Structural Calculations For:

PATHAK REMODEL

8541 SE 82nd Street

Mercer Island, WA 98040

Prepared for: CAST Architecture

Job #: 00640-2023-02

Date: May 31st , 2024

STRUCTURAL ENGINEERING

SEATTLE 2124 Third Avenue, Suite 100, Seattle, WA 98121
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Criteria Sheet

Codes

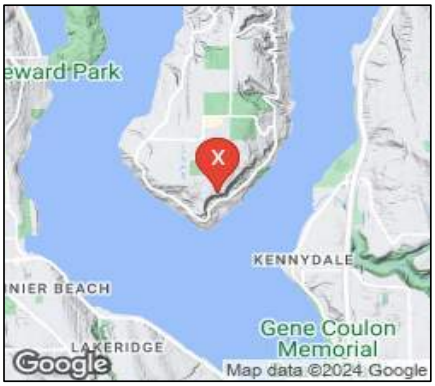
Structural	IBC 2021
Loading	ASCE 7-16
Wood:	NDS 2018 / SDPWS 2021
Steel:	AISC 360-16
Concrete:	ACI 318-19
Masonry:	TMS 402/602-16

Project Location

Street & Number	8541 SE 82nd Street
City:	Mercer Island
State:	WA
ZIP:	98040
Latitude:	47.5302 N
Longitude:	-122.2242 W
Ground Elevation	315 ft

Occupancy Category

Risk Category: II — ASCE 7 Table 1.5-1



Seismic Load Summary:

Analysis Procedure:	Equivalent Lateral Force Procedure		
Lateral System:	Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance		
R:	6.50	C_d=	4
Base Shear V =	25 kips	Ω_o=	2.5
S_S=	1.463	S_1=	0.504
S_{DS}=	0.98	S_{D1}=	0.86
C_s=	0.150	I_E=	1.0

Story Information

# Stories Above Grade (Including Mezzanine Levels)	1

Horizontal and Vertical Irregularities:

Is the building a "Regular Structure"? (No horizontal or vertical irregularities)	Yes

Wind Load Summary:

V=	98	K_{ZT}=	1.19
Exposure =	C		

Dead Loads:

Roof			Floor		
Roofing	1	psf	Slab on Grade	50	psf
1/2" Sheathing	1.8	psf			
Joists	2.5	psf			
Misc./Mech.	1.5	psf			
Ceiling Finish	3	psf			
Solar Panels	0	psf			
	10	psf			
Use	10	psf			
Add'l Seismic Weight	5	psf			
Seismic Weight	15	psf			

Live Loads:

Roof	25	psf
Floor	40	psf

Snow Loading Criteria:

Ground Snow, p_g	25 psf	Flat Roof Snow Load, p_f	25.0 psf	Importance Factor, I_s	1.00
Exposure Factor, C_e	0.90	Sloped Roof Snow Load, p_s	25.0 psf		
Thermal Factor, C_t	1.00	Slope Factor, C_s	0.75		

Soils:

Allowable Bearing	2500	psf	Active	55/35	pcf (Restrained/Unrestrained)
Sliding, μ	0.3		Seismic Surcharge	8H	
Passive	250	pcf			

Soils Report Provided?	Yes
Site Specific Ground Motion Hazard Analysis Provided?	No

Seismic Design

ASCE 7-16 Seismic Analysis | Equivalent Lateral Force Procedure | Apply Section 12.8.1.3 (Where Applicable)? Yes

Seismic Force Resisting System Per Table 12.2-1		
	System:	Bearing Wall Systems
	Type:	Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance

Seismic Design Cat.	D	
Risk Category	II	I, II, or III, or IV per Table 1.5-1
Site Class	D	Per soils report.
Diaphragm Flexibility	Flexible	

Section 12.8.1.3

1. Regular Structure	Yes
2. ≤ 5 Stories above grade	Yes
3. T ≤ 0.5s	Yes
4. ρ = 1.0	No
5. Not Site Class E or F	Yes
6. Risk Category I or II	Yes

If all items above are met, S_{DS} may be taken as 1.0, but not less than 0.7*(Calculated S_{DS})

S_S	1.463 g	2% in 50 yr, Latitude & Longitude lookup
S_1	0.504 g	2% in 50 yr, Latitude & Longitude lookup
R	6.50	
C_d	4.0	
Ω_o	2.5	
I_e	1.00	Table 1.5-2
h_n	20.5 ft	
Ct	0.02	Table 12.8-2
x	0.75	Table 12.8-2
T_a	0.19 sec	
T	0.19 sec	Eq. 12.8-7
T_0	0.18 sec	
T_S	0.88 sec	
T_L	6.00 sec	
F_a	1.00	Table 11.4-1
F_v	1.70	Table 11.4-2
S_{MS}	1.46 g	Eq. 11.4-1
S_{M1}	1.29 g	Eq. 11.4-2
S_{DS}	0.975 g	Eq. 11.4-3
S_{D1}	0.857 g	Eq. 11.4-4
C_s	***0.150 Controls***	Eq. 12.8-2
	0.684	Eq. 12.8-3 need not exceed, T < T_L
	0.010	Eq. 12.8-5 or 12.8-6 minimum
C_s, design	0.150	
Bldg. Weight	168.2 k	
V = C_SW	25.2 k	Eq. 12.8-1, Strength Level Base Shear
V = C_{Sasd}W	17.7 k	Eq. 12.8-1 ASD Base Shear

Building Period Per Alternate Analysis

T (sec)	

Per Geotech Report

F_a	
F_v	

$$T_a = C_t h_n^x \quad \text{Eq. 12.8.7}$$

$$S_{MS} = F_a S_S \quad \text{Eq. 11.4-1}$$
$$S_{M1} = F_v S_1 \quad \text{Eq. 11.4-2}$$
$$S_{DS} = {}^2/_3\, S_{MS} \quad \text{Eq. 11.4-3}$$
$$S_{D1} = {}^2/_3\, S_{M1} \quad \text{Eq. 11.4-4}$$

$$C_S = \frac{S_{DS}}{(R/I_e)} \quad \text{Eq. 12.8-2}$$
$$C_S = \frac{S_{D1}}{T(R/I_e)} \quad \text{Eq. 12.8-3}$$
$$C_S = \frac{S_{D1} T_L}{T^2(R/I_e)} \quad \text{Eq. 12.8-4}$$
$$C_S \geq 0.044 S_{DS} I_e \quad \text{Eq. 12.8-5}$$
$$C_S \geq 0.01 \quad \text{Eq. 12.8-5}$$
$$C_S \geq 0.5 \frac{S_1}{(R/I_e)} \quad \text{Eq. 12.8-6}$$

$$C_{VX} = w_x h_x^k / \sum_{i=1}^{n} w_x h_i^k \quad \text{Eq. 12.8-12}$$

$$F_{px} = {}^{\sum_{i=x}^{n} F_i}/_{\sum_{i=x}^{n} w_i}\, w_{px} \quad \text{Eq. 12.10-1}$$
$$F_{px} \geq 0.2 S_{DS} I_e w_{px} \quad \text{Eq. 12.10-2}$$
$$F_{px} \leq 0.4 S_{DS} I_e w_{px} \quad \text{Eq. 12.10-3}$$

Vertical Distribution ASD ρ= 1.3 k= 1.000

Level	h_x (ft)	W_x (k)	h_x^k (ft)	$W_x h_x^k$	Story Shear ASD			Diaphragm Force (ρ not included)				
					C_{vx} (%)	F_x (k)	SV (k)	$F_{px,calc}$	$F_{px,min}$	$F_{px,max}$	$F_{px,design}$	$\gamma=F_{px}/F_x$
Roof	20.5	99.3	20.5	2036	0.787	18.1	**18.1**	13.9	13.6	27.1	**13.9**	0.77
Upper Floor	8.0	68.9	8.0	551	0.213	4.9	**23.0**	7.2	9.4	18.8	**9.4**	1.92
Σ		168.2		2587		**23.0**						

Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method	ASD

Wind Coefficients

Exposure	C	
V=	98	mph
K_d=	0.85	Table 26.6-1
K_h=	0.85	Table 27.3-1
K_e=	0.99	Table 26.9-1
G=	0.85	26.9.4

Location and Building Dimensions

Calculate Kzt?	Yes	
Kzt	1.19	
Roof Type	Gable	
Roof Slope - Transverse Dir	22	degrees
Roof Slope - Long Dir	22	degrees
Ground to top of roof	18	ft
Bot of roof to top of roof	6.5	ft
Mean Roof Height, h	14.75	ft
Short Plan Dimension	80	ft
Long Plan Dimension	98	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft

Velocity Pressure at Mean Roof Height, q_h =	20.8	psf

Transverse Wind Pressures

L/B = 0.82 h/L = 0.18

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-0.26 / 0.24
Leeward Roof	-0.60

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	**P_{walls} (psf)**
0-15	0.85	20.86	14.19	8.85	**13.8**
15-20	0.9	22.09	15.02	8.85	**14.3**
20-25	0.94	23.07	15.69	8.85	**14.7**
25-30	0.98	24.05	16.36	8.85	**15.1**
30-40	1.04	25.53	17.36	8.85	**15.7**
41-50	1.09	26.75	18.19	8.85	**16.2**
51-60	1.13	27.73	18.86	8.85	**16.6**
61-70	1.17	28.72	19.53	8.85	**17.0**
71-80	1.21	29.70	20.19	8.85	**17.4**
81-90	1.24	30.43	20.70	8.85	**17.7**
91-100	1.26	30.93	21.03	8.85	**17.9**

Roof Pressures (Unfactored) ASD

Windward		Leeward	**Horiz Proj (psf)**
Max	Min		
4.3	-4.6	-10.6	**8.93**

Longitudinal Wind Pressures

L/B = 1.23 h/L = 0.15

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.46
Windward Roof	-0.26 / 0.24
Leeward Roof	-0.60

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	**P_{walls} (psf)**
0-15	0.85	20.86	14.19	8.06	**13.35**
15-20	0.9	22.09	15.02	8.06	**13.85**
20-25	0.94	23.07	15.69	8.06	**14.25**
25-30	0.98	24.05	16.36	8.06	**14.65**
30-40	1.04	25.53	17.36	8.06	**15.25**
41-50	1.09	26.75	18.19	8.06	**15.75**
51-60	1.13	27.73	18.86	8.06	**16.15**
61-70	1.17	28.72	19.53	8.06	**16.55**
71-80	1.21	29.70	20.19	8.06	**16.95**
81-90	1.24	30.43	20.70	8.06	**17.25**
91-100	1.26	30.93	21.03	8.06	**17.45**

Roof Pressures (Unfactored) ASD

Windward		Leeward	**Horiz Proj (psf)**
Max	Min		
4.3	-4.6	-10.6	**8.93**

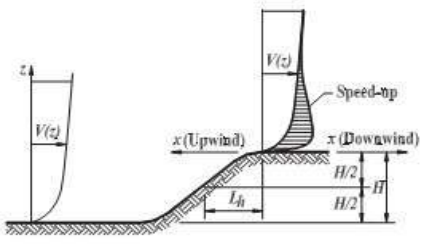
Site Address

Address	8541 SE 82nd Street			Wind Radius	2.00 Miles
City:	Mercer Islanc State:		WA	Angle	0 ˚
Lat Long	47.530155	-122.2242		Exposure	C

Profile 1 : 0 ˚ to 180 ˚
Profile 2 : 270 ˚ to 90 ˚
Profile 3 : 315 ˚ to 135 ˚
Profile 4 : 45 ˚ to 225 ˚

SITE MAP

Topography from Figure 26.8-1



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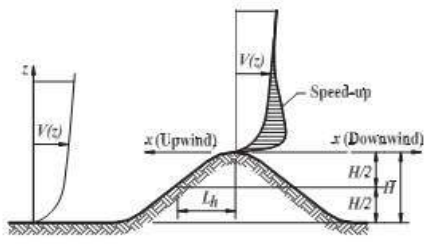
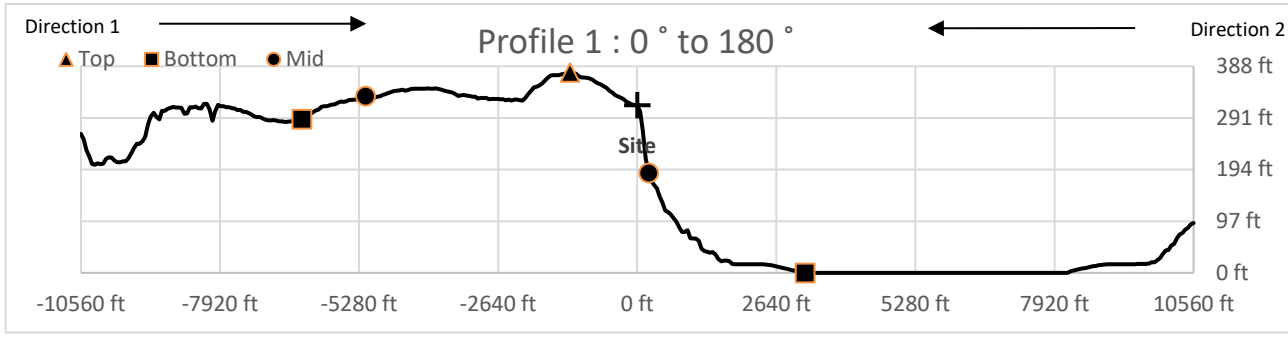
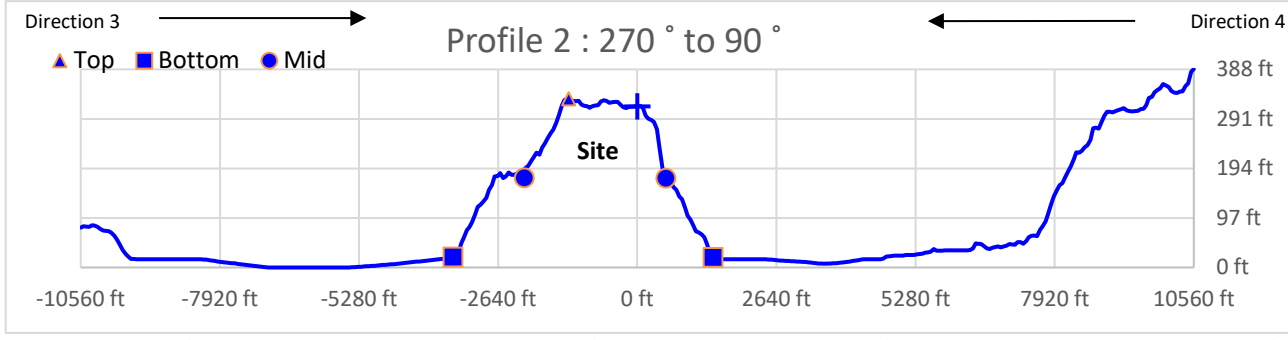


2-D RIDGE OR 3-D AXISYMMETRICAL HILL

$$K_{zt} = (1 + K_1 K_2 K_3)^2$$
$$K_1 = \text{Per Figure}$$
$$K_2 = (1 - |x|/\mu L_h)$$
$$K_3 = e^{-\gamma z / L_h}$$
$$K_{zt} = 1, \text{ If } H/Lh \le 0.2$$

PER FIGURE 26.8-1





Direction 1 - 0 ˚to Site

Site Conditions (26.8.1)

1. Unubstructed	No	Kzt=1
2. Isolated	Yes	

	Hill

Kzt Calculations

Direction 2 - Site to 180 ˚

Site Conditions (26.8.1)

1. Unubstructed	Yes
2. Isolated	Yes
3. Upper Half Hill	Yes
4. H/Lh ≥ 0.2	Yes
5. H≥ 15'	Yes

Terrain Data

Terrain	Escrpmnt
Top of Hill Dist.	-1274
Bott. of Hill Dist.	3184
L @ H/2	212
Site	upwind
Top of Hill Elev.	376
Bott. of Hill Elev.	0
Site Elev.	315.0
Site Dist.	0
H/2	188

Kzt Calculations

H=	376
Lh=	1486
x=	1274
z=	14.75
μ=	1.5
γ=	2.5
K1 value =	0.85
K1=	0.22
K2=	0.43
k3=	0.98
H/Lh =	0.25
Kzt =	1.19

Direction 3 - 270 ˚to Site

Site Conditions (26.8.1)

1. Unubstructed	Yes
2. Isolated	Yes
3. Upper Half H	Yes
4. H/Lh ≥ 0.2	Yes
5. H≥ 15'	Yes

Terrain Data

Terrain	Hill
Top of Hill Dist.	-1300
Bott. of Hill Dist.	-3499
L @ H/2	-2150
Site	downwnd
Top of Hill Elev.	330
Bott. of Hill Elev.	21
Site Elev.	315.0
Site Dist.	0
H/2	175

Kzt Calculations

H=	310
Lh=	850
x=	1300
z=	14.75
μ=	1.5
γ=	4
K1 value =	1.05
K1=	0.38
K2=	0.00
k3=	0.93
H/Lh =	0.36
Kzt =	1.00

Direction 4 - Site to 90 ˚

Site Conditions (26.8.1)

1. Unubstructed	No	Kzt=1
2. Isolated	Yes	

	Hill
	-1300
	1433
	537

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PATHAK REMODEL - Carport/Garage

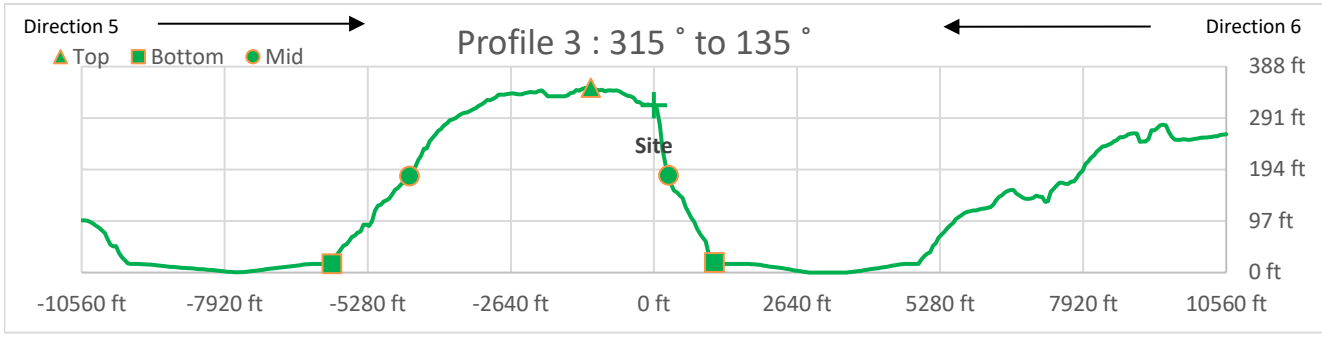
Kzt Calculations

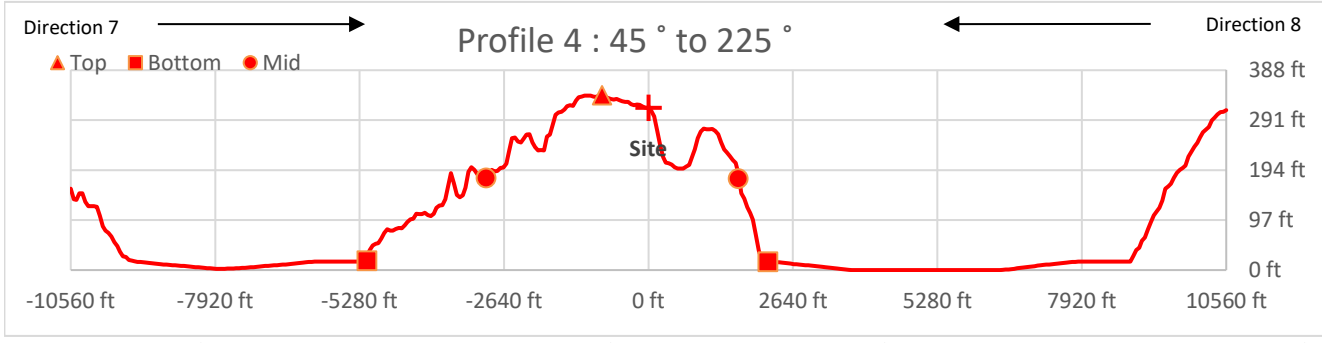
DATE 5/3/2024

PROJ. #

DESIGN LTN

SHEET 5 7/107





Direction 5 - 315 ˚to Site | **Direction 6 - Site to 135 ˚** | **Direction 7 - 45 ˚to Site** | **Direction 8 - Site to 225 ˚**

Site Conditions (26.8.1)

1. Unobstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	Yes	
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Site Conditions (26.8.1)

1. Unobstructed	No	Kzt=1
2. Isolated		

Site Conditions (26.8.1)

1. Unobstructed	No	Kzt=1
2. Isolated	Yes	

Site Conditions (26.8.1)

1. Unobstructed	No	Kzt=1
2. Isolated	Yes	

Terrain Data

Terrain	Hill		Hill		Hill		Hill
Top of Hill Dist.	-1167						
Bott. of Hill Dist.	-5943						
L @ H/2	-4511						
Site	downwnd						
Top of Hill Elev.	348						
Bott. of Hill Elev.	16						
Site Elev.	315.0						
Site Dist.	0						
H/2	182						

Kzt Calculations

H=	332						
Lh=	3344						
x=	1167						
z=	14.75						
μ=	1.5						
γ=	4						
K1 value =	1.05						
K1=	0.10						
K2=	0.77						
k3=	0.98						
H/Lh =	0.10						
Kzt =	1.00						

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COMBINED (MAIN RESIDENCE & CARPORT/GARAGE)

SEISMIC WEIGHT:

$W_{T\,Roof} = 82.4^{K} + 16.9^{K}$
$= 99.3^{K}$

$W_{T\,Upper\ Floor} = 68.9^{K}$

SEISMIC SHEAR:

$V_{ROOF,SEISMIC} = 18.1^{K}$

$V_{UPPER\ FLR,SEISMIC} = 23.0^{K}$

WIND SHEAR: $k_{zt} = 1.19$

$V^{WIND,ROOF}_{N-S} = 13.85\ PSF \times 850\ SF$
$= 11.8^{K}$

$V^{WIND,ROOF}_{E,W} = 4.3\ PSF \times 800\ SF$
$= 11.4^{K}$

$V^{WIND,UPPER\ FLR}_{N-S} = 13.35\ PSF \times 790\ SF$
$= 10.6^{K}$

$V^{WIND,UPPER\ FLR.}_{E-W} = 13.8\ PSF \times 650\ SF$
$= 9^{K}$

→ Seismic controls in both directions.

