft	Wall Sum	Begin at	End at	Drag-force Beg	Drag-force End	Area req'd: Fir:	Area req'd: Steel:	#16d Req	#16d Use:	Splice Class
W1	1714	3297	-3346	A	4		4	0	4	0	343	0.45	0.01	2	16	I
						4	4	4	8	343	257	0.45	0.01	2	16	I
ADDL			Net UP		6		10	8	14	257	257	0.34	0.01	2	16	I
W sum =	1714	3297	0			4	10	14	18	257	343	0.45	0.01	2	16	I
R' 1					4		14	18	22	343	0	0.45	0.01	2	16	I
							14	22	22	0	0	0.00	0.00	0	16	I
V=	1714	3297					14	22	22	0	0	0.00	0.00	0	16	I
Control=		3297	WIND				14	22	22	0	0	0.00	0.00	0	16	I
Drag Overstrength=		1	B				14	22	22	0	0	0.00	0.00	0	16	I

SHEAR WALL STRESS vWIND= 236 plf Drag Length= 22 ft
TotalSW= 14 ft vSEIS= 122 plf vDRAG= 150 plf

Plate Nails: Drag L = 22 FT Sill= 2 x SPACING 16d 24 " oc max or 5/8AB@ 160 " o.c. max
Wall trib w = 6 FT w= 106.9 plf 16d 17 " oc max or 5/8AB@ 41 " o.c. max
USE: 16d 16 " oc max or 5/8AB@ 41 " o.c. max

Shear Wall Overturning: Line 1 WIND: V lb OT Mom SEIS: V lb OT Mom

H: 12 ft L= 4 ft Weight:psf T.W. plf Net DL R MOM lb lb*ft LATERAL= 3297 39567 TOTAL= 1714 20571

WALL	10	12	120			
ROOF	14	4	56			
FLOOR			0	.6DL>	422	845 SEIS
					288	576 WIND
TOTAL:			176 plf			

Line length 22 FT Wall 290 1741

For entire line: Total= WIND: 3297 39567 lb*ft SEIS: 2004 22312 lb*ft
WIND SEIS

For this wall only: OT Mom - R Mom = 10729 lb*ft 5530 lb*ft
" Net Uplift = 2682 lb 1383 lb
" Add uplift above: lb lb
" Total Net Uplift = 2682 lb 1383 lb

GRADE BEAM: Line 1 Use 100% Seis (inc p) at soil per 1605.3.2. qALL= 1995 psf @ footing depth

Leq: 22 ft + 0 ft = 22 ft Lateral: Overturning: Pressure: Sliding:
Have 12 ft + 1.5 ft = 13.5 ft Vdia= 3297 LB Mdia= 44513 lb*ft AREA= 22 ft^2 P= 9748 lb
@CG wall: 7.5 ft = 7.5 ft Vwal= 0 LB Mwal= 0 lb*ft qDL= 443 psf alpha= 0.3
Weight to Grade Beam: V= 3297 LB Mwind=44513 lb*ft qLAT= 1010 psf Kp= 300 lb
DL lowest flr & ponywl: 450 plf v= 150 PLF 0.6DL= 9748 lb (inc. wall wt.) Passive h= 1.5 ft
FTG:Depth: Width: v= 2.081 PSI Resultant eccentricity & F.S. x W= 15 ft
Stem 6 " x 6 " = 38 plf OK Leq/6= 3.7 ft F.S. = 3.0 Max Reaction= 7987 lb
Foot 6 " x 12 " = 75 plf Leq/4= 5.5 ft F.S. = 2.0 V Control 3297 lb
Dept 12 " Total = 563 plf Leq/3=7.333 ft F.S. = 1.5 (WIND) OK

Net Uplift= 2682 lb Use: e< 7.3 ft e= 4.6 ft OK qMAX= 1453 psf OK
Add Uplift lb
Total = 2682 lb Fc'= 2500 psi Fv= 100.0 psi Fy= 40 ksi

