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C 55138

Structural Calculations:
ADU Prototype, City of Fort Bragg

Prepared at the Request of

Boone Low Ratliff Architects
Santa Cruz, CA

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Job 08-55

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Basis of Design:	Contents:	Sheet:
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Lateral analysis : seismic

For zip code 95437, from USGS ground motion web site :

$S_S = 1.546$ S_{DS} max $= 1.031$
$S_1 = .781$ S_{D1} max $= .781$ } site class "D" - assumed.

From ASCE 7-05 :

$$V = C_S W \qquad (12.8\text{-}1)$$

where $C_S = S_{DS} / (R/I)$

$R = 6.5$ - wood shear walls.

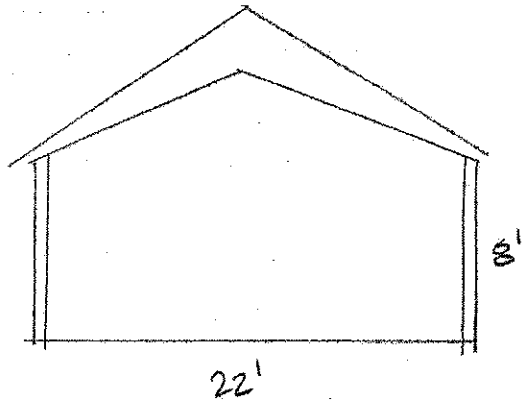
$\therefore$ $V = 1.03 / 6.5$ $W = .16$

w/ $\rho = 1.3$ and allowable stress design
$(\div 1.4)$

$$\Rightarrow V = .16 \times \frac{1.3}{1.4} = \underline{\underline{.15\,W}}$$

TOPS 35502

determine wt. of typical section:



large section:

$$w = \underset{\text{Roof/ceiling}}{14\text{ psf} \times 26'} + \left(\frac{8'}{2} \times 2\right) \times \underset{\text{wall}}{16\text{psf}} = 492 \text{ lbs/LF}$$

Small section:

$$w = 14\text{ psf} \times 20' + \left(\frac{8}{2} \times 2\right) \times 16 = 408 \text{ lbs/LF}$$

$\therefore F_1 = 73.8$ plf

$F_2 = 61.2$ plf.

see next page for wind calculations.

TOPS. 35502

Lateral analysis: wind

$P_s = \lambda K_{zt} I P_{s30}$

assume $K_{zt} = 1.0$

$I = 1.0$

& For 6:12 P_{S30}:

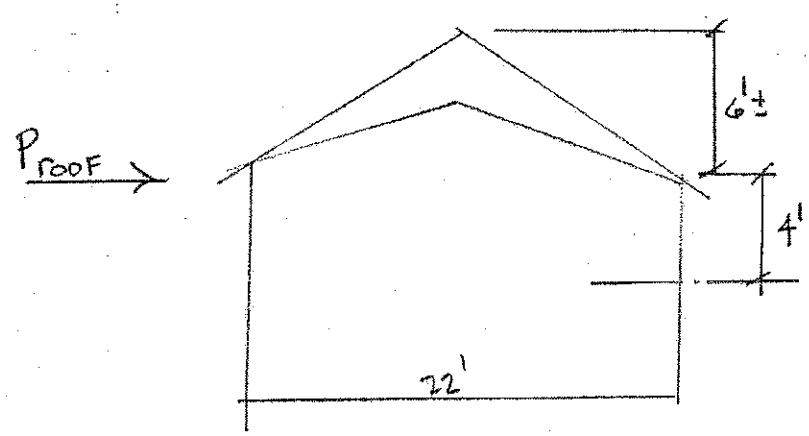
zone	P_{S30}	
A	14.4	17.4
B	2.3	2.8
C	10.4	12.6
D	2.4	2.9

$\times 1.21$

modified for exposure C

end distance a:

$= 3'$



$P_{roof} = 17.4 \times 4 + 6 \times 2.8 = 86.4$ end section "a"

