

Harriott Valentine Engineers Inc.

STRUCTURAL CALCULATIONS

Project:

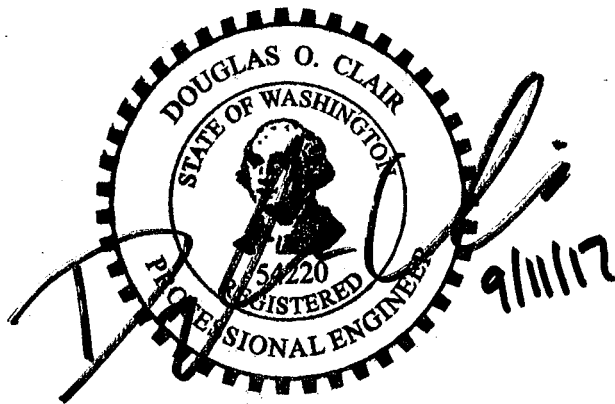
LS Residence
5460 E. Mercer Way
Mercer Island, WA 98040

Architect:

Jeff Babienko
815 Seattle Boulevard South
Seattle, WA 98134

Structural Engineer:

Harriott Valentine Engineers, Inc.
1932 First Avenue, Suite 720
Seattle, WA 98101
tel. 206-624-4760



Harriott Valentine Engineers Inc.

SECTION 1: GENERAL

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel. 206-624-4760 | fax 447-6971

CRITERIA

Project Name **LS Residence**
 Project Address **5460 E.Mercer Way**
Mercer Island, WA 98040

Gravity

roof	dead	2" concrete	0.0	live snow	25.0 psf
		1/2" plywood	1.5		
		SLT 5	17.0		
		R30 insulation	1.2		
		miscellaneous	3.0 13%		
			<u>23 psf</u>		

total dead + live 48 psf

2nd floor	dead	2" concrete	25.0	live residential	40.0 psf
w/ SLT3		3/4" plywood	2.3		
		SLT3	10.5		
		miscellaneous	4.0 10%		
			<u>42 psf</u>		

total dead + live 82 psf

2nd floor	dead	2" concrete	25.0	live residential	40.0 psf
w/ TJI		3/4" plywood	2.3		
		11-7/8" TJI 230 @ 16"oc	2.1		
		acoustic insulation	1.0		
		5/8" gyp. wallboard	2.8		
		miscellaneous	5.0 13%		
			<u>38 psf</u>		

total dead + live 78 psf

2nd floor	dead	Green Roof	58.0	live residential	40.0 psf
w/ Green roof		3/4" plywood	2.3		
		SLT7	25.0		
		miscellaneous	9.0 10%		
			<u>94 psf</u>		

total dead + live 134 psf

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1nd floor	dead	2" concrete	25.0	live residential	40.0 psf
w/ SLT5		3/4" plywood	2.3		
		SLT5	17.0		
		miscellaneous	5.0 10%		
			<u>49</u> psf		
	total	dead + live	89 psf		

1nd floor	dead	2" concrete	25.0	live residential	40.0 psf
w/ TJI		3/4" plywood	2.3		
		11-7/8" TJI 110 @ 16"oc	1.9		
		acoustic insulation	1.0		
		5/8" gyp. wallboard	2.8		
		miscellaneous	5.0 13%		
			<u>38</u> psf		

total dead + live 78 psf

1nd floor	dead	2" concrete	25.0	live residential	40.0 psf
w/ SLT7		3/4" plywood	2.3		
		SLT7	25.0		
		miscellaneous	6.0 10%		
			<u>58</u> psf		
	total	dead + live	98 psf		

walls	dead	cement fiber board	4.1		
		battens 2x2 @ 24"oc	0.3		
		1/2" plywood	1.5		
		2x4 @ 16"oc	1.1		
		R21 insulation	0.8		
		1/2" gyp. wallboard	2.2		
		miscellaneous	0.0 0%		
			<u>10.0</u> psf		

FLOOR SLAB COMPARISON CROSSLAM® VS. CONCRETE

MAX SPANS	CrossLam® PANEL THICKNESS (in)	SLAB THICKNESS REQUIRED (in)	RATIO CLIMCONC THICKNESS (%)	VIBRATION CONTROLLED SPAN (ft)	CONCRETE SLAB ONE END CONT (dx24) (ft)
SLT3	3.90	5.91	66	10.67	7.32
SLT5	6.66	7.87	85	14.94	12.50
SLT7	9.42	10.24	92	18.90	17.68
SLT9	12.18	12.20	100	22.56	22.56

Text in *red* indicates CrossLam® thickness advantage.

Architects and Designers can design with freedom.

Engineers receive a strong, stable building.

General Contractors receive a predictable experience on site.

Owners receive a green building that is on budget and on time.

Panel Properties

The Allowable Bending Capacities^(a) for Structurlam's CrossLam® CLT (for use in the US).

CLT Grade ^(b)	Name	Layers	Depth (in)	Weight (lbs) per sq. ft	Major Strength Direction				Minor Strength Direction			
					$F_b S_{eff,0}$ (lb-ft/ft)	$EI_{eff,0}$ (10 ⁶ lb-ft-in. ² /ft)	$GA_{eff,0}$ (10 ⁶ lb-ft/ft)	$V_{r,0}$ (lb-ft)	$F_b S_{eff,90}$ (lb-ft/ft)	$EI_{eff,90}$ (10 ⁶ lb-ft-in. ² /ft)	$GA_{eff,90}$ (10 ⁶ lb-ft/ft)	$V_{r,90}$ (lb-ft)
V2M1	SLT3	3	3.90	10.5	1800	79	0.49	1,340	280	3.7	0.52	495
	SLT5	5	6.66	17.0	4,275	321	1.0	1,860	2,410	96	1.0	1,440
	SLT7	7	9.42	25.0	7,700	818	1.5	2,370	5,500	364	1.6	1,970
	SLT9	9	12.18	32.0	12,075	1,662	2.1	2,875	9,675	898	2.1	2,470

- (a) Tabulated values are allowable design values and not permitted to be increased for the lumber size adjustment factor in accordance with the NDS.
- (b) The CLT grades are developed based on ANSI/APA PRG 320, as permitted by the standard using all visually graded No. 2 SPF lumber in both major and minor strength directions.

Allowable Design Properties^(a) for Structurlam's CrossLam® CLT (for use in the US).

CLT Grade	Major Strength Direction						Minor Strength Direction					
	$f_{b,0}$ (psi)	E_0 (10 ⁶ psi)	$f_{t,0}$ (psi)	$f_{c,0}$ (psi)	$f_{v,0}$ (psi)	$f_{s,0}$ (psi)	$f_{b,90}$ (psi)	E_{90} (10 ⁶ psi)	$f_{t,90}$ (psi)	$f_{c,90}$ (psi)	$f_{v,90}$ (psi)	$f_{s,90}$ (psi)
V2M1	875	1.4	450	1,150	135	45	875	1.4	450	1,150	135	45

- (a) Tabulated values are allowable design values and not permitted to be increased for the lumber size adjustment factor in accordance with the NDS. The design values shall be used in conjunction with the section properties provided by the CLT manufacturer based on the actual layout used in manufacturing the CLT panel (see Table above).

Roof

CrossLam® Roof Panel Load Table

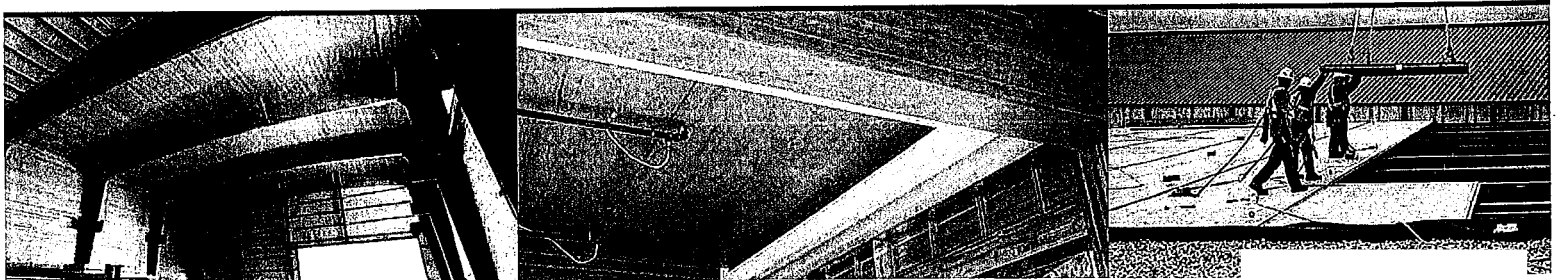
MAX. SPAN (ft)		NON-SNOW LOAD 125% (psf)	SNOW LOAD 115% (psf)											
			20		20		30		40		55		100	
PANEL TYPE	SIZE (in)	L/300*	L/180	L/300*	L/180	L/300*	L/180	L/300*	L/180	L/300*	L/180	L/300*	L/180	
		(4)	(5)	(4)	(5)	(4)	(5)	(4)	(5)	(4)	(5)	(4)	(5)	
single span	SLT3	3.90	14.80	19.53	14.80	19.53	13.73	17.73	12.90	16.44	11.94	15.03	10.11	12.24
	SLT5	6.66	21.54	29.21	21.54	29.21	18.73	26.92	19.32	25.20	18.11	23.27	15.68	18.33
	SLT7	9.42	26.95	37.36	26.95	37.36	22.73	34.89	24.70	32.95	23.40	29.76	20.64	23.81
	SLT9	12.18	32.08	40.00*	32.08	40.00*	30.85	40.00*	29.78	39.28	28.41	35.73	25.74	29.01
double span	SLT3	3.90	20.00	20.00*	20.00	20.00**	18.60	20.00*	17.48	18.11	15.90	15.90	12.74	12.24
	SLT5	6.66	27.00	27.00*	27.00	27.00**	24.00	27.00*	25.48	25.20	21.80	21.80	18.75	18.33
	SLT7	9.42	33.00	33.00*	33.00	33.00**	30.00	33.00*	31.48	32.95	27.80	27.80	23.75	23.81
	SLT9	12.18	39.00	39.00*	39.00	39.00**	36.00	39.00*	37.48	39.28	33.80	33.80	29.75	29.01

*US CLT Handbook recommends L/300 for preliminary design.

**Span is governed by maximum panel length of 40ft - design as simple span using table values above.

Notes:

1. For panel properties – see page 3. Span table assumes dry service conditions.
2. The following factors were used for calculations: $C_D=1.25$ (non-snow) and $C_D=1.15$ (snow); $C_M=1.0$; $C_t=1.0$; $C_L=1.0$. (ref: Table 1 – Chapter 3 – 2013 US Edition of the CLT Handbook: cross-laminated timber).
3. Span table above includes panel self-weight plus 10psf miscellaneous dead load. [Ref: International Building Code 2012 - art. 1607.5]. Full deadloads were assumed.
4. Values in left column (**green**) correspond to a span governed by allowable bending stress, allowable shear stress or by time dependant deflection (creep - calculated using the following factor: $K_{cr}=2$) limit of L/300.
5. Values in right column correspond to maximum span governed by either allowable bending stress, allowable shear stress or by dead plus live load deflection limit of L/180.
6. Spans shown represent distance between the centerlines of supports and are to be used for preliminary design only.
7. Spans are assumed to be equal for double span panels.
8. Engineer of Record to ensure that assumed deflection limit is appropriate for intended use.
9. CLT is NOT an isotropic material. Therefore the presented values must only be used for bending of panels in the longitudinal (major) axis.
10. Structurlam recommends considering long term deflection (creep) according to the proposed design method included in the 2013 US Edition of the CLT Handbook: cross-laminated timber.
11. For applications with deflection limits or loading different than what is included above, contact your Structurlam sales representative.



Floor

CrossLam® Floor Panel Load Table

MAX. SPAN (ft)		FLOOR LIVE LOAD (psf)										
		40 Residential		50 Office/ Classroom		75 Mechanical Room		100 Assembly/ Storage		150 Library		
PANEL TYPE	SIZE (in)	L/300* (4)	L/240 (5)	L/300* (4)	L/240 (5)	L/300* (4)	L/240 (5)	L/300* (4)	L/240 (5)	L/300* (4)	L/240 (5)	
single span	SLT3	3.90	11.50	13.60	11.43	12.94	10.43	11.70	9.70	10.71	8.64	9.06
	SLT5	6.66	16.22	21.07	16.22	20.14	16.12	17.88	15.10	16.10	13.60	13.71
	SLT7	9.42	20.42	27.75	20.42	26.16	20.42	23.14	19.25	20.98	18.10	18.01
	SLT9	12.18	24.35	33.32	24.35	31.56	24.35	28.14	24.35	25.63	22.14	22.14
double span	SLT3	3.90	11.50	14.83	11.50	13.81	11.50	11.97	10.71	10.71	9.06	9.06
	SLT5	6.66	16.22	20.00**	16.22	20.00**	16.22	17.88	16.10	16.10	13.71	13.71
	SLT7	9.42	<i>*US CLT Handbook recommends L/300 for preliminary design.</i>								18.01	18.01
	SLT9	12.18	<i>**Span is governed by maximum panel length of 40ft - design as simple span using table values above.</i>									

CrossLam® Floor Panel Load Table (with 2" concrete topping)

MAX. SPAN (ft)		FLOOR LIVE LOAD (psf)										
		40 Residential		50 Office/ Classroom		75 Mechanical Room		100 Assembly/ Storage		150 Library		
PANEL TYPE	SIZE (in)	L/300* (4)	L/240 (5)	L/300* (4)	L/240 (5)	L/300* (4)	L/240 (5)	L/300* (4)	L/240 (5)	L/300* (4)	L/240 (5)	
single span	SLT3	3.90	10.26	12.37	9.95	11.90	9.32	10.93	8.81	9.95	8.03	8.58
	SLT5	6.66	15.20	19.28	15.48	18.31	14.60	16.41	13.86	15.00	12.73	13.01
	SLT7	9.42	20.40	24.82	20.40	23.66	19.34	21.36	18.46	19.62	17.05	17.13
	SLT9	12.18	24.31	30.05	24.31	28.73	23.94	26.08	22.92	24.05	21.10	21.10
double span	SLT3	3.90	11.50	12.98	11.50	12.28	10.93	10.93	9.95	9.95	8.58	8.58
	SLT5	6.66	16.22	19.28	16.22	18.31	16.22	16.41	15.00	15.00	13.01	13.01
	SLT7	9.42	20.00**	20.00**	20.00**	20.00**	20.00**	20.00**	19.62	19.62	17.13	17.13
	SLT9	12.18	<i>*US CLT Handbook recommends L/300 for preliminary design.</i>									
<i>**Span is governed by maximum panel length of 40ft - design as simple span using table values above.</i>												

Notes:

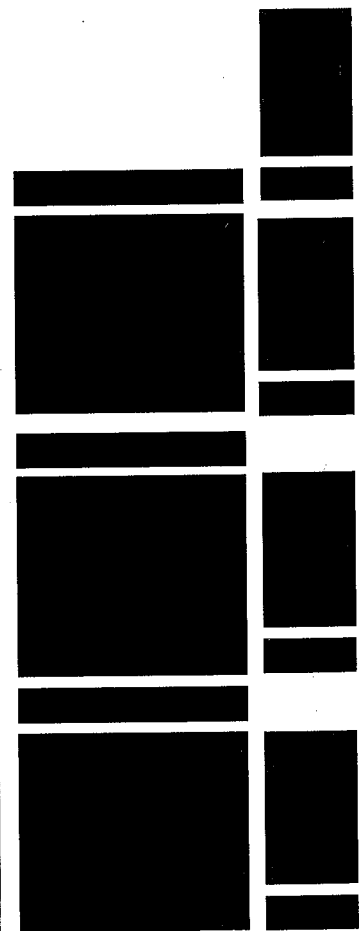
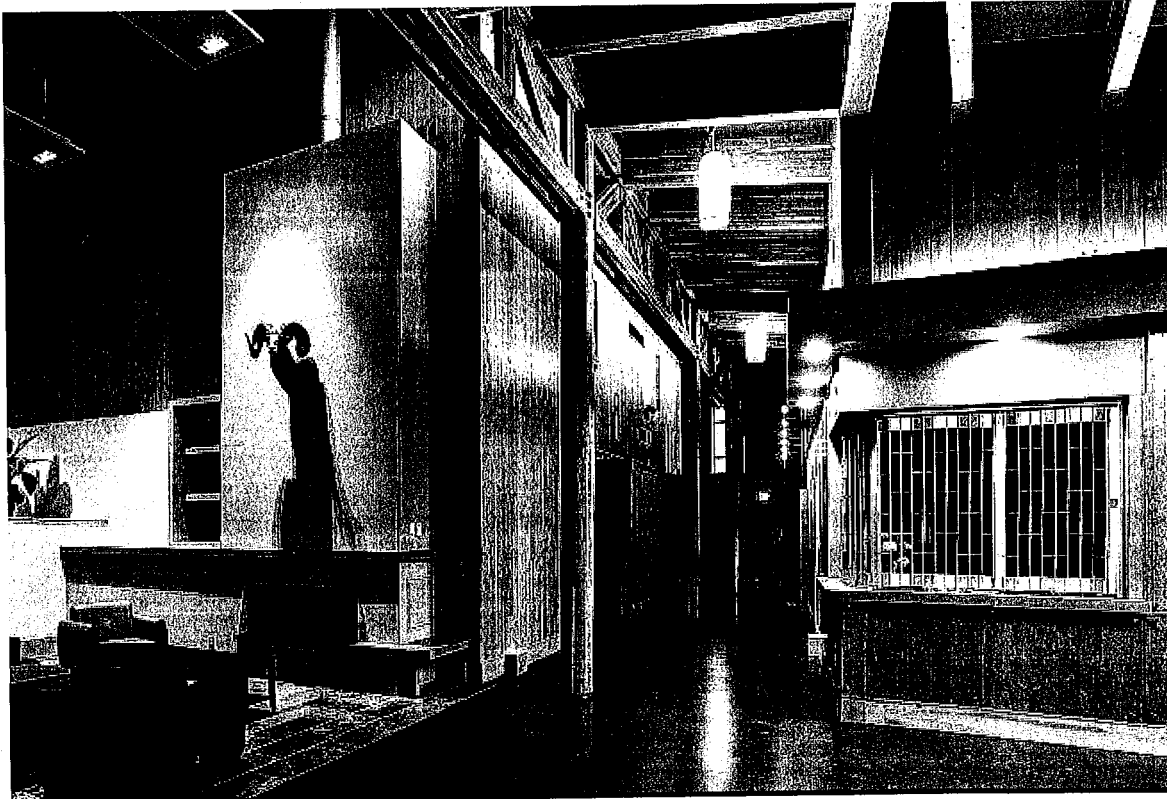
1. For panel properties – see page 3. Span table assumes dry service conditions.
2. The following factors were used for calculations: $C_D=1.0$; $C_M=1.0$; $C_t=1.0$; $C_L=1.0$. (ref: Table 1 – Chapter 3 – 2013 US Edition of the CLT Handbook: cross-laminated timber).
3. Span table above includes panel self-weight, 20psf for the concrete topping plus 20psf miscellaneous dead load, and a 15psf partition load. (Ref: International Building Code 2012 - art. 1607.5.)
4. Values in left column (**green**) correspond to a span governed by allowable bending stress, allowable shear stress or by either allowable vibration (**bolded text** - calculated according to chapter 7 of the 2013 US Edition of the CLT Handbook) or by time dependant deflection (creep - calculated using the following factor: $K_{cr}=2$) limit of L/300.
5. Values in right column correspond to maximum span governed by either allowable bending stress, allowable shear stress or by dead plus live load deflection limit of L/240.
6. Spans shown represent distance between the centerlines of supports and are to be used for preliminary design only.
7. Spans are assumed to be equal for double span panels.
8. Engineer of Record to ensure that assumed deflection limit is appropriate for intended use.
9. CLT is NOT an isotropic material. Therefore the presented values must only be used for bending of panels in the longitudinal (major) axis.
10. Structurlam recommends considering vibration and long term deflection (creep) according to the proposed design method included in the 2013 US Edition of the CLT Handbook: cross-laminated timber.
11. For applications with deflection limits or loading different than what is included above, contact your Structurlam sales representative.