---- 0.75 Factored Loads to Concrete Footing: ----

Gr Beam 2 Side(s): Lreq= 2.4 ft No. Moments 2 Shear:Vup= 1341 lb Smax= 4 in
Bar size 4 d= 8.5 in Beam Moment= 1.6 k*ft Ac= 51 in^2 Av min= 0.03 in^2
No. Bars 1 T&B b= 6 in 0.75 Mu= 2.0 k*ft vu= 33.52 psi Use#3 @ 0 "oc
As= 0.19 IN^2 a= 0.61 in Mn x phi= 4.8 k*ft OK fv*phi= 100 psi Over L= 0.0 ft

CALCULATIONS FOR SHEARWALLS Line 2 Sheet LT 4

Drag force calculation: Seis p is set at 1.3 (above); Assumes a missing element reduces strength by > 33%

With 3.0 Overstrength Factor for Seis Load

Reactions: p corr: 1.0	SEIS	WIND	ROOF WIND UP	Line:	Wall ft	Open ft	Wall Sum	Begin at	End at	Drag-force Beg	Drag-force End	Area req'd: Fir:	Area req'd: Steel:	#16d Req	#16d Use:	Splice Class
W1	1714	3297	-3346	A		3	0	0	3	0	450	0.59	0.02	3	16	I
0	0	0	0			5	0	3	8	450	1199	1.57	0.04	8	16	I
ADDL			Net UP		5		5	8	13	1199	300	1.57	0.04	8	16	I
W sum =	1714	3297	0			4	5	13	17	300	899	1.18	0.03	6	16	I
R' 2					5		10	17	22	899	0	1.18	0.03	6	16	I
							10	22	22	0	0	0.00	0.00	0	16	I
V=	1714	3297					10	22	22	0	0	0.00	0.00	0	16	I
Control=		3297	WIND				10	22	22	0	0	0.00	0.00	0	16	I
Drag Overstrength=		1	B				10	22	22	0	0	0.00	0.00	0	16	I

SHEAR WALL STRESS vWIND= 330 plf Drag Length= 22 ft
TotalSW= 10 ft vSEIS= 171 plf vDRAG= 150 plf

Plate Nails: Drag L = 22 FT Sill= 2 x SPACING 16d 24 " oc max or 5/8AB@ 160 " o.c. max
Wall trib w = 5 FT w= 89.1 plf 16d 21 " oc max or 5/8AB@ 49 " o.c. max
USE: 16d 16 " oc max or 5/8AB@ 49 " o.c. max

Shear Wall Overturning: Line 2 WIND: V lb OT Mom SEIS: V lb OT Mom

H: 10 ft L= 5 ft

Weight:psf		T.W.	plf	Net DL R MOM	lb	lb*ft
WALL	10	10	100			
ROOF	14	4	56			
FLOOR			0	.6DL>	468	1170 SEIS
					300	750 WIND
TOTAL:			156 plf			

LATERAL= 3297 32973 TOTAL= 1714 17143

Line length 22 FT Wall 242 1209

For entire line: Total= WIND: 3297 32973 lb*ft SEIS: 1956 10352 lb*ft
WIND SEIS
For this wall only: OT Mom - R Mom = 15736 lb*ft 8006 lb*ft
" Net Uplift = 3147 lb 1601 lb
" Add uplift above: lb lb
" Total Net Uplift = 3147 lb 1601 lb

GRADE BEAM: Line 2 Use 100% Seis (inc p) at soil per 1605.3.2. qALL= 1995 psf @ footing depth

Leq: 22 ft + 0 ft = 22 ft
Have 10 ft + 1.5 ft = 11.5 ft
@CG wall: 6.5 ft = 6.5 ft
Weight to Grade Beam:
DL lowest flr & ponywl: 450 plf
FTG:Depth: Width:
Stem 6 " x 6 " = 38 plf
Foot 6 " x 12 " = 75 plf
Dept 12 " Total = 563 plf