& $P_{roof} = 10.4 \times 4 + 2.4 \times 6 = 56$ plf mid section

but, per 6.4.2.1.1: $P_{min} = 10\,psf \times 10 = \underline{100\ plf}$

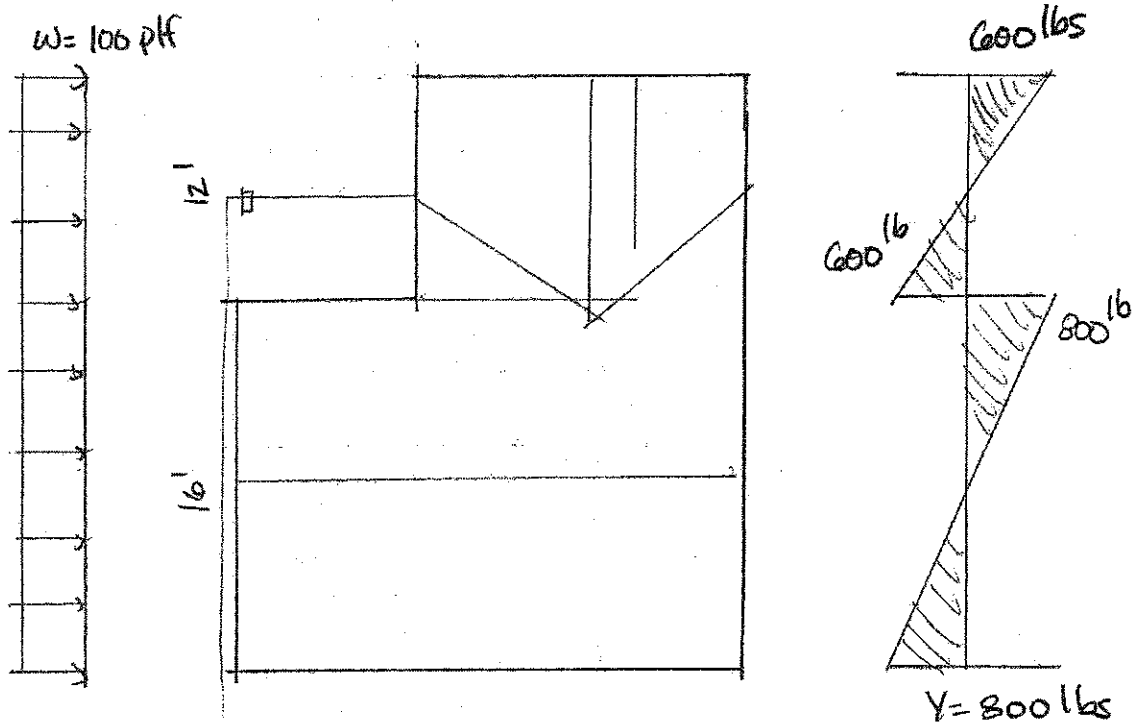
governs.

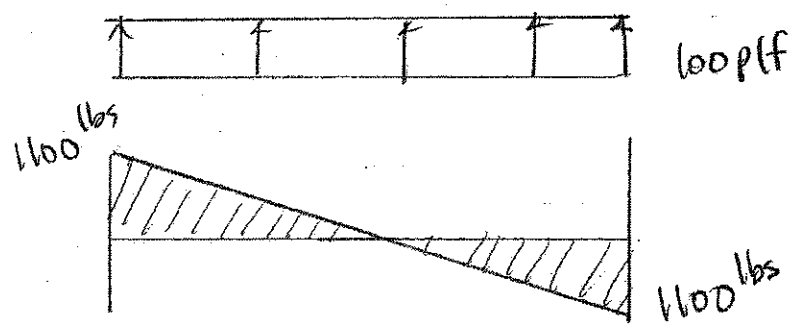
Wind on end wall:

Proof = $14.4 \times 10'/2 = 72$ eave

$10.4 \times 8' = 81.6$ mid section

use 100 plf ea. direction





Shear walls:

grid lines (3) & (C):

Both have abundant shear an therefore meet CBC. 2308.12.4 for braced walls, seismic design category D.

therefore use ½" CDX wall sheathing with 8d's @ 6" edge, 12" field no holdowns required.

grid line (2)

V = 1400 lbs

v = 1400/5.5' = 255 plf. < 260 plf △1

hd force ≈ 255 plf × 10' = 2550 lbs [1]

↑ ≈ wall ht.

△1 8d's @ 6 & 12, ½" CDX PLYWD.
5/8"ϕ galv. anchor bolts @ 4'-0" oc
A35 clips @ 20" oc
LPT4 clps @ 30" oc
sole plate: 16d's @ 7" oc

[1] PHD2-SDS3. hold own - allowable = 3080 lbs.

TOPS 35503

grid line (1)

V= 800 lbs

v= 800/4.5+3.5 = 100 plf. — △1

hd force @ 8' x 100 = 800 lbs - [1]

grid line (A) & (B)

V=1000 lbs

consider ea. wall seperately to resist 1000 lbs.