(5) By inspection, it is more conservative in the N-S direction to design the main residence & carport as "separate" elements; especially with the design of new steel moment frames.

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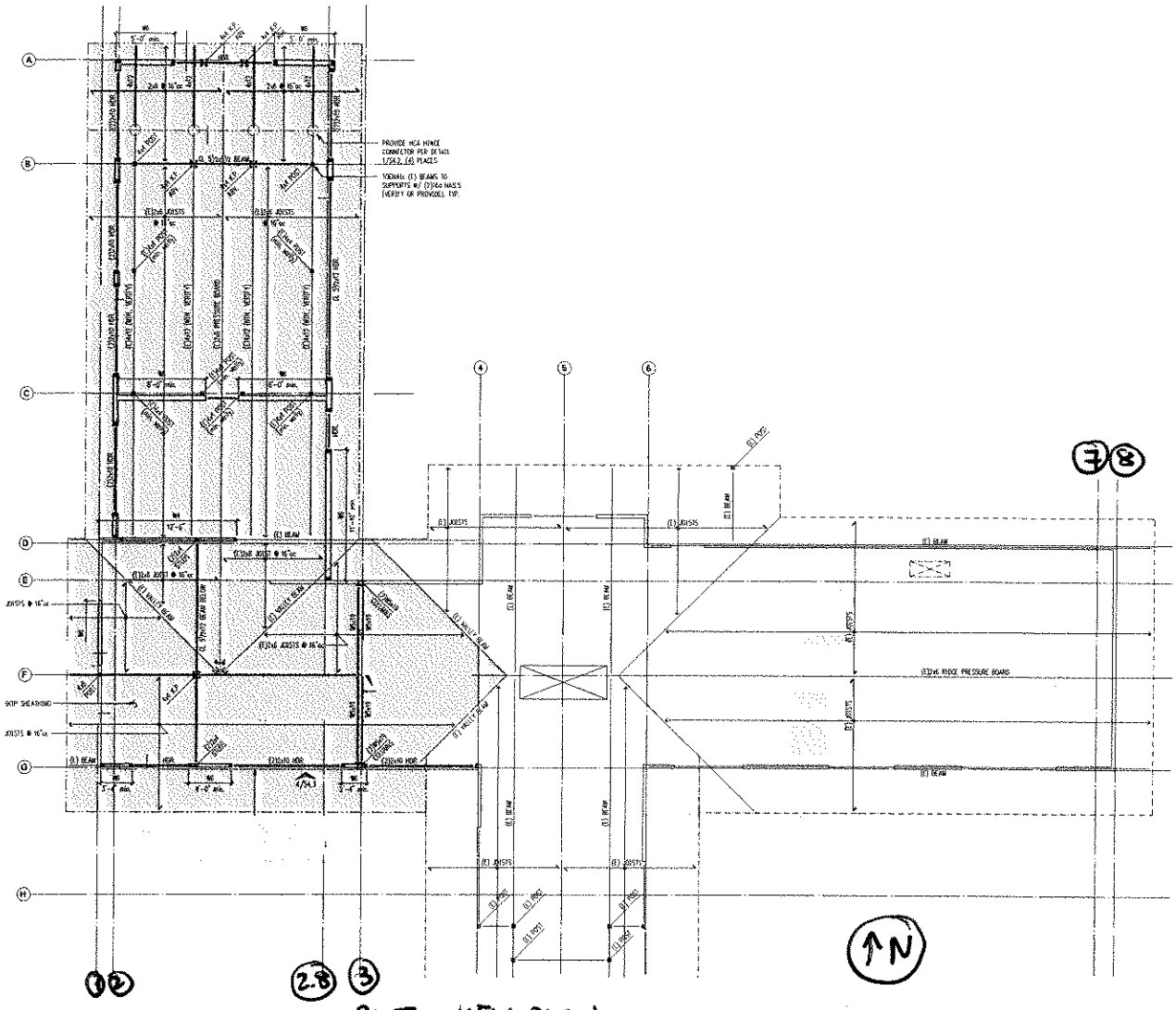
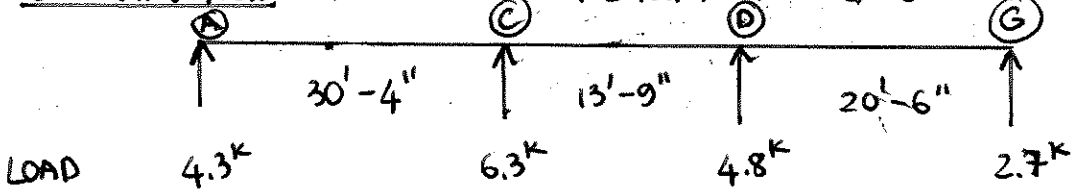
COMBINED (MAIN RESIDENCE & CARPORT)



ROOF KEY PLAN

E-W DIRECTION.

$V = 18.1^K / 64.5\ FT = 281\ PLF$



(★) NEW LINES OF RESISTANCE ARE ADDED ALONG GRID A & C.

(★) GRID D TOTAL SHEARWALL LENGTH REMAIN UNCHANGED.

(★) GRID G HAS SOME NEW OPENINGS BETWEEN GRID 1 & 4 & SW PIERS BETWEEN GRID 1 & 4 ARE MOVED & REARRANGED. EXIST. SW PIERS BETWEEN GRID 4 & 8 REMAIN UNCHANGED. THE TOTAL SW PIERS LENGTH ALONG GRID G ARE THE SAME AS THE ORIGINAL SW LENGTH ALONG GRID G. (31'-9" NEW VS. 31'-9" EXISTING)

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STRUCTURAL ENGINEERING

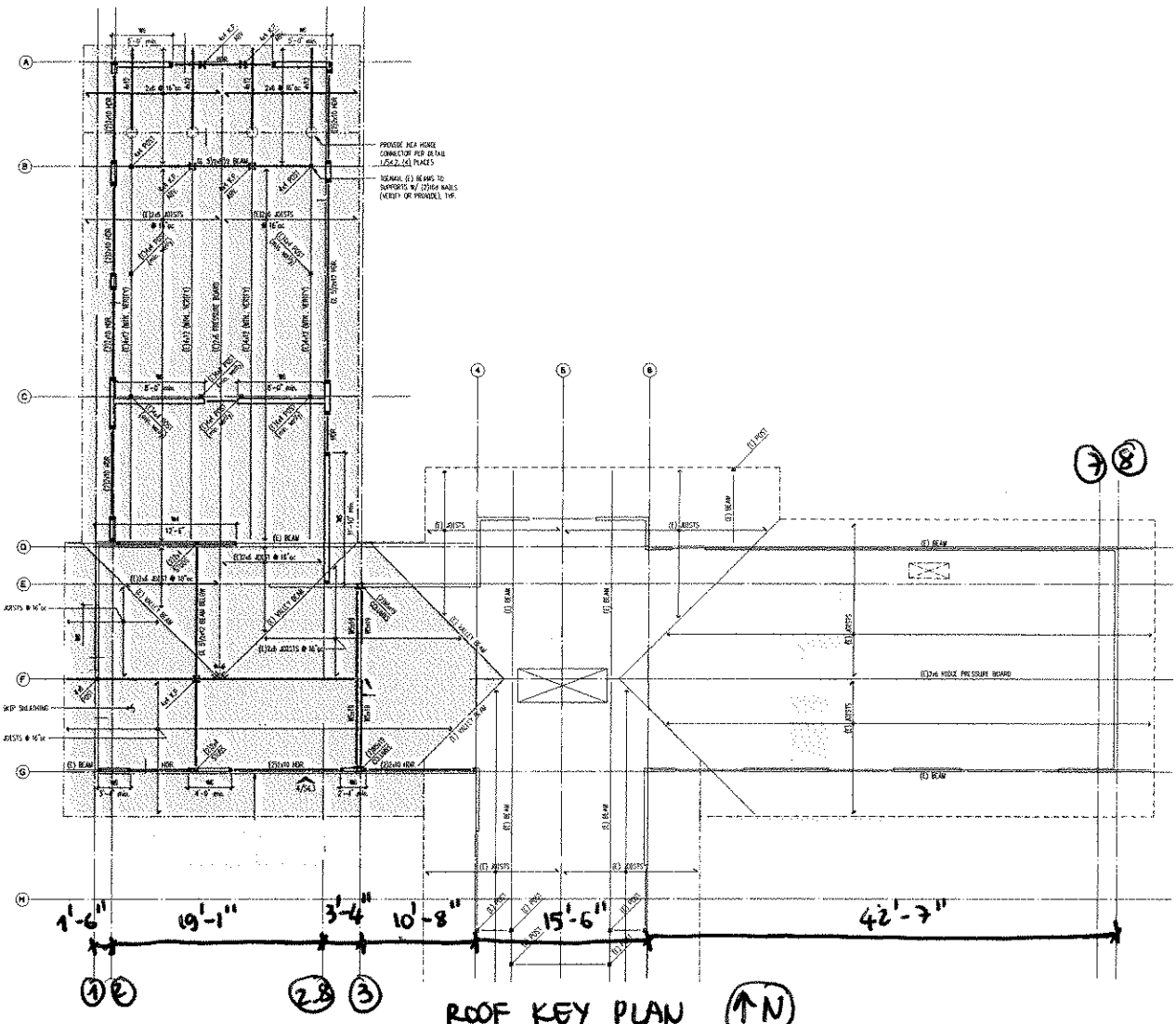
PROJECT: PATHAK REMODEL

DATE: 05.03.24

PROJ #:

DESIGN: LIN

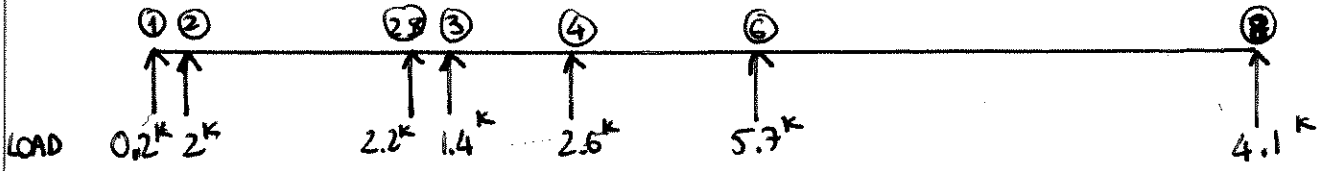
SHEET: 10/107



ROOF KEY PLAN (↑N)

N-S DIRECTION:

$V = 18.1^{K} / 93^{FT} = 195\ PLF$



(1) AT GRID 1, EXIST. MASONRY CHIMNEY IS TO BE REMOVED, & WALL TO BE INFILLED WITH WOOD SHEARWALL.

(A) AT GRID 3, EXIST. INTERIOR WALL IS TO BE REMOVED & REPLACED WITH NEW STEEL MOMENT FRAMES.

(2) ALL OTHER LINES OF RESISTANCE FROM GRID 4 → 8 ON BOTH LEVELS ARE NOT CHANGED OR MODIFIED.

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SSF STRUCTURAL ENGINEERING

PROJECT: PATHAK REMODEL

DATE: 05.03.24

PROJ. #:

DESIGN: LTN

SHEET: 11/107

NOTES:

1. EVEN THOUGH THE MAIN RESIDENCE AND THE CARPORT/ GARAGE ARE CONNECTED AS ONE STRUCTURE; BY INSPECTION, IT IS MORE CONSERVATIVE TO DESIGN THE MAIN RESIDENCE AND CARPORT AS TWO "SEPARATE" STRUCTURES; ESPECIALLY FOR THE DESIGN OF THE NEW STEEL MOMENT FRAMES.

2. THE EXISTING SHEARWALLS ALONG GRIDLINE G (BETWEEN GRIDLINES 1 & 4) ARE BEING REPLACED WITH NEW SHEARWALLS DIRECTLY BELOW THE SHEARWALLS ABOVE.

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Criteria Sheet

Codes

Structural	IBC 2021
Loading	ASCE 7-16
Wood:	NDS 2018 / SDPWS 2021
Steel:	AISC 360-16
Concrete:	ACI 318-19
Masonry:	TMS 402/602-16

Project Location

Street & Number	8541 SE 82nd Street
City:	Mercer Island State: WA
ZIP:	98040
Latitude:	47.5302 N
Longitude:	-122.2242 W
Ground Elevation	315 ft

Occupancy Category

Risk Category: II ASCE 7 Table 1.5-1

Seismic Load Summary:

Analysis Procedure:	Equivalent Lateral Force Procedure		
Lateral System:	Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance		
R:	6.50	C_d=	4
Base Shear V =	23 kips	Ω_o=	2.5
S_S=	1.463	S_1=	0.504
S_{DS}=	0.98	S_{D1}=	0.86
C_s=	0.150	I_E=	1.0

Story Information

# Stories Above Grade (Including Mezzanine Levels)	2

Horizontal and Vertical Irregularities:

Is the building a "Regular Structure"? (No horizontal or vertical irregularities)	No

Wind Load Summary:

V=	98	K_{ZT}=	1.18
Exposure =	C		

Dead Loads:

Roof		Floor	
Cedar Shingles Roofing	2 psf	Finish Floor	2 psf
1/2" plywood	1.75 psf	3/4" Sheathing	2.7 psf
1x4 Skip Sheathing @ 6" OC	1.9 psf	2x8 Joists @ 16" oc	1.8 psf
2x6 Joists @ 16"oc	1.5 psf	Misc./Mech.	1 psf
Misc./Mech.	1 psf	Ceiling Finish	2.5
Ceiling Finish	1.5 psf		10 psf
	9.65 psf	Use	10 psf
Use	10 psf	Add'l Seismic Weight (Partitions)	10 psf
Add'l Seismic Weight (Partitions)	5 psf	Seismic Weight	20 psf
Seismic Weight	15 psf		

Live Loads:

Roof	25	psf
Floor	40	psf
Deck	60	psf

Snow Loading Criteria:

Ground Snow, p_g	25 psf	Flat Roof Snow Load, p_f	25.0 psf	Importance Factor, I_s	1.00
Exposure Factor, C_e	0.90	Sloped Roof Snow Load, p_s	25.0 psf		
Thermal Factor, C_t	1.00	Slope Factor, C_s	0.75		

Soils:

Allowable Bearing	2500 psf	Active	55/35	pcf (Restrained/Unrestrained)
Sliding, μ	0.3	Seismic Surcharge	8H	
Passive	250 pcf			

Soils Report Provided?	Yes
Site Specific Ground Motion Hazard Analysis Provided?	No

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PATHAK REMODEL - MAIN RESIDENCE

Criteria

DATE 5/3/2024

PROJ. #

DESIGN LTN

SHEET 1

Seismic Design

ASCE 7-16 Seismic Analysis | Equivalent Lateral Force Procedure | Apply Section 12.8.1.3 (Where Applicable)? No

Seismic Force Resisting System Per Table 12.2-1		
	System	Bearing Wall Systems
	Type:	Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance

Seismic Design Cat.	D	
Risk Category	II	I, II, or III, or IV per Table 1.5-1
Site Class	D	Per soils report.
Diaphragm Flexibility	Flexible	

Section 12.8.1.3

1. Regular Structure	No
2. ≤ 5 Stories above grade	Yes
3. T ≤ 0.5s	Yes
4. ρ = 1.0	No
5. Not Site Class E or F	Yes
6. Risk Category I or II	Yes

If all items above are met, S_{DS} may be taken as 1.0, but not less than 0.7*(Calculated S_{DS})

S_S	1.463 g	2% in 50 yr, Latitude & Longitude lookup
S_1	0.504 g	2% in 50 yr, Latitude & Longitude lookup
R	6.50	
C_d	4.0	
Ω_o	2.5	
I_e	1.00	Table 1.5-2
h_n	20.5 ft	
Ct	0.02	Table 12.8-2
x	0.75	Table 12.8-2
T_a	0.19 sec	
T	0.19 sec	Eq. 12.8-7
T_0	0.18 sec	
T_S	0.88 sec	
T_L	6.00 sec	
F_a	1.00	Table 11.4-1
F_v	1.70	Table 11.4-2
S_{MS}	1.46 g	Eq. 11.4-1
S_{M1}	1.29 g	Eq. 11.4-2
S_{DS}	0.975 g	Eq. 11.4-3
S_{D1}	0.857 g	Eq. 11.4-4
C_s	***0.150 Controls***	Eq. 12.8-2
	0.684	Eq. 12.8-3 need not exceed, T < T_L
	0.010	Eq. 12.8-5 or 12.8-6 minimum
C_s, design	0.150	
Bldg. Weight	151.3 k	
V = C_SW	22.7 k	Eq. 12.8-1, Strength Level Base Shear
V = C_{Sasd}W	15.9 k	Eq. 12.8-1 ASD Base Shear

Building Period Per Alternate Analysis

T (sec)	

Per Geotech Report

F_a	
F_v	

$$T_a = C_t h_n^x \quad \text{Eq. 12.8.7}$$

$$S_{MS} = F_a S_S \quad \text{Eq. 11.4-1}$$
$$S_{M1} = F_v S_1 \quad \text{Eq. 11.4-2}$$
$$S_{DS} = {}^2/_3\, S_{MS} \quad \text{Eq. 11.4-3}$$
$$S_{D1} = {}^2/_3\, S_{M1} \quad \text{Eq. 11.4-4}$$

$$C_S = \frac{S_{DS}}{(R/I_e)} \quad \text{Eq. 12.8-2}$$
$$C_S = \frac{S_{D1}}{T(R/I_e)} \quad \text{Eq. 12.8-3}$$
$$C_S = \frac{S_{D1} T_L}{T^2(R/I_e)} \quad \text{Eq. 12.8-4}$$
$$C_S \geq 0.044 S_{DS} I_e \quad \text{Eq. 12.8-5}$$
$$C_S \geq 0.01 \quad \text{Eq. 12.8-5}$$
$$C_S \geq 0.5 \frac{S_1}{(R/I_e)} \quad \text{Eq. 12.8-6}$$

$$C_{VX} = w_x h_x^k / \sum_{i=1}^{n} w_x h_i^k \quad \text{Eq. 12.8-12}$$

$$F_{px} = {}^{\sum_{i=x}^{n} F_i}/_{\sum_{i=x}^{n} w_i}\, w_{px} \quad \text{Eq. 12.10-1}$$
$$F_{px} \geq 0.2 S_{DS} I_e w_{px} \quad \text{Eq. 12.10-2}$$
$$F_{px} \leq 0.4 S_{DS} I_e w_{px} \quad \text{Eq. 12.10-3}$$