Shear Wall and Diaphragm Applications

<i>CrossLam® In-Plane Allowable Shear Capacity</i>				
Panel d (in)	SLT3 3.90	SLT5 6.66	SLT7 9.42	SLT9 12.18
	Vr (lbs/ft)			
	2906	5812	8718	11624

Notes:

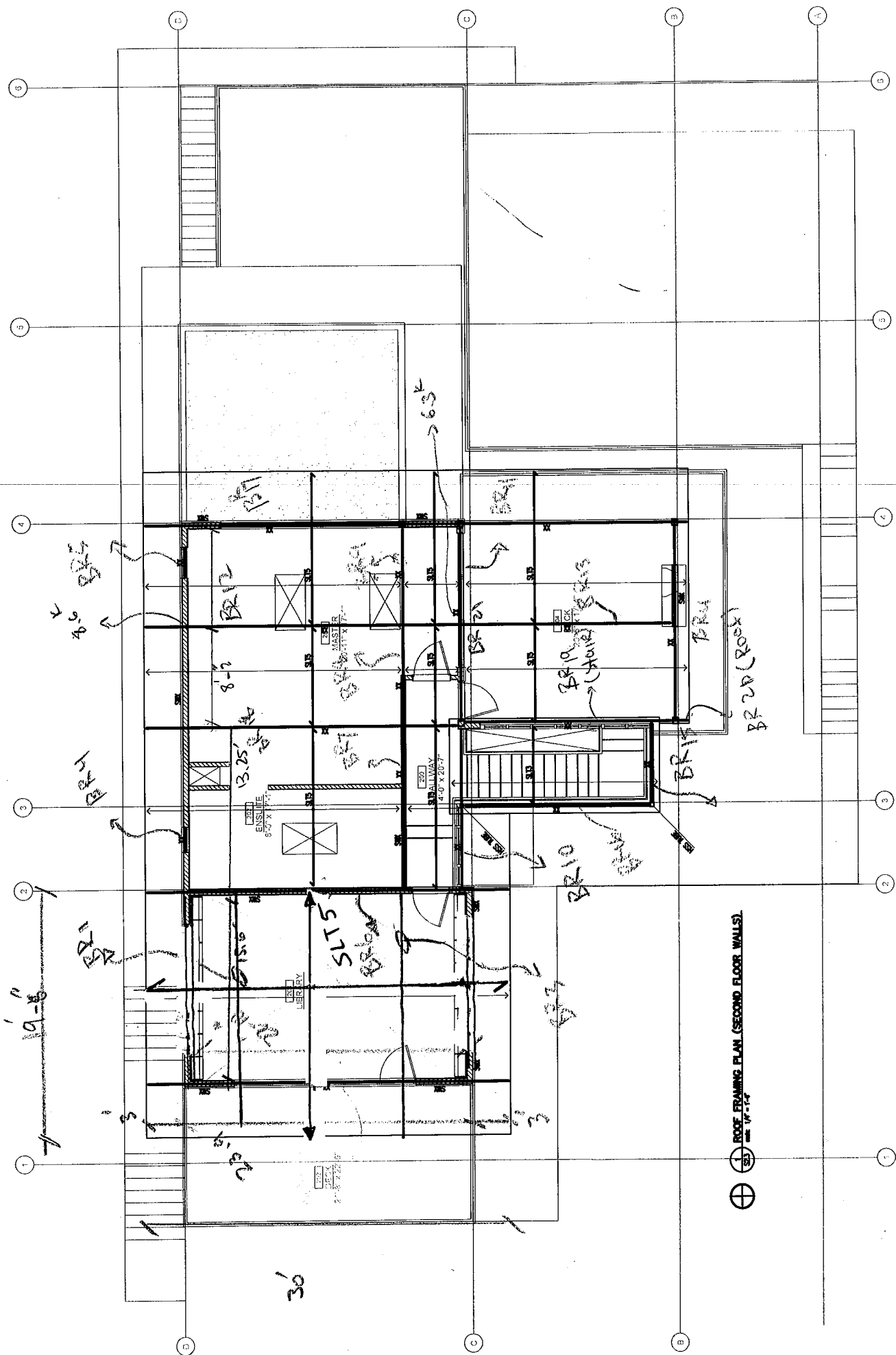
1. For panel properties – see page 3. Table assumes dry service conditions.
2. The following factors were used for calculations: $k_{mod} = 0.8$; $\gamma_m = 1.25$.
3. Computed values based on "In-Plane Shear Capacity and Verification Methods" by Prof. G. Schickhofer, University of Graz.
4. Minimum width of wood used in lay-up is 3.5".
5. Values are for CrossLam® panel only, not for shear connectors.
6. Table values are to be used for preliminary design only.
7. Engineer of Record to ensure that assumed shear capacity is appropriate for intended use.
8. For applications different than what is included above, contact your Structurlam sales representative.



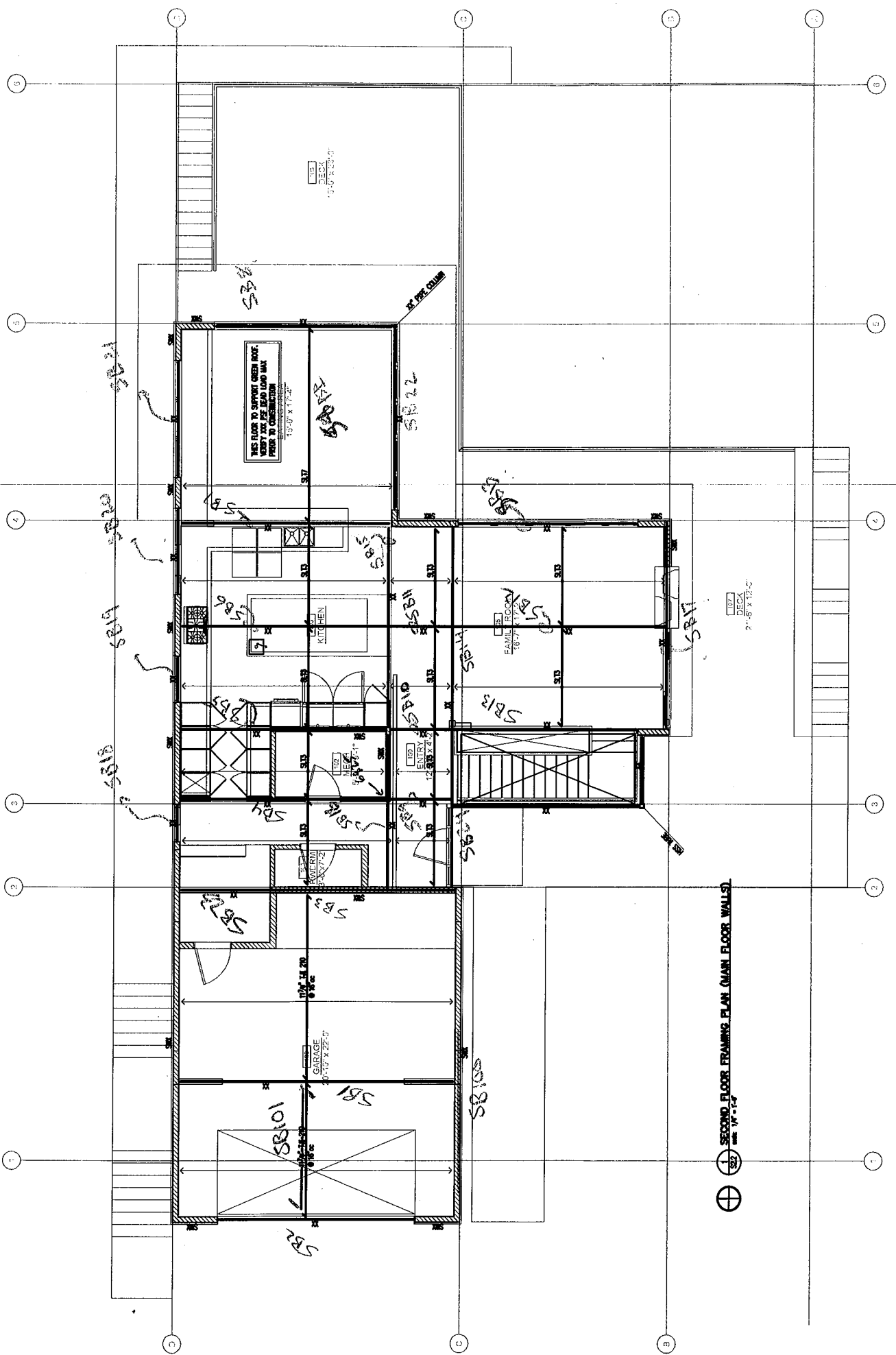
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SECTION 2: FRAMING

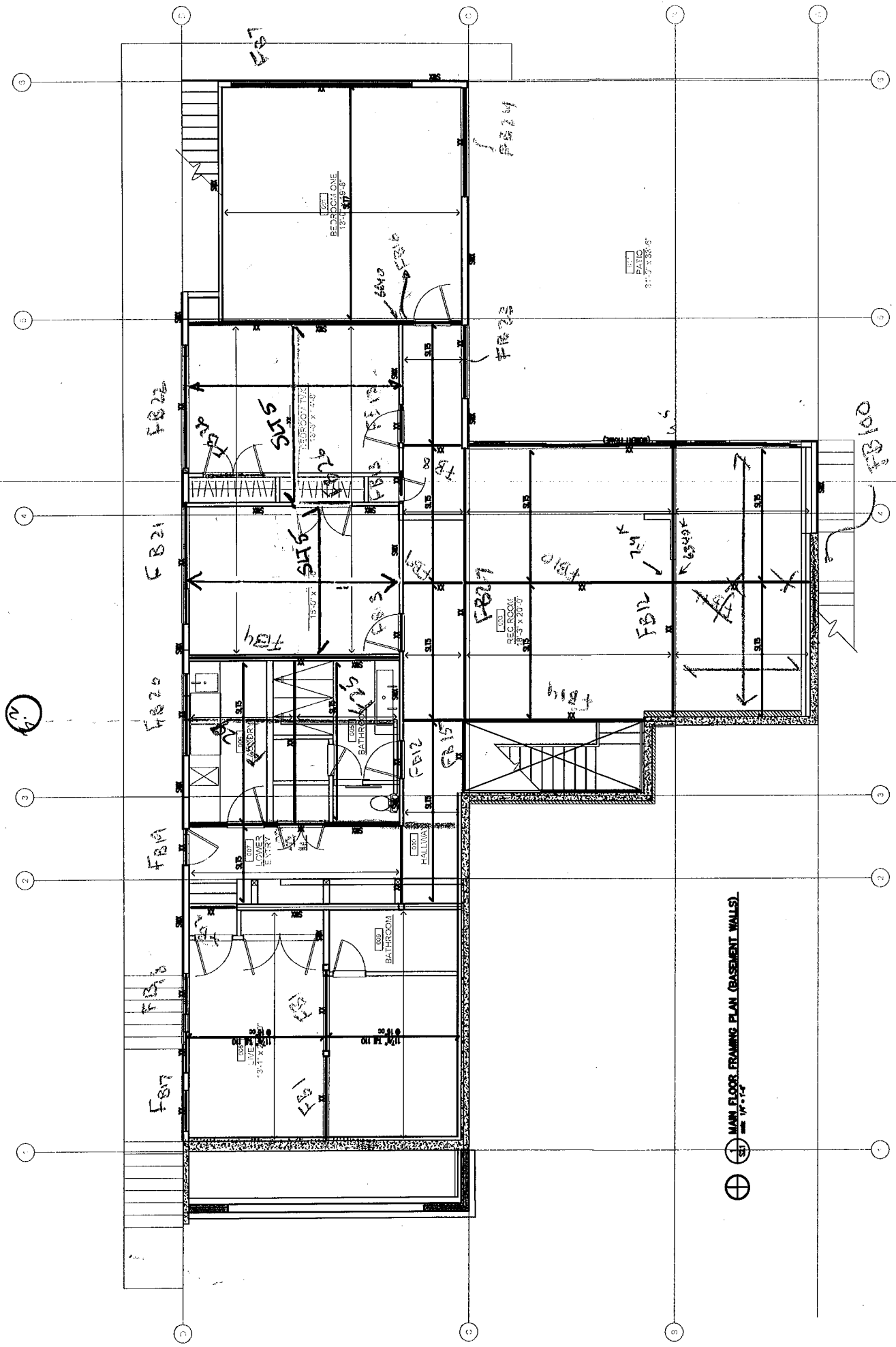
USE SLT w/ 9'-10.5" width



⊕ ROOF FRAMING PLAN (SECOND FLOOR WALLS)
DATE 10-1-14

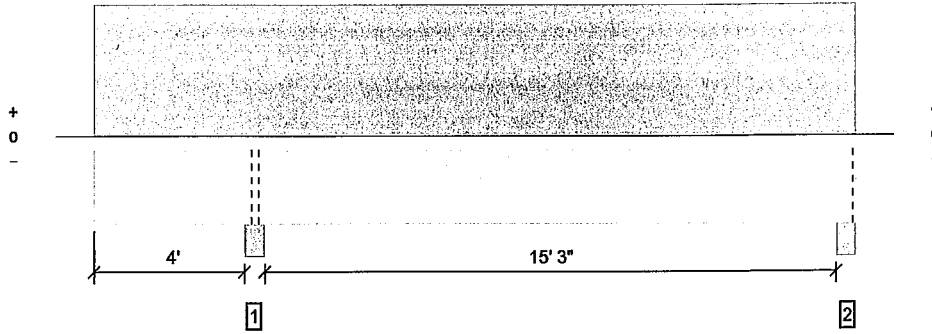


⊕ SECOND FLOOR FRAMING PLAN (MAIN FLOOR WALLS)
 1/4" = 1'-0"



1 MAIN FLOOR FRAMING PLAN (BASEMENT WALLS)
 DATE: 11-1-17

Overall Length: 20' 2"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	11487 @ 4' 2 3/4"	19663 (5.50")	Passed (58%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	6399 @ 5' 7"	15085	Passed (42%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	24395 @ 12' 6 3/16"	38424	Passed (63%)	1.15	1.0 D + 1.0 S (All Spans)
Neg Moment (Ft-lbs)	-8150 @ 4' 2 3/4"	38424	Passed (21%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	-0.131 @ 0	0.282	Passed (2L/774)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	-0.364 @ 0	0.423	Passed (2L/278)	--	1.0 D + 1.0 S (Alt Spans)

System : Roof
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD
 Member Pitch: 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 20' 2" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 20' 2" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 14' 7 5/8".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 5' 4 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Support	Reaction (lbs)	Shear (lbs)	Moment (Ft-lbs)	Reaction (lbs)	Shear (lbs)	Moment (Ft-lbs)	Notes
1 - Column - DF	5.50"	5.50"	3.21"	7969	3519	11488	Blocking
2 - Column - DF	5.50"	5.50"	1.95"	4781	2191	6972	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

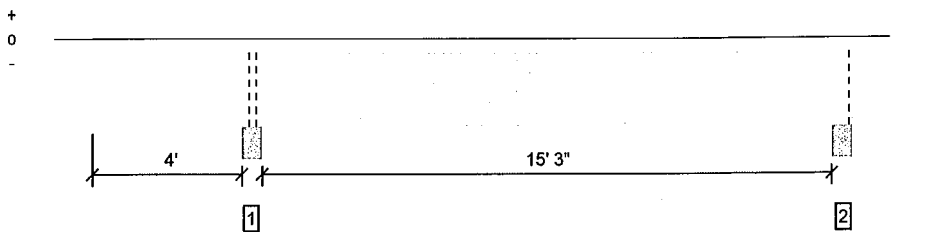
Load	Location (ft)	Intensity (psf)	Reaction (lbs)	Shear (lbs)	Moment (Ft-lbs)
0 - Self Weight (PLF)	0 to 20' 2"	N/A	18.0		
1 - Uniform (PSF)	0 to 20' 2" (Top)	11' 2"	55.0	25.0	Roof

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 The product application, input design loads, dimensions and support information have been provided by Forte Software Operator



Forte Software Operator	Job Notes
Wes Isbell Harriott Valentine Engineers (20) 662-4476 wisbell@harriottvalentine.com	

Overall Length: 20' 2"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Member Reaction (lbs)	11739 @ 4' 2 3/4"	19663 (5.50")	Passed (60%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	6539 @ 5' 7"	15085	Passed (43%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	24931 @ 12' 6 3/16"	38424	Passed (65%)	1.15	1.0 D + 1.0 S (All Spans)
Neg Moment (Ft-lbs)	-8329 @ 4' 2 3/4"	38424	Passed (22%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	-0.134 @ 0	0.282	Passed (2L/758)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	-0.372 @ 0	0.423	Passed (2L/272)	--	1.0 D + 1.0 S (All Spans)

System : Roof
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD
 Member Pitch: 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 20' 2" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 20' 2" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 14' 7 5/8".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 5' 4 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Column	DF	5.50"	5.50"	3.28"	8142	3597	11739	Blocking
1 - Column - DF		5.50"	5.50"	3.28"	8142	3597	11739	Blocking
2 - Column - DF		5.50"	5.50"	1.99"	4885	2240	7125	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

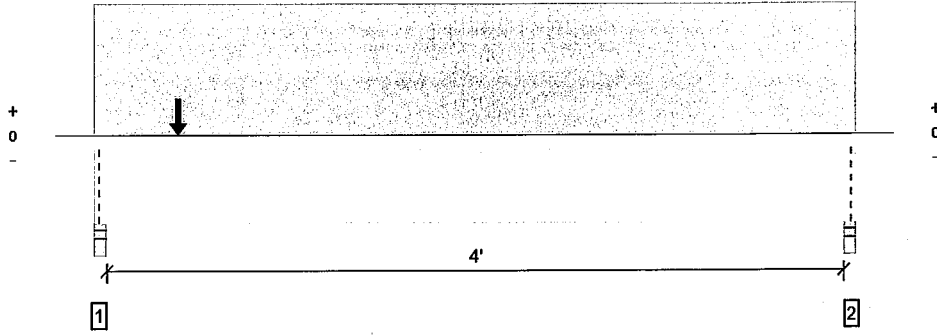
Self Weight (PLF)	0 to 20' 2"	N/A	18.0		
0 - Self Weight (PLF)	0 to 20' 2"	N/A	18.0		
1 - Uniform (PSF)	0 to 20' 2" (Top)	11' 5"	55.0	25.0	Roof

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Refer to current Weyerhaeuser literature for installation details. (www.woodbywy.com) Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC ES under technical reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports refer to http://www.woodbywy.com/services/s_CodeReports.aspx.
 The product application, input design loads, dimensions and support information have been provided by Forte Software Operator



Forte Software Operator	Job Notes
Wes Isbell Harriott Valentine Engineers (20) 662-4476 wisbell@harriottvalentine.com	

Overall Length: 4' 7"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal. Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	7837 @ 2"	12031 (3.50")	Passed (65%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1248 @ 1' 5"	15085	Passed (8%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	2725 @ 1' 3 1/2"	38424	Passed (7%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.001 @ 2' 2"	0.142	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.004 @ 2' 2"	0.213	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

System : Roof
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD
 Member Pitch: 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 4' 7" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 4' 7" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 4' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Support	Bracing			Reaction (lbs)			Accessories
	Top	Avails	Reqd	Dist	Wgt	Grd	
1 - Stud wall - DF	3.50"	3.50"	2.28"	5386	2451	7837	Blocking
2 - Stud wall - DF	3.50"	3.50"	1.50"	1275	562	1837	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Load	Location (Side)	tributary Width	D.L. (PSF)	S.L. (PLF)	Comments
0 - Self Weight (PLF)	0 to 4' 7"	N/A	18.0		
1 - Point (lb)	6" (Top)	N/A	4876	2240	Roof
2 - Uniform (PSF)	0 to 4' 7" (Top)	6' 9"	55.0	25.0	

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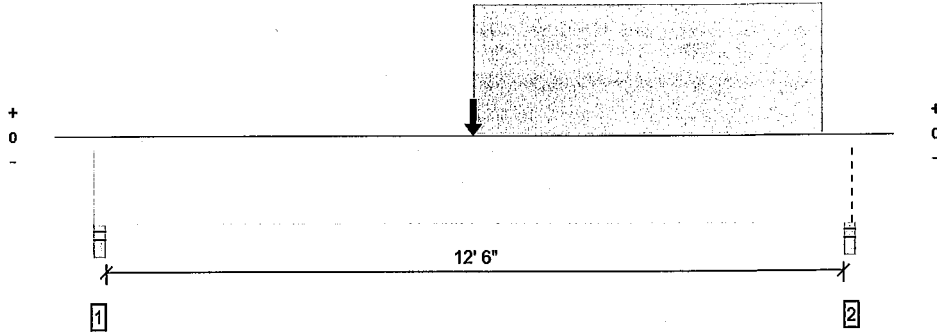
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Wes Isbell Harriott Valentine Engineers (20) 662-4476 wisbell@harriottvalentine.com	

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Overall Length: 13' 1"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal. Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5206 @ 12' 11"	12031 (3.50")	Passed (43%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	4330 @ 11' 8"	13118	Passed (33%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	20773 @ 6' 6"	38424	Passed (54%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	-0.077 @ 6' 9 1/16"	0.425	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.261 @ 6' 8 5/8"	0.637	Passed (L/586)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

System : Roof
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD
 Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 13' 1" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 13' 1" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 12' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

SUPPORTS	Actual		Allowable		Reaction (lb)		Notes	
	Dist	Avail	Dist	Avail	Shear	Moment		
1 - Stud wall - DF	3.50"	3.50"	1.50"	2379	515	767	3661	None
2 - Stud wall - DF	3.50"	3.50"	1.51"	3584	1405	758	5747	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Height / Width	Dist (ft)	Reaction (lb)	Notes
0 - Self Weight (PLF)	0 to 13' 1"	N/A	18.0		
1 - Point (lb)	6' 6" (Top)	N/A	3086	-	1525
2 - Uniform (PSF)	6' 6" to 12' 6" (Top)	8'	55.0	40.0	-

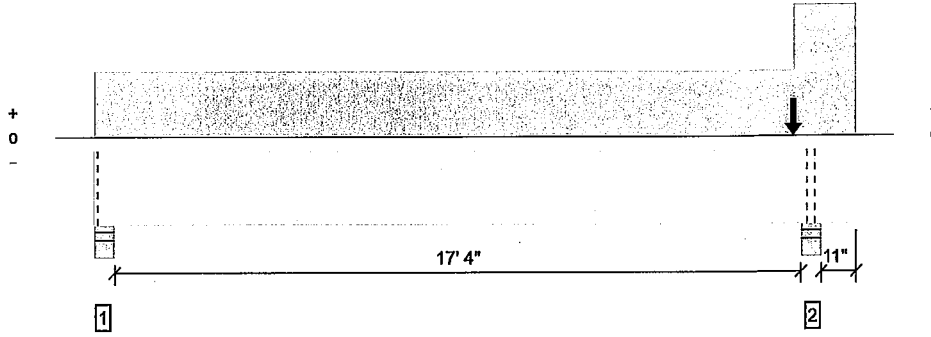
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Overall Length: 19' 2"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5930 @ 18' 1/4"	18906 (5.50")	Passed (31%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2819 @ 16' 6 1/2"	16761	Passed (17%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	13580 @ 9' 3 1/4"	46881	Passed (29%)	1.15	1.0 D + 1.0 S (Alt Spans)
Neg Moment (Ft-lbs)	-433 @ 18' 1/4"	47438	Passed (1%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.082 @ 9' 2 11/16"	0.590	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.276 @ 9' 2 1/2"	0.884	Passed (L/770)	--	1.0 D + 1.0 S (Alt Spans)