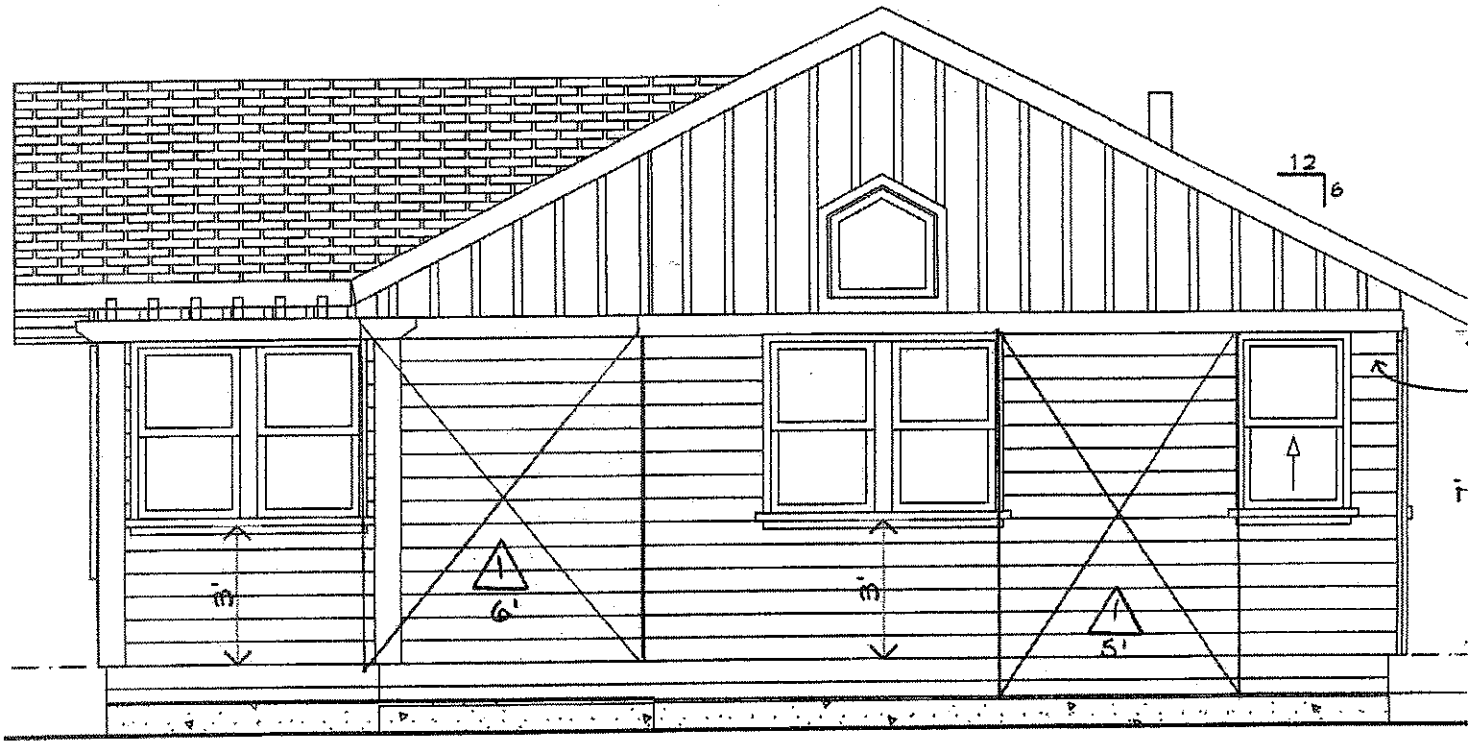
grid line (A) wall is shorter:

v= 1000/5 = 200 plf - △1

hd force @ 200 x 8 = 1600 lbs — [1]

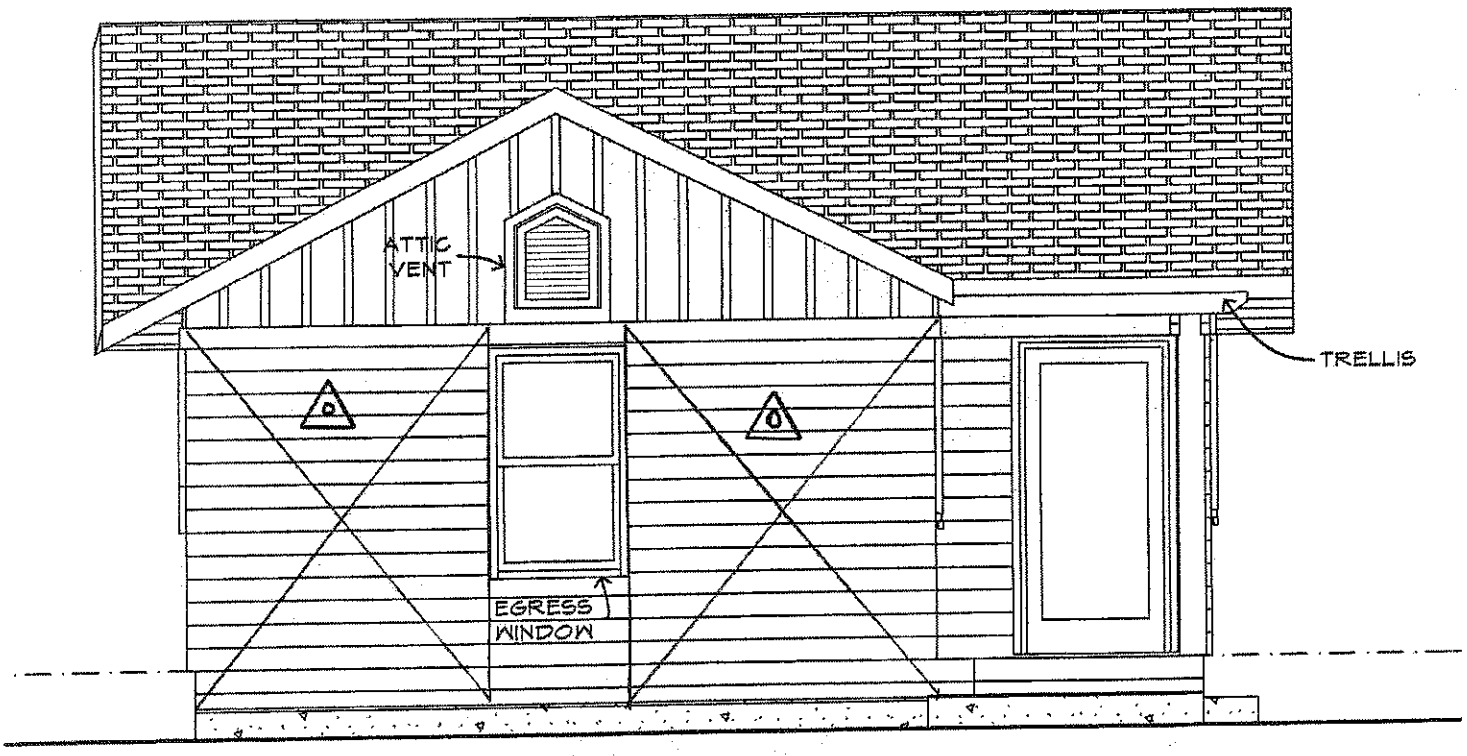
use same for both walls.