Vertical Distribution ASD ρ= 1.3 k= 1.000

Level	h_x (ft)	W_x (k)	h_x^k (ft)	$W_x h_x^k$	Story Shear ASD			Diaphragm Force (ρ not included)				
					C_{vx} (%)	F_x (k)	ΣV (k)	$F_{px,calc}$	$F_{px,min}$	$F_{px,max}$	$F_{px,design}$	γ=F_{px}/F_x
Roof	20.5	82.4	20.5	1689	0.754	15.6	**15.6**	12.0	11.3	22.5	**12.0**	0.77
Upper Floor	8.0	68.9	8.0	551	0.246	5.1	**20.7**	7.2	9.4	18.8	**9.4**	1.85
Σ		151.3		2240		**20.7**						

Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method	ASD

Wind Coefficients

Exposure	C	
V=	98	mph
K_d=	0.85	Table 26.6-1
K_h=	0.85	Table 27.3-1
K_e=	0.99	Table 26.9-1
G=	0.85	26.9.4

Location and Building Dimensions

Calculate Kzt?	Yes	
Kzt	1.18	
Roof Type	Gable	
Roof Slope - Transverse Dir	22	degrees
Roof Slope - Long Dir	0	degrees
Ground to top of roof	18	ft
Bot of roof to top of roof	6.5	ft
Mean Roof Height, h	14.75	ft
Short Plan Dimension	27	ft
Long Plan Dimension	98	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft

Transverse Wind Pressures

L/B = 0.28 h/L = 0.55

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-0.38 / 0.06
Leeward Roof	-0.60

Velocity Pressure at Mean Roof Height, q_h =	20.6	psf

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	**P_{walls} (psf)**
0-15	0.85	20.66	14.05	8.77	**13.7**
15-20	0.9	21.88	14.88	8.77	**14.2**
20-25	0.94	22.85	15.54	8.77	**14.6**
25-30	0.98	23.82	16.20	8.77	**15.0**
30-40	1.04	25.28	17.19	8.77	**15.6**
41-50	1.09	26.50	18.02	8.77	**16.1**
51-60	1.13	27.47	18.68	8.77	**16.5**
61-70	1.17	28.44	19.34	8.77	**16.9**
71-80	1.21	29.41	20.00	8.77	**17.3**
81-90	1.24	30.14	20.50	8.77	**17.6**
91-100	1.26	30.63	20.83	8.77	**17.8**

Roof Pressures (Unfactored) ASD

Windward		Leeward	**Horiz Proj (psf)**
Max	Min		
1.1	-6.7	-10.5	**6.97**

Longitudinal Wind Pressures

L/B = 3.63 h/L = 0.15

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.22
Windward Roof	-0.9 / -0.18
Leeward Roof	-0.30

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	**P_{walls} (psf)**
0-15	0.85	20.66	14.05	3.83	**10.73**
15-20	0.9	21.88	14.88	3.83	**11.23**
20-25	0.94	22.85	15.54	3.83	**11.62**
25-30	0.98	23.82	16.20	3.83	**12.02**
30-40	1.04	25.28	17.19	3.83	**12.61**
41-50	1.09	26.50	18.02	3.83	**13.11**
51-60	1.13	27.47	18.68	3.83	**13.51**
61-70	1.17	28.44	19.34	3.83	**13.90**
71-80	1.21	29.41	20.00	3.83	**14.30**
81-90	1.24	30.14	20.50	3.83	**14.60**
91-100	1.26	30.63	20.83	3.83	**14.80**

Roof Pressures (Unfactored) ASD

Windward		Leeward	**Horiz Proj (psf)**
Max	Min		
-3.2	-15.8	-5.3	**4.80**

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MAIN RESIDENCE:

WEST ROOF: (Grids 1 → 4)

Cedar Roofing:	2 PSF
1/2" Plywood Overlay :	1.75 PSF
1x4 Skip Sheathing :	1.9 PSF
2x6 Joists @ 16" oc :	1.4 PSF
Misc. /Mech :	1.0 PSF
Wood Ceiling Finish:	1.5 PSF
Partition :	5 PSF
	15 PSF

EAST ROOF: (Grids 4 → 8)

Cedar Roofing :	2 PSF
1x4 Skip Sheathing :	1.9 PSF
2x6 Joists @ 16" oc :	1.4 PSF
2x8 Ceiling Joist @ 16" oc :	1.8 PSF
Ceiling Finish :	2.5 PSF
Misc /Mech:	0.4 PSF
Partition :	5 PSF
	15 PSF

UPPER FLOOR:

Flooring :	2 PSF
3/4" Plywood Sheathing :	2.7 PSF
2x8 Joist @ 16" oc :	1.8 PSF
Ceiling Finish :	2.5 PSF
Misc/Mech :	1 PSF
Partition :	10 PSF

→ Use 20 PSF

SEISMIC WEIGHT:

ROOF:

- Roof Area = 3200 SF
- Roof Weight = 15 PSF x 3200 SF
  = 48 K
- Center Chimney Weight =
  120 pcf x (8' x 3' − 2 x 1.33' x 1.33') x 14'
  = 34.4 K

$WT_{ROOF} = 48^K + 34.4^K = 82.4^K$

FLOOR:

- Floor Area: 2400 SF
- Floor Weight = 20 PSF x 2400 SF
  = 48 K
- Center Chimney Weight =
  120 PCF x (8' x 3' − 2 x 1.33' x 1.33') x 8.5'
  = 20.9 K

$WT_{FLOOR} = 48^K + 20.9^K = 68.9^K$

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PROJECT: BATHAK REMODEL
MAIN RESIDENCE

DATE: 04.19.24
PROJ. #:
DESIGN: LTN
SHEET: 16/107

MAIN RESIDENCE:

LATERAL DESIGN:

SEISMIC SHEAR: $\rho = 1.3$

$V^{SEISMIC}_{ROOF} = 15.6^{K}$

$V^{SEISMIC}_{UPPER\ FLR.} = 20.7^{K}$

WIND SHEAR: $K_{zt} = 1.19$

N-S DIRECTION:

$V^{WIND\ N-S}_{ROOF} = 11.6\ PSF \times 480\ SF$
$= 5.6^{K}$

$V^{WIND\ N-S}_{UPPER\ FLR.} = 11.2\ PSF \times 350\ SF$
$= 4.0^{K}$

E-W DIRECTION:

$V^{WIND\ E-W}_{ROOF} = 14.6\ PSF \times 900\ SF$
$= 13.2^{K}$

$V^{WIND\ E-W}_{UPPER\ FLR.} = 14.2\ PSF \times 750\ SF$
$= 10.6^{K}$

→ Seismic controls

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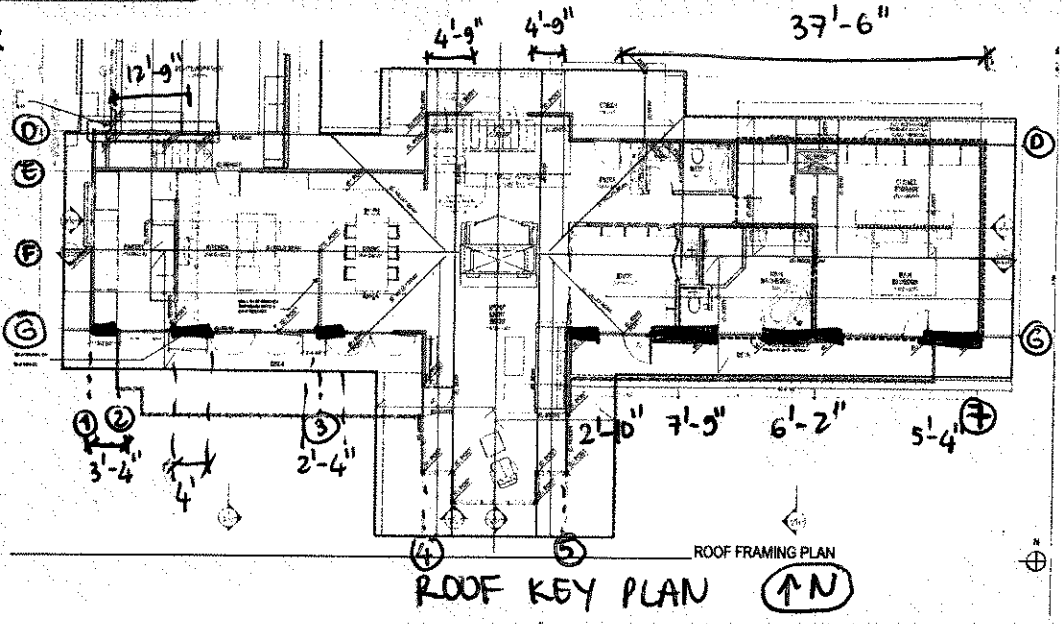
LATERAL DESIGN: MAIN RESIDENCE

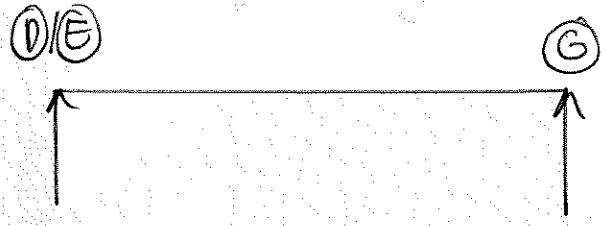
ROOF:



ROOF KEY PLAN (↑N)

EAST - WEST DIRECTION:

ROOF:



LOAD:	7.8^{K}	7.8^{K}
LENGTH	59.75^{FT}	31.75^{FT}
SHEAR	131^{PLF}	246 PLF < 260 PLF
WALL	W6	W6
OT		1968$^{\#}$
0.6DL		123$^{\#}$
Σ =		1842$^{\#}$
HOLDOWN		CS14

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SSF STRUCTURAL ENGINEERING

PROJECT: PATHAK REMODEL MAIN RESIDENCE

DATE: 02/21/24

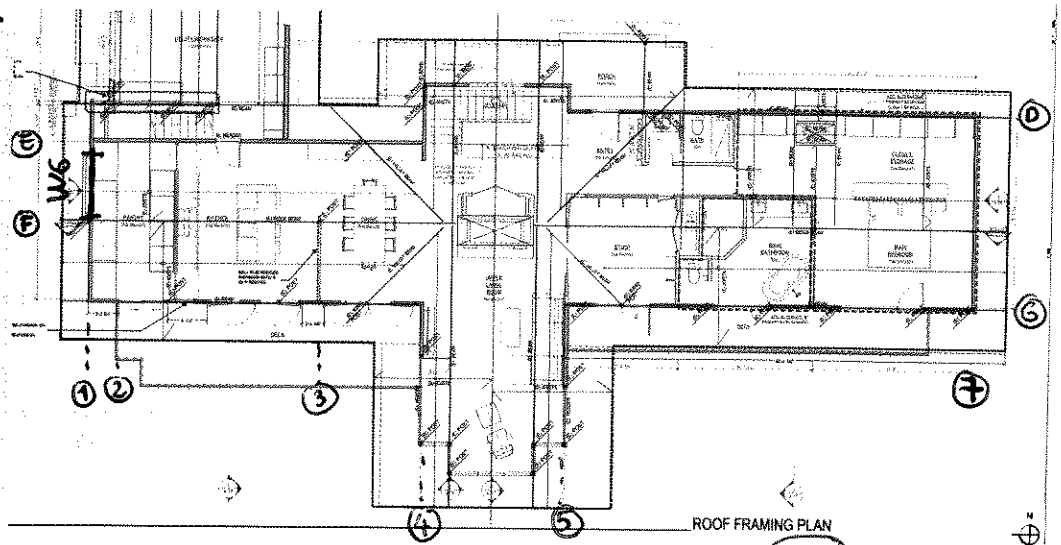
PROJ. #:

DESIGN: LTN

SHEET: 18/107

LATERAL DESIGN: MAIN RESIDENCE

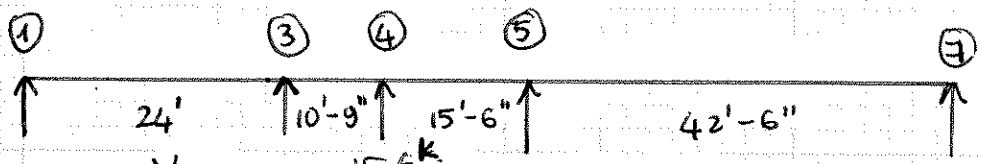
ROOF:



ROOF KEY PLAN (↑N)

N-S DIRECTION:

ROOF:



$v = \frac{V}{span} = \frac{15.6^k}{92.75'} = 168$ PLF

LOAD	2.02^k	2.92^k	2.2^k	4.87^k	3.57^k
	(REMOVE (E) MASONRY CHIMNEY & INFILL W/ WOOD SHEARWALL)	(NEW MOMENT FRAMES TO REPLACE (E) INTERIOR WALL)	NO CHANGE TO EXISTING WALLS/LINES OF RESISTANCE. EXISTING EXTERIOR WALLS ARE W6 SHEARWALLS.		
LENGTH	20.5'	—			
SHEAR	99 PLF	—			
WALL	W6	—			
OT	891#	—			
0.6DL	1200#				
Σ =	309# → NO HOLDOWN REQ'D				

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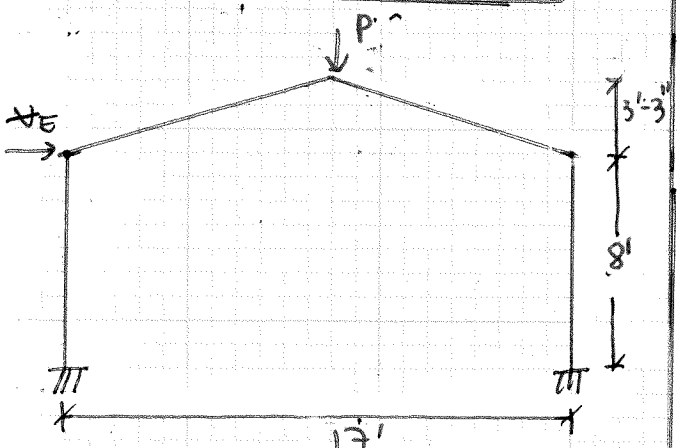
PROJECT: PATHAK REMODEL MAIN RESIDENCE
DATE: 02/21/24
PROJ #:
DESIGN: LTN
SHEET: 19/107

MOMENT FRAMES



ELEVATION VIEW

$V_E = 1.5^k$ ((2) MF's ; each takes $V_E = 1.5^k$)

$P = P_D + P_S$

$P_D = (500\# + 10PSF \times 13' \times 15')/2$
$= (2450\#)/2 = 1225\#$

$P_S = (900\# + 25PSF \times 13' \times 15')/2$
$= (5775\#)/2 = 2890\#$

DRIFT:

$\delta_x = \frac{C_d \times \delta_{xe}}{I_e} = \Delta_i$ (Story Drift)

$h_{xs} = \frac{8' + 11.25'}{2} = 9.625'$

$\Delta_{allow} = \frac{\Delta_a}{\rho}$ (ASCE 7-16 (12.12.1.1)

$= \frac{0.025 h_{xs}}{1.3} = 0.019 h_{xs}$

$= 0.019 \times (9.625' \times 12) = 2.2"$

★) $R = 6.5$; $C_d = 4$

(Light frame bearing wall system w/ wood struct. panel)

$\delta_{xe} = 0.62"$ ($\rho = 1.3$ included)

$\Delta_i = \frac{4 \times (0.62"/1.3)}{1} = 1.91"$

$\Delta_i < \Delta_{allow} = 2.2"$ OK ✓

★ $R = 8$; $C_d = 5.5$

(Special Steel Moment Frame)

$\delta_{xe} = \left(\frac{0.62"}{1.3}\right) \times \frac{6.5}{8}$

$= 0.39"$

$\Delta_i = \frac{5.5 \times 0.39"}{1} = 2.15"$

$\Delta_i < \Delta_{allow} = 2.2"$ OK ✓

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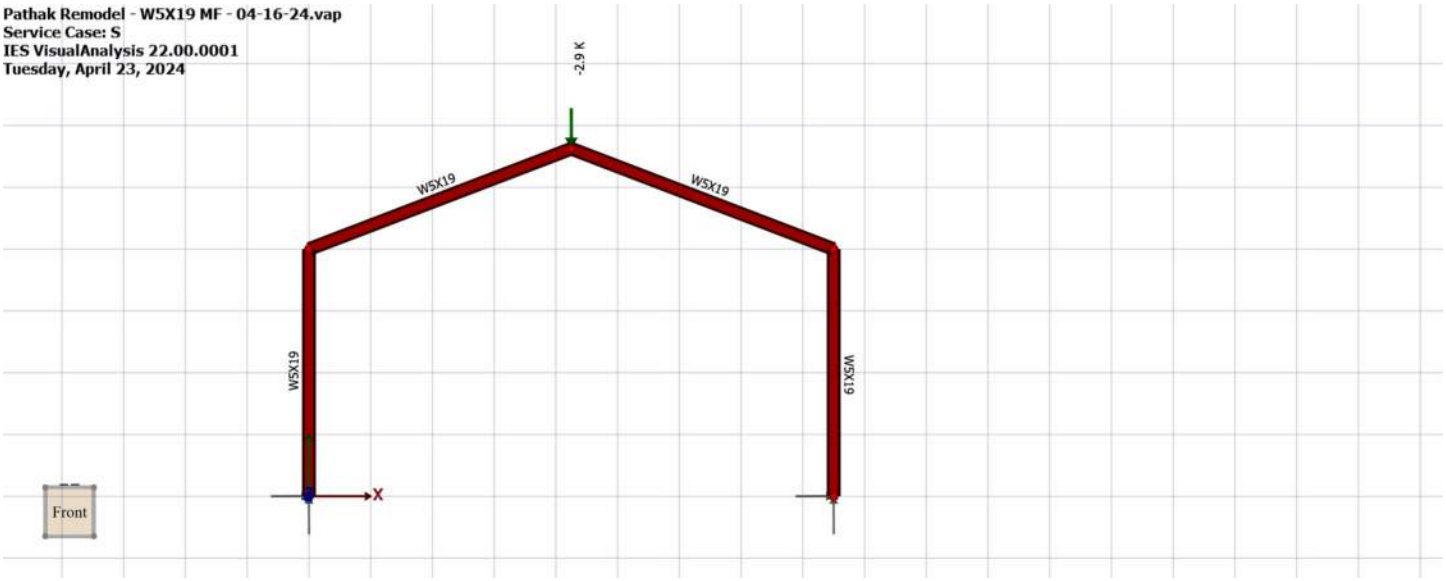


Model Summary

Model Dimensions:
X: 17 ft
Y: 11 ft
Z: 0 ft
Object Counts:
Nodes: 5
Spring Supports: 0
Members: 4
Cables: 0
Areas: 0
Plates: 0
Auto-Meshed Areas: 0
Auto-Meshed Plates: 0
Foundations: 0
Nonlinear Features:
One-Way Spring Supports: 0
One-Way Members: 0

Model Check Information

No errors were found in your model.