System : Roof
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD
 Member Pitch: 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 19' 2" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 19' 2" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 0.99 that was calculated using length L = 17' 7 3/8".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 1' 2 3/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Support	Top	Bottom	Left	Right	Top	Bottom	Notes
1 - Stud wall - DF	5.50"	5.50"	1.50"	2221	931	3152	Blocking
2 - Stud wall - DF	5.50"	5.50"	1.72"	4110	1820	5930	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Load	Location (ft)	Span (ft)	W (lb/ft)	P (lb)	Combination
0 - Self Weight (PLF)	0 to 19' 2"	N/A	20.0		
1 - Uniform (PSF)	0 to 17' 7" (Top)	4'	55.0	25.0	Roof
2 - Point (lb)	17' 7" (Top)	N/A	1382	672	
3 - Uniform (PSF)	17' 7" to 19' 2" (Top)	8'	55.0	25.0	

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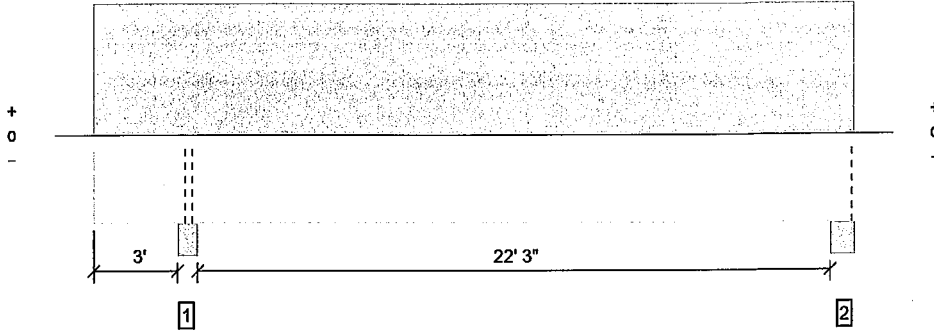
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Overall Length: 26' 3 1/4"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	10080 @ 3' 2 3/4"	24131 (5.50")	Passed (42%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	6695 @ 4' 11 1/2"	24685	Passed (27%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	42113 @ 14' 8 3/4"	77879	Passed (54%)	1.15	1.0 D + 1.0 S (Alt Spans)
Neg Moment (Ft-lbs)	-3560 @ 3' 2 3/4"	83835	Passed (4%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	-0.089 @ 0	0.215	Passed (2L/874)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	-0.287 @ 0	0.323	Passed (2L/270)	--	1.0 D + 1.0 S (Alt Spans)

System : Roof
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD
 Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 26' 3" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 26' 3" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 0.93 that was calculated using length L = 22' 2 9/16".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 3' 8 5/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Dimensions			Reaction Support (lbs)			Blocking
	Top	Bottom	Depth	Dist.	Side	Total	
1 - Column - DF	5.50"	5.50"	2.30"	7066	3014	10080	Blocking
2 - Beam - GLB	6.75"	6.75"	1.80"	5509	2373	7882	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (ft)	Height (ft)	Dist. (ft)	Height (ft)	Comments
0 - Self Weight (PLF)	0 to 26' 3 1/4"	N/A	29.5		
1 - Uniform (PSF)	0 to 26' 3 1/4" (Top)	8' 2"	55.0	25.0	Roof

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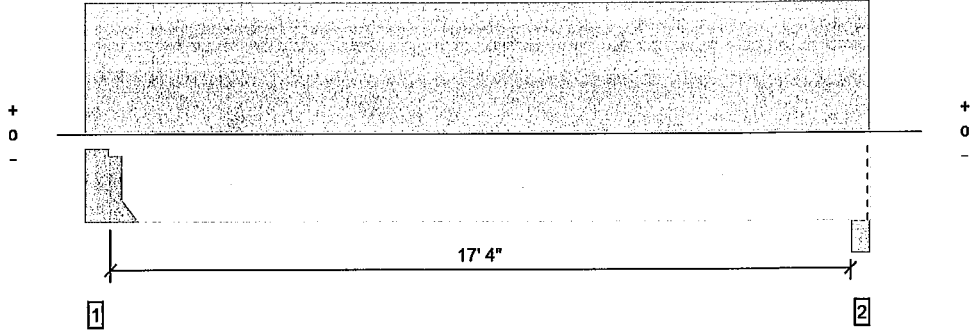
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Overall Length: 18' 4 1/4"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5762 @ 6 3/4"	5762 (1.61")	Passed (100%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	4937 @ 1' 9 3/4"	16761	Passed (29%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	25147 @ 8' 8 3/4"	46923	Passed (54%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.150 @ 9' 3 1/2"	0.582	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.496 @ 9' 3 1/2"	0.873	Passed (L/423)	--	1.0 D + 1.0 S (All Spans)

System : Roof
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD
 Member Pitch: 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 17' 10" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 17' 10" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 0.99 that was calculated using length L = 17' 5 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Support	Col	Beam	Reaction	Reaction	Reaction	Reaction	Notes
1 - Hanger on 15" GLB beam	6.75"	Hanger ¹	1.61"	4263	1858	6121	See note ¹
2 - Column - DF	5.50"	5.50"	1.67"	4169	1812	5981	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- ¹ See Connector grid below for additional information and/or requirements.

Connector	Part	Length	Top Edge	Bottom Edge	Notes	Notes
1 - Face Mount Hanger	HGU5.62 (H1=13)	5.25"	N/A	N/A	36-SDS self-drilling wood screw 0.242 dia. x 2 1/2"	24-SDS self-drilling wood screw 0.242 dia. x 2 1/2"

Load	Span	Height	(ft)	(ft)	Notes
0 - Self Weight (PLF)	6 3/4" to 18' 4 1/4"	N/A	20.0		
1 - Uniform (PSF)	0 to 18' 4 1/4" (Top)	8'	55.0	25.0	Roof

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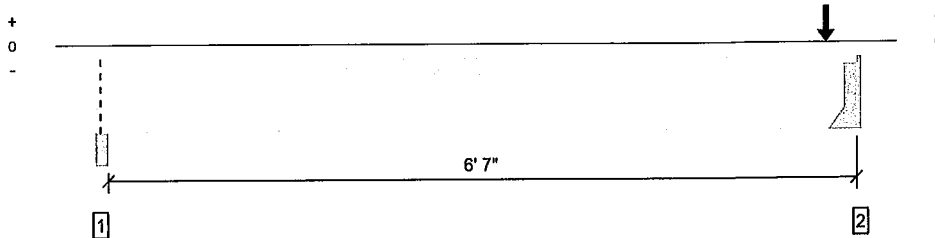


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Overall Length: 7'



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Member Reaction (lbs)	4703 @ 6' 10 1/2"	5363 (1.50")	Passed (88%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	773 @ 5' 7 1/2"	16761	Passed (5%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	1021 @ 5' 6 3/4"	47438	Passed (2%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.001 @ 3' 9 7/16"	0.224	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.003 @ 3' 9 1/2"	0.335	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 6' 11" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 6' 11" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 6' 8 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Support	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
1 - Column - DF	3.50"	3.50"	1.50"	254	135	389	Blocking
2 - Hanger on 15" DF beam	1.50"	Hanger ¹	1.50"	3144	1565	4709	See note ¹

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- ¹ See Connector grid below for additional information and/or requirements.

Support	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
2 - Face Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	N/A	N/A

Support	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
0 - Self Weight (PLF)	0 to 6' 10 1/2"	N/A	20.0				
1 - Uniform (PSF)	0 to 7' (Top)	1'	25.0	25.0		Residential - Living Areas	
2 - Point (lb)	6' 8" (Top)	N/A	3086	1525			

WARRANTY

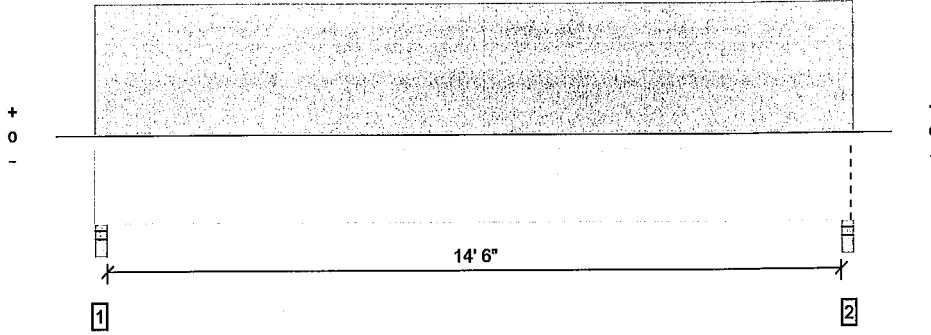
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Forte Software Operator	Job Notes
Wes Isbell Harriott Valentine Engineers (20) 862-4476 wisbell@harriottvalentine.com	

Overall Length: 15' 1"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3892 @ 2"	12031 (3.50")	Passed (32%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3225 @ 1' 3 1/2"	13409	Passed (24%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	14034 @ 7' 6 1/2"	30360	Passed (46%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.117 @ 7' 6 1/2"	0.492	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.386 @ 7' 6 1/2"	0.738	Passed (L/459)	--	1.0 D + 1.0 S (All Spans)

System : Roof
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD
 Member Pitch: 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 15' 1" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 15' 1" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 14' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Support	Reaction (lbs)	Shear (lbs)	Moment (Ft-lbs)	Deflection (in)	Notes
1 - Stud wall - DF	3891	3225	14034	0.117	None
2 - Stud wall - DF	3891	3225	14034	0.117	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

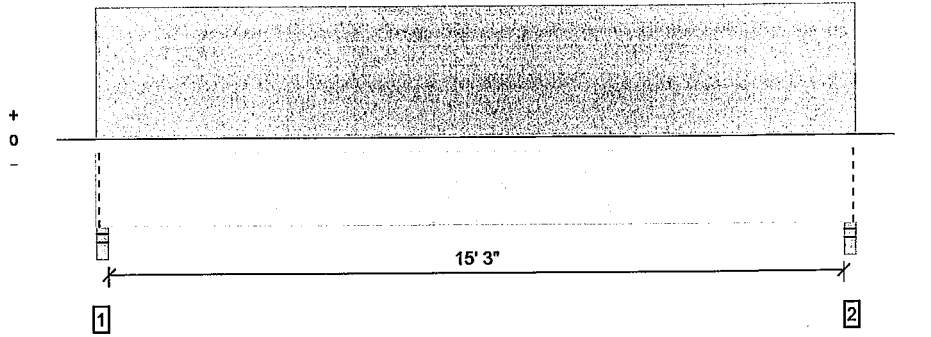
Load	Location (ft)	Intensity (psf)	Value (lbs)	Notes
0 - Self Weight (PLF)	0 to 15' 1"	N/A	16.0	
1 - Uniform (PSF)	0 to 15' 1" (Top)	6' 3"	55.0	25.0 Roof

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 The product application, input design loads, dimensions and support information have been provided by Forte Software Operator



Forte Software Operator	Job Notes
Wes Isbell Harriott Valentine Engineers (20) 662-4476 wisbell@harriottvalentine.com	

Overall Length: 15' 10"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	4589 @ 2"	12031 (3.50")	Passed (38%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3696 @ 1' 6 1/2"	16761	Passed (22%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	17410 @ 7' 11"	47438	Passed (37%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.089 @ 7' 11"	0.517	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.270 @ 7' 11"	0.775	Passed (L/688)	--	1.0 D + 1.0 S (All Spans)

System : Roof
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD
 Member Pitch: 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 15' 10" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 15' 10" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 15' 6".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Blocking	Span	Height	Depth	Reaction	Shear	Moment	Notes
1 - Stud wall - DF	3.50"	3.50"	1.50"	3072	1517	4589	Blocking
2 - Stud wall - DF	3.50"	3.50"	1.50"	3072	1517	4589	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Load	Span	Height	Depth	Reaction	Shear	Moment	Notes
0 - Self Weight (PLF)	0 to 15' 10"	N/A	20.0				
1 - Uniform (PSF)	0 to 15' 10" (Top)	7' 8"	48.0	25.0			Roof

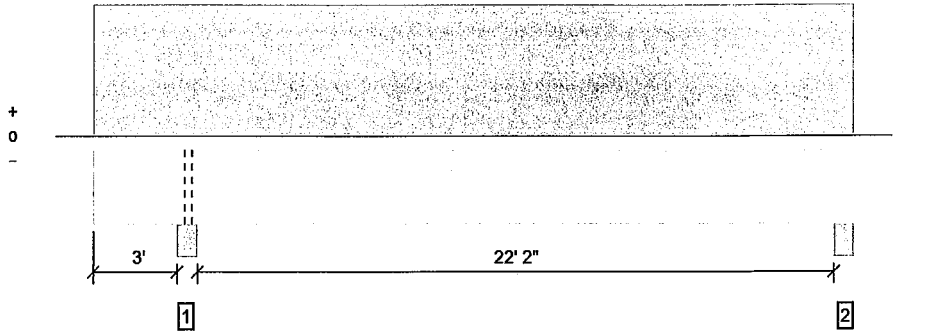


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Forte Software Operator	Job Notes
Wes Isbell Harriott Valentine Engineers (20) 662-4476 wisbell@harriottvalentine.com	

Overall Length: 26' 1"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	13224 @ 3' 2 3/4"	31281 (5.50")	Passed (42%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	8770 @ 4' 11 1/2"	31999	Passed (27%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	54976 @ 14' 8 1/4"	98405	Passed (56%)	1.15	1.0 D + 1.0 S (Alt Spans)
Neg Moment (Ft-lbs)	-4683 @ 3' 2 3/4"	108675	Passed (4%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	-0.089 @ 0	0.215	Passed (2L/870)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	-0.288 @ 0	0.323	Passed (2L/270)	--	1.0 D + 1.0 S (Alt Spans)

System : Roof
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD
 Member Pitch: 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 26' 1" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 26' 1" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 0.91 that was calculated using length L = 22' 1 1/2".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 3' 8 5/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

SUPPORT	Actual	Allowed	Reaction	Reaction	Reaction	Reaction	
1 - Column - DF	5.50"	5.50"	2.33"	9267	3956	13223	Blocking
2 - Column - DF	5.50"	5.50"	1.80"	7153	3085	10238	None

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Load	Location (ft)	Member Width	DL (psf)	LL (psf)	Notes
0 - Self Weight (PLF)	0 to 26' 1"	N/A	38.3		
1 - Uniform (PSF)	0 to 26' 1" (Top)	10' 9"	55.0	25.0	Roof

Weyerhaeuser Notes

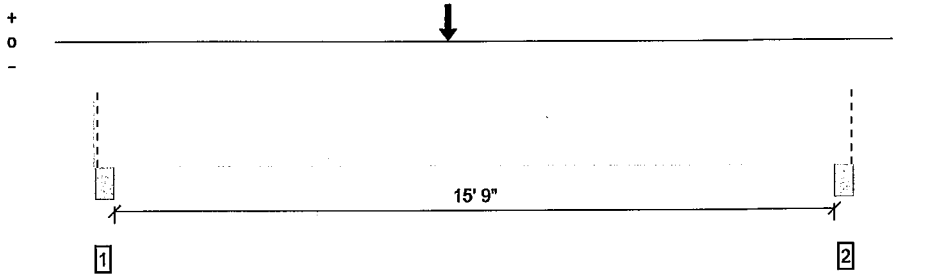
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Forte Software Operator	Job Notes
Wes Isbell Harriott Valentine Engineers (20) 662-4476 wisbell@harriottvalentine.com	

Overall Length: 16' 8"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	7662 @ 4"	24131 (5.50")	Passed (32%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	7604 @ 1' 11 1/2"	24685	Passed (31%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	55942 @ 7' 9"	80476	Passed (70%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.103 @ 8' 2 3/16"	0.533	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.350 @ 8' 2 1/4"	0.800	Passed (L/548)	--	1.0 D + 1.0 S (All Spans)

System : Roof
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD
 Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 16' 8" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 16' 8" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 0.96 that was calculated using length L = 16'.
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Support	Reaction (lbs)			Reaction (kips)			Remarks
	Total	Available	Required	Total	Available	Required	
1 - Column - DF	5.50"	5.50"	1.75"	5433	2230	7663	Blocking
2 - Column - DF	5.50"	5.50"	1.52"	4728	1926	6654	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Load	Location (ft)	tributary Width (ft)	Dead (lb)	Live (lb)	Comments
0 - Self Weight (PLF)	0 to 16' 8"	N/A	29.5		
1 - Point (lb)	7' 9" (Top)	N/A	5506	2373	Roof
2 - Point (lb)	7' 9" (Top)	N/A	4162	1783	

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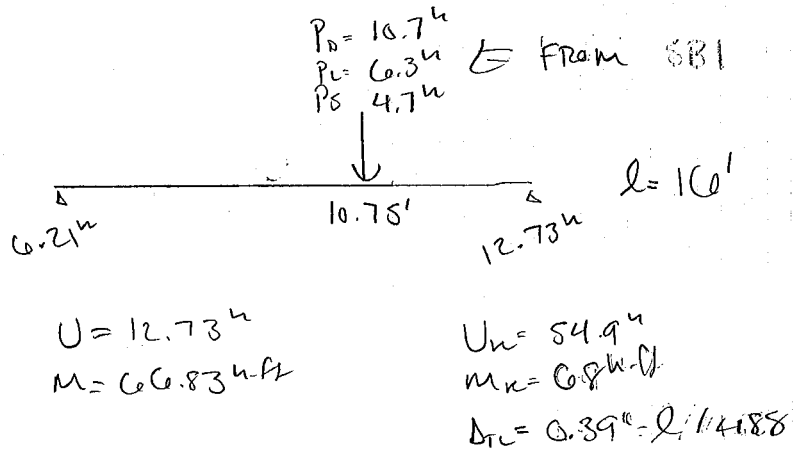


Forte Software Operator	Job Notes
Wes Isbell Harriott Valentine Engineers (20) 662-4476 wisbell@harriottvalentine.com	

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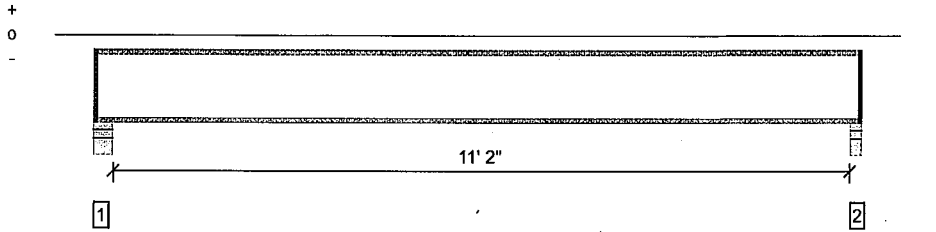
BEAM DESIGN

SBI100



USE W14x20

Overall Length: 11' 11"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	UDF	Load Combination (Pattern)
Member Reaction (lbs)	600 @ 11' 8 1/2"	1041 (2.25")	Passed (58%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	581 @ 5 1/2"	1220	Passed (48%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1670 @ 6' 1/2"	2500	Passed (67%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.118 @ 6' 1/2"	0.283	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.229 @ 6' 1/2"	0.567	Passed (L/593)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	51	40	Passed	--	--

System : Floor
 Member Type : Joist
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 3' 10" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 11' 9" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None

Supports	Beading Length			Fasteners (lbs)			Accessories
	Total	Available	Required	Dead	Live	Total	
1 - Stud wall - SPF	5.50"	4.25"	1.75"	306	322	628	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	298	313	611	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Loads	Location (Side)	Spacing	Dead (Q ₃₀)	Live (L ₃₀₀)	Comments
1 - Uniform (PSF)	0 to 11' 11"	16"	38.0	40.0	Residential - Living Areas

Weyerhaeuser Notes

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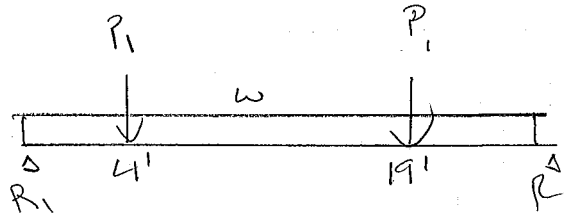
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Forte Software Operator	Job Notes
Doug Clair HVE (206) 624-4760 dclair@harrioltvalentine.com	

BEAM DESIGN

SBI



$l = 24'$

$w: w_D = 505 \text{ plf}$
 $w_L = 530 \text{ plf}$
 $w_S = 0$

$U = 19.1'$
 $M = 99.8 \text{ k-ft}$

$U_w = 83.41'$
 $M_w = 176 \text{ k-ft}$
 $\Delta_{D+L} = 0.82'' = l/353$
 $\Delta_D = 0.49'' = l/583$
 $\Delta_L = 0.32'' = l/900$

$P_1: P_D = 4.14'$
 $P_S = 4.58'$

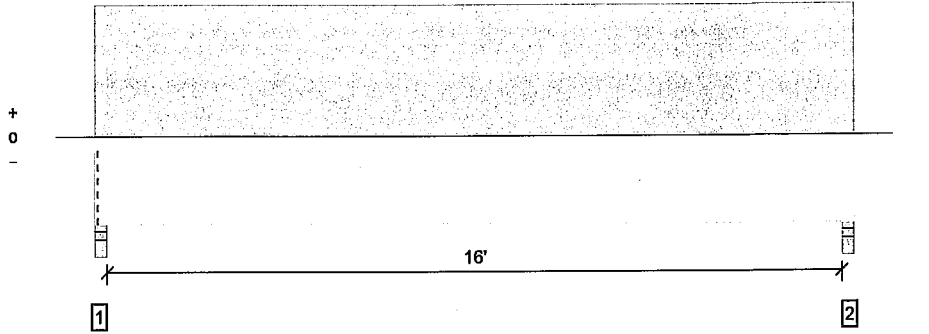
CAMBER
 $1/2''$

USE W12x53 (CAMBER $1/2''$)

$R_1 \Rightarrow D = 10.7'$
 $L = 6.3'$
 $S = 4.7'$



Overall Length: 16' 7"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3690 @ 2"	12031 (3.50")	Passed (31%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3115 @ 1' 3 1/2"	11660	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	14690 @ 8' 3 1/2"	26400	Passed (56%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.242 @ 8' 3 1/2"	0.542	Passed (L/805)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.490 @ 8' 3 1/2"	0.813	Passed (L/398)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 16' 7" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 16' 7" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 16' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Bracing			Load to Support (lbs)			Remarks
	Top	Availble	Required	Dead	Live	Total	
1 - Stud wall - DF	3.50"	3.50"	1.50"	1866	1824	3690	Blocking
2 - Stud wall - DF	3.50"	3.50"	1.50"	1866	1824	3690	None