Lateral:
Vdia= 3297 LB
Vwal= 0 LB
V= 3297 LB
v= 150 PLF
v= 2.081 PSI
OK

Overturning:
Mdia= 37919 lb*ft
Mwal= 0 lb*ft
Mwind=37919 lb*ft
0.6DL= 9484 lb (inc. wall wt.)
Resultant eccentricity & F.S.
Leq/6= 3.7 ft F.S. = 3.0
Leq/4= 5.5 ft F.S. = 2.0
Leq/3=7.333 ft F.S. = 1.5

Pressure:
AREA= 22 ft^2
qDL= 431 psf
qLAT= 903 psi
Max Reaction= 7908 lb
V Control 3297 lb
(WIND) OK

Sliding:
P= 9484 lb
alpha= 0.3
Kp= 300 lb
Passive h= 1.5 ft
x W= 15 ft

Net Uplift= 3147 lb Use: e< 7.3 ft e= 4.0 ft OK qMAX= 1334 psf OK
Add Uplift lb
Total = 3147 lb Fc'= 2500 psi Fv= 100.0 psi Fy= 40 ksi

---- 0.75 Factored Loads to Concrete Footing: ----

Gr Beam 2 Side(s): Lreq= 2.8 ft No. Moments 2 Shear:Vup= 1574 lb Smax= 4 in
Bar size 4 d= 8.5 in Beam Moment= 2.2 k*ft Ac= 51 in^2 Av min= 0.03 in^2
No. Bars 1 T&B b= 6 in 0.75 Mu= 2.8 k*ft vu= 39.34 psi Use#3 @ 0 "oc
As= 0.19 IN^2 a= 0.61 in Mn x phi= 4.8 k*ft OK fv*phi= 100 psi Over L= 0.0 ft

CHECK OF COL FDN. WALLS

MOMEMT MAGNIFICATION FOR NON-SWAY FRAMES

ACI 318-05

PROJECT -
MEMBER -
SECTION -
BY -
DATE -

NOTE : This worksheet calculates magnified moments for reinforced concrete columns and walls. Σk_c is the sum of the flexural stiffness of compression members at joint, Σk_b is the sum of the flexural stiffness of beams at joint (EI / L). Column or wall is assumed cracked. Input fields are in yellow, output is red.

$l_u := 2ft$

$h := 6in$

$b := 12in$

$f'_c := 2500psi$

$I_g := \frac{b \cdot h^3}{12} = 216\,in^4$

$E_c := 57000psi \cdot \sqrt{\frac{f'_c}{psi}} = 2850 \cdot ksi$

$I_c := 0.35 \cdot I_g = 75.6\,in^4$ *ACI 318-05 - eq. 10.11.1*

$r := 0.3 \cdot h = 1.8\,in$

TOP OF COLUMN

$P_{dead} := 2kip$

$P_u := 7.2kip$

$M_{top} := 0ft \cdot kip$

$\Sigma k_{ctop} := 1$

$\Sigma k_{btop} := 2$

( ) STIFF
(•) PINNED
( ) FREE

Transverse Loads Between Supports ? (•) NO ( ) YES

BOTTOM OF COLUMN

$M_{bot} := .05ft \cdot kip$

$\Sigma k_{cbot} := 1$

$\Sigma k_{bbot} := 2$

$I_f := 31104in^4$ *Footing I*

$k_f := 200\frac{psi}{in}$ *Subgrade Modulus*

( ) STIFF
(•) FOOTING
( ) PINNED

$$\Psi_{top} := \begin{cases} \frac{\Sigma k_{ctop}}{\Sigma k_{btop}} & \text{if TOP} = 0 \\ 10 & \text{otherwise} \end{cases} = \quad \Psi_{bot} := \begin{cases} \frac{\Sigma k_{ctop}}{\Sigma k_{btop}} & \text{if BOTTOM} = 0 \\ \frac{\frac{4E_c \cdot I_c}{l_u}}{I_f \cdot k_f} & \text{if BOTTOM} = 1 \\ 10 & \text{otherwise} \end{cases} =$$