Members

Name	Node 1	Node 2	Shape	Material	End Connection	Crossing Connection?	Beta, B deg	Length ft	Weight K	Offset y in	Offset z in	Framing	Action
B1	N002	N003	W5X19	ASTM A992 Grade 50	Rigid Connect	Yes	0.0	9.1	0.2	0.0	0.0	Beam	Normal
B2	N003	N004	W5X19	ASTM A992 Grade 50	Rigid Connect	Yes	0.0	9.1	0.2	0.0	0.0	Beam	Normal
C1	N001	N002	W5X19	ASTM A992 Grade 50	Rigid Connect	Yes	0.0	8.0	0.2	0.0	0.0	Column	Normal
C2	N004	N005	W5X19	ASTM A992 Grade 50	Rigid Connect	Yes	0.0	8.0	0.2	0.0	0.0	Column	Normal

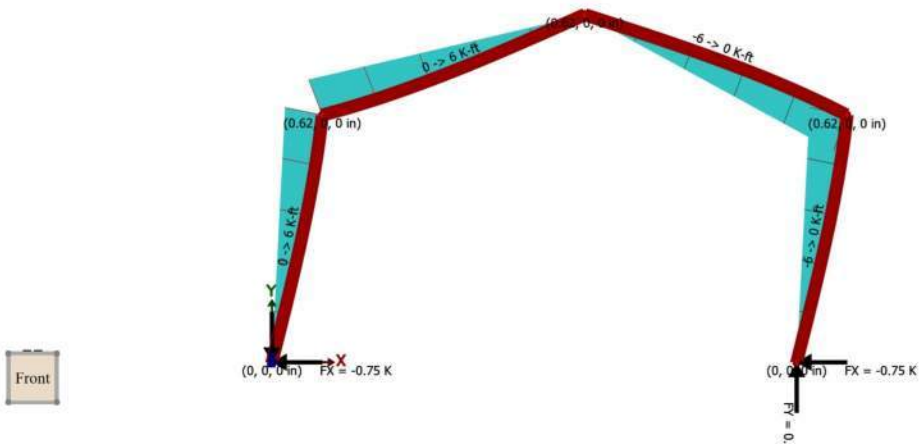
Nodal Supports

Name	Fix DX	Fix DY	Fix RZ
N001	Yes	Yes	No
N005	Yes	Yes	No

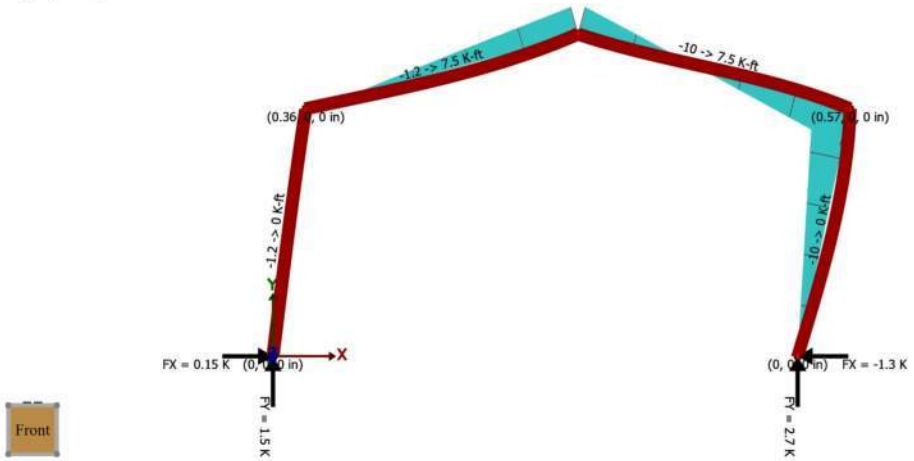
Analysis Information

FEA Model Node Count:5
FEA Model Member Count:4 (4 unique)
FEA Model Degrees of Freedom: 30
FEA Stiffness Matrix Terms: 250
FEA Stiffness Diagonal Maximum: 59716.473899644, Minimum: 388.919229461127
Lowest Frequencies Calculated (Hz) : 3.6, 9.1, 250, 265, 362

Pathak Remodel - W5X19 MF - 04-16-24.vap
Result Case: E+X
IES VisualAnalysis 22.00.0001
Tuesday, April 23, 2024



Pathak Remodel - W5X19 MF - 04-16-24.vap
Result Case: 9. D+0.75(E+S) »+X
IES VisualAnalysis 22.00.0001
Tuesday, April 23, 2024



Member Forces (extreme rows: max and min)

Member	Fx Min K	Fx Max K	Vy K	Vz K	Torsion K-ft	My Min K-ft	My Max K-ft	Mz Min K-ft	Mz Max K-ft
B1	**-1.6 (6)**	0.5 (3)	**1.8 (6)**	0.0 (11)	0.0 (11)	0.0 (11)	0.0 (11)	**-6.8 (6)**	**9.0 (6)**
B2	**-1.6 (6)**	-0.3 (8)	**-1.8 (6)**	0.0 (11)	0.0 (11)	0.0 (11)	0.0 (11)	**-6.9 (9)**	**9.0 (6)**
C1	**-2.4 (6)**	**0.8 (3)**	-0.9 (6)	0.0 (11)	0.0 (11)	0.0 (11)	0.0 (11)	**-6.8 (6)**	**6.0 (3)**
C2	**-2.4 (6)**	**-0.5 (8)**	0.9 (9)	0.0 (11)	0.0 (11)	0.0 (11)	0.0 (11)	**-6.9 (9)**	0.0 (6)

Node Reactions (extreme rows: max and min)

Node	Result Case	FX K	FY K	MZ K-ft
N001	3. D+S	**0.9**	**2.4**	0.0
N001	E+X	-0.8	**-0.8**	0.0
N005	3. D+S	-0.9	**2.4**	0.0
N005	8. D+0.7E »+X	**-0.9**	1.7	0.0

Column Global Drift

Member	Result Case	Total DX in	Drift X in	(Drift X)/L	Total DZ in	Drift Z in	(Drift Z)/L
C2	E+X	0.6	0.6	0.0	0.0	0.0	0.0
C1	E+X	0.6	0.6	0.0	0.0	0.0	0.0
C2	8. D+0.7E »+X	0.5	0.5	0.0	0.0	0.0	0.0
C2	10. 0.6D+0.7E »+X	0.5	0.5	0.0	0.0	0.0	0.0
C1	10. 0.6D+0.7E »+X	0.4	0.4	0.0	0.0	0.0	0.0
C1	8. D+0.7E »+X	0.4	0.4	0.0	0.0	0.0	0.0
C2	3. D+S	0.1	0.1	0.0	0.0	0.0	0.0
C2	4. D+0.75(L+S)	0.1	0.1	0.0	0.0	0.0	0.0
C2	S	0.1	0.1	0.0	0.0	0.0	0.0
C2	1. D	0.0	0.0	0.0	0.0	0.0	0.0
C2	D	0.0	0.0	0.0	0.0	0.0	0.0
C2	7. 0.6D+0.6W	0.0	0.0	0.0	0.0	0.0	0.0
C1	7. 0.6D+0.6W	0.0	0.0	0.0	0.0	0.0	0.0
C1	1. D	0.0	0.0	0.0	0.0	0.0	0.0
C1	D	0.0	0.0	0.0	0.0	0.0	0.0
C1	S	-0.1	0.1	0.0	0.0	0.0	0.0
C1	4. D+0.75(L+S)	-0.1	0.1	0.0	0.0	0.0	0.0
C1	3. D+S	-0.1	0.1	0.0	0.0	0.0	0.0

MF Columns: Results

Deflections	Axial	Size Constraints
Strong (dy): None Weak (dz): None	Manual Kz: False Kz Sidesway?: False Manual Ky: False Ky Sidesway?: False	Limit Depth?: False Limit Width?: False

MF Columns: Results (continued)

Overrides Override Fy?: False Override Cb?: False Override HSS t_des?: False Advanced Torsion: False		
Steel Material: ASTM A992 Grade 50 Specification: AISC 360-16 ASD Composite Beam?: False Seismic Compactness: Highly Ductile Material Ry: 1.1 Check Constrained Axis FTB?: False Overstrength?: False Live Load Reduction: None Disable Checks?: False Check Level: All	Bracing Lateral Top (+y): Unbraced Lateral Bottom (-y): Unbraced Strong (z): Unbraced	Torsional Bracing Lateral Top (+y): True Lateral Bottom (-y): True Strong (z): True

MF Columns: Combined Torsion Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand	Capacity	Code Reference	Unity Check	Details
C1	W5X19	0.0	1. D	0.0	1.0	H3-7 and H3-8	**0.0**	Combined Torsion Check Skipped, Torsion Unity < 0.10
C2	W5X19	0.0	1. D	0.0	1.0	H3-7 and H3-8	**0.0**	Combined Torsion Check Skipped, Torsion Unity < 0.10

MF Columns: Torsion Shear Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand Tau Ksi	Capacity Tau Ksi	Code Reference	Unity Check	Details
C1	W5X19	0.0	1. D	0.0	18.0	H3-8	**0.0**	Tr = 0 K-ft, Venant Shear = 0 Ksi
C2	W5X19	0.0	1. D	0.0	18.0	H3-8	**0.0**	Tr = 0 K-ft, Venant Shear = 0 Ksi

MF Columns: Combined Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand	Capacity	Code Reference	Unity Check	Details
C1	W5X19	8.0	3. D+S	0.2	1.0	H1-1b	**0.2**	KLz = 8 ft, KLy = 8 ft, KL(torsion) = 8 ft, Lb = 8 ft, Axial Unity = 0.02, Mz Unity = 0.24, My Unity = 0, Kz = 1, Ky = 1, K(torsion) = 1, Cb = 1.7
C2	W5X19	0.0	3. D+S	0.2	1.0	H1-1b	**0.2**	KLz = 8 ft, KLy = 8 ft, KL(torsion) = 8 ft, Lb = 8 ft, Axial Unity = 0.02, Mz Unity = 0.24, My Unity = 0, Kz = 1, Ky = 1, K(torsion) = 1, Cb = 1.7

MF Columns: Axial Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand Fx K	Capacity Fx K	Code Reference	Unity Check	Details
C1	W5X19	0.0	3. D+S	2.4	110.4	E3-2	**0.0**	KLz = 8 ft, KLy = 8 ft, KL(torsion) = 8 ft, Fcr = 33 Ksi, Fe (E3-4) = 51 Ksi, Kz = 1, Ky = 1, K(torsion) = 1
C2	W5X19	8.0	3. D+S	2.4	110.4	E3-2	**0.0**	KLz = 8 ft, KLy = 8 ft, KL(torsion) = 8 ft, Fcr = 33 Ksi, Fe (E3-4) = 51 Ksi, Kz = 1, Ky = 1, K(torsion) = 1

MF Columns: Strong Flexure Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand Mz K-ft	Capacity Mz K-ft	Code Reference	Unity Check	Details
C2	W5X19	0.0	8. D+0.7E »+X	-6.9	28.9	F2-1	**0.2**	Lb = 8 ft, Cb = 1.7

MF Columns: Strong Shear Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand Vy K	Capacity Vy K	Code Reference	Unity Check	Details
C2	W5X19	0.0	8. D+0.7E »+X	0.9	27.8	G2-1	**0.0**	Shear Area = 1.4 in^2, Cv = 1, h/tw = 14

MF Columns: Weak Shear Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand Vz K	Capacity Vz K	Code Reference	Unity Check	Details
C1	W5X19	0.0	1. D	0.0	77.7	G6-1	**0.0**	Shear Area = 4.3 in^2, Cv = 1
C2	W5X19	0.0	1. D	0.0	77.7	G6-1	**0.0**	Shear Area = 4.3 in^2, Cv = 1

MF Columns: Seismically Compact Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Width/Thickness	λ_seismic	Code Reference	Unity Check	Details
C1	W5X19	0.0	1. D	5.8	7.3	Table D1.1 Seismic	**0.8**	Ry = 1.1
C2	W5X19	0.0	1. D	5.8	7.3	Table D1.1 Seismic	**0.8**	Ry = 1.1

MF Beams: Results

Deflections Strong (dy): None Weak (dz): None	Axial Manual Kz: False Kz Sidesway?: False Manual Ky: False Ky Sidesway?: False	Size Constraints Limit Depth?: False Limit Width?: False
Overrides Override Fy?: False Override Cb?: False Override HSS t_des?: False Advanced Torsion: False		

MF Beams: Results (continued)

Steel Material: ASTM A992 Grade 50 Specification: AISC 360-16 ASD Composite Beam?: False Seismic Compactness: Highly Ductile Material Ry: 1.1 Check Constrained Axis FTB?: False Overstrength?: False Live Load Reduction: None Disable Checks?: False Check Level: All	Bracing Lateral Top (+y): Unbraced Lateral Bottom (-y): Unbraced Strong (z): Unbraced	Torsional Bracing Lateral Top (+y): True Lateral Bottom (-y): True Strong (z): True

MF Beams: Combined Torsion Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand	Capacity	Code Reference	Unity Check	Details
B1	W5X19	0.0	1. D	0.0	1.0	H3-7 and H3-8	**0.0**	Combined Torsion Check Skipped, Torsion Unity < 0.10
B2	W5X19	0.0	1. D	0.0	1.0	H3-7 and H3-8	**0.0**	Combined Torsion Check Skipped, Torsion Unity < 0.10

MF Beams: Torsion Shear Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand Tau Ksi	Capacity Tau Ksi	Code Reference	Unity Check	Details
B1	W5X19	0.0	1. D	0.0	18.0	H3-8	**0.0**	Tr = 0 K-ft, Venant Shear = 0 Ksi
B2	W5X19	0.0	1. D	0.0	18.0	H3-8	**0.0**	Tr = 0 K-ft, Venant Shear = 0 Ksi

MF Beams: Combined Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand	Capacity	Code Reference	Unity Check	Details
B1	W5X19	9.1	3. D+S	0.3	1.0	H1-1b	**0.3**	KLz = 9.1 ft, KLy = 9.1 ft, KL(torsion) = 9.1 ft, Lb = 9.1 ft, Axial Unity = 0.02, Mz Unity = 0.31, My Unity = 0, Kz = 1, Ky = 1, K(torsion) = 1, Cb = 2.2
B2	W5X19	0.0	3. D+S	0.3	1.0	H1-1b	**0.3**	KLz = 9.1 ft, KLy = 9.1 ft, KL(torsion) = 9.1 ft, Lb = 9.1 ft, Axial Unity = 0.02, Mz Unity = 0.31, My Unity = 0, Kz = 1, Ky = 1, K(torsion) = 1, Cb = 2.2

MF Beams: Axial Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand Fx K	Capacity Fx K	Code Reference	Unity Check	Details
B1	W5X19	0.0	3. D+S	1.6	97.9	E3-2	**0.0**	KLz = 9.1 ft, KLy = 9.1 ft, KL(torsion) = 9.1 ft, Fcr = 29 Ksi, Fe (E3-4) = 39 Ksi, Kz = 1, Ky = 1, K(torsion) = 1
B2	W5X19	9.1	3. D+S	1.6	97.9	E3-2	**0.0**	KLz = 9.1 ft, KLy = 9.1 ft, KL(torsion) = 9.1 ft, Fcr = 29 Ksi, Fe (E3-4) = 39 Ksi, Kz = 1, Ky = 1, K(torsion) = 1

MF Beams: Strong Flexure Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand Mz K-ft	Capacity Mz K-ft	Code Reference	Unity Check	Details
B1	W5X19	9.1	3. D+S	9.0	28.9	F2-1	**0.3**	Lb = 9.1 ft, Cb = 2.2
B2	W5X19	0.0	3. D+S	9.0	28.9	F2-1	**0.3**	Lb = 9.1 ft, Cb = 2.2

MF Beams: Strong Shear Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand Vy K	Capacity Vy K	Code Reference	Unity Check	Details
B1	W5X19	0.0	3. D+S	1.8	27.8	G2-1	**0.1**	Shear Area = 1.4 in^2, Cv = 1, h/tw = 14
B2	W5X19	9.1	3. D+S	-1.8	27.8	G2-1	**0.1**	Shear Area = 1.4 in^2, Cv = 1, h/tw = 14

MF Beams: Weak Shear Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Demand Vz K	Capacity Vz K	Code Reference	Unity Check	Details
B1	W5X19	0.0	1. D	0.0	77.7	G6-1	**0.0**	Shear Area = 4.3 in^2, Cv = 1
B2	W5X19	0.0	1. D	0.0	77.7	G6-1	**0.0**	Shear Area = 4.3 in^2, Cv = 1

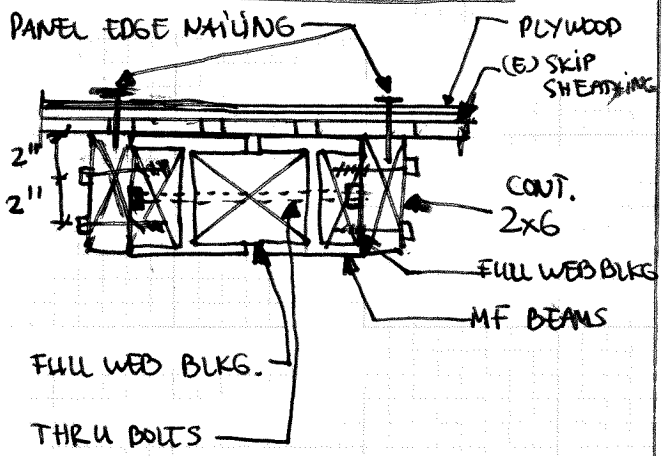
MF Beams: Seismically Compact Check (extreme rows: max)

Member	Section	Offset ft	Result Case	Width/Thickness	λ_seismic	Code Reference	Unity Check	Details
B1	W5X19	0.0	1. D	5.8	7.3	Table D1.1 Seismic	**0.8**	Ry = 1.1
B2	W5X19	0.0	1. D	5.8	7.3	Table D1.1 Seismic	**0.8**	Ry = 1.1

Member Unity Checks

Member	Section	Unity Check	Status	Result Case	Code Reference	Type	Design Group
B1	W5X19	0.8	Pass	9. D+0.75(E+S) »+X	Table D1.1 Seismic	Seismically Compact Check	MF Beams
B2	W5X19	0.8	Pass	9. D+0.75(E+S) »+X	Table D1.1 Seismic	Seismically Compact Check	MF Beams
C1	W5X19	0.8	Pass	9. D+0.75(E+S) »+X	Table D1.1 Seismic	Seismically Compact Check	MF Columns
C2	W5X19	0.8	Pass	9. D+0.75(E+S) »+X	Table D1.1 Seismic	Seismically Compact Check	MF Columns

MOMENT FRAME CONNECTION:



- Diaphragm to Cont. 2x6:

$V_E = 1.5^K$ (per MF)

Beam length $= 9^{FT} \times 2 = 18^{FT}$

$v_E = \frac{1.5^K}{18^{FT}} = 83$ PLF

Panel Edge Nailing = 10d @ 6" oc (Unblocked)

$v_{n,diap.} = 530$ PLF / 2.8 [ASD]
$= 189$ PLF $> v_E$ OK ✓

→ Use 10d @ 6" oc Panel Edge Nailing

- Cont. 2x6 to Full web Blocking:
SDS 1/4" ϕ x 3"

$v'_{SDS,ASD} = C_D \times v_{allow}$
$= 1.6 \times 200$ #/SCREW
$= 320$ #/SCREW

Use (2) Row of SDS @ 12" oc (staggered)

$v_{SCREW} = 320^{\#/SCREWS} \times 1^{\frac{SCREWS}{FT}}$
$= 320^{PLF} > 89$ PLF
OK ✓

- Threaded Rod to MF beam
5/8" ϕ Bolt

$Z'_{\perp} = C_D \times Z_{\perp} = 1.6 \times 920^{\#}$
$= 1472^{\#}$/BOLT

Use (6) 5/8" ϕ Threaded Rods
[(3) EA. SIDE OF (4)]

$V_{A.B.} = 6 \times 1472^{\#} = 8.8^K$
$> V_E = 1.5^K$
OK ✓

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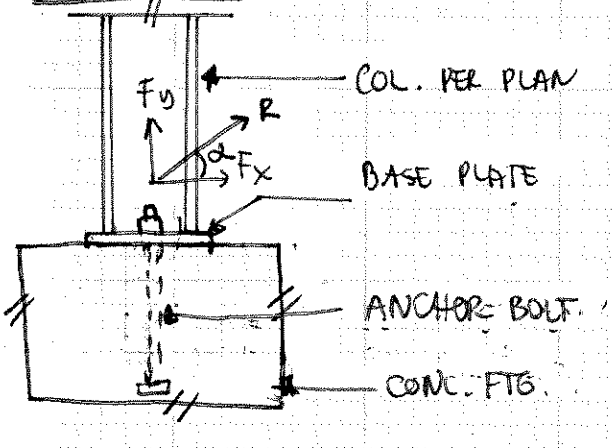
STRUCTURAL ENGINEERING

PROJECT: BATHAK REMODEL
MAIN RESIDENCE

DATE: 04.17.24
PROJ. #:
DESIGN: LTN
SHEET: 29/107

MOMENT FRAME (GRID 3): (cont.)