TOPS. 35502

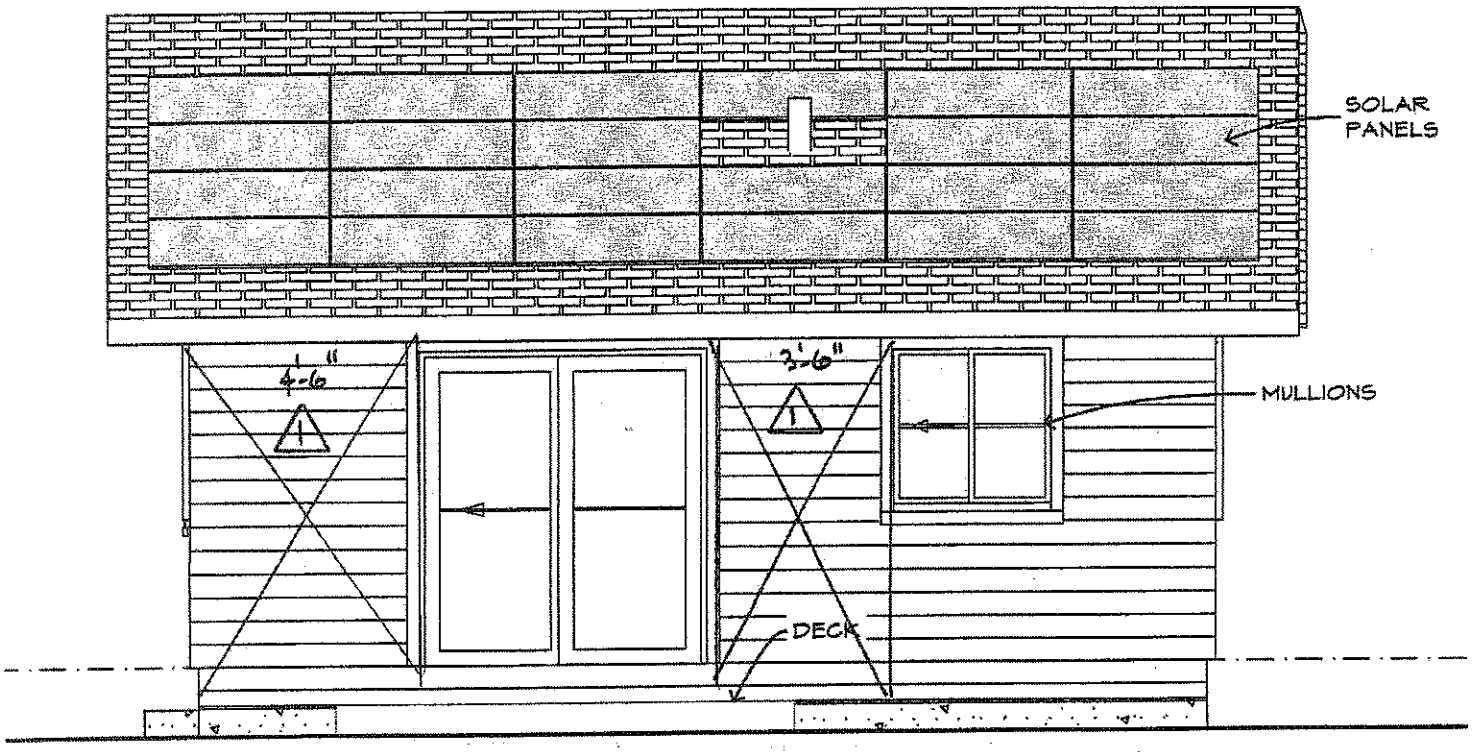


West Elevation

SCALE: 1/4" = 1'-0"