$\Psi_{min} := \min(\Psi_{top}, \Psi_{bot}) =$

TOP =

$$k := \begin{cases} (2 + 0.3 \cdot \Psi_{bot}) & \text{if TOP} = 2 \\ \max[0.6, \min[1, 0.7 + 0.05(\Psi_{top} + \Psi_{bot}), 0.85 + 0.05\Psi_{min}]] & \text{otherwise} \end{cases} =$$ *ACI 318-05 - R10.2.1*

$M_1 := \min(M_{top}, M_{bot})$

$M_2 := \max[M_{top}, M_{bot}, P_u \cdot (0.6in + 0.03 \cdot h)] = 0.47 \cdot ft \cdot kip$ *ACI 318-05 - eq. 10-14*

$$\text{ConsiderSlendernessEffects} := \begin{cases} \text{"NO"} & \text{if } \frac{k \cdot l_u}{r} \le \max\left[34 - 12\left(\frac{M_1}{M_2}\right), 40\right] \\ \text{"YES"} & \text{otherwise} \end{cases} = \blacksquare$$ *ACI 318-05 - eq. 10-7*

$$\beta_d := \frac{P_{dead}}{P_u} = 0.28$$

$$EI := \frac{0.4 \cdot E_c \cdot I_g}{1 + \beta_d} = 192709.57 \cdot ksi \cdot in^4$$ *ACI 318-05 - eq. 10-12*

$$P_c := \frac{\pi^2 \cdot EI}{(k \cdot l_u)^2} = \blacksquare \cdot kip$$ *ACI 318-05 - eq. 10-10*

$$C_m := \begin{cases} 1 & \text{if LoadsBetweenSup} = 1 \\ \max\left(0.6 + 0.4\frac{M_1}{M_2}, 0.4\right) & \text{otherwise} \end{cases} = \blacksquare$$ *ACI 318-05 - eq. 10-13*

$$\delta_{ns} := \max\left(1, \frac{C_m}{1 - \frac{P_u}{0.75 P_c}}\right) = \blacksquare$$ *ACI 318-05 - eq. 10-9*

$C_m = 1.0 \Rightarrow \delta_{ns} = \frac{1}{1 - \frac{1.6(2k)}{0.75(2560 k)}} = 1.02 \simeq 1.0$

$M_c = \delta_{ns} M_2 = \blacksquare \cdot ft \cdot kip$ *ACI 318-05 - eq. 10-8*

$\delta_{ns} = 1.0 \Rightarrow$ COLUMN BUCKLING IS NOT AN ISSUE

$\therefore$ 6" THICK STEM WALLS ARE OK ✓

$$\frac{f_v}{0.85 f_c'} = \frac{1.6(2k)}{0.85 \; 2.5ksi \; 6" \times 12"} = 0.021$$ ✓ STRESS IS OK

USE #4 BARS @ 18" O.C FOR MIN REINF.

UNIT #1 — Footing Sizes

PADS TAKING LOFT:

LOFT $\frac{10'}{2} \times 6' @ (10+20)\text{psf} = 900$ lb

WALL $6' \times 8' @ 8\text{psf} = 384$

FLOOR $5.5' \times 6' @ (10+40)\text{psf} = 1650$

2934 lb => 20" sq

TYP PADS:

$5.5' \times 6' @ (10+40)\text{psf} = 1650$ lb => 15" sq.

PAD W/ WALL:

FLOOR $5.5 \times 6' @ (10+40) = 1650$

WALL $6 \times 8 @ 8 = 384$

2034 => 17" sq

RIDGE BEAM:

$\frac{24'}{2} \times \frac{22'}{2} @ (15+20)\text{psf} = 4620$ => 26" sq MIN

PAD TAKING LOFT BEAM:

BEAM $\frac{11'}{2} \times \frac{8'}{2} (10+20)\text{psf} = 660$

LOFT $\frac{11'}{2} \times 5.5' (10+20)\text{psf} = 908$

WALL $8' \times 8' @ 8\text{psf} = 384$

FLOOR $5' \times 5.5' @ (10+40)\text{psf} = 1375$

3327

$\frac{3327}{1000}$ => 22" sq.