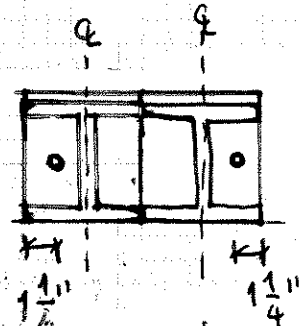
@ DECK SIDE:



WORST CASES: + compression ; - tension

① $F_x = 0.75^k$; $F_y = \pm 0.8^k$
(Earthquake only)

② $F_x = .1.3^k$; $F_y = 2.7^k$
(D + 0.75E + 0.75S)



PLAN VIEW

Base Plate: PL 3/8" x 5" x 5 1/2"

$$A_{req} = \frac{P \times 1.4 \text{ (ASD to LRFD)}}{0.65 \times 0.85 \times f'_c}$$

$$= \frac{2.7^k \times 1.4}{0.65 \times 0.85 \times 2.5 ksi} = 2.8 in^2$$

$A_{prov.} = 5" \times 5\frac{1}{2}" = 27.5 in^2$

$A_{prov.} > A_{brg.\ req}$ OK ✓

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SSF STRUCTURAL ENGINEERING

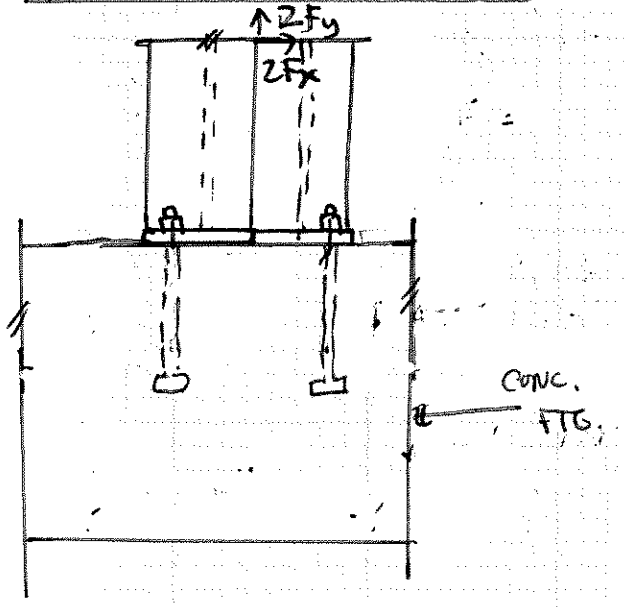
PROJECT: PATHAK RESIDENCE
MAIN RESIDENCE

DATE: 04/16/24
PROJ. #:
DESIGN: LTN
SHEET: 30/107

MOMENT FRAME CONNECTION: (CONT.)

@ DECK SIDE.

6x BLKG. INTO GL BEAM:



ELEV.

EMBED THRD. ROD A.B. INTO CONC FTG:

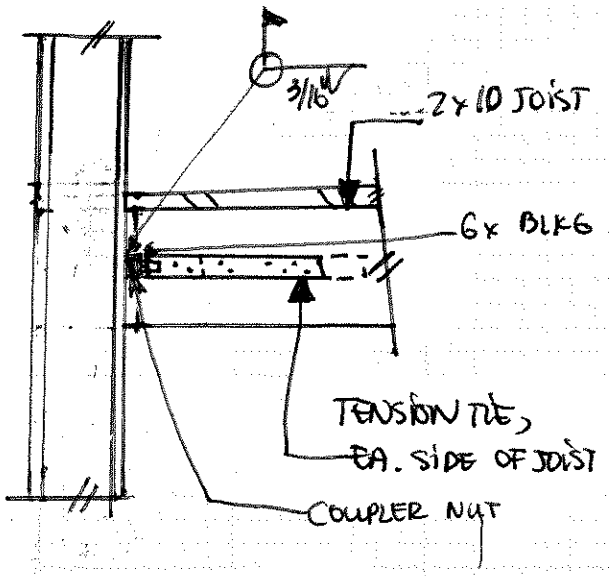
5/8" ϕ x 7" EMBED

$F_x^{LRFD} = 1.4 \times 0.75^K = 1.05^K$

$F_y^{LRFD} = 1.4 \times 0.8^K = 1.12^K$

OK ✓

[See Hilti Report]



SECTION

TENSION TIES (2) LTTP2 w/ 5/8" ϕ A.B.

Tallow = 2* 2135 # = 4270 #

> 1500 # OK ✓

Weld: Coupler Nut to Col. Flange

$\frac{r_n}{\Omega} = \left(0.6 \times 70\,ksi \times \frac{3}{16}" \times 0.707 \times 5/8"\right)/2$

$= 1.74^K$ Per Coupler Nut

$\frac{R_n}{\Omega} = 1.74^K \times 2 = 3.5^K > 1500\,\#$

OK ✓

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STRUCTURAL ENGINEERING

PROJECT: PATHAK REMODEL MAIN RESIDENCE

DATE: 04.22.24

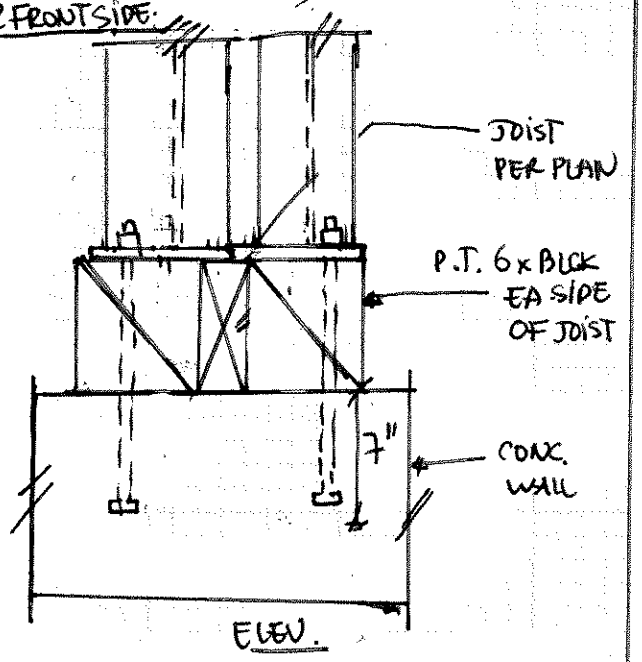
PROJ. #: LTN

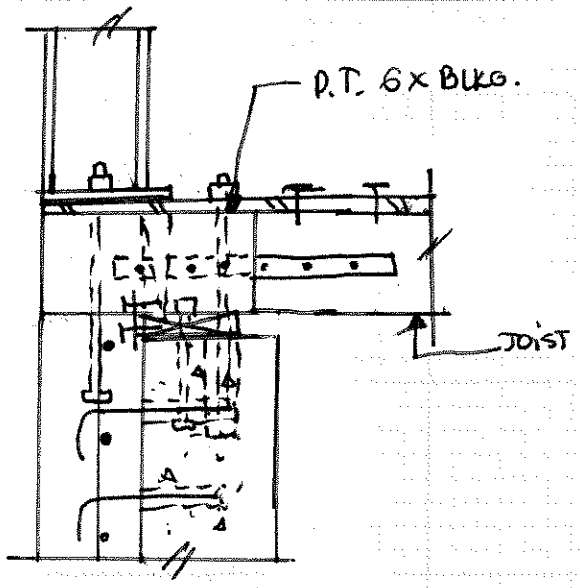
DESIGN:

SHEET: 31/107

MOMENT FRAME (CONT.):

@FRONT SIDE:





STRAP: MSTI26, EA. BLKG TO JOIST

EA STRAP
$T_{allow} = 2745^{\#} > 750^{\#}$ OK ✓

EMBED THRD. ROD A,B, INTO CONC. WALL: 5/8" ϕ x 7" EMBED

$F_x^{LRFD} = 1.4 \times 0.75^{k} = 1.05^{k}$

$F_y^{LRFD} = 1.4 \times 0.8^{k} = 1.12^{k}$

→ OK ✓

(See Hilti Report)

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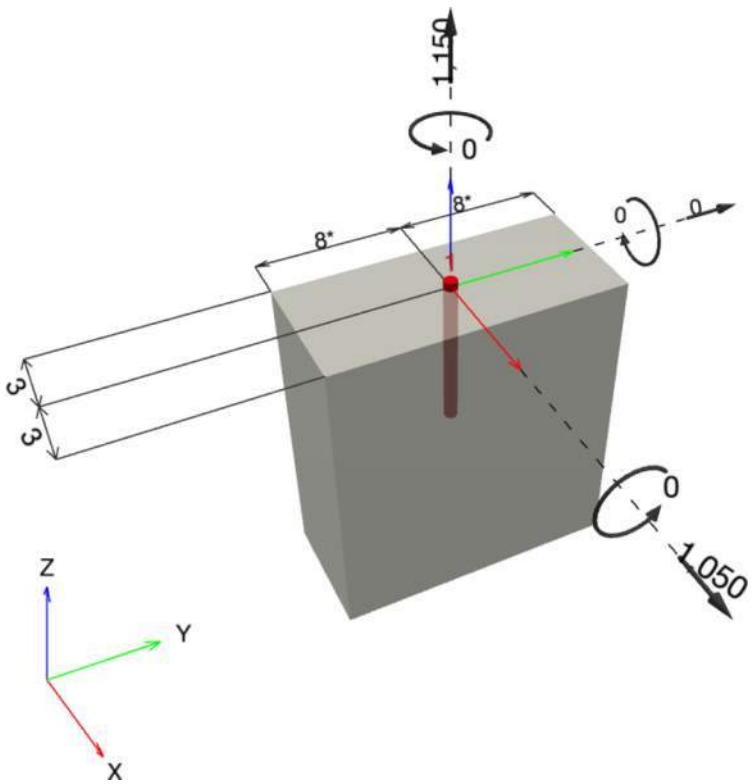
Company:	SSF STRUCTURAL ENGINEERING	Page:	1
Address:	2124 3RD AVE, SEATTLE, WA 98121	Specifier:	LAN NGUYEN
Phone I Fax:	2069563713 |	E-Mail:	LNGUYEN@SSFENGINEERS.COM
Design:	MF COL A.B. TO CONC. WALL (DETAIL 7/S4.3)	Date:	4/29/2024
Fastening point:			

Specifier's comments:

1 Input data

Anchor type and diameter:	**Hex Head ASTM F 1554 GR. 36 5/8**
Item number:	not available
Effective embedment depth:	h_{ef} = 7.000 in.
Material:	ASTM F 1554
Evaluation Service Report:	Hilti Technical Data
Issued I Valid:	- | -
Proof:	Design Method ACI 318-14 / CIP
Stand-off installation:	
Profile:	
Base material:	cracked concrete, 2500, f_c' = 2,500 psi; h = 18.000 in.
Reinforcement:	tension: condition B, shear: condition B; edge reinforcement: none or < No. 4 bar

Geometry [in.] & Loading [lb, ft.lb]



Company:	SSF STRUCTURAL ENGINEERING	Page:	2
Address:	2124 3RD AVE, SEATTLE, WA 98121	Specifier:	LAN NGUYEN
Phone I Fax:	2069563713 |	E-Mail:	LNGUYEN@SSFENGINEERS.COM
Design:	MF COL A.B. TO CONC. WALL (DETAIL 7/S4.3)	Date:	4/29/2024
Fastening point:			

1.1 Design results

Case	Description	Forces [lb] / Moments [ft.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 1,150; V_x = 1,050; V_y = 0; M_x = 0.000; M_y = 0.000; M_z = 0.000;	no	73

2 Load case/Resulting anchor forces

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	1,150	1,050	1,050	0

3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	1,150	9,831	12	OK
Pullout Strength*	1,150	6,356	19	OK
Concrete Breakout Failure**	1,150	3,152	37	OK
Concrete Side-Face Blowout, direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (anchors in tension)

Company:	SSF STRUCTURAL ENGINEERING	Page:	3
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Design:	MF COL A.B. TO CONC. WALL (DETAIL 7/S4.3)	Date:	4/29/2024
Fastening point:			

3.1 Steel Strength

$N_{sa} = A_{se,N} f_{uta}$ ACI 318-14 Eq. (17.4.1.2)
$\phi N_{sa} \geq N_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

$A_{se,N}$ [in.^{2}]	f_{uta} [psi]
0.23	58,000

Calculations

N_{sa} [lb]
13,108

Results

N_{sa} [lb]	ϕ_{steel}	ϕN_{sa} [lb]	N_{ua} [lb]
13,108	0.750	9,831	1,150

3.2 Pullout Strength

$N_{pN} = \psi_{c,p} N_p$ ACI 318-14 Eq. (17.4.3.1)
$N_p = 8 A_{brg} f'_c$ ACI 318-14 Eq. (17.4.3.4)
$\phi N_{pN} \geq N_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

$\psi_{c,p}$	A_{brg} [in.^{2}]	λ_a	f'_c [psi]
1.000	0.45	1.000	2,500

Calculations

N_p [lb]
9,080

Results

N_{pn} [lb]	$\phi_{concrete}$	ϕN_{pn} [lb]	N_{ua} [lb]
9,080	0.700	6,356	1,150

Company:	SSF STRUCTURAL ENGINEERING	Page:	4
Address:	2124 3RD AVE, SEATTLE, WA 98121	Specifier:	LAN NGUYEN
Phone I Fax:	2069563713 |	E-Mail:	LNGUYEN@SSFENGINEERS.COM
Design:	MF COL A.B. TO CONC. WALL (DETAIL 7/S4.3)	Date:	4/29/2024
Fastening point:			

3.3 Concrete Breakout Failure

$N_{cb} = \left(\frac{A_{Nc}}{A_{Nc0}}\right) \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b$ — ACI 318-14 Eq. (17.4.2.1a)

$\phi N_{cb} \geq N_{ua}$ — ACI 318-14 Table 17.3.1.1

A_{Nc} see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)

$A_{Nc0} = 9 h_{ef}^2$ — ACI 318-14 Eq. (17.4.2.1c)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5h_{ef}}\right) \leq 1.0$ — ACI 318-14 Eq. (17.4.2.5b)

$\psi_{cp,N} = \text{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}}\right) \leq 1.0$ — ACI 318-14 Eq. (17.4.2.7b)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ — ACI 318-14 Eq. (17.4.2.2a)

Variables

h_{ef} [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f'_c [psi]
5.333	3.000	1.000	-	24	1.000	2,500

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
96.00	256.00	0.813	1.000	14,780

Results

N_{cb} [lb]	$\phi_{concrete}$	ϕN_{cb} [lb]	N_{ua} [lb]
4,503	0.700	3,152	1,150

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Design:	MF COL A.B. TO CONC. WALL (DETAIL 7/S4.3)	Date:	4/29/2024
Fastening point:			

4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi$ V_n	Status
Steel Strength*	1,050	5,112	21	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	1,050	6,305	17	OK
Concrete edge failure in direction x+**	1,050	1,525	69	OK

* highest loaded anchor **anchor group (relevant anchors)

4.1 Steel Strength

$V_{sa} = 0.6\ A_{se,V}\ f_{uta}$ ACI 318-14 Eq. (17.5.1.2b)
$\phi\ V_{steel} \geq V_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [psi]
0.23	58,000

Calculations

V_{sa} [lb]
7,865

Results

V_{sa} [lb]	ϕ_{steel}	$\phi\ V_{sa}$ [lb]	V_{ua} [lb]
7,865	0.650	5,112	1,050

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Design:	MF COL A.B. TO CONC. WALL (DETAIL 7/S4.3)	Date:	4/29/2024
Fastening point:			

4.2 Pryout Strength

$V_{cp} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \right]$ ACI 318-14 Eq. (17.5.3.1a)

$\phi V_{cp} \geq V_{ua}$ ACI 318-14 Table 17.3.1.1

A_{Nc} see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)

$A_{Nc0} = 9 h_{ef}^2$ ACI 318-14 Eq. (17.4.2.1c)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0$ ACI 318-14 Eq. (17.4.2.5b)

$\psi_{cp,N} = \text{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0$ ACI 318-14 Eq. (17.4.2.7b)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ ACI 318-14 Eq. (17.4.2.2a)

Variables

k_{cp}	h_{ef} [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
2	5.333	3.000	1.000

c_{ac} [in.]	k_c	λ_a	f'_c [psi]
∞	24	1.000	2,500

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
96.00	256.00	0.813	1.000	14,780

Results

V_{cp} [lb]	$\phi_{concrete}$	ϕV_{cp} [lb]	V_{ua} [lb]
9,007	0.700	6,305	1,050

Company:	SSF STRUCTURAL ENGINEERING	Page:	7
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Design:	MF COL A.B. TO CONC. WALL (DETAIL 7/S4.3)	Date:	4/29/2024
Fastening point:			

4.3 Concrete edge failure in direction x+

$V_{cb} = \left(\frac{A_{Vc}}{A_{Vc0}}\right) \psi_{ed,V} \psi_{c,V} \psi_{h,V} \psi_{parallel,V} V_b$ — ACI 318-14 Eq. (17.5.2.1a)

$\phi V_{cb} \geq V_{ua}$ — ACI 318-14 Table 17.3.1.1

A_{Vc} see ACI 318-14, Section 17.5.2.1, Fig. R 17.5.2.1(b)

$A_{Vc0} = 4.5 c_{a1}^2$ — ACI 318-14 Eq. (17.5.2.1c)

$\psi_{ed,V} = 0.7 + 0.3\left(\frac{c_{a2}}{1.5c_{a1}}\right) \leq 1.0$ — ACI 318-14 Eq. (17.5.2.6b)

$\psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0$ — ACI 318-14 Eq. (17.5.2.8)

$V_b = \left(7\left(\frac{l_e}{d_a}\right)^{0.2}\sqrt{d_a}\right) \lambda_a \sqrt{f_c'} c_{a1}^{1.5}$ — ACI 318-14 Eq. (17.5.2.2a)

Variables

c_{a1} [in.]	c_{a2} [in.]	$\psi_{c,V}$	h_a [in.]	l_e [in.]
3.000	8.000	1.000	18.000	5.000

λ_a	d_a [in.]	f_c' [psi]	$\psi_{parallel,V}$
1.000	0.625	2,500	1.000

Calculations

A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]	$\psi_{ed,V}$	$\psi_{h,V}$	V_b [lb]
40.50	40.50	1.000	1.000	2,179

Results

V_{cb} [lb]	$\phi_{concrete}$	ϕV_{cb} [lb]	V_{ua} [lb]
2,179	0.700	1,525	1,050

5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.365	0.688	5/3	73	OK

$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} <= 1$

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Design:	MF COL A.B. TO CONC. WALL (DETAIL 7/S4.3)	Date:	4/29/2024
Fastening point:			

6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- For additional information about ACI 318 strength design provisions, please go to https://submittals.us.hilti.com/PROFISAnchorDesignGuide/

Fastening meets the design criteria!

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Design:	MF COL A.B. TO CONC. WALL (DETAIL 7/S4.3)	Date:	4/29/2024
Fastening point:			

7 Installation data

Anchor type and diameter: Hex Head ASTM F 1554 GR. 36 5/8

Profile: -

Item number: not available

Hole diameter in the fixture: -

Maximum installation torque: -

Plate thickness (input): -

Hole diameter in the base material: - in.

Hole depth in the base material: 7.000 in.

Minimum thickness of the base material: 7.922 in.

Hilti Hex Head headed stud anchor with 7 in embedment, 5/8, Steel galvanized, installation per instruction for use

Coordinates Anchor in.