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Member Width	Dead (k/ft)	Live (k/ft)	Comments
0 - Self Weight (PLF)	0 to 16' 7"	N/A	16.0		
1 - Uniform (PSF)	0 to 16' 7" (Top)	5' 6"	38.0	40.0	Residential - Living Areas

Weyerhaeuser Notes

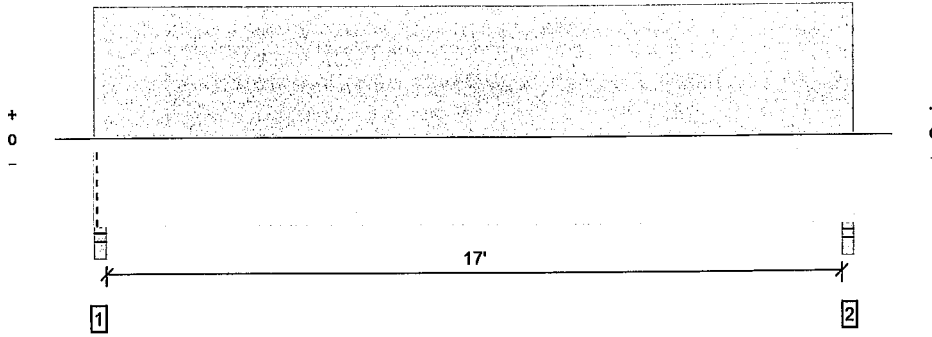
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Forte Software Operator	Job Notes
Wes Isbell Harriott Valentine Engineers (20) 662-4476 wisbell@harriottvalentine.com	

Overall Length: 17' 7"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal. Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5170 @ 2"	12031 (3.50")	Passed (43%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4410 @ 1' 3 1/2"	11660	Passed (38%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	21872 @ 8' 9 1/2"	26400	Passed (83%)	1.00	1.0 D + 1.0 L (All Spans)
Live-Load Defl. (in)	0.363 @ 8' 9 1/2"	0.575	Passed (L/570)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.822 @ 8' 9 1/2"	0.863	Passed (L/252)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 17' 7" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 17' 7" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 17' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Spacing			Load to Support (lbs)			Accessories
	Total	Avail. Br.	Clearance	Dead	Live	Total	
1 - Stud wall - DF	3.50"	3.50"	1.50"	2884	2286	5170	Blocking
2 - Stud wall - DF	3.50"	3.50"	1.50"	2884	2286	5170	None

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Height/Width	Dead (1.0)	Live (1.0)	Comments
0 - Self Weight (PLF)	0 to 17' 7"	N/A	16.0		
1 - Uniform (PSF)	0 to 17' 7" (Top)	6' 6"	48.0	40.0	Residential - Living Areas

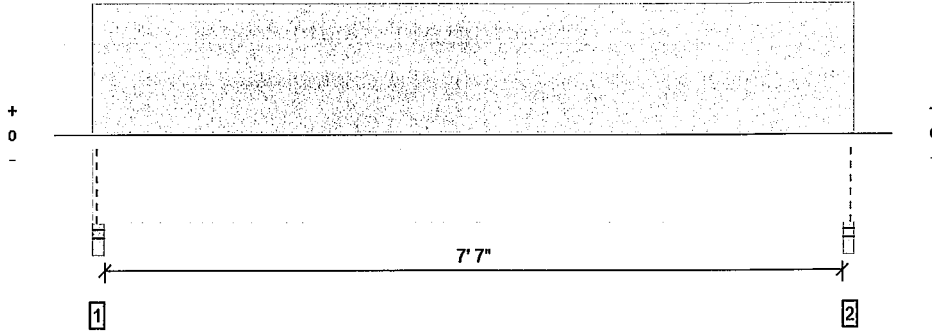
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Forte Software Operator	Job Notes
Wes Isbell Harriott Valentine Engineers (20) 662-4476 wisbell@harriottvalentine.com	

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Overall Length: 8' 2"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2581 @ 2"	12031 (3.50")	Passed (21%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1764 @ 1' 3 1/2"	11660	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	4848 @ 4' 1"	26400	Passed (18%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.017 @ 4' 1"	0.261	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.038 @ 4' 1"	0.392	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 2" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 8' 2" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 7' 10".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Support	Spacing			Load by Support (lbs)			Blocking
	Total	Available	Required	Dead	Live	Total	
1 - Stud wall - DF	3.50"	3.50"	1.50"	1438	1143	2581	Blocking
2 - Stud wall - DF	3.50"	3.50"	1.50"	1438	1143	2581	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (ft)	Width	Dist. (ft)	Dead (lb)	Live (lb)	Comments
0 - Self Weight (PLF)	0 to 8' 2"	N/A	16.0			
1 - Uniform (PSF)	0 to 8' 2" (Top)	7'	48.0	40.0		Residential - Living Areas

Weyerhaeuser Notes

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The product application, input design loads, dimensions and support information have been provided by Forte Software Operator

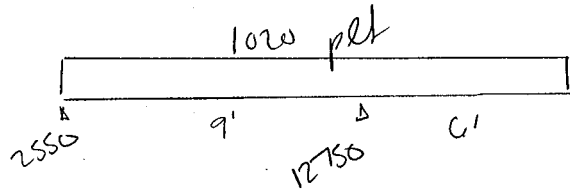


Forte Software Operator	Job Notes
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BEAM DESIGN

SBS

DL = 100 psf
SL = 25 psf



$$U = 6.03^k$$

$$U_k =$$

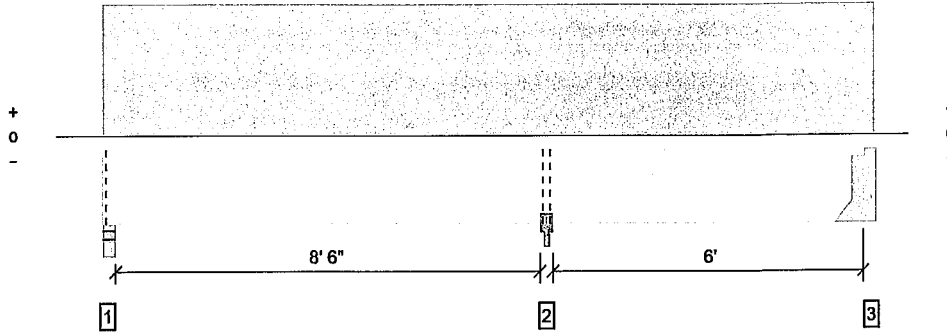
$$M = 18.36^k-ft$$

$$M_k =$$

$$\Delta_{DFS} = 0.10" = l/720$$

USE W12x30

Overall Length: 15' 4 1/2"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	10862 @ 8' 11 1/4"	12513 (3.50")	Passed (87%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4665 @ 7' 9 1/2"	11660	Passed (40%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	7286 @ 3' 9"	26400	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Neg Moment (Ft-lbs)	-8633 @ 8' 11 1/4"	26400	Passed (33%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.019 @ 4' 3 3/8"	0.292	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.060 @ 4' 2 1/16"	0.439	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 15' 1" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 15' 1" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 7' 1 15/16".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 4' 2 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Bearing			Total & Support (lbs)			
	Total	Available	Required	Beam	Top Flange	Total	Accessories
1 - Stud wall - DF	3.50"	3.50"	1.50"	3008	1250/-71	4258/-71	Blocking
2 - Column Cap - steel	3.50"	3.50"	3.04"	7802	3060	10862	Blocking
3 - Hanger on 12" GLB beam	3.50"	Hanger ¹	1.50"	1732	975/-201	2707/-201	See note ¹

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- ¹ See Connector grid below for additional information and/or requirements.

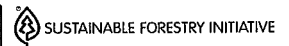
Connector: Simpson Strong-Tie Connectors						
Simpson	Model	Anchor Length	Top Nail	Top Nail	Member Nail	Accessories
3 - Face Mount Hanger	HGU5.62 (H1=11)	5.25"	N/A		36-SDS self-drilling wood screw 0.242 dia. x 2 1/2"	24-SDS self-drilling wood screw 0.242 dia. x 2 1/2"

Loads	Location (Side)	Uniform Width	Dead (D)	Live (L)	Comments
0 - Self Weight (PLF)	0 to 15' 1"	N/A	16.0		
1 - Uniform (PSF)	0 to 15' 4 1/2" (Top)	8'	100.0	40.0	Residential - Living Areas

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The product application, input design loads, dimensions and support information have been provided by Forte Software Operator



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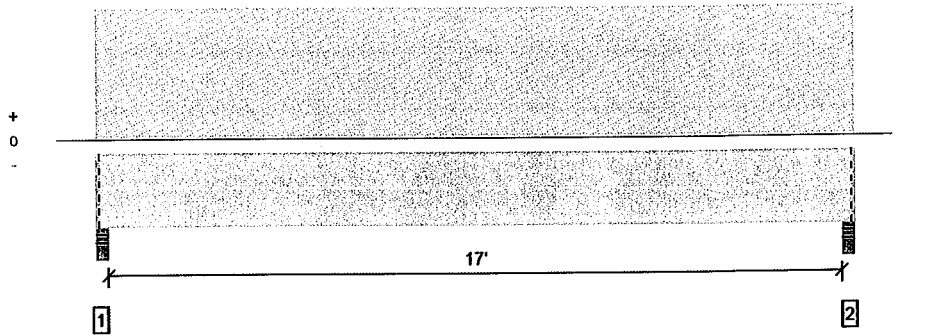
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MEMBER REPORT Level-2nd, Drop Beam SB9
1 piece(s) 5 1/2" x 12" 24F-V8 DF Glulam

PASSED

Overall Length: 17' 7"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5041 @ 2"	12031 (3.50")	Passed (42%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4300 @ 1' 3 1/2"	11660	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	21327 @ 8' 9 1/2"	26400	Passed (81%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.354 @ 8' 9 1/2"	0.575	Passed (L/585)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.801 @ 8' 9 1/2"	0.863	Passed (L/258)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 17' 7" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 17' 7" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 17' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - DF	3.50"	3.50"	1.50"	2814	2227	5041	Blocking
2 - Stud wall - DF	3.50"	3.50"	1.50"	2814	2227	5041	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 17' 7"	N/A	16.0		
1 - Uniform (PSF)	0 to 17' 7" (Top)	6' 4"	48.0	40.0	Residential - Living Areas

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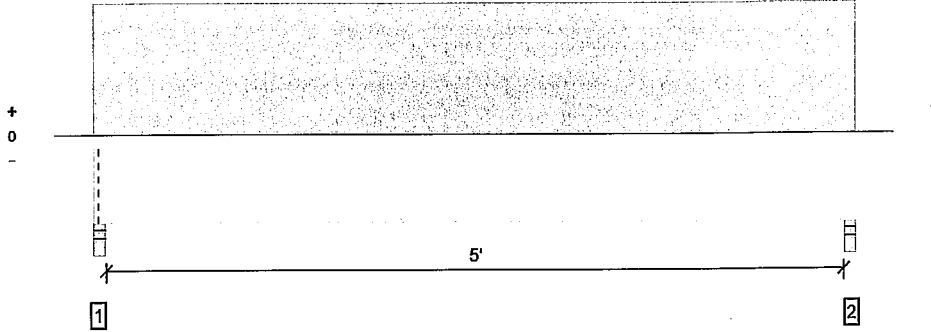


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Forte v5

09/11/17
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Overall Length: 5' 7"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal. Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1764 @ 2"	12031 (3.50")	Passed (15%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	948 @ 1' 3 1/2"	11660	Passed (8%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	2178 @ 2' 9 1/2"	26400	Passed (8%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.003 @ 2' 9 1/2"	0.175	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.008 @ 2' 9 1/2"	0.262	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 5' 7" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 5' 7" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 5' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Blocking			Reaction (lbs)			Remarks
	Total	Available	Required	Dist. 1	Dist. 2	Total	
1 - Stud wall - DF	3.50"	3.50"	1.50"	983	782	1765	Blocking
2 - Stud wall - DF	3.50"	3.50"	1.50"	983	782	1765	None

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Top Flange Width	Dist. (ft)	Dist. (ft)	Comments
0 - Self Weight (PLF)	0 to 5' 7"	N/A	16.0		
1 - Uniform (PSF)	0 to 5' 7" (Top)	7'	48.0	40.0	Residential - Living Areas

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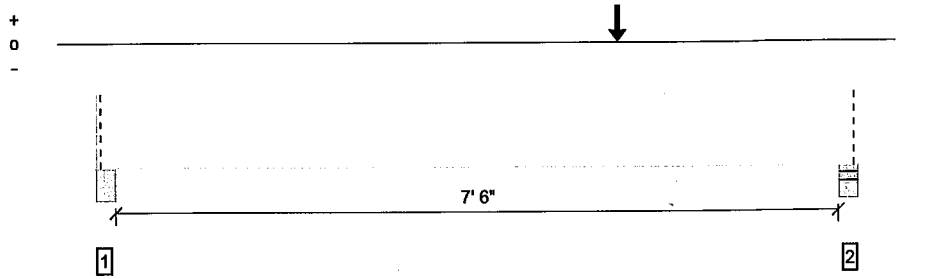
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Overall Length: 8' 5"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5815 @ 8' 1"	18906 (5.50")	Passed (31%)	--	1.0 D (All Spans)
Shear (lbs)	5791 @ 6' 11 1/2"	10494	Passed (55%)	0.90	1.0 D (All Spans)
Pos Moment (Ft-lbs)	13512 @ 5' 9"	23760	Passed (57%)	0.90	1.0 D (All Spans)
Live Load Defl. (in)	0.000 @ 0	0.258	Passed (2L/999+)	--	1.0 D (All Spans)
Total Load Defl. (in)	0.079 @ 4' 6 7/8"	0.387	Passed (L/999+)	--	1.0 D (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

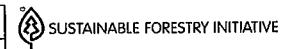
- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 5" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 8' 5" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 7' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Member	Span (ft)	Depth (ft)	Width (ft)	Reaction (lbs)	Reaction (kips)	Notes
1 - Column - DF	5.50"	5.50"	1.50"	2543	2543	Blocking
2 - Stud wall - DF	5.50"	5.50"	1.69"	5815	5815	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

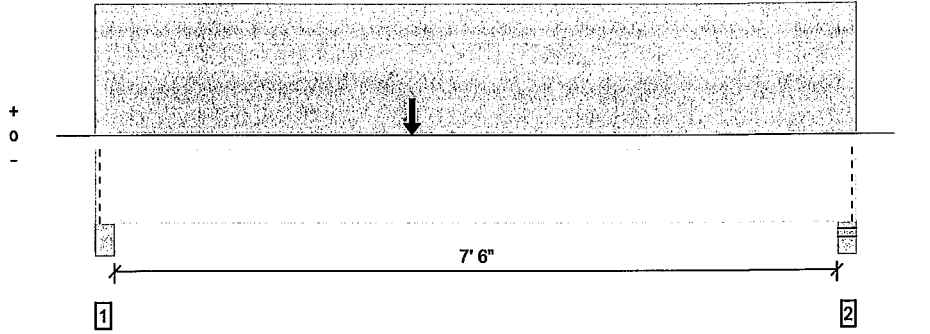
Member	Span (ft)	Depth (ft)	Width (ft)	Reaction (lbs)	Reaction (kips)	Notes
0 - Self Weight (PLF)	0 to 8' 5"	N/A		16.0		
1 - Point (lb)	5' 9" (Top)	N/A		8223		

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Overall Length: 8' 5"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	7628 @ 4"	19663 (5.50")	Passed (39%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	5859 @ 1' 3"	9231	Passed (63%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	16390 @ 3' 6"	16546	Passed (99%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.077 @ 4' 1 11/16"	0.258	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.250 @ 4' 1 1/2"	0.387	Passed (L/372)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 5" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 8' 5" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 7' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Support	Location	Reaction (lbs)	Shear (lbs)	Pos Moment (Ft-lbs)	Defl (in)	Reaction (lbs)	Shear (lbs)	Pos Moment (Ft-lbs)	Defl (in)
1 - Column - DF	5.50"	5.50"	2.13"	5204	1936	1296	8436	Blocking	
2 - Stud wall - DF	5.50"	5.50"	1.88"	4330	1936	895	7161	Blocking	

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Load	Location	Reaction (lbs)	Shear (lbs)	Pos Moment (Ft-lbs)	Defl (in)	Reaction (lbs)	Shear (lbs)	Pos Moment (Ft-lbs)	Defl (in)
0 - Self Weight (PLF)	0 to 8' 5"	N/A	12.7						
1 - Uniform (PSF)	0 to 8' 5" (Top)	11' 6"	48.0	40.0	-				Residential - Living Areas
2 - Point (lb)	3' 6" (Top)	N/A	4781	-	2191				

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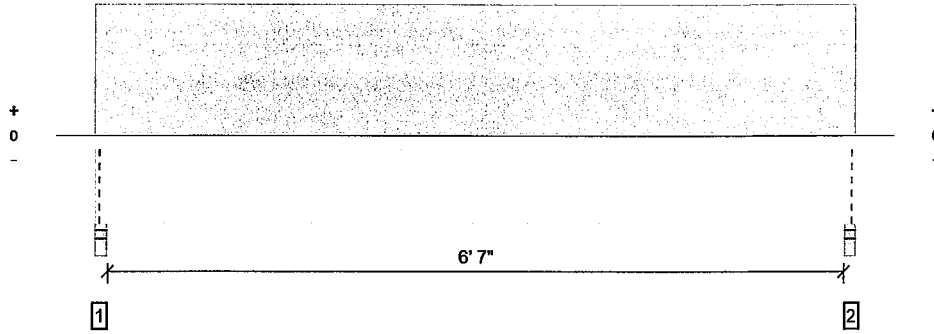
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Overall Length: 7' 2"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3167 @ 2"	7656 (3.50")	Passed (41%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2357 @ 11"	4638	Passed (51%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	5159 @ 3' 7"	6563	Passed (79%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.100 @ 3' 7"	0.228	Passed (L/823)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.196 @ 3' 7"	0.342	Passed (L/419)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 7' 2" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 7' 2" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 6' 10".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Dist (in)			Dist to Support (in)			Accessories
	Total	Available	Required	D-Br	U-Br	Total	
1 - Stud wall - DF	3.50"	3.50"	1.50"	1555	1613	3168	Blocking
2 - Stud wall - DF	3.50"	3.50"	1.50"	1555	1613	3168	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	tributary Width	Dead Load (DL)	Live Load (LL)	Comments
0 - Self Weight (PLF)	0 to 7' 2"	N/A	6.4		
1 - Uniform (PSF)	0 to 7' 2" (Top)	11' 3"	38.0	40.0	Residential - Living Areas

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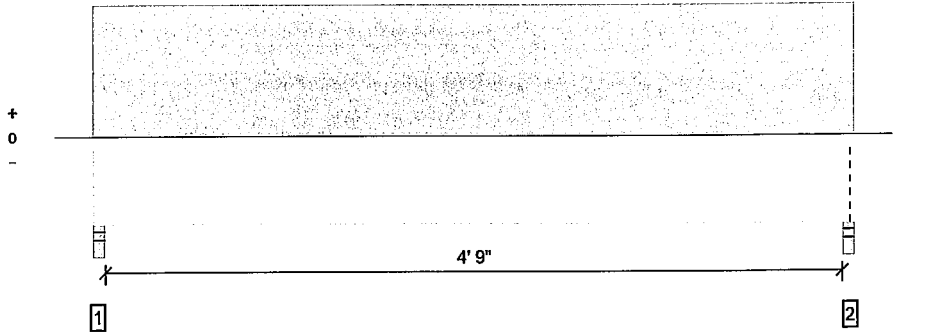
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Overall Length: 5' 4"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1896 @ 2"	7656 (3.50")	Passed (25%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1244 @ 11"	4638	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	2222 @ 2' 8"	6563	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.019 @ 2' 8"	0.167	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.045 @ 2' 8"	0.250	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 5' 4" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 5' 4" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 5'.
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Blocking			Reaction Support (lbs)			Accessories
	Total	Available	Required	Top	Bottom	Total	
1 - Stud wall - DF	3.50"	3.50"	1.50"	1105	791	1896	None
2 - Stud wall - DF	3.50"	3.50"	1.50"	1105	791	1896	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Tributary Width	Dead (D) (k/ft)	Live (L) (k/ft)	Comments
0 - Self Weight (PLF)	0 to 5' 4"	N/A	6.4		
1 - Uniform (PSF)	0 to 5' 4" (Top)	7' 5"	55.0	40.0	Residential - Living Areas

Weyerhaeuser Notes

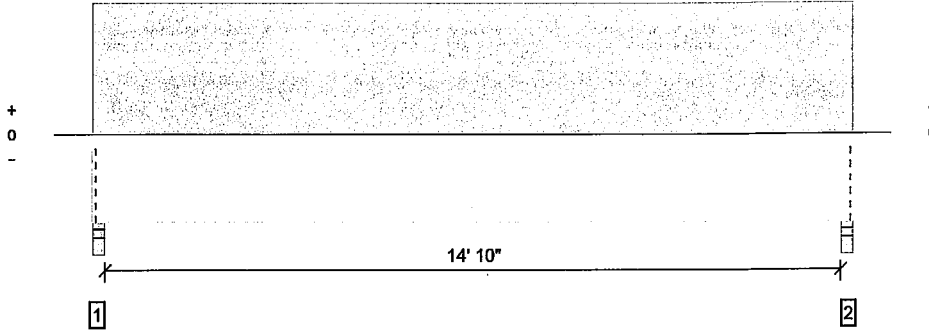
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 The product application, input design loads, dimensions and support information have been provided by Forte Software Operator



Forte Software Operator	Job Notes
Wes Isbell Harriott Valentine Engineers (20) 662-4476 wisbell@harriottvalentine.com	