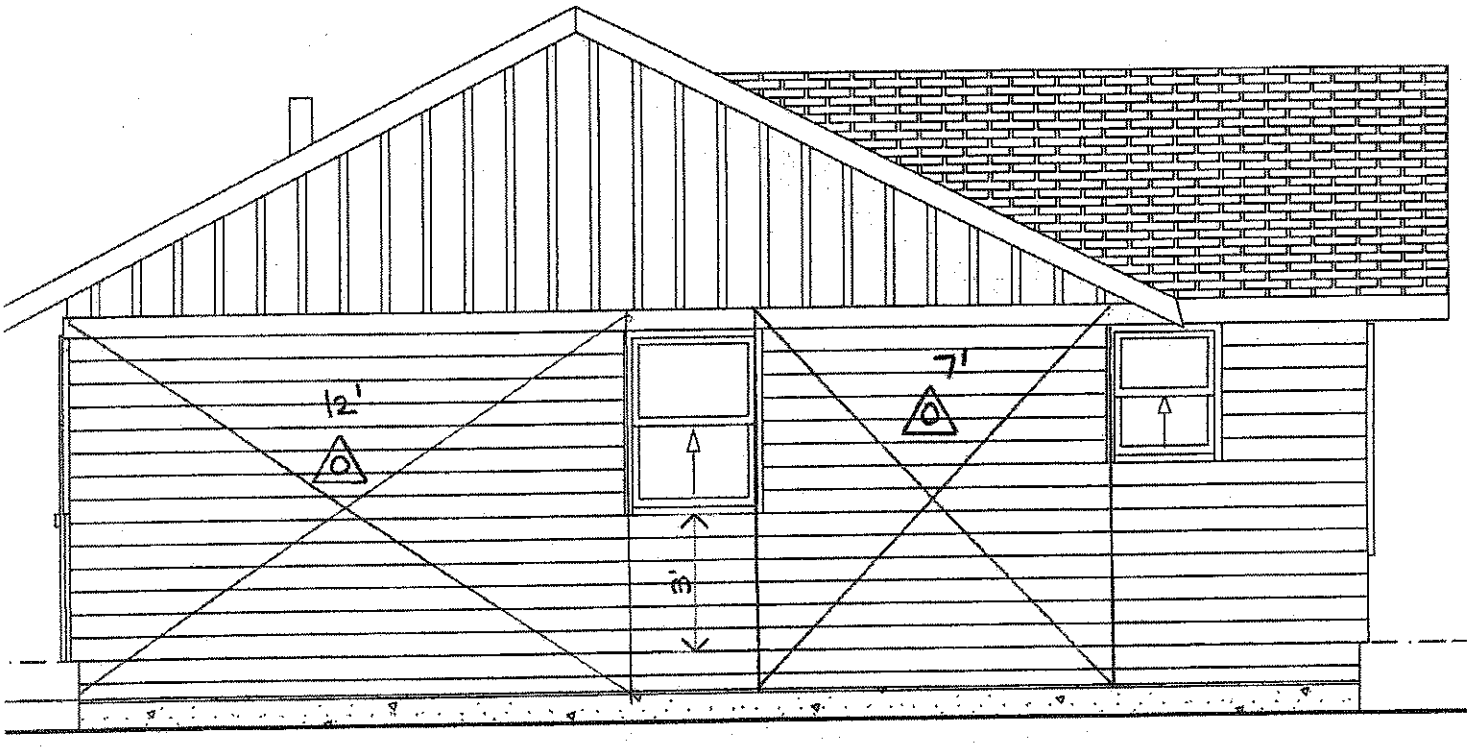


NORTH ELEVATION



South Elevation

SCALE: 1/4" = 1'-0"



EAST ELEVATION

SHEARWALL SCHEDULE

SYMBOL	SHEATHING NAILING		FRAMING CLIPS (A35/LPT4)	ANCHOR BOLTS	SOLE PLATE		ALLOWABLE SHEAR (PLF)
			450 LBS PER EACH A35 PER SIMPSON		NAILS	SDS SCREWS	
	EDGE	FIELD	670 LBS PER EACH LPT4 PER SIMPSON	1488 LBS PER BOLT PER 2005 NDS TABLE 11E (Z=930, Cd=1.6)	165 LBS PER 16d PER 2005 NDS TABLE 11N (Z=103, Cd=1.6)	319 LBS BASED ON SIMPSON, INCREASED BY Cd=1.33	PER 2007 CBC TABLE 2306.4.1
1	1/2" CDX PLYWOOD WITH 8d'S AT 6" OC	12" OC	20 / 30	68	7	14	260
2	1/2" CDX PLYWOOD WITH 8d'S AT 4" OC	12" OC	14 / 21	46	5	10	380
3	1/2" CD PLYWOOD WITH 8d'S AT 3" OC	12" OC	11 / 16	36	4	7	490
4	1/2" CDX PLYWOOD WITH 8d'S AT 2" OC	12" OC	8 / 12	27	3	5	640
5	1/2" CDX PLYWOOD WITH 8d'S AT 4" OC EA. SIDE OF WALL	12" OC	10 / 14	33	3	7	540

NOTES:

1 BACK ALL PANEL EDGES WITH 2X SOLID BLOCKING.

2 WHERE PANELS ARE APPLIED TO BOTH SIDES OF WALL, OFFSET PANELS JOINTS FROM EACH SIDE.

3 USE DOUBLE 2X BOUNDARY MEMBERS AT SHEARWALLS ENDS, UNO ON PLANS.

4 ALL BRACED WALL LINES HAVING SHEARWALLS SHALL HAVE A DOUBLE TOP PLATE SPLICED AS SHOWN ON THIS SHEET, OR TIED TO A COLLECTOR MEMBER AS SHOWN ON THE FRAMING PLANS.

5 ALL ANCHOR BOLTS SHALL HAVE A MINIMUM OF A 3"X3"X1/4" PLATE WASHER PER CBC

6 EXCEPT FOR SHEAR SYMBOL 1, ALL WALLS SHALL HAVE A 3X MEMBER AT ALL PANEL JOINTS AND AT THE SILL PLATE. STAGGER NAILS.

7 ALL NAILS SHALL BE EITHER COMMONS, OR HOT DIPPED GALVANIZED BOX NAILS.

8 ALL NAILS INSTALLED INTO PRESERVATIVE TREATED LUMBER SHALL BE HOT DIPPED GALVANIZED OR STAINLESS STEEL DUE TO THE CORROSIVE NATURE OF THIS MATERIAL ON FASTENERS.