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	0.000	0.000	3.000	3.000	8.000	8.000

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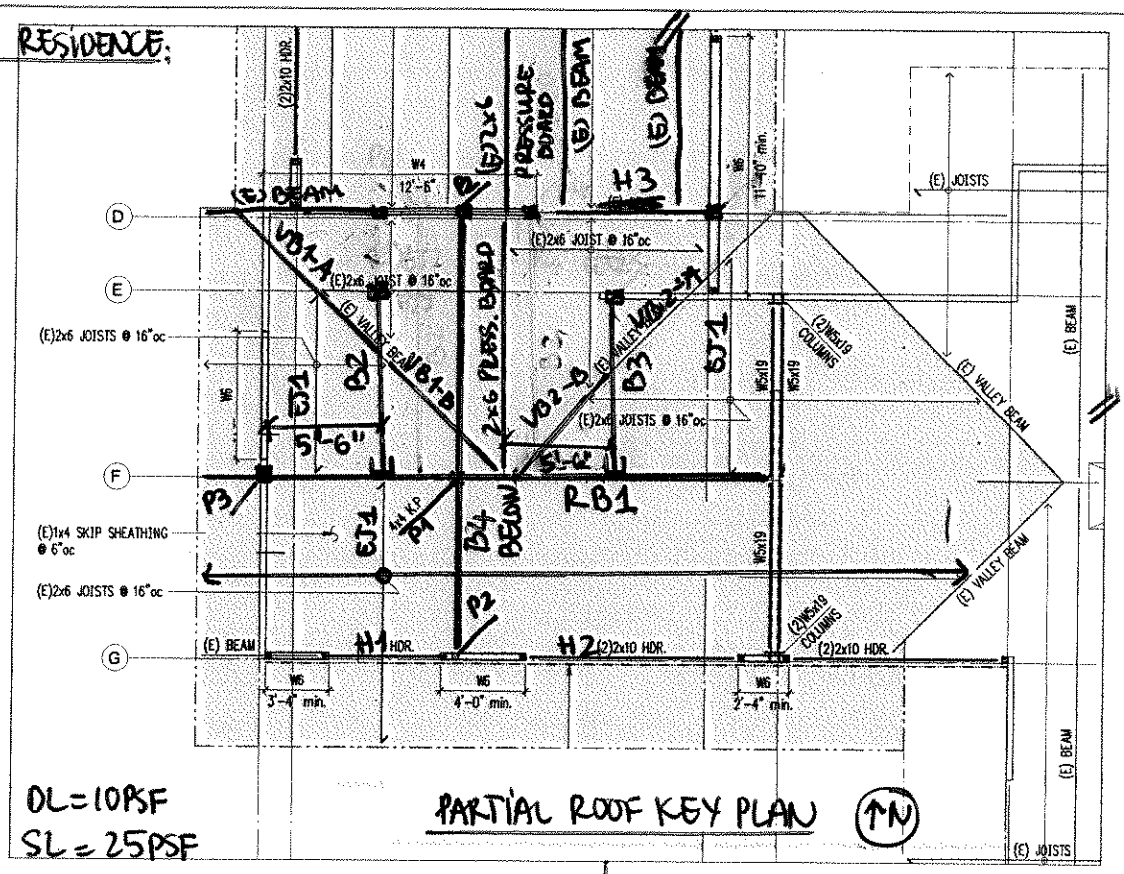
Design:	MF COL A.B. TO CONC. WALL (DETAIL 7/S4.3)	Date:	4/29/2024
Fastening point:			

8 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

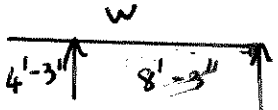
MAIN RESIDENCE:



DL = 10PSF
SL = 25PSF

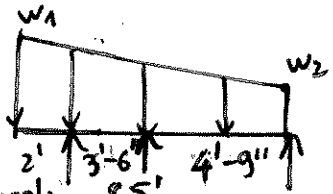
PARTIAL ROOF KEY PLAN (↑N)

EJ1: (E) 2x6 @ 16" oc



$w = (10 + 25\ PSF) \times 1.33^{FT} = 47\ PLF$

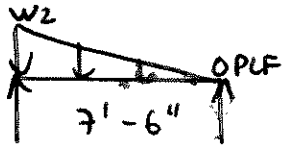
VB1-A:
(E) 2x6



$w_1 = (10+25)_{PSF} \times \left(\frac{12'}{2} + \frac{8.5'}{2}\right) = 360\ PLF$

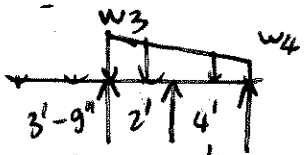
$w_2 = (10+25)_{PSF} \times \left(\frac{5.25'}{2} + \frac{3'}{2}\right) = 144\ PLF$

VB1-B:
(E) 2x6



$w_2 = 144\ PLF$

VB2-A:
(E) 2x6



$w_3 = (10+25)_{PSF} \times \left(\frac{10'}{2} + \frac{8.5'}{2}\right) = 324\ PLF$

$w_4 = (10+25)_{PSF} \times \left(\frac{5.5'}{2} + \frac{5.5'}{2}\right) = 193\ PLF$

VB2-B: Similar to VB1-B.
(E) 2x6

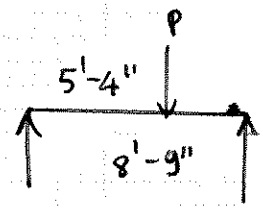
STRUCTURAL ENGINEERING

PROJECT: PATHAK REMODEL
DATE: 05.03.24
PROJ #:
DESIGN: LTN
SHEET: 43/107

SWENSON SAY FAGET
SEATTLE 2124 Third Avenue, Suite 100, Seattle, WA 98121
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402
CENTRAL WA 414 N Pearl Street, Suite 8, Ellensburg, WA 98926
206.443.6212
ssfengineers.com

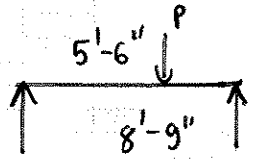
MAIN RESIDENCE (CONT.):

B2: 4x6



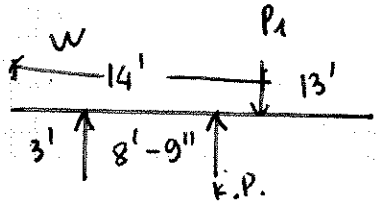
$P = 360^{\#} + 350^{\#} = 710^{\#}$

B3: 4x6



$P = 360^{\#} + 352^{\#} = 712^{\#}$

RB1:

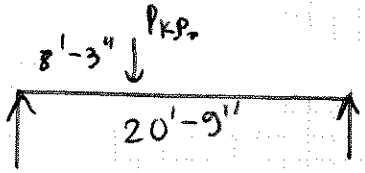


$w = (190^{\#} \times 2) / 1.33^{FT} = 286$ PLF

$P_1 = 180^{\#} \times 2 = 360^{\#}$

HSS 4 x 4 x 3/8

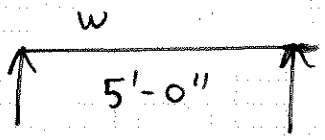
B4:



$P_{K.P.} = 4.75^{K}$

GL $5\frac{1}{2}$ x 12

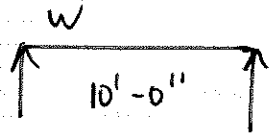
H1:



$w = \frac{393^{\#}}{1.33^{FT}} = 295$ PLF

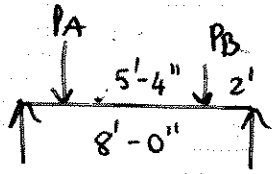
(2) 2x8

H2: (2). 2x10



w = 295 PLF

H3:



$P_A = 3.9^{K}$

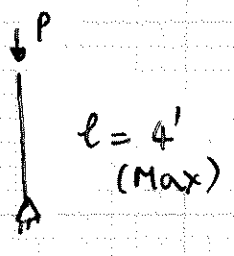
$P_B = 1.4^{K}$

(2) 2x10 HDR.

ROOF GRAVITY: MAIN RESIDENCE (CONT.)

P1: KING POST

$P = 4700^{\#}$

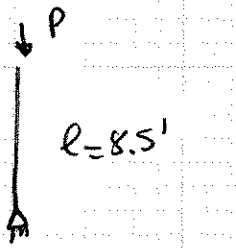


4x4 POST

$P_{allow} = 7650^{\#}$ OK ✓

P2:

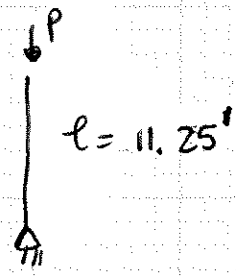
$P = 2861^{\#}$



(2) 2x4 STUDS OR 4x6 POST

P3:

$P = 1.5^{k}$



4x4 POST

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sseengineers.com
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TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470

Beam Analysis

Beam:		EJ1					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.013**		**0.033**		0.047	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**12.50**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.393	**3.25**
R_2	0.189	**12.50**
R_3	0.000	**12.50**
R_4	0.000	**12.50**
R_5	0.000	**12.50**
R_6	0.000	**12.50**
R_7	0.000	**12.50**
R_8	0.000	**12.50**
R_9	0.000	**12.50**
R_{10}	0.000	**12.50**

Demand Output		
Location, ft		**8.13**
Shear, k		0.01
Moment, k-ft	M =	0.38
Deflection, in	D =	-0.20
Δ/Span		L/554

Load Factors	
Dead	**1.00**
Live	**0.00**
Roof Live	**1.00**
Seismic	**1.00**

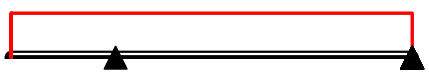
Stresses @ Input Location	
f_v (psi)	3
f_b (psi)	603

Max/Min Stresses	
f_{v_MAX} (psi)	44
f_{v_MIN} (psi)	-34
f_{b_MAX} (psi)	608
f_{b_MIN} (psi)	-390

Beam Properties	
E (ksi)	**1300**
b (in)	**1.5**
d (in)	**5.5**
I (in^4)	20.797
S (in^3)	7.5625
A (in^2)	8.25
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Left Cantilver	-	-0.151	-0.246	-	0.12 (↑)	0	L/650	0	0	L/∞
Span 1	0.242	-0.189	-0.246	0.383	-0.2 (↓)	8.1	L/554	0	3.3	L/∞

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PROJECT PATHAK REMODEL
MAIN RESIDENCE

DATE 5/3/2024
PROJ. #
DESIGN LTN
SHEET

Beam Analysis

Beam:		VB1-A					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.104**		**0.256**		0.360	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1	**-0.021**				-0.021	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		3
Total Beam Length		**10.25**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	1.288	**2.00**
R_2	0.951	**5.50**
R_3	0.348	**10.25**
R_4	0.000	**10.25**
R_5	0.000	**10.25**
R_6	0.000	**10.25**
R_7	0.000	**10.25**
R_8	0.000	**10.25**
R_9	0.000	**10.25**
R_{10}	0.000	**10.25**

Demand Output		
Location, ft		**0.00**
Shear, k		0.00
Moment, k-ft	M =	0.00
Deflection, in	D =	-0.09
Δ/Span		L/506

Load Factors	
Dead	**1.00**
Live	**0.00**
Roof Live	**1.00**
Seismic	**1.00**

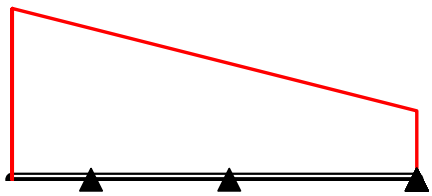
Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	0

Max/Min Stresses	
f_{v_MAX} (psi)	111
f_{v_MIN} (psi)	-123
f_{b_MAX} (psi)	601
f_{b_MIN} (psi)	-1098

Beam Properties	
E (ksi)	**1500**
b (in)	**1.5**
d (in)	**5.5**
I (in^4)	20.797
S (in^3)	7.5625
A (in^2)	8.25
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Left Cantilver	-	-0.678	-0.692	-	-0.095 (↓)	0	L/502	0	0	L/∞
Span 1	0.61	-0.375	-0.692	-	0.015 (↑)	3.4	L/2788	0	2	L/∞
Span 2	0.577	-0.348	-0.356	0.379	-0.044 (↓)	8	L/1292	0	5.5	L/∞

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PROJECT PATHAK REMODEL
MAIN RESIDENCE

DATE 5/3/2024
PROJ. #
DESIGN LTN
SHEET

Beam Analysis

Beam:		VB1-B					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.042**		**0.102**		0.144	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1	**-0.0192**				-0.019	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**7.50**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.360	**0.00**
R_2	0.180	**7.50**
R_3	0.000	**7.50**
R_4	0.000	**7.50**
R_5	0.000	**7.50**
R_6	0.000	**7.50**
R_7	0.000	**7.50**
R_8	0.000	**7.50**
R_9	0.000	**7.50**
R_{10}	0.000	**7.50**

Demand Output		
Location, ft		**3.61**
Shear, k		-0.03
Moment, k-ft	M =	0.51
Deflection, in	D =	-0.16
Δ/Span		L/547

Load Factors	
Dead	**1.00**
Live	**0.00**
Roof Live	**1.00**
Seismic	**1.00**

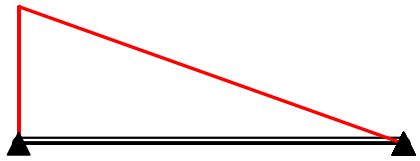
Stresses @ Input Location	
f_v (psi)	-6
f_b (psi)	812

Max/Min Stresses	
f_{v_MAX} (psi)	65
f_{v_MIN} (psi)	-33
f_{b_MAX} (psi)	825
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1500**
b (in)	**1.5**
d (in)	**5.5**
I (in^4)	20.797
S (in^3)	7.5625
A (in^2)	8.25
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	0.36	-0.18	-	0.52	-0.165 (↓)	3.6	L/545	0	0	L/∞

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Beam Analysis

Beam:		VB2-A					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.094**		**0.230**		0.324	**3.75**
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1	**-0.0218**				-0.022	**3.75**
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		3
Total Beam Length		**9.75**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.125	**3.75**
R_2	1.075	**5.75**
R_3	0.352	**9.75**
R_4	0.000	**9.75**
R_5	0.000	**9.75**
R_6	0.000	**9.75**
R_7	0.000	**9.75**
R_8	0.000	**9.75**
R_9	0.000	**9.75**
R_{10}	0.000	**9.75**

Demand Output		
Location, ft		**5.75**
Shear, k		0.59
Moment, k-ft	M =	-0.37
Deflection, in	D =	0.00
Δ/Span		#######

Load Factors	
Dead	**1.00**
Live	**0.00**
Roof Live	**1.00**
Seismic	**1.00**

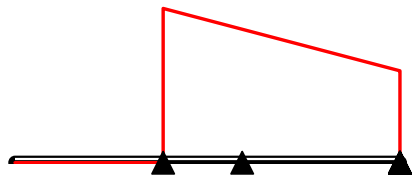
Stresses @ Input Location	
f_v (psi)	108
f_b (psi)	-584

Max/Min Stresses	
f_{v_MAX} (psi)	108
f_{v_MIN} (psi)	-87
f_{b_MAX} (psi)	478
f_{b_MIN} (psi)	-587

Beam Properties	
E (ksi)	**1500**
b (in)	**1.5**
d (in)	**5.5**
I (in^4)	20.797
S (in^3)	7.5625
A (in^2)	8.25
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Left Cantilver	-	0.125	0	-	-0.005 (↓)	0	L/17972	0	0	L/∞
Span 1	0.125	-0.48	-0.37	0.024	0.002 (↑)	5.1	L/11817	0	3.8	L/∞
Span 2	0.595	-0.352	-0.37	0.301	-0.024 (↓)	7.9	L/1999	0	5.8	L/∞

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Beam Analysis

Beam:		B2 & B3					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1					0.000	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1			**0.71**		0.710	**5.33**
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**8.75**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.278	**0.00**
R_2	0.432	**8.75**
R_3	0.000	**8.75**
R_4	0.000	**8.75**
R_5	0.000	**8.75**
R_6	0.000	**8.75**
R_7	0.000	**8.75**
R_8	0.000	**8.75**
R_9	0.000	**8.75**
R_{10}	0.000	**8.75**

Demand Output		
Location, ft		**5.33**
Shear, k		0.28
Moment, k-ft	M =	1.48
Deflection, in	D =	-0.21
Δ/Span		L/492

Load Factors	
Dead	**1.00**
Live	**0.00**
Roof Live	**1.00**
Seismic	**1.00**

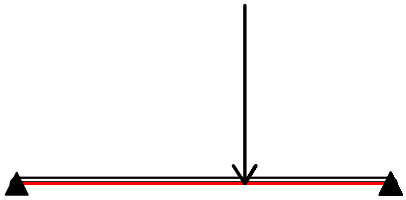
Stresses @ Input Location	
f_v (psi)	22
f_b (psi)	1006

Max/Min Stresses	
f_{v_MAX} (psi)	22
f_{v_MIN} (psi)	-34
f_{b_MAX} (psi)	1006
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1500**
b (in)	**3.5**
d (in)	**5.5**
I (in^4)	48.526
S (in^3)	17.646
A (in^2)	19.25
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	0.278	-0.432	-	1.48	-0.221 (↓)	4.7	L/475	0	0	L/∞

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PROJECT PATHAK REMODEL
MAIN RESIDENCE

DATE 5/3/2024
PROJ. #
DESIGN LTN
SHEET

Beam Analysis

Beam:		RB1					
Load		Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.060**		**0.226**		0.286	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1	**0.0756**		**0.2844**		0.360	**14.00**
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		3
Total Beam Length		**27.00**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	1.519	**3.00**
R_2	4.752	**11.75**
R_3	1.811	**27.00**
R_4	0.000	**27.00**
R_5	0.000	**27.00**
R_6	0.000	**27.00**
R_7	0.000	**27.00**
R_8	0.000	**27.00**
R_9	0.000	**27.00**
R_{10}	0.000	**27.00**

Demand Output		
Location, ft		**20.03**
Shear, k		0.18
Moment, k-ft	M =	5.67
Deflection, in	D =	-0.70
Δ/Span		L/263

Load Factors	
Dead	**1.00**
Live	**0.00**
Snow	**1.00**
Seismic	**1.00**

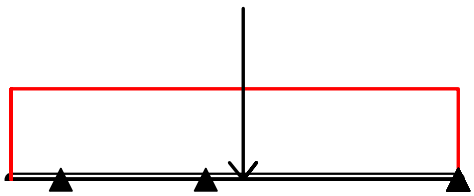
Stresses @ Input Location	
f_v (psi)	88
f_b (psi)	13274

Max/Min Stresses	
f_{v_MAX} (psi)	1413
f_{v_MIN} (psi)	-893
f_{b_MAX} (psi)	13404
f_{b_MIN} (psi)	-15088

Beam Properties	
E (ksi)	**29000**
b (in)	
d (in)	
I (in^4)	10.3
S (in^3)	5.13
A (in^2)	2.06
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section		HSS4x4x3/8	
F_y, ksi		50	
Beam Weight (plf)		17.27	
Axis of Bending		Strong	
Unbr. Length (L_b), ft		15.25	
C_b		1	
A_w	2.06 in^2	V_n/Ω_v	37.1 k
S	5.13 in^3	$\phi_v V_n$	55.6 k
Z	6.39 in^3	M_n/Ω_b	15.9 k-ft
I	10.3 in^4	$\phi_b M_n$	24 k-ft

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Left Cantilver	-	-0.858	-1.29	-	-0.107 (↓)	0	L/666	0	0	L/∞
Span 1	0.661	-1.84	-6.45	-	0.095 (↑)	8.6	L/1098	0	3	L/∞
Span 2	2.91	-1.81	-6.45	5.73	-0.696 (↓)	20	L/263	0	11.8	L/∞

PROJECT PATHAK REMODEL
MAIN RESIDENCE

DATE 5/3/2024
PROJ. #
DESIGN LTN
SHEET

Beam Analysis

Beam:		B4					
Load		Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	w_1					0.000	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1	**1.00**		**3.75**		4.750	**12.50**
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**20.75**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	1.889	**0.00**
R_2	2.861	**20.75**
R_3	0.000	**20.75**
R_4	0.000	**20.75**
R_5	0.000	**20.75**
R_6	0.000	**20.75**
R_7	0.000	**20.75**
R_8	0.000	**20.75**
R_9	0.000	**20.75**
R_{10}	0.000	**20.75**

Demand Output		
Location, ft		**12.49**
Shear, k		1.89
Moment, k-ft	M =	23.59
Deflection, in	D =	-0.98
Δ/Span		L/253

Load Factors	
Dead	**1.00**
Live	**0.00**
Snow	**1.00**
Seismic	**1.00**

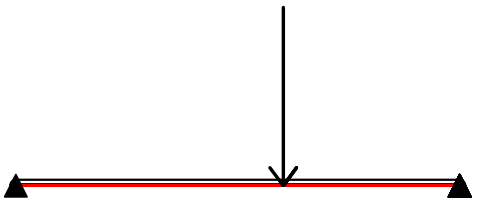
Stresses @ Input Location	
f_v (psi)	43
f_b (psi)	2145