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Overall Length: 15' 5"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	8031 @ 2"	12031 (3.50")	Passed (67%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	6555 @ 1' 5"	13118	Passed (50%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	29627 @ 7' 8 1/2"	33413	Passed (89%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.224 @ 7' 8 1/2"	0.503	Passed (L/809)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.598 @ 7' 8 1/2"	0.754	Passed (L/303)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 15' 5" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 15' 5" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 15' 1".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Reaction			Reaction Support (lbs)			Remarks
	req'd	avail'd	Required	Design	Capacity	Total	
1 - Stud wall - DF	3.50"	3.50"	2.34"	5024	3006	8030	Blocking
2 - Stud wall - DF	3.50"	3.50"	2.34"	5024	3006	8030	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Height Width	Design (0.90)	Use Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 15' 5"	N/A	18.0		
1 - Uniform (PSF)	0 to 15' 5" (Top)	9' 9"	65.0	40.0	Residential - Living Areas

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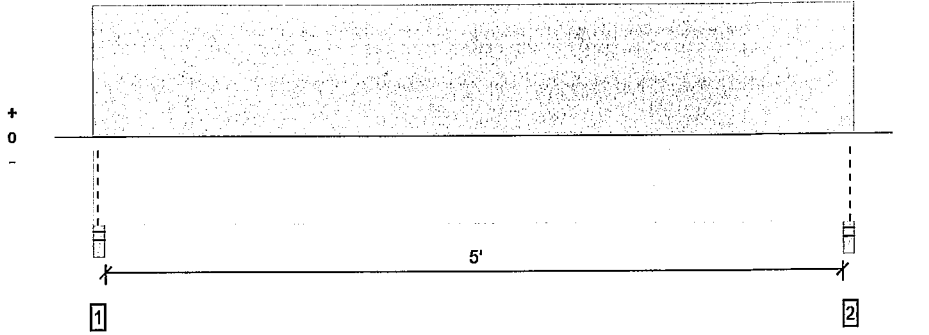
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Overall Length: 5' 7"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2829 @ 2"	7656 (3.50")	Passed (37%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1900 @ 11"	4638	Passed (41%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	3491 @ 2' 9 1/2"	6563	Passed (53%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.033 @ 2' 9 1/2"	0.175	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.078 @ 2' 9 1/2"	0.262	Passed (L/806)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 5' 7" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 5' 7" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 5' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	BRACING			LOADS @ SUPPORT (lbs)			Blocking
	Req'd	Available	Result	Dead	Live	Total	
1 - Stud wall - DF	3.50"	3.50"	1.50"	1645	1184	2829	Blocking
2 - Stud wall - DF	3.50"	3.50"	1.50"	1645	1184	2829	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Height (Width)	Dead (psf)	Live (psf)	Comments
0 - Self Weight (PLF)	0 to 5' 7"	N/A	6.4		
1 - Uniform (PSF)	0 to 5' 7" (Top)	10' 7 3/16"	55.0	40.0	Residential - Living Areas

Weyerhaeuser Notes

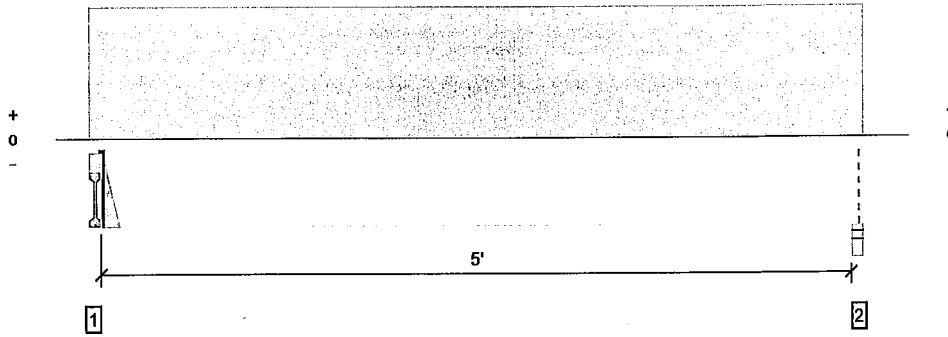
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Overall Length: 5' 7"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2025 @ 3 1/2"	3413 (1.50")	Passed (59%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1531 @ 11"	4638	Passed (33%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	2594 @ 2' 6 3/4"	6563	Passed (40%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.023 @ 2' 10 1/4"	0.171	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.055 @ 2' 10 1/4"	0.256	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 5' 4" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 5' 4" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 5' 1 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Bearing			Total to Support (lb)		Allowance	
	Total	Available	Required	Dead	Live		
1 - Hanger on Single 2X DF plate	3.50"	Hanger ¹	1.50"	1311	942	2253	See note ¹
2 - Stud wall - DF	3.50"	3.50"	1.50"	1256	901	2157	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- ¹ See Connector grid below for additional information and/or requirements.

Connector Simpson Strong-Tie Connectors						
Support	Block	Cap Length	Top Nails	End Nails	Member Nails	Accessories
1 - Top Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	

Load	Location (Side)	Triangular Width	Dead (lb)	Live (lb)	Comments
0 - Self Weight (PLF)	3 1/2" to 5' 7"	N/A	6.4		
1 - Uniform (PSF)	0 to 5' 7" (Top)	8' 3"	55.0	40.0	Residential - Living Areas

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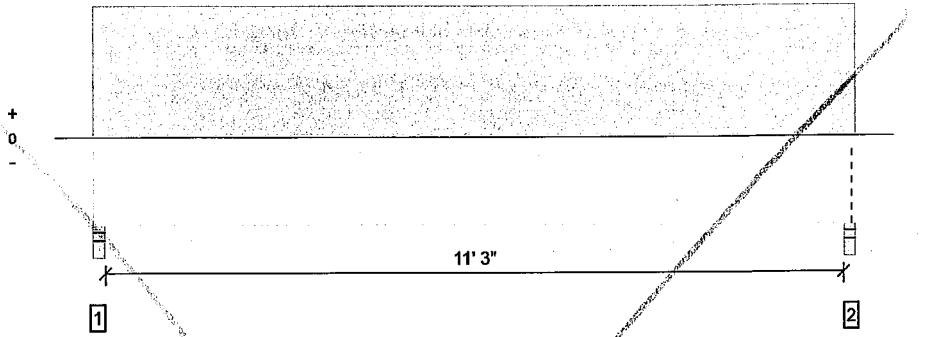
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Overall Length: 11' 10"



All locations are measured from the outside face of left support (or left cantilever end), All dimensions are horizontal, Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	6278 @ 2"	12031 (3.50")	Passed (52%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4907 @ 1' 3 1/2"	11660	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	17540 @ 5' 11"	26400	Passed (66%)	1.00	1.0 D + 1.0 L (All Spans)
Live-Load Defl. (in)	0.121 @ 5' 11"	0.383	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.293 @ 5' 11"	0.575	Passed (L/471)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 11' 10" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 11' 10" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 11' 6".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Reaction			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Live	Total	
1 - Stud wall - DF	3.50"	3.50"	1.83"	3674	2603	6277	None
2 - Stud wall - DF	3.50"	3.50"	1.83"	3674	2603	6277	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Span Width	PSF (0.5)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 11' 10"	N/A	16.0		
1 - Uniform (PSF)	0 to 11' 10" (Top)	11'	55.0	40.0	Residential - Living Areas

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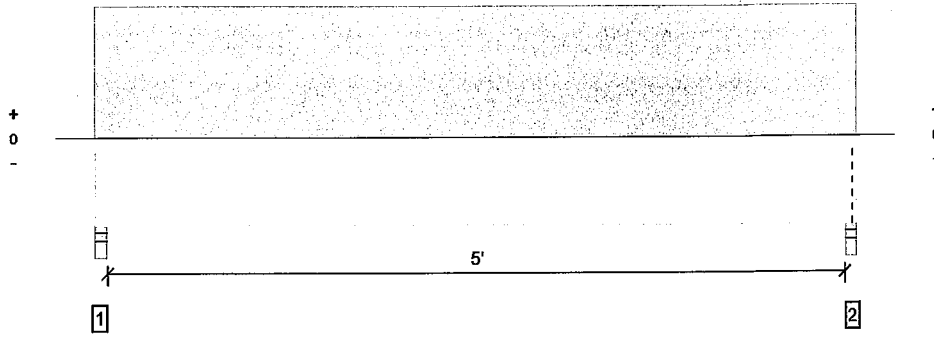
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Overall Length: 5' 7"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	4129 @ 2"	7656 (3.50")	Passed (54%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2773 @ 11"	4638	Passed (60%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	5095 @ 2' 9 1/2"	6563	Passed (78%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.045 @ 2' 9 1/2"	0.175	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.114 @ 2' 9 1/2"	0.262	Passed (L/552)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 5' 7" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 5' 7" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 5' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Bearings			Loads by Support (lbs)			Comments
	Total	Available	Required	Dead	Live	Total	
1 - Stud wall - DF	3.50"	3.50"	1.89"	2509	1619	4128	None
2 - Stud wall - DF	3.50"	3.50"	1.89"	2509	1619	4128	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Tributary Width	Dead (D) (lb/ft)	Live (L) (lb/ft)	Comments
0 - Self Weight (PLF)	0 to 5' 7"	N/A	6.4		
1 - Uniform (PSF)	0 to 5' 7" (Top)	5'	55.0	40.0	Residential - Living Areas
2 - Uniform (PSF)	0 to 5' 7" (Top)	9' 6"	65.0	40.0	

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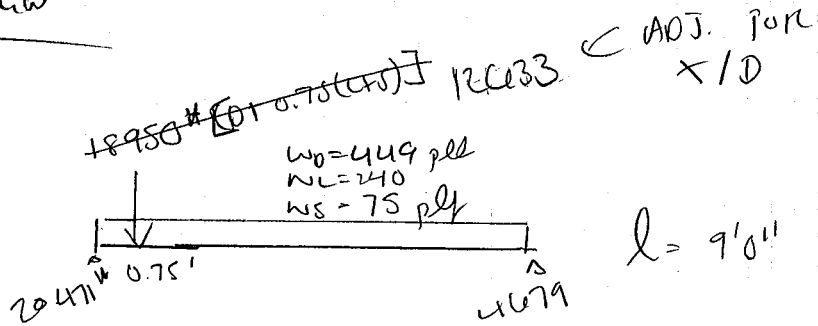


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BEAM DESIGN

FBI8



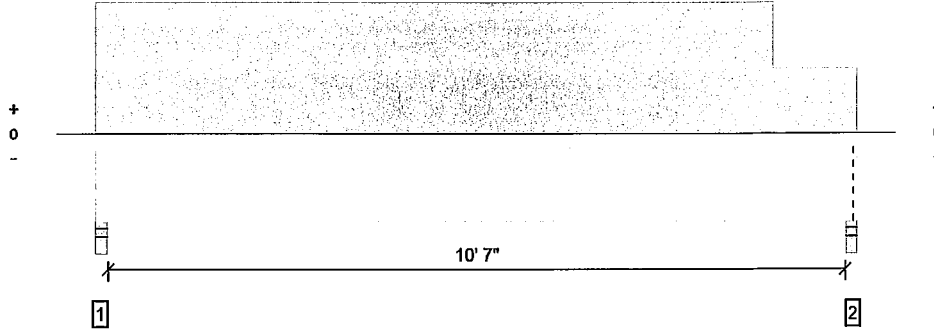
$U = 20.47 \times 14.68^6$
 $M = 15.89^4 - ft$

$U_w = 15.08^4$
 $M_w = 37.7^4 - ft$
 $D_{req} = 0.09^4 - l / 933$

USE CL 5'2" x 13'1/2"

REDUCE SHEAR BY X/D @ SUPPORT
 dist from support
 ASSUMED
 13.5" DEPTH

Overall Length: 11' 2"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal. Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	6899 @ 2"	12031 (3.50")	Passed (57%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	5362 @ 9' 10 1/2"	11660	Passed (46%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	18035 @ 5' 6 11/16"	26400	Passed (68%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (In)	0.115 @ 5' 6 15/16"	0.361	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (In)	0.267 @ 5' 6 15/16"	0.542	Passed (L/487)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 11' 2" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 11' 2" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 10' 10".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Edges			Reactions (lbs)			Accessories
	Total	Available	Required	Top	Bottom	Total	
1 - Stud wall - DF	3.50"	3.50"	2.01"	3918	2981	6899	None
2 - Stud wall - DF	3.50"	3.50"	1.80"	3534	2662	6196	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Sd)	tributary Width	Dead (D)	Live (L)	Comments
0 - Self Weight (PLF)	0 to 11' 2"	N/A	16.0		
1 - Uniform (PSF)	0 to 11' 2" (Top)	6' 5"	55.0	40.0	Residential - Living Areas
2 - Uniform (PSF)	0 to 9' 11" (Top)	7'	48.0	40.0	

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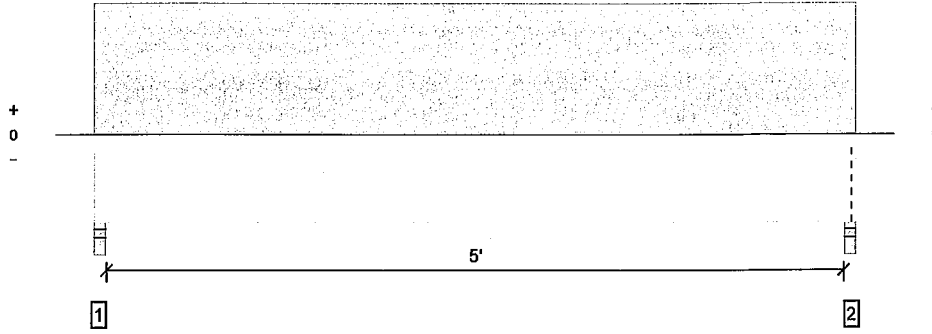
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Overall Length: 5' 7"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1941 @ 2"	7656 (3.50")	Passed (25%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1303 @ 11"	4638	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	2395 @ 2' 9 1/2"	6563	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.022 @ 2' 9 1/2"	0.175	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.054 @ 2' 9 1/2"	0.262	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 5' 7" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 5' 7" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 5' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Panel			Ends to Support (ft)			Accessories
	Total	Available	Required	Panel	End	Total	
1 - Stud wall - DF	3.50"	3.50"	1.50"	1131	810	1941	None
2 - Stud wall - DF	3.50"	3.50"	1.50"	1131	810	1941	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (ft)	Tabular Width	OSF (0.9)	ASDF (1.0)	Comments
0 - Self Weight (PLF)	0 to 5' 7"	N/A	6.4		
1 - Uniform (PSF)	0 to 5' 7" (Top)	7' 3"	55.0	40.0	Residential - Living Areas

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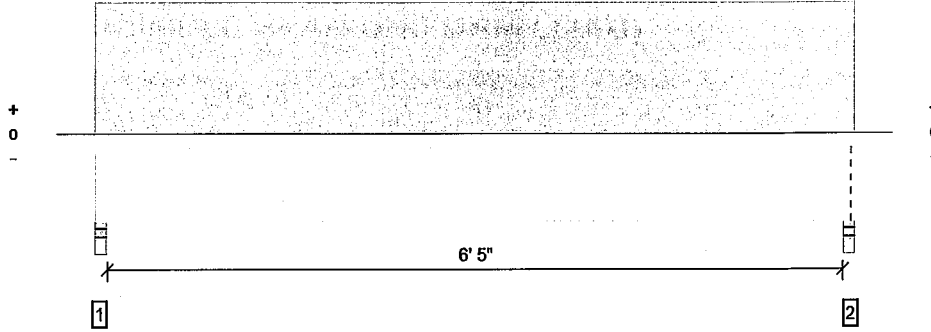
The product application, input design loads, dimensions and support information have been provided by Forte Software Operator



Forte Software Operator	Job Notes
Wes Isbell Harriott Valentine Engineers (20) 662-4476 wisbell@harriottvalentine.com	

4/13/2017 3:49:54 PM
 Forte v5.2, Design Engine: V6.6.0.14

Overall Length: 7'



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2190 @ 2"	12031 (3.50")	Passed (18%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1382 @ 1' 3 1/2"	11660	Passed (12%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	3476 @ 3' 6"	26400	Passed (13%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.008 @ 3' 6"	0.222	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.020 @ 3' 6"	0.333	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 7' o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 7' o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 6' 8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

SUPPORT	Blocking		Reaction (lbs)		Total	Assessment	
	Top	Avail	Design	Actual			
1 - Stud wall - DF	3.50"	3.50"	1.50"	1291	898	2189	None
2 - Stud wall - DF	3.50"	3.50"	1.50"	1291	898	2189	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Height Width	Design (psf)	Actual (psf)	Comment
0 - Self Weight (PLF)	0 to 7'	N/A	16.0		
1 - Uniform (PSF)	0 to 7' (Top)	6' 5"	55.0	40.0	Residential - Living Areas

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The product application, input design loads, dimensions and support information have been provided by Forte Software Operator



Forte Software Operator	Job Notes
Wes Isbell Harriott Valentine Engineers (20) 662-4476 wisbell@harriottvalentine.com	

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 Forte v5.2, Design Engine: V6.6.0.14

Harriott Valentine Engineers Inc.

(floor)
 total floor = 55 psf
 live load = 40 psf

<u>location</u>	<u>criteria</u>	<u>demand</u>	<u>capacity</u>
FB13	w (total) = 242 plf w (live) = 176 plf L = 3.00 ft floor = 4.40 ft roof = 0.00 ft wall = 0.00 ft	V = 0.36 k M = 0.27 k-ft EI (total) = 2.94E+06 lb-in2 EI (live) = 3.21E+06 lb-in2	Vr = 2.18 k Mr = 2.23 k-ft EI = 1.24E+08 lb-in2 d (total) = 0.00 in = L/ ##### d (live) = 0.00 in = L/ #####
			<u>use</u> (2) 2x8

FB2	w (total) = 186 plf w (live) = 135 plf L = 3.80 ft floor = 3.38 ft roof = 0.00 ft wall = 0.00 ft	V = 0.35 k M = 0.34 k-ft EI (total) = 4.58E+06 lb-in2 EI (live) = 5.00E+06 lb-in2	Vr = 2.18 k Mr = 2.23 k-ft EI = 1.24E+08 lb-in2 d (total) = 0.01 in = L/ 6488 d (live) = 0.01 in = L/ 8920
			<u>use</u> (2) 2x8

FB21	w (total) = 269 plf w (live) = 176 plf L = 9.25 ft floor = 4.40 ft roof = 0.00 ft wall = 3.00 ft	V = 1.24 k M = 2.88 k-ft EI (total) = 9.58E+07 lb-in2 EI (live) = 9.40E+07 lb-in2	Vr = 2.78 k Mr = 3.33 k-ft EI = 2.57E+08 lb-in2 d (total) = 0.17 in = L/ 644 d (live) = 0.11 in = L/ 985
			<u>use</u> (2) 2x10

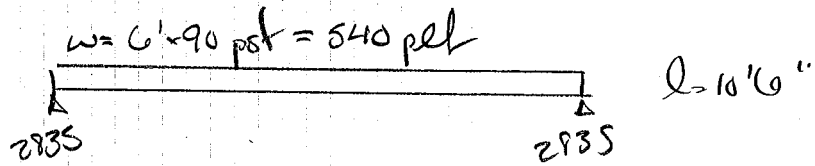
FB22	w (total) = 269 plf w (live) = 176 plf L = 9.70 ft floor = 4.40 ft roof = 0.00 ft wall = 3.00 ft	V = 1.30 k M = 3.16 k-ft EI (total) = 1.10E+08 lb-in2 EI (live) = 1.08E+08 lb-in2	Vr = 2.78 k Mr = 3.33 k-ft EI = 2.57E+08 lb-in2 d (total) = 0.21 in = L/ 559 d (live) = 0.14 in = L/ 854
			<u>use</u> (2) 2x10

(floor)
 total floor = 38 psf
 live load = 40 psf

<u>location</u>	<u>criteria</u>	<u>demand</u>	<u>capacity</u>
FB17	w (total) = 256 plf	V = 0.42 k	Vr = 2.18 k
FB18	w (live) = 232 plf	M = 0.34 k-ft	Mr = 2.23 k-ft
FB19	L = 3.25 ft	EI (total) = 3.96E+06 lb-in2	EI = 1.24E+08 lb-in2
	floor = 5.80 ft	EI (live) = 5.38E+06 lb-in2	d (total) = 0.01 in = L/ 7508
	roof = 0.00 ft		d (live) = 0.00 in = L/ 8297
	wall = 4.00 ft		
			<u>use</u> (2) 2x8

BEAM DESIGN

FB100



$$U = 2.84^k$$
$$M = 7.44^k\text{-ft}$$

$$U_w = 5.57^k$$
$$M_w = 9.45^k\text{-ft}$$
$$\Delta_{TL} = 0.39'' = L/326$$
$$\Delta_C = 0.17'' = L/726$$

USE 6L 3/2 x 9

COMBINED AXIAL AND FLEXURAL STRESSES - HSS

Post Max Loading
HSS 4x4x1/4

L = 11.00 ft
Fy = 46.00 ksi
E = 2.90E+04 ksi

Pr = 56.00 k
A = 3.37 in²
L = 11.00 ft
K = 1.00
r = 1.52 in

KL/r = 86.84
Fe = 37.95
.44Fy = 20.24
Fa = 27.70 ksi <= use
Fa = 33.28 ksi

Fcr = 27.70
Pn = 93.34
Q = 1.67
Pc = 55.89 kips

Pr/Pc = 1.00

WOOD COLUMN

4x OR 6x

Species: DF #2
Size: 4x

Fc* = 1300 psi Fc_⊥ = 405 psi << sill plate is
E = 1.60E+06 psi Hem-Fir
c' = 0.8
d = 3.5 in
KcE = 0.3

	le	FcE	F'c	4x4 Pa	4x6 Pa
	(ft)	(in)	(psi)	(psi)	(lb)
Pa (perp)				4961	7796

8.00	96.00	638	555	6802	10688	<< crushing governs up to a height of 9'-7" w/ Hem-Fir (7'-5" if Doug-Fir)
8.50	102.00	565	502	6150	9664	
9.00	108.00	504	455	5575	8760	
9.50	114.00	452	414	5069	7966	
10.00	120.00	408	377	4624	7266	
10.50	126.00	370	345	4231	6649	
11.00	132.00	337	317	3883	6103	
11.50	138.00	309	292	3575	5618	
12.00	144.00	284	269	3301	5187	

Species: DF #1
Size: 6x

Fc* = 925 psi Fc_⊥ = 405 psi << sill plate is
E = 1.60E+06 psi Hem-Fir
c' = 0.8
d = 5.5 in
KcE = 0.3

	le	FcE	F'c	6x6 Pa	4x6 Pa
	(ft)	(in)	(psi)	(psi)	(lb)
Pa (perp)				12251	7796

8.00	96.00	1576	775	23443	14918	<< crushing governs up to a height of 14'-8" w/ Hem-Fir (10'-8" if Doug-Fir)
8.50	102.00	1396	750	22701	14446	
9.00	108.00	1245	724	21897	13934	
9.50	114.00	1117	696	21041	13389	
10.00	120.00	1008	666	20145	12819	
10.50	126.00	915	636	19225	12234	
11.00	132.00	833	605	18296	11643	
11.50	138.00	762	574	17373	11056	
12.00	144.00	700	544	16470	10481	

WOOD COLUMN

MULTI-STUD

Species: HF stand.