9 FRAMING CLIPS ARE ONLY REQUIRED AT LOCATIONS WHERE THE SHEAR PLYWD IS INTERUPTED, IE AT INTERIOR SHEARWALLS WHERE THE SECOND FLOOR FRAMING CAUSES A BREAK IN THE SHEATHING.

10 WHERE SHEARWALL PLYWD IS APPLIED OVER 1/2" DRYWALL, USE 10d NAILS.

11 WHERE AN OPENING, IE WINDOW, OCCURS IN A SHEARWALL, SEE SHEARWALL WITH PERFORATION DETAIL THESE PLANS, TYPICAL.

Span Table

Douglas Fir No. 2
- Repetitive Members
- Normal Load Duration

Design Values:	Fb= 900 psi	Fv= 180 psi	E= 1.6E+06 psi

Mod. factors:	C_d	C_m	C_t	C_L	C_V	C_{fu}	C_r	C_c	C_f
	1	1	1	1	1	1	1.15	1	1

MEMBER	A	Allowable Bending Stress	Allowable M, V		deflection	Member Span (feet) 5	6	7	8	9	10	11	12	13	14	15	16	17	20	24
	S	Allowable Shear Stress	Moment:			0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	1.00	1.20
	I	Form Factor	Shear:			0.13	0.15	0.18	0.20	0.23	0.25	0.28	0.30	0.33	0.35	0.38	0.40	0.43	0.50	0.60
						Allowable Loading (plf)														
2x6	8.25	Fb'= 1346	848	ft-lbs	B	271	188	138	106	84	68	56	47	40	35	30	26	23	17	12
	7.56	Fv'= 180	990	lbs	TL	592	342	216	144	101	74	56	43	34	27	22	18	15	9	5
	20.80	C_F 1.3			LL	296	171	108	72	51	37	28	21	17	13	11	9	8	5	3
2x8	10.88	Fb'= 1242	1360	ft-lbs	B	435	302	222	170	134	109	90	76	64	56	48	42	38	27	19
	13.14	Fv'= 180	1306	lbs	TL	1,355	784	494	331	232	169	127	98	77	62	50	41	34	21	12
	47.63	C_F 1.2			LL	677	392	247	165	116	85	64	49	39	31	25	21	17	11	6
2x10	13.88	Fb'= 1139	2029	ft-lbs	B	649	451	331	254	200	162	134	113	96	83	72	63	56	41	28
	21.39	Fv'= 180	1666	lbs	TL	2,814	1,628	1,026	687	483	352	264	204	160	128	104	86	72	44	25
	98.93	C_F 1.1			LL	1,407	814	513	344	241	176	132	102	80	64	52	43	36	22	13
2x12	16.88	Fb'= 1035	2729	ft-lbs	B	873	606	446	341	270	218	180	152	129	111	97	85	76	55	38
	31.64	Fv'= 180	2026	lbs	TL	5,063	2,930	1,845	1,236	868	633	475	366	288	231	188	155	129	79	46
	178.00	C_F 1			LL	2,532	1,465	923	618	434	316	238	183	144	115	94	77	64	40	23
2x14	19.88	Fb'= 932	3407	ft-lbs	B	1,090	757	556	426	336	273	225	189	161	139	121	106	94	68	47
	43.89	Fv'= 180	2386	lbs	TL	8,272	4,787	3,014	2,019	1,418	1,034	777	598	471	377	306	252	210	129	75
	290.80	C_F 0.9			LL	4,136	2,393	1,507	1,010	709	517	388	299	235	188	153	126	105	65	37

notes:

Table displays the allowable loading in pounds per linear foot for the span shown for bending stress governs (B) total load deflection governs (TL), and live load only deflection (LL).

Values are based on the 2005 National Design Specification for Wood (2005 NDS).

Table is based on uniform loading conditions only.

Deflection Criteria:

total load deflection: l / 240

live load deflection: l / 480

Span Table

Douglas Fir No. 1
- Single Member Use
- Normal Load Duration

Design Values:	Fb= 1000 psi	Fv= 180 psi	E= 1.7E+06 psi

Mod. factors:	C_d	C_m	C_t	C_L	C_V	C_{fu}	C_r	C_c	C_f
	1	1	1	1	1	1	1	1	1

MEMBER	A	Allowable Stresses	Allowable M, V			Member Span (feet) 5	6	7	8	9	10	11	12	13	14	15	16	18	19	20
	S	Bending Stress	Moment:			0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.90	0.95	1.00
	I	Shear Stress	Shear:			0.17	0.20	0.23	0.27	0.30	0.33	0.37	0.40	0.43	0.47	0.50	0.53	0.60	0.63	0.67
4X6	19.25	Fb'= 1300	1912	ft-lbs	B	612	425	312	239	189	153	126	106	91	78	68	60	47	42	38
	17.65	Fv'= 180	2310	lbs	TL	1,467	849	535	358	251	183	138	106	83	67	54	45	31	27	23
	48.53	C_F 1.3			LL	978	566	356	239	168	122	92	71	56	45	36	30	21	18	15
4X8	25.38	Fb'= 1300	3322	ft-lbs	B	1,063	738	542	415	328	266	220	185	157	136	118	104	82	74	66
	30.66	Fv'= 180	3046	lbs	TL	3,359	1,944	1,224	820	576	420	315	243	191	153	124	103	72	61	52
	111.15	C_F 1.3			LL	2,239	1,296	816	547	384	280	210	162	127	102	83	68	48	41	35
4X10	32.38	Fb'= 1200	4991	ft-lbs	B	1,597	1,109	815	624	493	399	330	277	236	204	177	156	123	111	100
	49.91	Fv'= 180	3886	lbs	TL	6,976	4,037	2,542	1,703	1,196	872	655	505	397	318	258	213	150	127	109
	230.84	C_F 1.2			LL	4,651	2,692	1,695	1,135	797	581	437	336	265	212	172	142	100	85	73
4X12	39.38	Fb'= 1100	6768	ft-lbs	B	2,166	1,504	1,105	846	668	541	447	376	320	276	241	211	167	150	135
	73.83	Fv'= 180	4726	lbs	TL	12,551	7,263	4,574	3,064	2,152	1,569	1,179	908	714	572	465	383	269	229	196
	415.28	C_F 1.1			LL	8,367	4,842	3,049	2,043	1,435	1,046	786	605	476	381	310	255	179	152	131
4X14	46.38	Fb'= 1000	8534	ft-lbs	B	2,731	1,896	1,393	1,067	843	683	564	474	404	348	303	267	211	189	171
	102.41	Fv'= 180	5566	lbs	TL	20,505	11,866	7,473	5,006	3,516	2,563	1,926	1,483	1,167	934	759	626	439	374	320
	678.48	C_F 1			LL	13,670	7,911	4,982	3,337	2,344	1,709	1,284	989	778	623	506	417	293	249	214

notes:

Table displays the allowable loading in pounds per linear foot for the span shown for bending stress governs (B) total load deflection governs (TL), and live load only deflection (LL).

Values are based on the 2005 National Design Specification for Wood (2005 NDS).

Table is based on uniform loading conditions only.

Design assumptions:

Soil site classification : D
Seismic design category : D
Wind exposure "C"
Wind loading on Roof Diaphragm governs and is equal to 100 plf.

Plan notes:

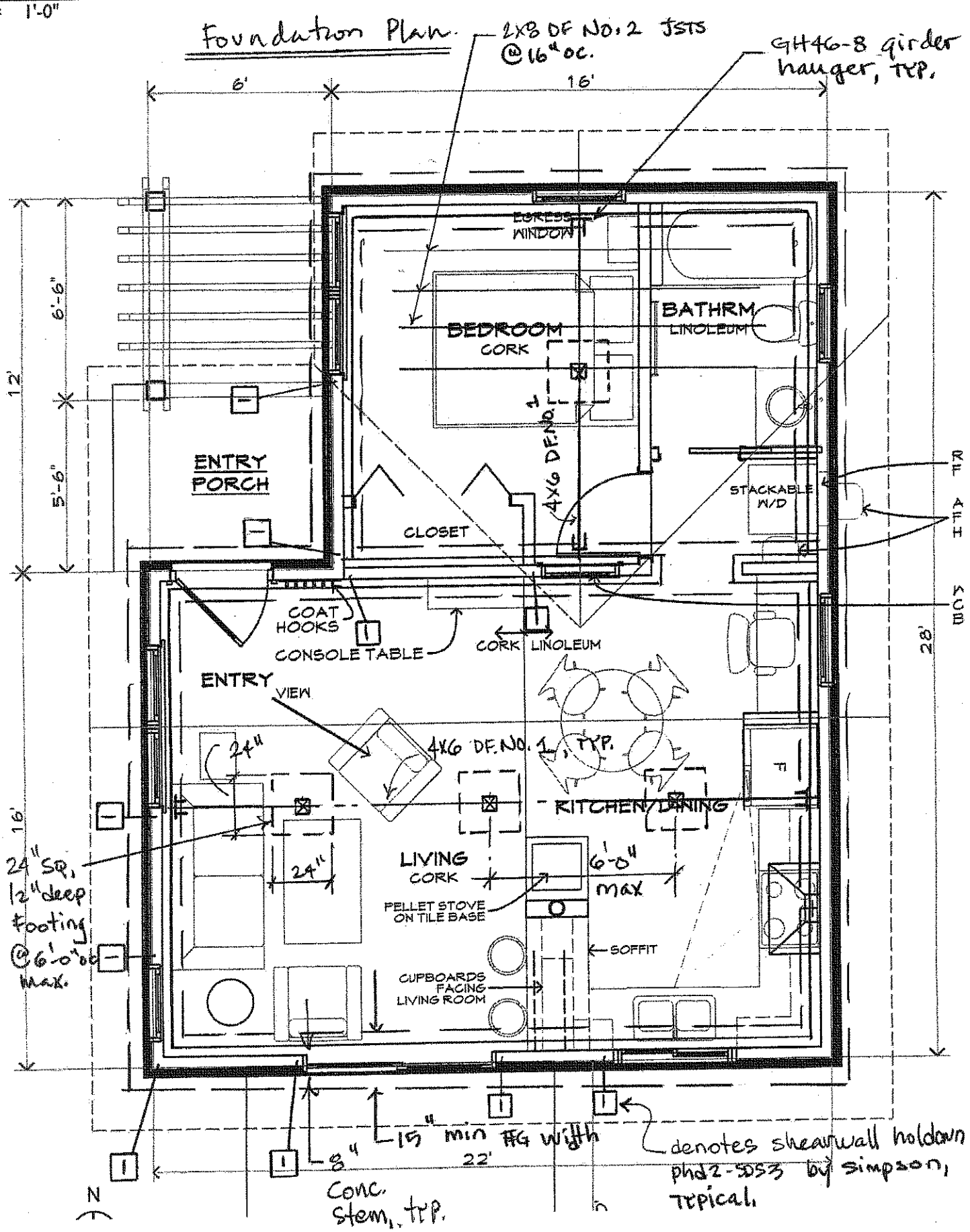
△1 Denotes shearwall : 1/2" CDX plywd with 8d's @ 6" edge, 12" field.