Size: 2x4

Fc* = 1300 psi Fc_⊥ = 405 psi
 E = 1.20E+06 psi
 c' = 0.8
 d = 3.5 in
 KcE = 0.3

<< sill plate is
Hem-Fir

le	le	FcE	F'c	(2)2x4 Pa	(3)2x4 Pa	(4)2x4 Pa	(5)2x4 Pa
(ft)	(in)	(psi)	(psi)	(lb)	(lb)	(lb)	(lb)
Pa (perp)				4253	6379	8505	10631

8.00	96.00	479	435	4566	6848	9131	11414
8.50	102.00	424	390	4099	6148	8198	10247
9.00	108.00	378	352	3696	5543	7391	9239
9.50	114.00	339	319	3346	5019	6691	8364
10.00	120.00	306	290	3041	4562	6083	7603
10.50	126.00	278	264	2775	4163	5550	6938
11.00	132.00	253	242	2541	3812	5083	6353
11.50	138.00	232	222	2335	3503	4670	5838
12.00	144.00	213	205	2152	3229	4305	5381

<< crushing governs
up to a height of
8'-4" w/ Hem-Fir
(6'-5" if Doug-Fir)

Species: HF stud

Size: 2x6

Fc* = 800 psi Fc_⊥ = 405 psi
 E = 1.20E+06 psi
 c' = 0.8
 d = 5.5 in
 KcE = 0.3

<< sill plate is
Hem-Fir

le	le	FcE	F'c	(2)2x6 Pa	(3)2x6 Pa	(4)2x6 Pa	(5)2x6 Pa
(ft)	(in)	(psi)	(psi)	(lb)	(lb)	(lb)	(lb)
Pa (perp)				6683	10024	13365	16706

8.00	96.00	1182	645	10642	15963	21284	26605
8.50	102.00	1047	620	10229	15343	20457	25572
9.00	108.00	934	593	9788	14683	19577	24471
9.50	114.00	838	565	9329	13994	18658	23323
10.00	120.00	756	537	8860	13290	17720	22151
10.50	126.00	686	509	8390	12586	16781	20976
11.00	132.00	625	480	7928	11892	15856	19820
11.50	138.00	572	453	7479	11219	14959	18699
12.00	144.00	525	427	7049	10574	14099	17624

<< crushing governs
up to a height of
12'-5" w/ Hem-Fir
(8'-5" if Doug-Fir)

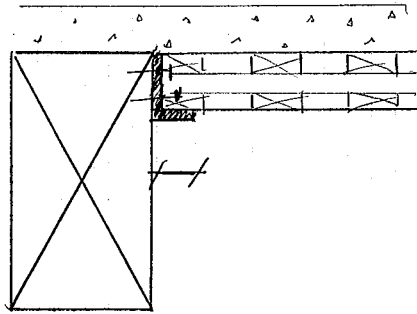
GL BEAM / LEDGER ATTACHMENT

DL = 8.25' x 50psf = 413 plf

LL = 8.25' x 40psf = 330 plf

TL = 743 plf

DL: SLTS w/
CONCRETE



$F_{u1} = 425 \text{ psi}$

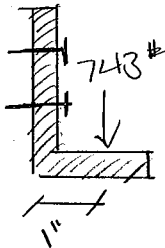
$I_d = 6.666''$

→ BEARING AREA FOR 12" WIDTH = 743 #

AREA REQD = $\frac{743 \#}{425 \text{ psi}} = 1.748 \text{ in}^2 / \text{FOOT}$

USE 2" ANGLE LEG

→ PL THICKNESS



$M_{or} = 743 \# \cdot \text{in}$

$M_{or} = \frac{F_b S_r}{2} \Rightarrow S_r = \frac{2 M_{or}}{F_b}$

$S_r \geq \frac{1.67(0.743 \# \cdot \text{in})}{30 \text{ ksi}}$

$S_r \geq 0.034 \text{ in}^3$

→ SDS SCREWS [1/4" x 3" LONG]

$\Rightarrow \frac{743 \#}{425 \#} = 1.769 \text{ SCREWS / FT}$

⇒ USE (1) ROW @ 0 1/2" OC

(2) ROWS @ 12" OC ←

EDGE DIST. = 1" MIN.

SPACING = 1" MIN.

$\Rightarrow S_r = b d^2 / 6$

$\Rightarrow d \geq \sqrt{\frac{6 S_r}{b}} \geq 0.13''$

USE 1/4" THICKNESS



Company:		Date:	9/8/2017
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1. Project Information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location: Detail 4/S3.1
Fastening description:

2. Input Data & Anchor Parameters

General

Design method: ACI 318-14
Units: Imperial units

Anchor Information:

Anchor type: Concrete screw
Material: Carbon Steel
Diameter (inch): 0.625
Nominal Embedment depth (inch): 4.000
Effective Embedment depth, h_{ef} (inch): 2.970
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
 h_{min} (inch): 6.00
 C_{ac} (inch): 4.50
 C_{min} (inch): 1.75
 S_{min} (inch): 3.00

Base Material

Concrete: Normal-weight
Concrete thickness, h (inch): 12.00
State: Uncracked
Compressive strength, f_c (psi): 2500
 $\Psi_{c,v}$: 1.4
Reinforcement condition: B tension, B shear
Supplemental reinforcement: No
Reinforcement provided at corners: No
Do not evaluate concrete breakout in tension: No
Do not evaluate concrete breakout in shear: No
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate

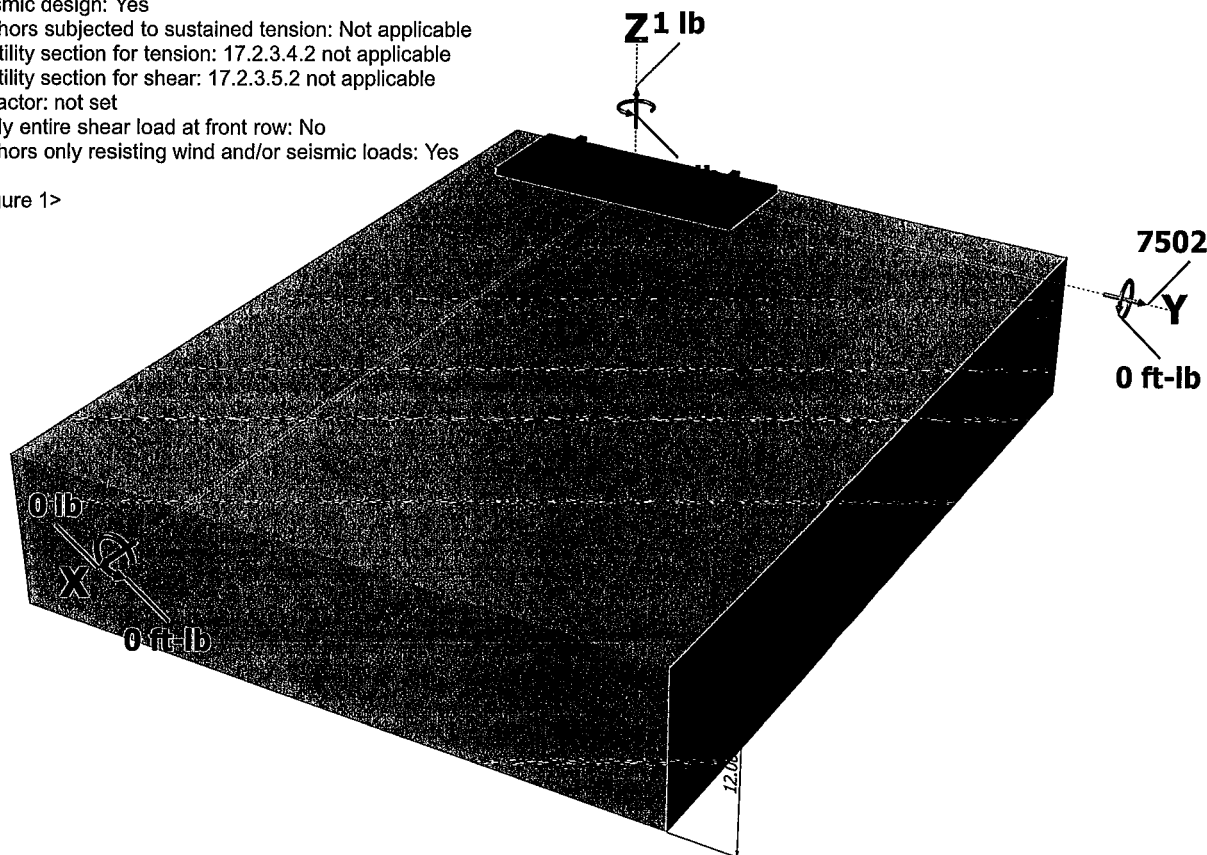
Length x Width x Thickness (inch): 7.00 x 18.00 x 0.50
Yield stress: 3408 psi

Profile type/size: W12X35

Load and Geometry

Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: Not applicable
Ductility section for tension: 17.2.3.4.2 not applicable
Ductility section for shear: 17.2.3.5.2 not applicable
 Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

<Figure 1>

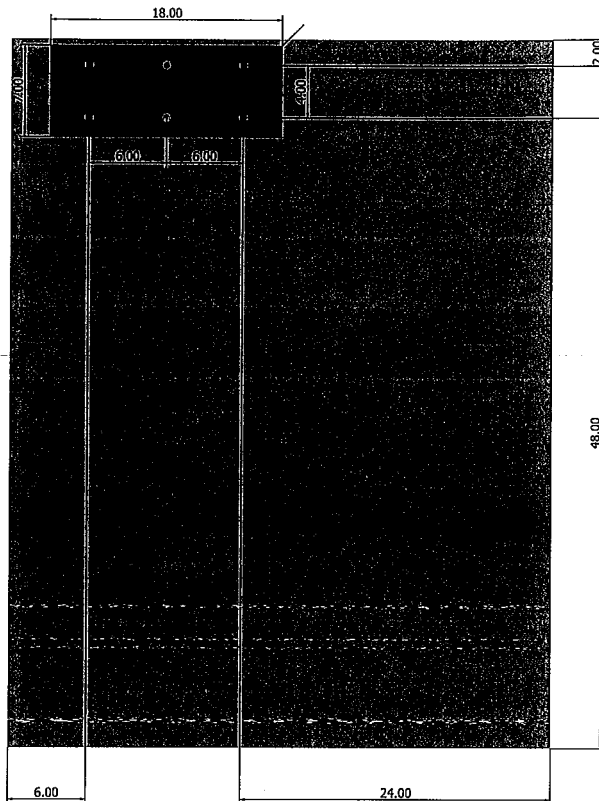




Anchor Designer™
Software
Version 2.5.6163.3

Company:		Date:	9/8/2017
Engineer:		Page:	2/5
Project:			
Address:			
Phone:			
E-mail:			

<Figure 2>



Recommended Anchor

Anchor Name: Titen HD® - 5/8"Ø Titen HD (THDB model), hnom:4" (102mm)
Code Report: ICC-ES ESR-2713





Company:		Date:	9/8/2017
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Address:			
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3. Resulting Anchor Forces

Anchor	Tension load, N _{ua} (lb)	Shear load x, V _{uax} (lb)	Shear load y, V _{uay} (lb)	Shear load combined, √(V _{uax}) ² + (V _{uay}) ² (lb)
1	0.2	0.0	1250.3	1250.3
2	0.2	0.0	1250.3	1250.3
3	0.2	0.0	1250.3	1250.3
4	0.2	0.0	1250.3	1250.3
5	0.2	0.0	1250.3	1250.3
6	0.2	0.0	1250.3	1250.3
Sum	1.0	0.0	7502.0	7502.0

Maximum concrete compression strain (‰): 0.00

<Figure 3>

Maximum concrete compression stress (psi): 0

Resultant tension force (lb): 1

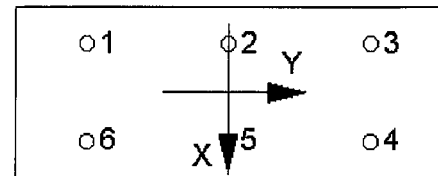
Resultant compression force (lb): 0

Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00

Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00

Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00

Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00



4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N _{sa} (lb)	φ	φN _{sa} (lb)
30360	0.65	19734

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.4.2.2a)

k _c	λ _a	f' _c (psi)	h _{ef} (in)	N _b (lb)
24.0	1.00	2500	2.970	6142

$0.75 \phi N_{cbg} = 0.75 \phi (A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1b)

A _{Nc} (in ²)	A _{Nco} (in ²)	c _{a,min} (in)	Ψ _{ec,N}	Ψ _{ed,N}	Ψ _{c,N}	Ψ _{cp,N}	N _b (lb)	φ	0.75 φ N _{cbg} (lb)
218.61	79.39	2.00	1.000	0.835	1.00	0.990	6142	0.65	6813

6. Pullout Strength of Anchor in Tension (Sec. 17.4.3)

$0.75 \phi N_{pn} = 0.75 \phi \Psi_{c,P} \lambda_a N_p (f'_c / 2,500)^n$ (Sec. 17.3.1, Eq. 17.4.3.1 & Code Report)

Ψ _{c,P}	λ _a	N _p (lb)	f' _c (psi)	n	φ	0.75 φ N _{pn} (lb)
1.0	1.00	6143	2500	0.50	0.65	2995



Anchor Designer™
Software
Version 2.5.6163.3

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8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
8000	1.0	0.60	4800

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.5.2)

Shear perpendicular to edge in y-direction:

$$V_{by} = \min[7(l_e/d_a)^{0.2}d_a\lambda_a\sqrt{f_c}c_{a1}^{1.5}; 9\lambda_a\sqrt{f_c}c_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{by} (lb)
2.97	0.625	1.00	2500	32.00	68408

$$\phi V_{cbgy} = \phi (A_{Vc}/A_{Vco})\Psi_{ec,v}\Psi_{ed,v}\Psi_{c,v}\Psi_{h,v}V_{by} \text{ (Sec. 17.3.1 \& Eq. 17.5.2.1b)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,v}$	$\Psi_{ed,v}$	$\Psi_{c,v}$	$\Psi_{h,v}$	V_{by} (lb)	ϕ	ϕV_{cbgy} (lb)
648.00	4608.00	1.000	0.713	1.400	2.000	68408	0.70	13434

Shear parallel to edge in y-direction:

$$V_{bx} = \min[7(l_e/d_a)^{0.2}d_a\lambda_a\sqrt{f_c}c_{a1}^{1.5}; 9\lambda_a\sqrt{f_c}c_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{bx} (lb)
2.97	0.625	1.00	2500	2.00	1069

$$\phi V_{cbgx} = \phi (2)(A_{Vc}/A_{Vco})\Psi_{ec,v}\Psi_{ed,v}\Psi_{c,v}\Psi_{h,v}V_{bx} \text{ (Sec. 17.3.1, 17.5.2.1(c) \& Eq. 17.5.2.1b)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,v}$	$\Psi_{ed,v}$	$\Psi_{c,v}$	$\Psi_{h,v}$	V_{bx} (lb)	ϕ	ϕV_{cbgx} (lb)
54.00	18.00	1.000	1.000	1.400	1.000	1069	0.70	6285

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$$\phi V_{cpg} = \phi k_{cp}N_{cbg} = \phi k_{cp}(A_{Nc}/A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b \text{ (Sec. 17.3.1 \& Eq. 17.5.3.1b)}$$

k_{cp}	A_{Nc} (in ²)	A_{Nco} (in ²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
2.0	218.61	79.39	1.000	0.835	1.000	0.990	6142	0.70	19567

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.6)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	0	19734	0.00	Pass
Concrete breakout	1	6813	0.00	Pass (Governs)
Pullout	0	2995	0.00	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	1250	4800	0.26	Pass
T Concrete breakout y+	7502	13434	0.56	Pass (Governs)
Concrete breakout x-	3751	6285	0.60	Pass (Governs)
Pryout	7502	19567	0.38	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.6.2	0.00	0.60	59.7 %	1.0	Pass

5/8"Ø Titen HD (THDB model), hnom:4" (102mm) meets the selected design criteria.



Anchor Designer™
Software
Version 2.5.6163.3

Company:		Date:	9/8/2017
Engineer:		Page:	5/5
Project:			
Address:			
Phone:			
E-mail:			

Base Plate Thickness

Required base plate thickness: 0.008 inch

12. Warnings

- Per designer input, the tensile component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor tensile force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.4.2 for tension need not be satisfied – designer to verify.
- Per designer input, the shear component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor shear force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.5.2 for shear need not be satisfied – designer to verify.
- Designer must exercise own judgement to determine if this design is suitable.
- Refer to manufacturer's product literature for hole cleaning and installation instructions.

SECTION 3: LATERAL

USGS Design Maps Summary Report

User-Specified Input

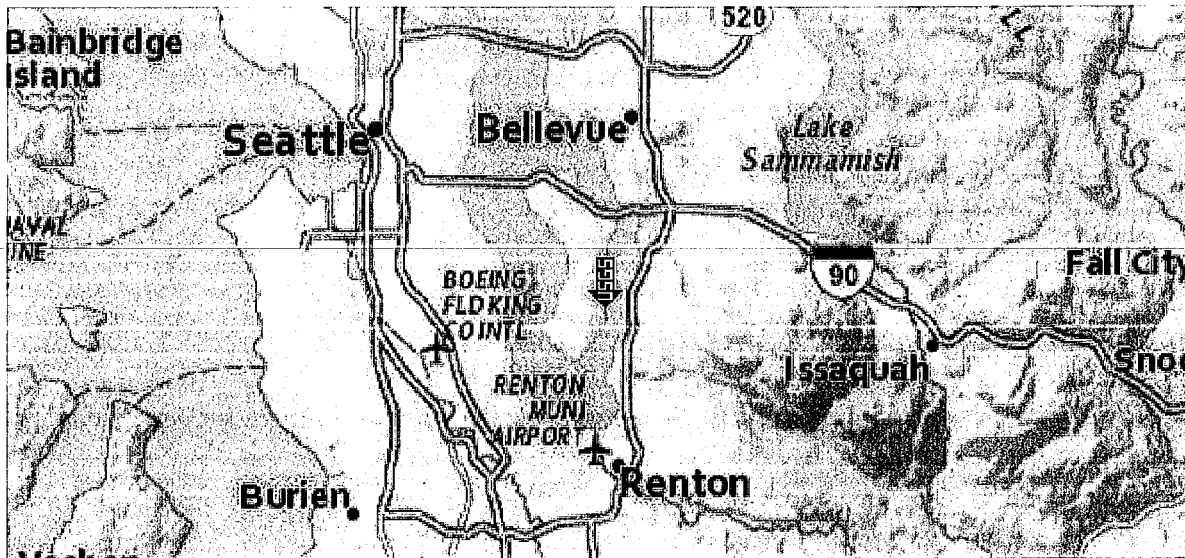
Report Title LS Residence
Tue March 14, 2017 20:41:52 UTC

Building Code Reference Document ASCE 7-10 Standard
(which utilizes USGS hazard data available in 2008)

Site Coordinates 47.55295°N, 122.21043°W

Site Soil Classification Site Class D - "Stiff Soil"

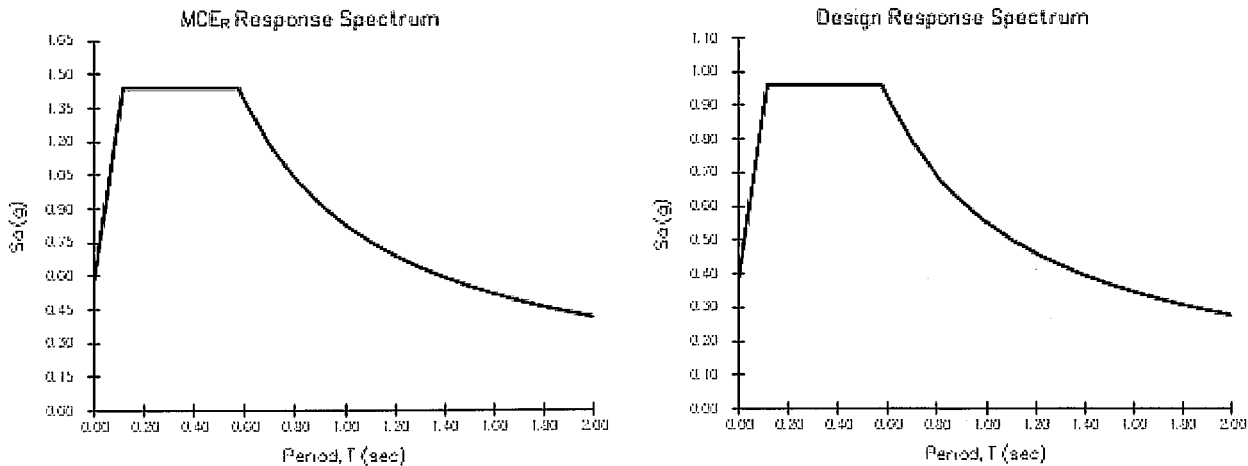
Risk Category I/II/III



USGS-Provided Output

$S_s = 1.440 \text{ g}$	$S_{MS} = 1.440 \text{ g}$	$S_{DS} = 0.960 \text{ g}$
$S_1 = 0.552 \text{ g}$	$S_{M1} = 0.828 \text{ g}$	$S_{D1} = 0.552 \text{ g}$

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

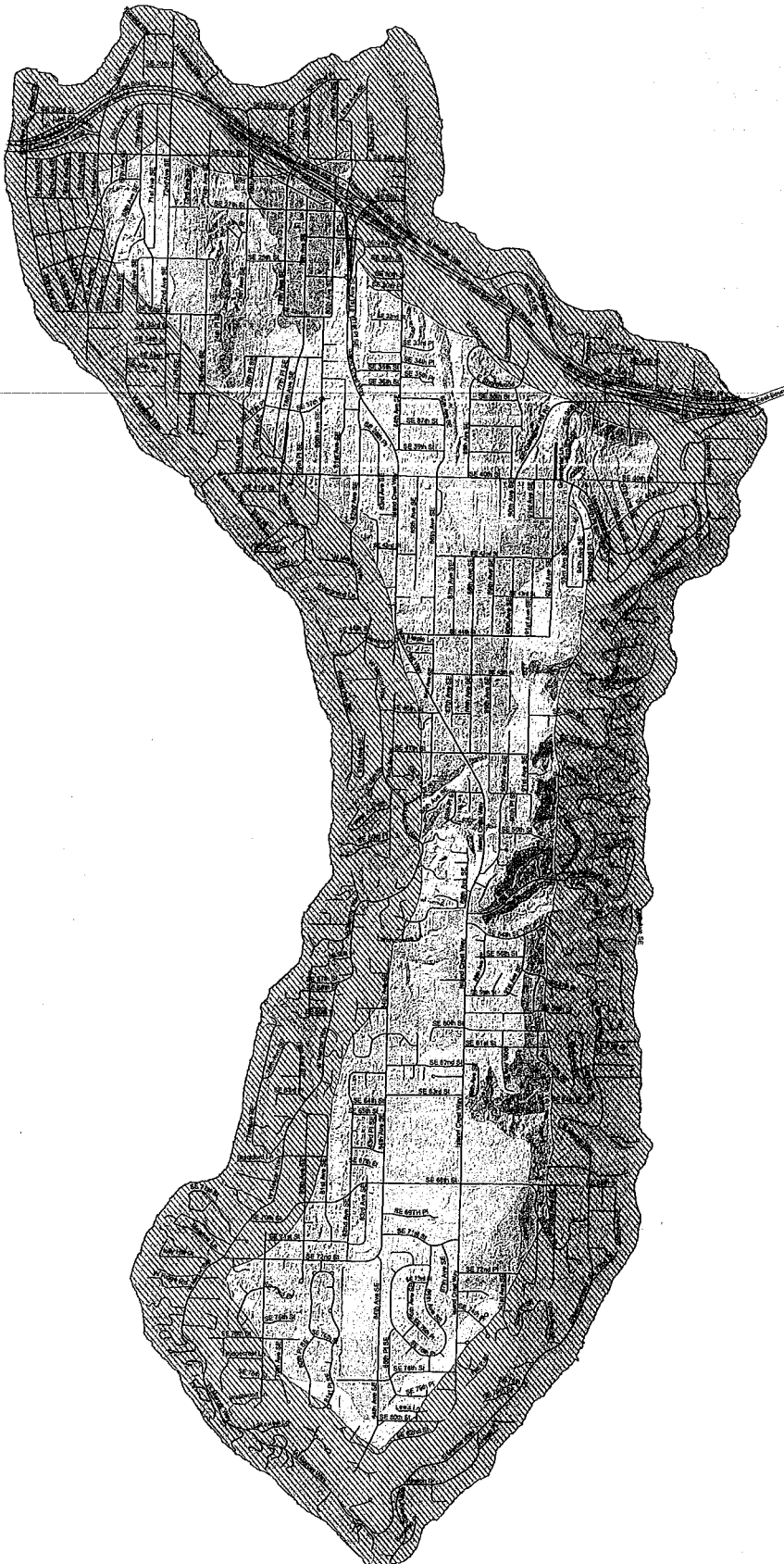


For PGA_M , T_L , C_{RS} , and C_{R1} values, please [view the detailed report](#).

Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.

Mercer Island Wind Exposure and Wind Speed-Up (Topographic Effect)

by Development Services Group (DSG), City of Mercer Island
April 2009



WIND EXPOSURE CATEGORIES & WIND SPEED-UP FACTORS (ICC Section 1609 & ASCE 7-05 Chapter 6)

It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the K_{zt} factor to be utilized for each specific project. The K_{zt} factors and wind exposure categories indicated on this map are the minimum values accepted by the City of Mercer Island without requiring the design professional to submit additional calculations and supporting topographic documentation (to verify the values utilized in their wind load determination).

Please note - The K_{zt} values indicated on this map are approximations based upon periodic calculations of representative samplings around Mercer Island. These values are intended for City of Mercer Island's plan review purposes only.

WIND EXPOSURE CATEGORIES:

Wind Exposure Category		Exposure 'C' (1500 feet from Lake)
		Exposure 'B' (all other areas)

WIND SPEED-UP (TOPOGRAPHIC EFFECT) - K_{zt} Factor:

K_{zt} Factor		$K_{zt} = 1.0$
		$K_{zt} = 1.3$
		$K_{zt} = 1.6$
		$K_{zt} = 1.9$

GENERAL NOTES FOR WIND EXPOSURE AND WIND SPEED-UP MAP

This map is the Wind Exposure Category and Wind Speed-up (Topographic Effects) Map for the City of Mercer Island. This map shows the minimum wind exposure category and the minimum wind speed-up, K_{zt} factor, which will be accepted without site specific documentation and calculation.

Other wind speed phenomena may occur on Mercer Island that is not specifically identified on this map. It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the appropriate design wind speed and exposure category for their specific project and location.

This map is for the sole use of the staff of the City of Mercer Island's Development Services Group (DSG) for the purposes of permit application evaluation. This map provides DSG staff a general assessment of Wind Exposure Category and Wind Speed-up (Topographic Effects). All areas have not been specifically evaluated and there may be locations that are not correctly represented on this map. It is the responsibility of individual property owners and map users to evaluate risk associated with their proposed development. No site-specific assessment of risk is implied or otherwise indicated by the City of Mercer Island with this map.

Information about data used for the map, references, and data limitation are all described the associated "Read Me" document. The digital version of this map is accompanied by a meta data file containing pertinent information about map construction. This data map is available on the City of Mercer Island website.

The City of Mercer Island is using guidance provided within ICC Section 1609 & ASCE 7-05 Chapter 6 regarding definitions used when creating this map.

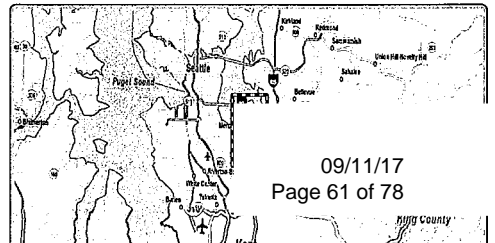
DEFINITIONS:

K_{zt} factor: The topographic effect of wind speed-up at isolated hills, ridges, and escarpments constituting abrupt changes in the general topography, located in any exposure category, that meet all of the conditions noted in ASCE 7-05 Minimum Design Loads for Buildings and Other Structures, Section 6.5.7.

Exposure B: The wind exposure category that applies where the site in question is located a minimum of 1500 feet from the shoreline and the mean roof height is less than or equal to 30 feet per IBC 2006 section 1609.4.3.

Exposure C: The wind exposure category that applies where the site in question is located within 1500 feet from the shoreline per IBC 2006 section 1609.4.3.

Wind Speed: Minimum 85 mph 3-second gust per IRC Figure R301.2(4)





5460 East Mercer Way

W Mercer Way

Island Crest Way
SE 54th St
SE 55th St

SE 56th St

Island Crest Park

Island Crest Way

SE 60th St
SE 61st St

E Mercer Way

Pioneer Park

W Mercer Way
SE 71st St
SE 72nd St
SE 73rd St
SE 74th St
SE 75th St
SE 76th St
SE 77th St
SE 78th St
SE 79th St
SE 80th St
SE 81st St
SE 82nd St
SE 83rd St
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SE 85th St
SE 86th St
SE 87th St
SE 88th St
SE 89th St
SE 90th St
SE 91st St
SE 92nd St
SE 93rd St
SE 94th St
SE 95th St
SE 96th St
SE 97th St
SE 98th St
SE 99th St
SE 100th St

SE 84th St

SE 84th St

Island Crest Way

E Mercer Way

SE 78th St

E Mercer Way

W Mercer Way

W Mercer Way

E Mercer Way

Google

Lake Washington Blvd N
N 98th St

WIND DESIGN

ASCE 7-10

Simplified Envelope Method (Chapter 28)

$$p_s = \lambda K_{zt} I p_{s30}$$

$$\lambda = \text{adjustment factor} = 1.40$$

$$I = \text{importance factor} = 1.00$$

$$K_{zt} = \text{topographic factor} = 1.00$$

Part of Figure 28.6-1 - Adjustment Factor for Building Height and Exposure, λ

Mean Roof Height (ft)	Exposure		
	B	C	D
15	1.00	1.21	1.47
16	1.00	1.23	1.49
17	1.00	1.24	1.50
18	1.00	1.26	1.52
19	1.00	1.27	1.53
20	1.00	1.29	1.55
21	1.00	1.30	1.56
22	1.00	1.31	1.57
23	1.00	1.33	1.59
24	1.00	1.34	1.60
25	1.00	1.35	1.61
26	1.00	1.36	1.62
27	1.00	1.37	1.63
28	1.00	1.38	1.64
29	1.00	1.39	1.65
30	1.00	1.40	1.66

Zone
Computation

a = 10% of least horizontal dimension or 0.4 x h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 feet.

$$w = 55.00 \text{ ft} \times 0.1 = 5.50 \text{ ft}$$

$$h = 30.00 \text{ ft} \times 0.4 = 12.00 \text{ ft}$$

$$w = 55.00 \text{ ft} \times 0.04 = 2.20 \text{ ft}$$

$$a = 5.50 \text{ ft}$$

$$2a = 11.00 \text{ ft}$$

Zone B - end zone of roof

Zone A - end zone of wall

Zone D - interior zone of roof

Zone C - interior zone of wall

Part of Figure 28.6-1 - Method 2 Design Wind Pressure, p_{s30}

Basic Speed	Roof Angle	Roof Pitch	Horizontal Pressures (psf)			
			A	B	C	D
110	0 to 5	flat	19.2	-10.0	12.7	-5.9
	10	2	21.6	-9.0	14.4	-5.2
	15	3	24.1	-8.0	16.0	-4.6
	20	4	26.6	-7.0	17.7	-3.9
	25	6	24.1	3.9	17.4	4.0
	30 to 45	7 to 12	21.6	14.8	17.2	11.8

Design Wind Pressure, ps

Basic Speed	Roof Angle	Roof Pitch	Horizontal Pressures (psf)			
			A	B	C	D
110	0 to 5	flat	26.9	-14.0	17.8	-8.3
	10	2	30.2	-12.6	20.2	-7.3
	15	3	33.7	-11.2	22.4	-6.4
	20	4	37.2	-9.8	24.8	-5.5
	25	6	33.7	5.5	24.4	5.6
	30 to 45	7 to 12	30.2	20.7	24.1	16.5

WIND LOAD

EXPOSE C. M. GOVERNED.

$$h_{30} = 1.4$$

$$k_{zt} = 1$$

BASED ON $V_{\text{Basic}} = 110 \text{ mph}$

Roof ANGLE = 0°

$$P_A = 1.4 \times 19.2 = 26.9 \text{ psf}$$

$$P_B = 1.4 \times (-10) = -14 \text{ psf}$$

$$P_C = 1.4 \times (12.7) = 17.8 \text{ psf}$$

$$P_D = 1.4 \times (-5.9) = -8.26 \text{ psf}$$

$$a = \text{MAX} \left[\text{MIN} \left(\underbrace{0.1 \times 55'}_{5.5}, \underbrace{0.4(h=30')}_{2.2} \right), \underbrace{0.04(55')}_{2.2}, \underbrace{3 \text{ ft}}_3 \right] = 5.5'$$

Roof:

$$W_A = 26.9 \text{ psf} \times \left(\frac{h}{2} = 4.5' \right) = 121.05 \text{ pif (A-AREA)}$$

$$W_C = 17.8 \text{ psf} \times \text{ " } = 80.1 \text{ pif (C-AREA)}$$

FLOOR

$$W_A = 26.9 \text{ psf} \times a' = 242.1 \text{ pif (A-AREA)}$$

$$W_C = 17.8 \text{ psf} \times \text{ " } = 160.2 \text{ pif (C-AREA)}$$

SEISMIC DESIGN - LIGHT FRAME

ASCE 7-10
Equivalent Lateral Force Procedure

Occupancy Category	II	Table 1-1
Seismic Design Category	D	Table 11.6-1
Importance Factor	1.00	Table 11.5-1
Site Class	D	Table 20.3-1
S _s	144.00 %g	(from USGS Seismic Hazard Curves, 2008 data)
S ₁	55.20 %g	(from USGS Seismic Hazard Curves, 2008 data)
F _a	1.00	Table 11.4-1
F _v	1.50	Table 11.4-2
C _t	0.02	Table 12.8-2
x	0.75	Table 12.8-2
h _n	30.00 feet	(height to highest level)

S _{MS} = F _a *S _s	1.4400	Eq. 11.4-1
S _{M1} = F _v *S ₁	0.8280	Eq. 11.4-2
S _{DS} = (2/3)*S _{MS}	0.9600 g	Eq. 11.4-3
S _{D1} = (2/3)*S _{M1}	0.5520 g	Eq. 11.4-4
Period T _a = C _t *h _n ^{0.75}	0.2564 s	Eq. 12.8-7
T _o	0.1150 s	per section 11.4.5
T _s	0.5750 s	per section 11.4.5
S _a	0.9600 g	per section 11.4.5

R	6.5	Table 12.2-1
Ω _o	3	Table 12.2-1
C _d	4	Table 12.2-1
Section 9.5.5 ok?	Yes	Table 12.6-1

Equivalent Lateral Force Procedure (section 12.8)

C _s	0.1477	Eq. 12.8-2
W, weight	164,702 lb	per table below
Q _E	24,325 lb	Eq. 12.8-1

Vertical Force Distribution (section 12.8.3)

k = 1.00

Level	H _x (ft)	Floor Area (ft ²)	Seismic Dead Ld (psf)	Floor Wt. (k)	Wall Length (ft)	Wall Wt. (k)	Total Wt. (k)	W _x H _x (k-ft)	C _v (%)	(LRFD) Q _E (k)	(ASD) 0.7Q _E (k)
Roof (S2.3)	30.00	2026	23	46.6	198	8.9	55.5	1665.2	42.1	10.23	7.16
Upper Floor (S2.2)	21.00	1643	42	69.0	198	8.9	77.9	1636.2	41.3	10.06	7.04
Upper Floor (S2.2)-GREEN R	21.00	297	94	27.9	56	3.4	31.3	656.8	16.6	4.04	2.83
Ground Floor (S2.1)	9.00	2366	49	115.9	170	10.2	126.1	1135.2	28.7	6.98	4.88
Ground Floor (S2.1)-SLT7	9.00	410	65	26.7	56	2.5	29.2	262.5	6.6	1.61	1.13
							164.70	3958.31	100.00	24.33	17.03

SEISMIC DESIGN - OMF

ASCE 7-10
Equivalent Lateral Force Procedure

Occupancy Category	II	Table 1-1
Seismic Design Category	D	Table 11.6-1
Importance Factor	1.00	Table 11.5-1
Site Class	D	Table 20.3-1
S _s	144.00 %g	(from USGS Seismic Hazard Curves, 2008 data)
S ₁	55.20 %g	(from USGS Seismic Hazard Curves, 2008 data)
F _a	1.00	Table 11.4-1
F _v	1.50	Table 11.4-2
C _t	0.02	Table 12.8-2
x	0.75	Table 12.8-2
h _n	30.00 feet	(height to highest level)
S _{MS} = F _a *S _s	1.4400	Eq. 11.4-1
S _{M1} = F _v *S ₁	0.8280	Eq. 11.4-2
S _{DS} = (2/3)*S _{MS}	0.9600 g	Eq. 11.4-3
S _{D1} = (2/3)*S _{M1}	0.5520 g	Eq. 11.4-4
Period T _a = C _t *h _n ^{0.75}	0.2564 s	Eq. 12.8-7
T _o	0.1150 s	per section 11.4.5
T _s	0.5750 s	per section 11.4.5
S _a	0.9600 g	per section 11.4.5
R	3.5	Table 12.2-1
Ω _o	3	Table 12.2-1
C _d	3	Table 12.2-1
Section 9.5.5 ok?	Yes	Table 12.6-1

Equivalent Lateral Force Procedure (section 12.8)

C _s	0.2743	Eq. 12.8-2
W, weight	313,274 lb	per table below
Q _E	85,927 lb	Eq. 12.8-1

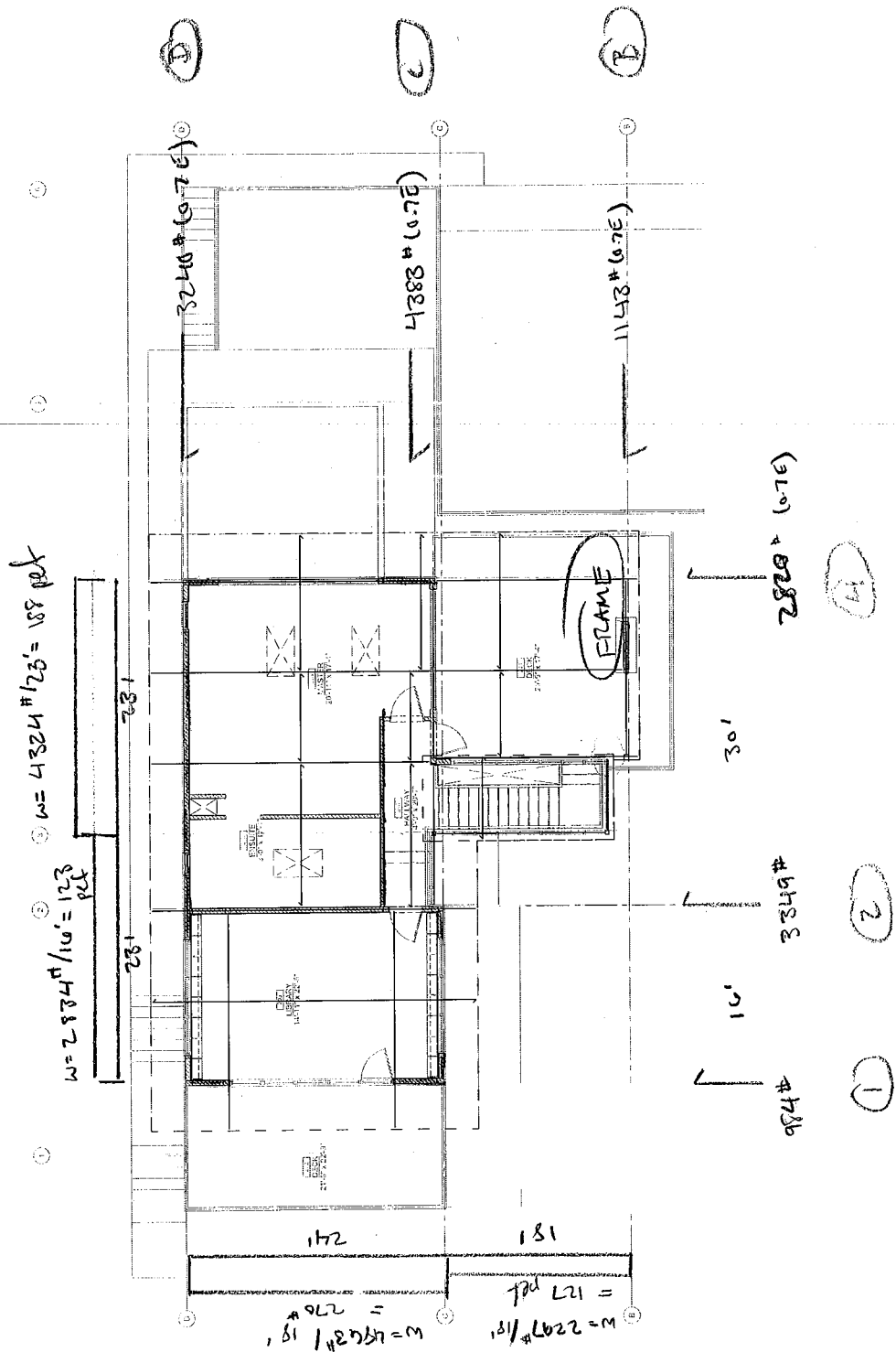
Vertical Force Distribution (section 12.8.3)

k = 1.00

Level	Hx (ft)	Floor Area (ft ²)	Seismic Dead Ld (psf)	Floor Wt. (k)	Wall Length (ft)	Wall Wt. (k)	Total Wt. (k)	WxHx (k-ft)	Cvx (%)	(LRFD) Q _E (k)	(ASD) 0.7Q _E (k)
Roof (S2.3)	30.00	2026	23	46.6	198	7.1	53.7	1611.8	30.8	26.49	18.54
Upper Floor (S2.2)	21.00	1643	42	69.0	198	7.1	76.1	1598.8	30.6	26.27	18.39
Upper Floor (S2.2)-GREEN ROOF	21.00	297	94	27.9	57	2.7	30.7	643.7	12.3	10.58	7.40
Ground Floor (S2.1)	9.00	2366	49	115.9	170	8.2	124.1	1116.8	21.4	18.35	12.85
Ground Floor (S2.1)-SLT7	9.00	410	65	26.7	56	2.0	28.7	258.0	4.9	4.24	2.97
							313.27	5229.17	100.00	85.93	60.15

ROOF CATEGRA

$F_{WUF} = 7100 \# (0.7E)$



LATERAL DESIGN

SEISMIC COEFFICIENTS
0.7E

(1) $R = 984$
 $l = 8.75'$
 $v = 112 \text{ plf}$ SW1
 $h = 9.5'$
 $OT = 1064 \#$
 $DL = \emptyset$
 $CS = \text{CS10}$
 $POST = (2)2 \times 4$