△0 Denotes braced wall panel : 1/2" CDX plywd w/ 8d's @ 6" edge, 12" field, no holdown required. see plan for length.

[1] Denotes typical holdown device for TYPE △1 shearwall. - PHD2-SDS3 holdown by simpson.

lan - Option A

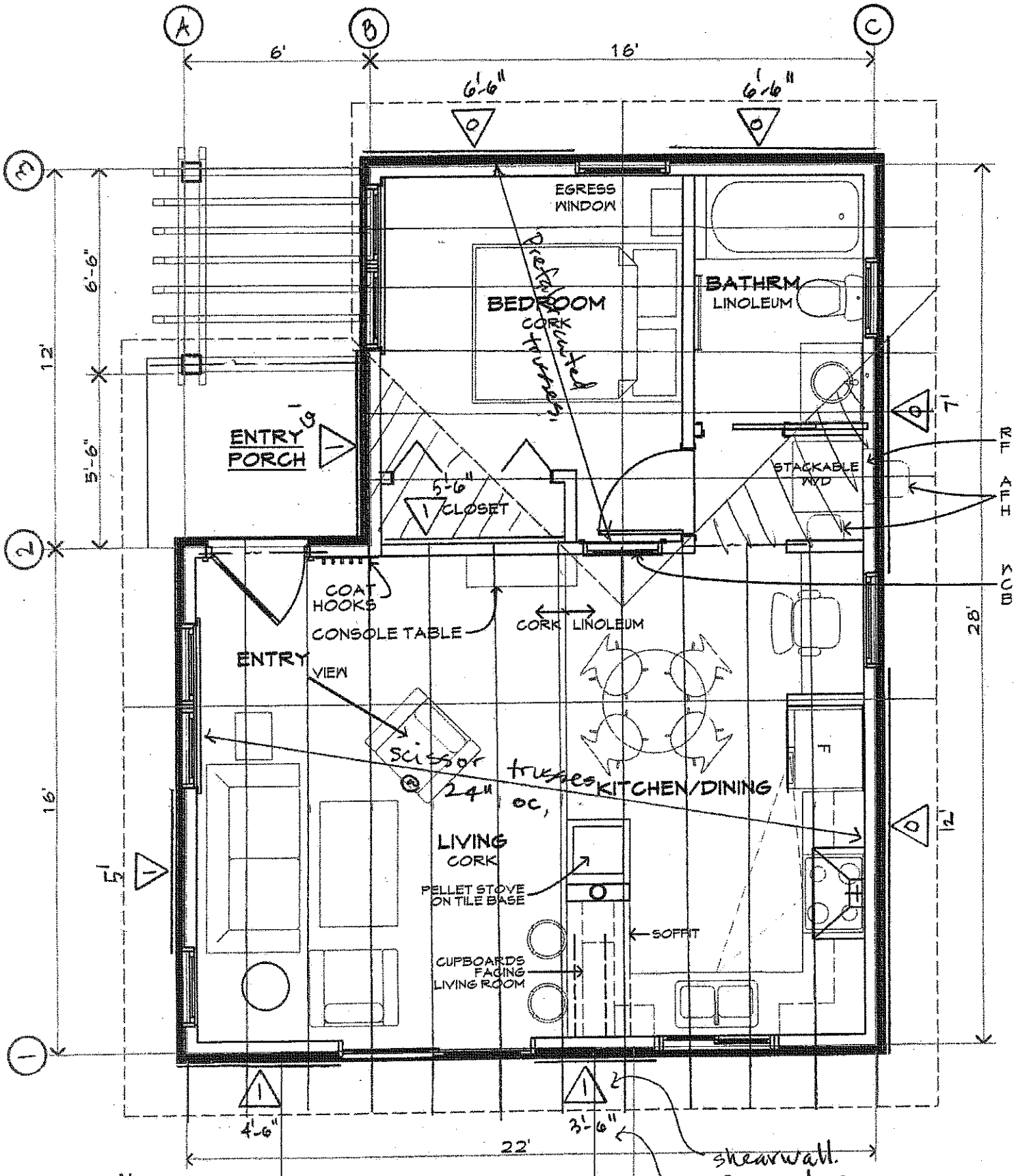
" = 1'-0"



lan - Option A

" = 1'-0"

"calif" frame on site



ROOF Framing Plan