(2) $R = 3849 \#$
 $l = 19'$
 $v = 176 \text{ plf}$ SW1
 $h = 9.5'$
 $OT = 1674 \#$
 $DL = 4.75' \times 23 \text{ plf} \times 19 / 2 \times 0.6$
 $= 885$
 $OT - DL(O.G.) = 789 \#$
 $CS = \text{CS10}$
 $POST = (2)2 \times 4$

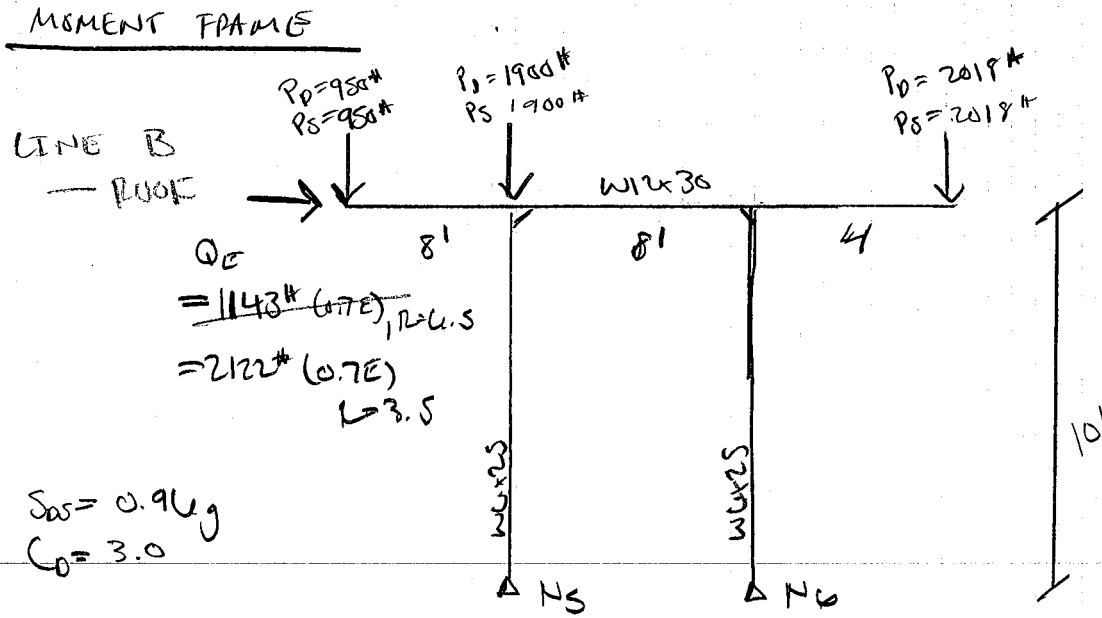
(4) $R = 2820$
 $l = 9.5'$
 $v = 381 \text{ plf}$ SW2
 $h = 9.5'$
 $OT = 3151 \#$
 $DL = 7.67' \times 23 \text{ plf} \times 5' \times 0.6$
 $= 529$
 $OT - DL(O.G.) = 2621$
 $CS = (2)\text{CS10}$
 $POST = (2)2 \times 4$

ROOF

(B) $R = 1143 \#$
 $l = 5.0'$
 $v = 229 \#$ SW1 OR FRAMBO
 $h = 9.5'$
 $OT = 2170$
 $DL = 9.25' \times 10' \times 23 \text{ plf} \times 0.6 = 1189 \#$
 $OT - DL(O.G.) = 1081 \#$ USE CS10
 $TL = 9.25' \times 10' \times 23 \text{ plf}$
 $+ 0.75(9.25' \times 10' \times 23 \text{ plf}) = 3444 \#$
 $OT(O.G.) + TL = 5071 \#$ USE (2)2x4

(C) $R = 4383 \#$
 $l = 28'$
 $v = 190 \text{ plf}$ SW2 ** FOR TALL SLENDER WALLS*
 $v' = 190 \times 3.5' / 2 = 333 \text{ plf}$
 $h = 9.5$
 $OT = 1906 \#$ USE (2)CS10 OR CS11
 $POST = (2)2 \times 4$

(D) $R = 3240 \#$
 $l = 26'$
 $v = 124 \text{ plf}$ SW1
 $h = 9.5$
 $OT = 1183$ CS10
 $(2)2 \times 4$



ALLOWABLE DRAFT = $0.025 h_{sx}$
= $0.025 (10' \times 12'') = \underline{3.0''}$

ACTUAL DRAFT = $\frac{\Delta C \omega}{I} = \frac{0.0044 (3.0)}{1.0} = 1.93'' < 3.0'' \checkmark$

MEMBER FORCES

COLUMN W12x25 \rightarrow $U_{max} = 1.35k$
 $M_{max} = 73.47k-ft$ $DUR = 0.41$
 \uparrow BENDING

BEAM W12x30 \rightarrow $U_{max} = 3.53k$
 $M_{max} = 21.85k-ft$ $DUR = 0.32$
 \uparrow BENDING
 $\Delta_{AS, UNBALANCED} = 0.177''$
 $= R/5004 \checkmark$

REACTIONS @ SUPPORTS

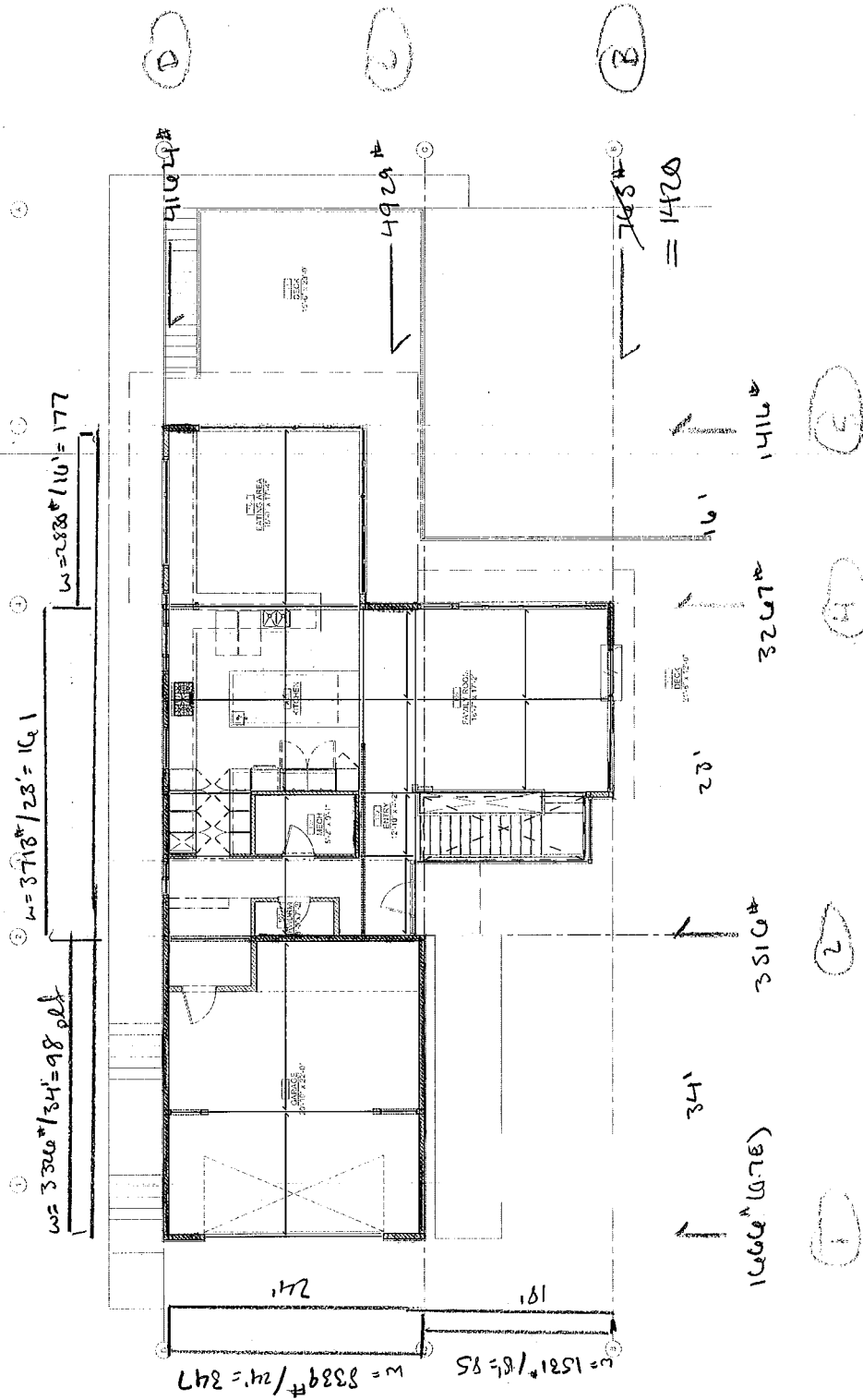
$N_5 \Rightarrow F_x = 1.35k$
 $F_y = +7.53k$
 $-0.97k$

$N_6 \Rightarrow F_x = 1.35k$
 $F_y = +6.28k$
 $-1.41k$

DIAPI $\rightarrow 2122\# / 250\# = 8.48$ (9) SCREWS $\rightarrow @ 24''$

U. FLOOR - LATERAL

$F_{\text{Roof}} = 7040 \#$
 $F_{\text{Green}} = 2836 \#$
 Roof



LATERAL DESIGN

UPPER FLOOR

① $R = 1066 + 984 = 2050 \#$
 $l = 8.75'$
 $v = 302 \text{ plf}$ SW2
 $h = 8.5'$
 $OT = 2574$ HDU4
(2) 2x4

② $R = 3516 + 3849 = 6865 \#$
 $l = 15.5'$
 $v = 249 \text{ plf}$ SW2
 $h = 8.5'$
 $OT = 2119$ (2) CS16
(2) 2x4

③ $R = 326 + 2870 = 6137 \#$
 $l = 5.5'$
 $v = 1115 \text{ plf}$ SW6
 $h = 8.5'$
 $OT = 9484$
 $OT_{total} = 9484 + 3151 = 12999 \#$
USE HDU14

④ $R = 1416 \#$
 $l = 3'3"$ ($h_{ll} = 2.0$)
 $v = 435$
 $v' = 435 \times 2.0/2 = 509 \text{ plf}$ SW4
 $h = 8.5'$
 $OT = 3098$ (3) CS16
 $TL = 5278$
 $C = 0732$ (3) 2x6

⑤ $R = 1420 + 212 + 3542 = 5084 \#$
 $R = 205 + 1143 = 1908 \#$
 $l = 4.0'$
 $v = 886$ SW5
 $v = 1777 \text{ plf}$
 $h = 8.5'$
 $OT = 4054$
 $C = 7520$ HDU11
(3) 2x6

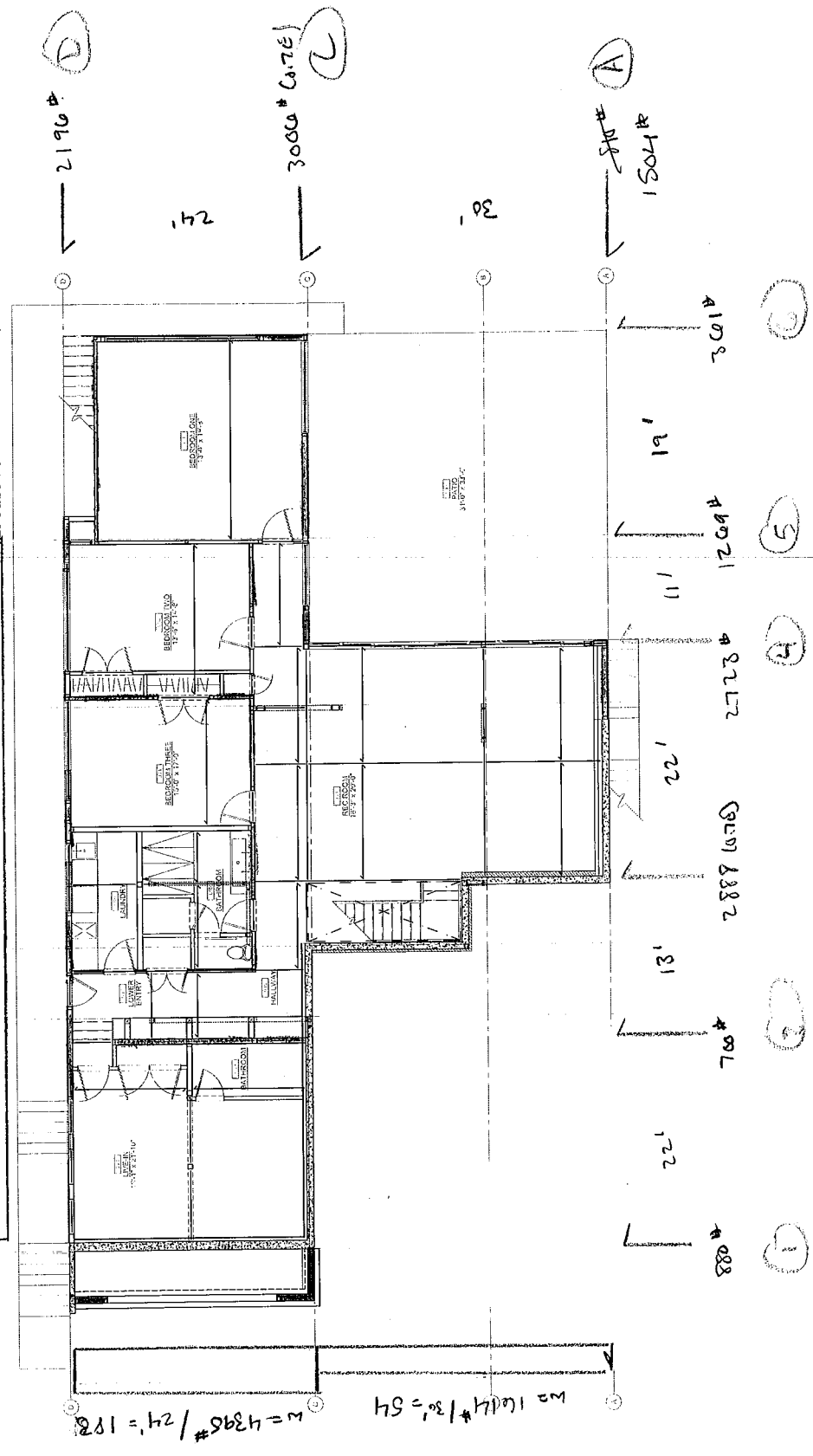
⑥ $R = 4920 + 4388 = 9308 \#$
 $l = 38'$
 $v = 281 \text{ plf}$ SW2
 $h = 8.5'$
 $OT = 2396$ HDU4
(2) 2x4

⑦ $R = 4164 + 3240 = 7404 \#$
 $l = 48'$
 $v = 154 \text{ plf}$ SW1
 $OT = 1405$ CS16
(2) 2x6

MAIN FLOOR LAYOUT

$F_{MAIN} = 4880 \#$
 $F_{800,1} = 1130 \#$

$w = 1469 \# / 35' = 42 \text{ psf}$
 $w = 3035 \# / 22' = 138 \text{ psf}$
 $w = 1130 \# / 30' = 38 \text{ psf}$



LATERAL DESIGN - MAIN FLOOR

$h + 4r = 9'$

(2) $R = 700^{\#} + 6865^{\#} = 7565^{\#}$
 $Q = 18.67'$
 $U = 405 \text{ per } \boxed{\text{SW3}}$
 $OT = 3647^{\#} \quad \underline{\text{HDU5}}$
 (2)2x4

(1) $R = 2723^{\#} + 6137^{\#} = 8860^{\#}$
 $Q = 12'$
 $U = 738 \text{ per } \boxed{\text{SW5}}$
 $OT = 6045 \quad \underline{\text{HDG8}}$
 (4)2x4

(5) $R = 1269^{\#} + 1416^{\#} = 2685^{\#}$
 $Q = 16.0'$
 $U = 1107 \text{ per } \boxed{\text{SW1}}$
 $OT = 1510 \quad \underline{\text{HDU2}}$
 (2)2x4

(6) $R = 301^{\#}$
 $Q = 4.33'$
 $U = 83 \text{ per } \boxed{\text{SW1}}$
 $OT = 750 \quad \underline{\text{HDU2}}$
 (2)2x6

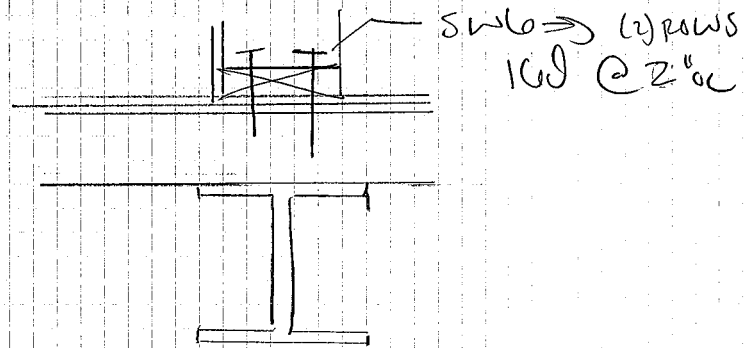
(1) $R = 810^{\#} + 3542^{\#} = 5046^{\#}$
 $Q = 11.5'$
 $U = 438 \text{ per } \boxed{\text{SW3}}$
 $h = 2.0'$
 $U_{\text{DRIFT}} = 5046 / 23''$
 $= 219 \text{ per } < 270 \text{ per } \checkmark$

$OT = 870^{\#}$
 $o.c.d = 1000^{\#}$
 $OT - D = \checkmark$
 (2)2x6

(0) $R = 3006^{\#} + 9303^{\#} = 12309^{\#}$
 $1/2 \text{ IR } 17.5' \text{ CONC WALL}$
 $R' = 6155^{\#}$
 $Q = 14.75'$
 $U = 417 \text{ per } \boxed{\text{SW3}}$
 $OT = 3755 \quad \underline{\text{HDU5}}$
 (2)2x6

(P) $R = 2196^{\#} + 7404^{\#} = 9600^{\#}$
 $Q = 42'$
 $U = 228 \text{ per } \boxed{\text{SW2}}$
 $OT = 2657 \quad \underline{\text{HDU2}}$
 (2)2x6

SWL LOAD TRANSFER



→ (2) ROWS 16 @ 2" oc

$$\rightarrow Z = 89\# \times \frac{12''}{2'' \text{ oc}} \times 2 \text{ ROWS} \times 1.6 = 1708\# / \text{ft} \quad \leftarrow C_0$$

→ (2) ROWS 114" x 5" LONG @ 12" oc

$$\rightarrow Z = 420\# \times \frac{12''}{12''} \times (2) \text{ ROWS} \times 1.6 = 1344\# / \text{ft}$$

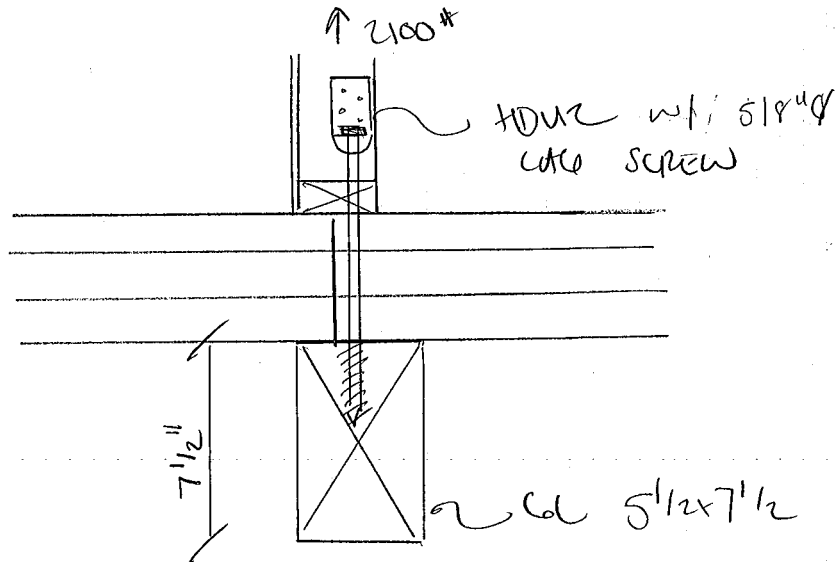
@ 10" oc

$$= 1612\# / \text{ft}$$

⊕ 8" oc

$$= 2016\# / \text{ft}$$

HOLDOWN INTO GL BEAM



$$W = 447 \# / \text{in} \quad (C_b = 1.0)$$

$$= 715 \# / \text{in} \quad (C_b = 1.6)$$

HOLD 2: INCHES $REQ'D = \frac{2100 \#}{715 \# / \text{in}} = 2.937" \Rightarrow$ USE 3" THICK NO PENETRATION

HOLD 4: INCH $REQ'D = \frac{2500 \#}{715 \# / \text{in}} = 3.49" \Rightarrow$ USE 3 1/2"

HOLD 8: " $REQ'D = \frac{12999 \#}{715} = 18.195$ NO....

SECTION 4: FOUNDATION

FOOTING WITH COMBINED AXIAL AND FLEXURAL LOADS

Wall 1 In-Plane

Sizes and Loads:

superstructure:

frame 4,300 lb

footing:

length 6.00 ft (along same axis as applied moment)
width 2.00 ft (perpendicular to applied moment)
depth 1.00 ft
weight 1,740 lb

soil abv. 1,440 lb

total R = 7,480 lb

M = 12,200 lbft

e = 1.63 ft

B/6 = 1.00 ft

Bearing Pressures:

Reaction is OUTSIDE kern.

(Use these results)

(Do not use these results)

x = 1.37 ft

fa = 623 psf

fb = 1017 psf

fp = 1821 psf

fp = 1640 psf

Fa = 2,000 psf

Fa = 2,000 psf

Stability:

Mot = 12,200 lbft (using 0.6W, per ASD Load Combinations)

Mr = 13,464 lbft (using 0.6D, per ASD Load Combinations)