Max/Min Stresses	
f_{v_MAX} (psi)	43
f_{v_MIN} (psi)	-65
f_{b_MAX} (psi)	2145
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1800**
b (in)	**5.5**
d (in)	**12**
I (in^4)	792
S (in^3)	132
A (in^2)	66
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	1.89	-2.86	-	23.6	-1.01 (↓)	11	L/247	0	0	L/∞

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STRUCTURAL ENGINEERING

PROJECT: PATHAK REMODEL
MAIN RESIDENCE

DATE: 5/3/2024
PROJ. #:
DESIGN: LTN
SHEET:

Beam Analysis

Beam:	H1					
Load	Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft) w_1	**0.062**		**0.233**		0.295	
w_2					0.000	
w_3					0.000	
w_4					0.000	
w_5					0.000	
w_6					0.000	
w_7					0.000	
w_8					0.000	
w_9					0.000	
w_{10}					0.000	
Trapezoidal (k/ft/ft) t_1					0.000	
t_2					0.000	
t_3					0.000	
t_4					0.000	
t_5					0.000	
t_6					0.000	
Point (k) P_1					0.000	
P_2					0.000	
P_3					0.000	
P_4					0.000	
P_5					0.000	
P_6					0.000	
P_7					0.000	
P_8					0.000	
P_9					0.000	
P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**5.00**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.739	**0.00**
R_2	0.739	**5.00**
R_3	0.000	**5.00**
R_4	0.000	**5.00**
R_5	0.000	**5.00**
R_6	0.000	**5.00**
R_7	0.000	**5.00**
R_8	0.000	**5.00**
R_9	0.000	**5.00**
R_{10}	0.000	**5.00**

Demand Output		
Location, ft		**2.50**
Shear, k		0.00
Moment, k-ft	M =	0.92
Deflection, in	D =	-0.03
Δ/Span		L/1788

Load Factors	
Dead	**1.00**
Live	**0.00**
Roof Live	**1.00**
Seismic	**1.00**

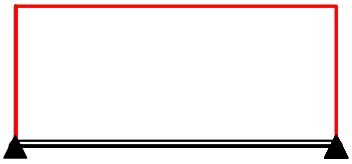
Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	422

Max/Min Stresses	
f_{v_MAX} (psi)	51
f_{v_MIN} (psi)	-51
f_{b_MAX} (psi)	421
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1300**
b (in)	**3**
d (in)	**7.25**
I (in^4)	95.27
S (in^3)	26.281
A (in^2)	21.75
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	0.739	-0.739	-	0.923	-0.034 (↓)	2.5	L/1765	0	0	L/∞

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Beam Analysis

Beam:		H2					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.062**		**0.233**		0.295	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**10.00**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	1.477	**0.00**
R_2	1.477	**10.00**
R_3	0.000	**10.00**
R_4	0.000	**10.00**
R_5	0.000	**10.00**
R_6	0.000	**10.00**
R_7	0.000	**10.00**
R_8	0.000	**10.00**
R_9	0.000	**10.00**
R_{10}	0.000	**10.00**

Demand Output		
Location, ft		**5.00**
Shear, k		0.00
Moment, k-ft	M =	3.69
Deflection, in	D =	-0.26
Δ/Span		L/464

Load Factors	
Dead	**1.00**
Live	**0.00**
Roof Live	**1.00**
Seismic	**1.00**

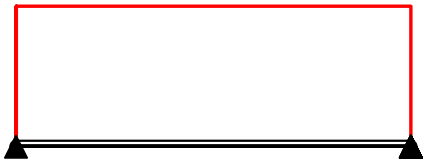
Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	1036

Max/Min Stresses	
f_{v_MAX} (psi)	80
f_{v_MIN} (psi)	-80
f_{b_MAX} (psi)	1035
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1300**
b (in)	**3**
d (in)	**9.25**
I (in^4)	197.86
S (in^3)	42.781
A (in^2)	27.75
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	1.48	-1.48	-	3.69	-0.258 (↓)	5	L/465	0	0	L/∞

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Beam Analysis

Beam:		H3					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1					0.000	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1			**1.40**		1.400	**2.00**
	P_2			**3.9**		3.900	**7.00**
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**8.00**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	1.538	**0.00**
R_2	3.763	**8.00**
R_3	0.000	**8.00**
R_4	0.000	**8.00**
R_5	0.000	**8.00**
R_6	0.000	**8.00**
R_7	0.000	**8.00**
R_8	0.000	**8.00**
R_9	0.000	**8.00**
R_{10}	0.000	**8.00**

Demand Output		
Location, ft		**4.15**
Shear, k		0.14
Moment, k-ft	M =	3.37
Deflection, in	D =	-0.15
Δ/Span		L/645

Load Factors	
Dead	**1.00**
Live	**0.00**
Roof Live	**1.00**
Seismic	**1.00**

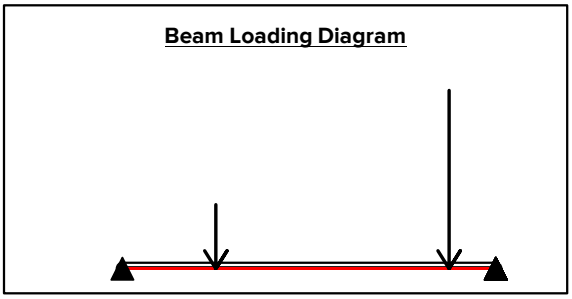
Stresses @ Input Location	
f_v (psi)	7
f_b (psi)	946

Max/Min Stresses	
f_{v_MAX} (psi)	83
f_{v_MIN} (psi)	-203
f_{b_MAX} (psi)	1055
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1500**
b (in)	**3**
d (in)	**9.25**
I (in^4)	197.86
S (in^3)	42.781
A (in^2)	27.75
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	1.54	-3.76	-	3.76	-0.149 (↓)	4.2	L/644	0	0	L/∞

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SEATTLE TACOMA
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PROJECT PATHAK REMODEL
MAIN RESIDENCE

DATE 5/3/2024
PROJ. #
DESIGN LTN
SHEET

Column Buckling Calculations

NDS 2018

Column Geometry Data

4X Posts Doug Fir - Larch #2		
Doug Fir Plates		
b	3.5	in
d	3.5	in
Le_1	4.00	ft
Le_2	4.00	ft
$le_{bending}$	4	ft

Bracing

No Brace
No Brace

Column Design Values

F_b	900	psi
F_c	1350	psi
E'min	580	ksi
Fcperp	625	psi
cb	1.00	

Bearing
Area
Increase
No

Column Loading

P	7650	lbs
W_1	0	plf
M1	0	ft-lbs
W_2	0	plf
M2	0	ft-lbs

Flexural Stress Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.50
Repetitive - C_r	1.00

Compressive Parallel Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.15

Other Factors

Visually Graded Lumber	
c	0.8
Solid Column	
Kf	1
Column: Pinned Pinned	
Ke	1

Column Stability Factor Calculation

Strong Axis			Weak Axis		
Fce_1	2535	psi	Fce_2	2535	psi
Fc^*_1	1785	psi	Fc^*_2	1785	psi
Fce_1/Fc^*_1	1.420		Fce_2/Fc^*_2	1.420	
Cp_1	0.796		Cp_2	0.796	

Beam Stability Factor Calculation

Strong Axis			Weak Axis		
Fbe_1	50750	psi	Fbe_2	28,194	psi
Fb'_1	1553	psi	Fb'_2	1553	psi
Fbe_1/Fb'_1	32.7		Fbe_2/Fb'_2	18	
le	4.0	ft			
CL_1	1.00				

Adjusted Allowable Stresses

Strong Axis			Weak Axis		
Fc'_1	1422	psi	Fc'_2	1422	psi
Fb'_1	1553	psi	Fb'_2	1553	psi

Imposed Column Stresses

Strong Axis			Weak Axis		
fc_1	624	psi	fc_2	624	psi
fb_1	0	psi	fb_2	0	psi

Perpendicular to Grain Stress Check fcp/Fcp =	***624 / 625***	**OK**
Slenderness Check le/d	**14**	**OK**
Slenderness Check le/b	**14**	**OK**

(1) $$\left(\frac{f_c}{F_c'}\right)^2+\frac{f_{b1}}{F_{b1}'\left[1-f_c/F_{cE1}\right]}+\frac{f_{b2}}{F_{b2}'\left[1-f_c/F_{cE2}-\left(f_{b1}/F_{bE1}\right)\right]}\le 1.0$$

(2) $$\frac{fc}{F_{cE2}}+\left(\frac{f_{b1}}{F_{bE}}\right)^2<1.0$$

(3) $$\frac{f_c}{F_{c'}},\frac{f_{b1}}{F_{b1}'},\frac{f_{b2}}{F_{b2}'}<1.0$$

Allowable Stress Interaction Formula	**0.44**	**OK**

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Project: PATHAK REMODEL *Date:* *5/22/2024*

P1 Project #:

4X4 KING POST Design: LTN

Sheet:

Column Buckling Calculations

NDS 2018

Column Geometry Data

4X Posts Doug Fir - Larch #2		
Doug Fir Plates		
b	3.5	in
d	5.5	in
Le_1	8.50	ft
Le_2	8.50	ft
$le_{bending}$	8.5	ft

Bracing

No Brace
No Brace

Column Design Values

F_b	900	psi
F_c	1350	psi
E'min	580	ksi
Fcperp	625	psi
cb	1.00	

Bearing
Area
Increase
No

Column Loading

P	3000	lbs
W_1	0	plf
M1	0	ft-lbs
W_2	0	plf
M2	0	ft-lbs

Flexural Stress Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.30
Repetitive - C_r	1.00

Compressive Parallel Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.10

Other Factors

Visually Graded Lumber	
c	0.8
Solid Column	
Kf	1
Column: Pinned Pinned	
Ke	1

Column Stability Factor Calculation

Strong Axis			Weak Axis		
Fce_1	1386	psi	Fce_2	561	psi
Fc^*_1	1708	psi	Fc^*_2	1708	psi
Fce_1/Fc^*_1	0.812		Fce_2/Fc^*_2	0.329	
Cp_1	0.615		Cp_2	0.302	

Beam Stability Factor Calculation

Strong Axis			Weak Axis		
Fbe_1	15198	psi	Fbe_2	32,764	psi
Fb'_1	1346	psi	Fb'_2	1346	psi
Fbe_1/Fb'_1	11.3		Fbe_2/Fb'_2	24	
le	8.5	ft			
CL_1	1.00				

Adjusted Allowable Stresses

Strong Axis			Weak Axis		
Fc'_1	1050	psi	Fc'_2	517	psi
Fb'_1	1339	psi	Fb'_2	1346	psi

Imposed Column Stresses

Strong Axis			Weak Axis		
fc_1	156	psi	fc_2	156	psi
fb_1	0	psi	fb_2	0	psi

Perpendicular to Grain Stress Check fcp/Fcp =	***156 / 625***	**OK**
Slenderness Check le/d	**19**	**OK**
Slenderness Check le/b	**29**	**OK**

(1) $$\left(\frac{f_c}{F_c'}\right)^2+\frac{f_{b1}}{F_{b1}'\left[1-f_c/F_{cE1}\right]}+\frac{f_{b2}}{F_{b2}'\left[1-f_c/F_{cE2}-\left(f_{b1}/F_{bE1}\right)\right]}\le 1.0$$

(2) $$\frac{fc}{F_{cE2}}+\left(\frac{f_{b1}}{F_{bE}}\right)^2<1.0$$

(3) $$\frac{f_c}{F_{c'}},\frac{f_{b1}}{F_{b1}'},\frac{f_{b2}}{F_{b2}'}<1.0$$

Allowable Stress Interaction Formula	**0.30**	**OK**

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Project: PATHAK REMODEL *Date:* *5/22/2024*

P2 Project #:

4X6 POST Design: LTN

Sheet:

Column Buckling Calculations

NDS 2018

Column Geometry Data

4X Posts Doug Fir - Larch #2		
Doug Fir Plates		
b	3.5	in
d	3.5	in
Le_1	11.25	ft
Le_2	11.25	ft
$le_{bending}$	11.25	ft

Bracing

No Brace
No Brace

Column Design Values

F_b	900	psi
F_c	1350	psi
E'min	580	ksi
Fcperp	625	psi
cb	1.00	

Bearing
Area
Increase
No

Column Loading

P	2000	lbs
W_1	0	plf
M1	0	ft-lbs
W_2	7	plf
M2	111	ft-lbs

Flexural Stress Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.50
Repetitive - C_r	1.00

Compressive Parallel Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.15

Other Factors

Visually Graded Lumber	
c	0.8
Solid Column	
Kf	1
Column: Pinned Pinned	
Ke	1

Column Stability Factor Calculation

Strong Axis			Weak Axis		
Fce_1	320	psi	Fce_2	320	psi
Fc^*_1	1785	psi	Fc^*_2	1785	psi
Fce_1/Fc^*_1	0.179		Fce_2/Fc^*_2	0.179	
Cp_1	0.172		Cp_2	0.172	

Beam Stability Factor Calculation

Strong Axis			Weak Axis		
Fbe_1	18044	psi	Fbe_2	10,025	psi
Fb'_1	1553	psi	Fb'_2	1553	psi
Fbe_1/Fb'_1	11.6		Fbe_2/Fb'_2	6	
le	11.3	ft			
CL_1	1.00				

Adjusted Allowable Stresses

Strong Axis			Weak Axis		
Fc'_1	308	psi	Fc'_2	308	psi
Fb'_1	1553	psi	Fb'_2	1553	psi

Imposed Column Stresses

Strong Axis			Weak Axis		
fc_1	163	psi	fc_2	163	psi
fb_1	0	psi	fb_2	186	psi

Perpendicular to Grain Stress Check fcp/Fcp =	***163 / 625***	**OK**
Slenderness Check le/d	**39**	**OK**
Slenderness Check le/b	**39**	**OK**

(1) $$\left(\frac{f_c}{F_c'}\right)^2+\frac{f_{b1}}{F_{b1}'\left[1-f_c/F_{cE1}\right]}+\frac{f_{b2}}{F_{b2}'\left[1-f_c/F_{cE2}-\left(f_{b1}/F_{bE1}\right)\right]}\le 1.0$$

(2) $$\frac{fc}{F_{cE2}}+\left(\frac{f_{b1}}{F_{bE}}\right)^2<1.0$$

(3) $$\frac{f_c}{F_{c'}},\frac{f_{b1}}{F_{b1}'},\frac{f_{b2}}{F_{b2}'}<1.0$$

Allowable Stress Interaction Formula	**0.53**	**OK**

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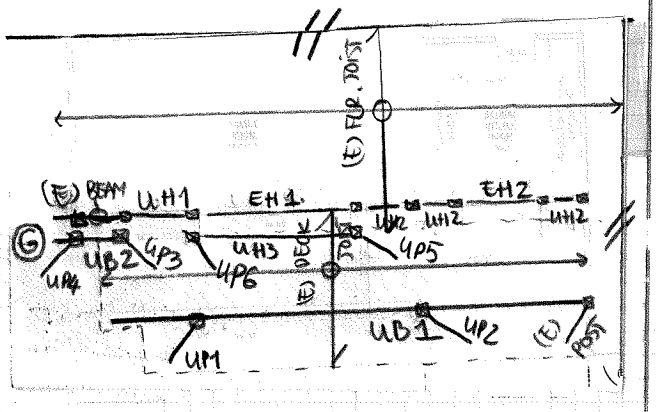
Project: PATHAK REMODEL *Date:* 5/22/2024

P3 Project #:

4X4 POST Design: LTN

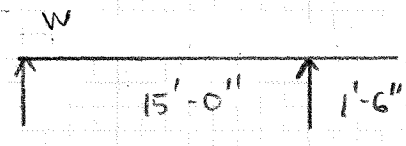
Sheet:

UPPER FLOOR:



N UPPER FLOOR PARTIAL KEY PLAN

(E) FLOOR JOIST: 2 x 10 @ 16" oc

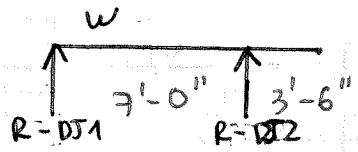


$w = w_{DL} + w_{LL}$

$= (10\ PSF + 40\ PSF) \times 1.33'$

$= 66.5\ PLF$

(E) DECK JOIST: @ 16" oc

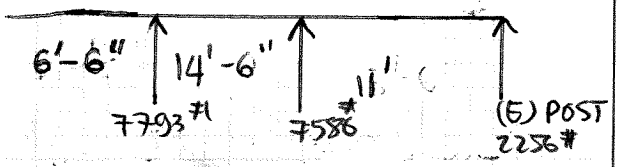


$w = w_{DL} + w_{LL}$

$= (10\ PSF + 60\ PSF) \times 1.33'$

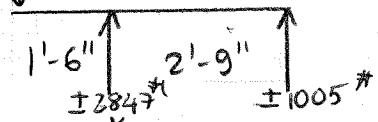
$= 93\ PLF$

UB1: CEDAR GL 5 1/2 x 9 1/2"



$w = \frac{R\text{-}DJ2}{1.33'} = \frac{733\ \#}{1.33'} = 551\ PLF$

UB2: P 4 x 8



$P = \pm 1.842^{K}$ (Holdown Force)

$f_b = 1080\ psi$

$F'_b = C_D \times C_F \times F_b = 1.6 \times 1.3 \times 1000 psi$

$= 2080\ psi$ OK ✓

$f_v = 109\ psi$

$F'_v = C_D \times F_v = 1.6 \times 180 psi = 288 psi$

OK ✓

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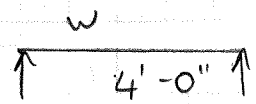
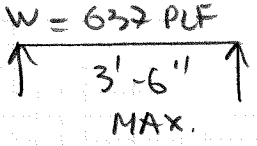
UPPER FLOOR (CONT.):

UH1: (2) 2x8



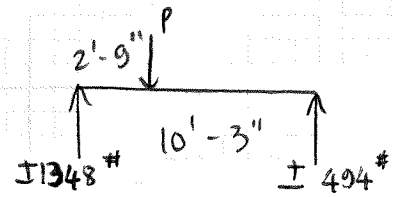
$w = \frac{244^{\#}}{1.33'} + \frac{603^{\#}}{1.33'} = 637$ PLF

UH2: (2) 2x8



UH3: (2) 2x8 or 4x8

Seismic:

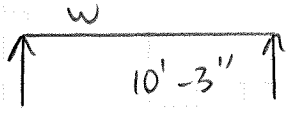


$P = \pm 1842^{\#}$ (Holdown Force)

$f_b = 1689$ psi $< F_b' = 1.6 \times 1.2 \times 1000$ psi ($C_D \times C_F$)
$= 1920$ psi OK ✓

$f_v = 93$ psi $< F_v' = 1.6 \times 180$ psi (C_D)
$= 288$ psi OK ✓

Gravity:



$w = (10 + 60\ (w_D + w_L)\ \text{PSF}) \times 3.5'\ \text{Trib}$
$= 245$ PLF [Conservative]

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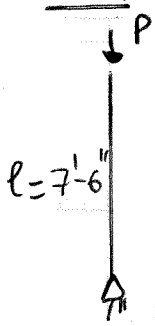
UPPER FLOOR (CONT.):

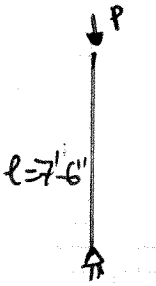
UP1:



P = 7793#

P.T. 4 x 6

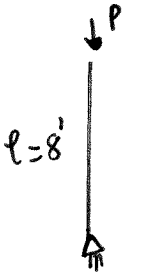
UP2:



P = 7586

P.T. 4 x 6

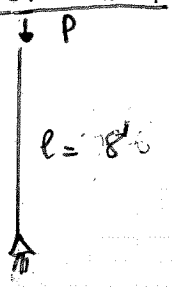
UP3 & UP4:



P = ±2847# (Worst case)

(2) 2x6 Studs

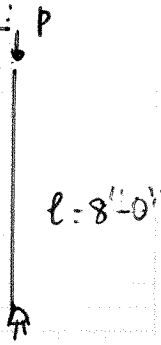
UP5 & UP6:



P = ±1348# (worst case)

(2) 2x6 Studs

(E) POST:



P = 2256#
+ (10 + 40 PSF) x 16'/2 x 3'/2
= 2856#

Verify Min (2) 2x4 Studs

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Beam Analysis

Beam:		Existing Upper Floor Joist					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.013**	**0.053**			0.067	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**16.50**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.494	**0.00**
R_2	0.603	**15.00**
R_3	0.000	**15.00**
R_4	0.000	**15.00**
R_5	0.000	**15.00**
R_6	0.000	**15.00**
R_7	0.000	**15.00**
R_8	0.000	**15.00**
R_9	0.000	**15.00**
R_{10}	0.000	**15.00**

Demand Output		
Location, ft		**7.47**
Shear, k		0.00
Moment, k-ft	M =	1.83
Deflection, in	D =	-0.50
Δ/Span		L/361

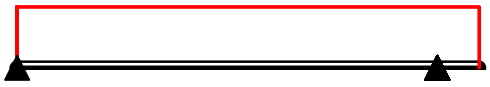
Load Factors	
Dead	**1.00**
Live	**1.00**
Roof Live	**1.00**
Seismic	**1.00**

Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	1028

Max/Min Stresses	
f_{v_MAX} (psi)	53
f_{v_MIN} (psi)	-54
f_{b_MAX} (psi)	1027
f_{b_MIN} (psi)	-42

Beam Properties	
E (ksi)	**1500**
b (in)	**1.5**
d (in)	**9.25**
I (in^4)	98.932
S (in^3)	21.391
A (in^2)	13.875
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	0.494	-0.504	-0.075	1.83	-0.498 (↓)	7.5	L/361	-0.399 (↓)	7.5	L/451
Right Cantilever	0.1	-	-0.075	-	0.156 (↑)	16.5	L/228	0.125 (↑)	16.5	L/288

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PROJECT PATHAK REMODEL
MAIN RESIDENCE

DATE 5/22/2024
PROJ. #
DESIGN LTN
SHEET 1

Beam Analysis

Beam:		Existing Deck Joist					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.013**	**0.080**			0.093	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**10.50**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.244	**0.00**
R_2	0.733	**7.00**
R_3	0.000	**7.00**
R_4	0.000	**7.00**
R_5	0.000	**7.00**
R_6	0.000	**7.00**
R_7	0.000	**7.00**
R_8	0.000	**7.00**
R_9	0.000	**7.00**
R_{10}	0.000	**7.00**

Demand Output		
Location, ft		**10.50**
Shear, k		0.00
Moment, k-ft	M =	0.00
Deflection, in	D =	-0.10
Δ/Span		L/868

Load Factors	
Dead	**1.00**
Live	**1.00**
Roof Live	**1.00**
Seismic	**1.00**

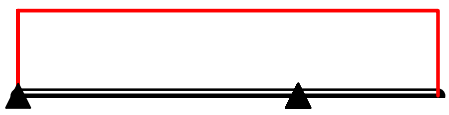
Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	0

Max/Min Stresses	
f_{v_MAX} (psi)	59
f_{v_MIN} (psi)	-74
f_{b_MAX} (psi)	509
f_{b_MIN} (psi)	-904

Beam Properties	
E (ksi)	**1500**
b (in)	**1.5**
d (in)	**5.5**
I (in^4)	20.797
S (in^3)	7.5625
A (in^2)	8.25
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	0.244	-0.407	-0.57	0.321	-0.029 (↓)	3	L/2894	-0.025 (↓)	3	L/3357
Right Cantilever	0.326	-	-0.57	-	-0.042 (↓)	10.5	L/1992	-0.036 (↓)	10.5	L/2320

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PROJECT PATHAK REMODEL
MAIN RESIDENCE

DATE 5/22/2024
PROJ. #
DESIGN LTN
SHEET 2

Beam Analysis

Beam:		UB1					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.077**	**0.474**			0.551	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		3
Total Beam Length		**32.00**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	7.793	**6.50**
R_2	7.586	**21.00**
R_3	2.256	**32.00**
R_4	0.000	**32.00**
R_5	0.000	**32.00**
R_6	0.000	**32.00**
R_7	0.000	**32.00**
R_8	0.000	**32.00**
R_9	0.000	**32.00**
R_{10}	0.000	**32.00**

Demand Output		
Location, ft		**0.00**
Shear, k		0.00
Moment, k-ft	M =	0.00
Deflection, in	D =	-0.49
Δ/Span		L/318

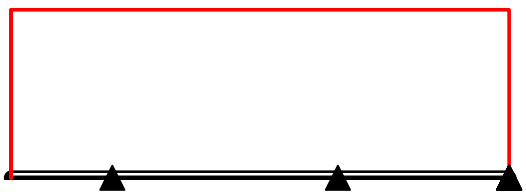
Load Factors	
Dead	**1.00**
Live	**1.00**
Roof Live	**1.00**
Seismic	**1.00**

Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	0

Max/Min Stresses	
f_{v_MAX} (psi)	121
f_{v_MIN} (psi)	-109
f_{b_MAX} (psi)	670
f_{b_MIN} (psi)	-1683

Beam Properties	
E (ksi)	**1500**
b (in)	**5.5**
d (in)	**9.5**
I (in^4)	392.96
S (in^3)	82.729
A (in^2)	52.25
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Left Cantilver	-	-3.58	-11.6	-	-0.491 (↓)	0	L/316	-0.422 (↓)	0	L/368
Span 1	4.21	-3.78	-11.6	4.44	-0.154 (↓)	14.1	L/1127	-0.133 (↓)	14.1	L/1305
Span 2	3.81	-2.26	-8.52	4.62	-0.124 (↓)	27.4	L/1059	-0.107 (↓)	27.4	L/1227

PROJECT PATHAK REMODEL
MAIN RESIDENCE

DATE 5/22/2024
PROJ. #
DESIGN LTN
SHEET 3

Beam Analysis

Beam:		UB2					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1					0.000	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1				**1.842**	1.842	**0.00**
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**4.25**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	2.847	**1.50**
R_2	-1.005	**4.25**
R_3	0.000	**4.25**
R_4	0.000	**4.25**
R_5	0.000	**4.25**
R_6	0.000	**4.25**
R_7	0.000	**4.25**
R_8	0.000	**4.25**
R_9	0.000	**4.25**
R_{10}	0.000	**4.25**

Demand Output		
Location, ft		**0.00**
Shear, k		0.00
Moment, k-ft	M =	0.00
Deflection, in	D =	-0.06
Δ/Span		L/592

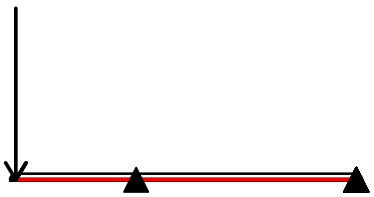
Load Factors	
Dead	**1.00**
Live	**1.00**
Roof Live	**1.00**
Seismic	**1.00**

Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	0

Max/Min Stresses	
f_{v_MAX} (psi)	59
f_{v_MIN} (psi)	-109
f_{b_MAX} (psi)	0
f_{b_MIN} (psi)	-1080

Beam Properties	
E (ksi)	**1500**
b (in)	**3.5**
d (in)	**7.25**
I (in^4)	111.15
S (in^3)	30.661
A (in^2)	25.375
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Left Cantilver	-	-1.84	-2.76	-	-0.061 (↓)	0	L/588	0	0	L/∞
Span 1	1	1	-2.76	-	0.014 (↑)	2.7	L/2353	0	1.5	L/∞

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PROJECT PATHAK REMODEL
MAIN RESIDENCE

DATE 5/22/2024
PROJ. #
DESIGN LTN
SHEET 4

Beam Analysis

Beam:		UB2 - UPLIFT					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1					0.000	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1				**-1.842**	-1.842	**0.00**
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**4.25**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	-2.847	**1.50**
R_2	1.005	**4.25**
R_3	0.000	**4.25**
R_4	0.000	**4.25**
R_5	0.000	**4.25**
R_6	0.000	**4.25**
R_7	0.000	**4.25**
R_8	0.000	**4.25**
R_9	0.000	**4.25**
R_{10}	0.000	**4.25**

Demand Output		
Location, ft		**2.66**
Shear, k		-1.00
Moment, k-ft	M =	1.60
Deflection, in	D =	-0.01
Δ/Span		L/2375

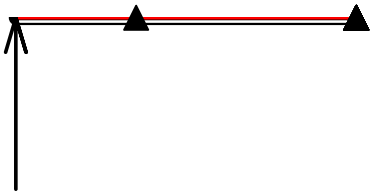
Load Factors	
Dead	**1.00**
Live	**1.00**
Roof Live	**1.00**
Seismic	**1.00**

Stresses @ Input Location	
f_v (psi)	-59
f_b (psi)	625

Max/Min Stresses	
f_{v_MAX} (psi)	109
f_{v_MIN} (psi)	-59
f_{b_MAX} (psi)	1080
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1500**
b (in)	**3.5**
d (in)	**7.25**
I (in^4)	111.15
S (in^3)	30.661
A (in^2)	25.375
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Left Cantilver	-	1.84	-	2.76	0.061 (↑)	0	L/588	0	0	L/∞
Span 1	-1	-1	-	2.76	-0.014 (↓)	2.7	L/2353	0	1.5	L/∞

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PROJECT PATHAK REMODEL
MAIN RESIDENCE

DATE 5/22/2024
PROJ. #
DESIGN LTN
SHEET 5

Beam Analysis

Beam:		UH1					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.637**				0.637	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**4.00**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	1.274	**0.00**
R_2	1.274	**4.00**
R_3	0.000	**4.00**
R_4	0.000	**4.00**
R_5	0.000	**4.00**
R_6	0.000	**4.00**
R_7	0.000	**4.00**
R_8	0.000	**4.00**
R_9	0.000	**4.00**
R_{10}	0.000	**4.00**

Demand Output		
Location, ft		**2.00**
Shear, k		0.00
Moment, k-ft	M =	1.27
Deflection, in	D =	-0.03
Δ/Span		L/1869

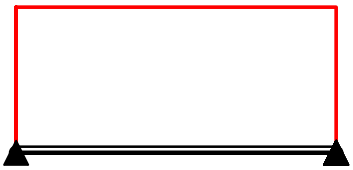
Load Factors	
Dead	**1.00**
Live	**1.00**
Roof Live	**1.00**
Seismic	**1.00**

Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	582

Max/Min Stresses	
f_{v_MAX} (psi)	88
f_{v_MIN} (psi)	-88
f_{b_MAX} (psi)	580
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1500**
b (in)	**3**
d (in)	**7.25**
I (in^4)	95.27
S (in^3)	26.281
A (in^2)	21.75
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	1.27	-1.27	-	1.27	-0.026 (↓)	2	L/1846	0	0	L/∞

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PROJ. #
DESIGN LTN
SHEET 6

Beam Analysis

Beam:		UH2					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.637**				0.637	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**3.50**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	1.115	**0.00**
R_2	1.115	**3.50**
R_3	0.000	**3.50**
R_4	0.000	**3.50**
R_5	0.000	**3.50**
R_6	0.000	**3.50**
R_7	0.000	**3.50**
R_8	0.000	**3.50**
R_9	0.000	**3.50**
R_{10}	0.000	**3.50**

Demand Output		
Location, ft		**1.75**
Shear, k		0.00
Moment, k-ft	M =	0.98
Deflection, in	D =	-0.02
Δ/Span		L/2791

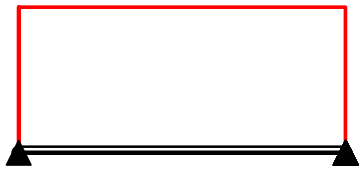
Load Factors	
Dead	**1.00**
Live	**1.00**
Roof Live	**1.00**
Seismic	**1.00**

Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	445

Max/Min Stresses	
f_{v_MAX} (psi)	77
f_{v_MIN} (psi)	-77
f_{b_MAX} (psi)	445
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1500**
b (in)	**3**
d (in)	**7.25**
I (in^4)	95.27
S (in^3)	26.281
A (in^2)	21.75
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	1.11	-1.11	0	0.975	-0.015 (↓)	1.8	L/2800	0	0	L/∞

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PROJECT PATHAK REMODEL
MAIN RESIDENCE

DATE 5/22/2024
PROJ. #
DESIGN LTN
SHEET 7

Beam Analysis

Beam:		UH3					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1					0.000	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1				**1.842**	1.842	**2.75**
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**10.25**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	1.348	**0.00**
R_2	0.494	**10.25**
R_3	0.000	**10.25**
R_4	0.000	**10.25**
R_5	0.000	**10.25**
R_6	0.000	**10.25**
R_7	0.000	**10.25**
R_8	0.000	**10.25**
R_9	0.000	**10.25**
R_{10}	0.000	**10.25**

Demand Output		
Location, ft		**4.55**
Shear, k		-0.49
Moment, k-ft	M =	2.82
Deflection, in	D =	-0.37
Δ/Span		L/333

Load Factors	
Dead	**1.00**
Live	**1.00**
Roof Live	**1.00**
Seismic	**1.00**

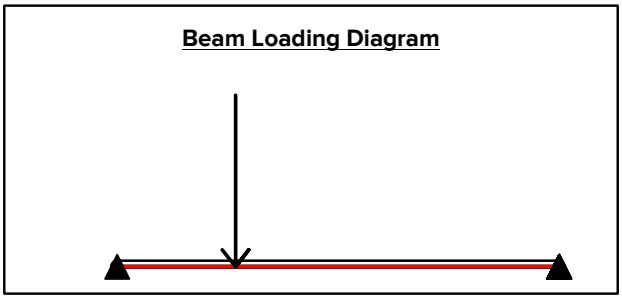
Stresses @ Input Location	
f_v (psi)	-34
f_b (psi)	1286

Max/Min Stresses	
f_{v_MAX} (psi)	93
f_{v_MIN} (psi)	-34
f_{b_MAX} (psi)	1689
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1500**
b (in)	**3**
d (in)	**7.25**
I (in^4)	95.27
S (in^3)	26.281
A (in^2)	21.75
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	1.35	-0.494	-	3.7	-0.369 (↓)	4.6	L/333	0	0	L/∞

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DESIGN LTN
SHEET 8

Beam Analysis

Beam:		UH3-UPLIFT					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1					0.000	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1				**-1.842**	-1.842	**2.75**
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**10.25**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	-1.348	**0.00**
R_2	-0.494	**10.25**
R_3	0.000	**10.25**
R_4	0.000	**10.25**
R_5	0.000	**10.25**
R_6	0.000	**10.25**
R_7	0.000	**10.25**
R_8	0.000	**10.25**
R_9	0.000	**10.25**
R_{10}	0.000	**10.25**

Demand Output		
Location, ft		**0.00**
Shear, k		-1.35
Moment, k-ft	M =	0.00
Deflection, in	D =	0.00
Δ/Span		∞

Load Factors	
Dead	**1.00**
Live	**1.00**
Roof Live	**1.00**
Seismic	**1.00**

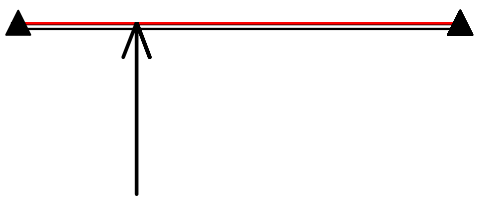
Stresses @ Input Location	
f_v (psi)	-93
f_b (psi)	0

Max/Min Stresses	
f_{v_MAX} (psi)	34
f_{v_MIN} (psi)	-93
f_{b_MAX} (psi)	0
f_{b_MIN} (psi)	-1689

Beam Properties	
E (ksi)	**1500**
b (in)	**3**
d (in)	**7.25**
I (in^4)	95.27
S (in^3)	26.281
A (in^2)	21.75
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	-1.35	0.494	-3.7	-	0.369 (↑)	4.6	L/333	0	0	L/∞

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Beam Analysis

Beam:		UH3-gravity					
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.035**	**0.210**			0.245	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**10.25**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	1.256	**0.00**
R_2	1.256	**10.25**
R_3	0.000	**10.25**
R_4	0.000	**10.25**
R_5	0.000	**10.25**
R_6	0.000	**10.25**
R_7	0.000	**10.25**
R_8	0.000	**10.25**
R_9	0.000	**10.25**
R_{10}	0.000	**10.25**

Demand Output		
Location, ft		**5.13**
Shear, k		0.00
Moment, k-ft	M =	3.22
Deflection, in	D =	-0.43
Δ/Span		L/289

Load Factors	
Dead	**1.00**
Live	**1.00**
Roof Live	**1.00**
Seismic	**1.00**

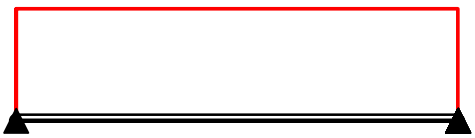
Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	1469

Max/Min Stresses	
f_{v_MAX} (psi)	87
f_{v_MIN} (psi)	-87
f_{b_MAX} (psi)	1470
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1500**
b (in)	**3**
d (in)	**7.25**
I (in^4)	95.27
S (in^3)	26.281
A (in^2)	21.75
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	1.26	-1.26	-	3.22	-0.426 (↓)	5.1	L/289	-0.365 (↓)	5.1	L/337

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PROJECT PATHAK REMODEL
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DATE 5/22/2024
PROJ. #
DESIGN LTN
SHEET 10

Column Buckling Calculations

NDS 2018

Column Geometry Data

4X Posts Doug Fir - Larch #2		
Other		
b	3.5	in
d	5.5	in
Le_1	7.50	ft
Le_2	7.50	ft
$le_{bending}$	7.5	ft

Bracing

No Brace
No Brace

Column Design Values

F_b	900	psi
F_c	1350	psi
E'min	580	ksi
Fcperp	650	psi
cb	1.00	

Bearing
Area
Increase
No

Column Loading

P	7793	lbs
W_1	0	plf
M1	0	ft-lbs
W_2	6.875	plf
M2	48	ft-lbs

Flexural Stress Adjustment Factors

Roof/EQ / Wind - C_D	1.60
Size Factor - C_F	1.30
Repetitive - C_r	1.00

Compressive Parallel Adjustment Factors

Roof/EQ / Wind - C_D	1.60
Size Factor - C_F	1.10

Other Factors

Visually Graded Lumber	
c	0.8
Solid Column	
Kf	1
Column: Pinned Pinned	
Ke	1

Column Stability Factor Calculation

Strong Axis			Weak Axis		
Fce_1	1780	psi	Fce_2	721	psi
Fc^*_1	2376	psi	Fc^*_2	2376	psi
Fce_1/Fc^*_1	0.749		Fce_2/Fc^*_2	0.303	
Cp_1	0.585		Cp_2	0.281	

Beam Stability Factor Calculation

Strong Axis			Weak Axis		
Fbe_1	17224	psi	Fbe_2	37,132	psi
Fb'_1	1872	psi	Fb'_2	1872	psi
Fbe_1/Fb'_1	9.2		Fbe_2/Fb'_2	20	
le	7.5	ft			
CL_1	0.99				

Adjusted Allowable Stresses

Strong Axis			Weak Axis		
Fc'_1	1389	psi	Fc'_2	669	psi
Fb'_1	1861	psi	Fb'_2	1872	psi

Imposed Column Stresses

Strong Axis			Weak Axis		
fc_1	405	psi	fc_2	405	psi
fb_1	0	psi	fb_2	52	psi

Perpendicular to Grain Stress Check fcp/Fcp =	***405 / 650***	**OK**
Slenderness Check le/d	**16**	**OK**
Slenderness Check le/b	**26**	**OK**

(1) $$\left(\frac{f_c}{F_c'}\right)^2+\frac{f_{b1}}{F_{b1}'\left[1-f_c/F_{cE1}\right]}+\frac{f_{b2}}{F_{b2}'\left[1-f_c/F_{cE2}-\left(f_{b1}/F_{bE1}\right)\right]}\le 1.0$$

(2) $$\frac{fc}{F_{cE2}}+\left(\frac{f_{b1}}{F_{bE}}\right)^2<1.0$$

(3) $$\frac{f_c}{F_{c'}},\frac{f_{b1}}{F_{b1}'},\frac{f_{b2}}{F_{b2}'}<1.0$$

Allowable Stress Interaction Formula	**0.61**	**OK**

STRUCTURAL ENGINEERING

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Project: PATHAK REMODEL *Date:* 5/22/2024

Project #:

UP1 Design: LTN

Sheet:

Column Buckling Calculations

NDS 2018

Column Geometry Data

Doug Fir - Larch #2 Studs		
Doug Fir Plates		
b	3	in
d	5.5	in
Le_1	8.00	ft
Le_2	8.00	ft
$le_{bending}$	8	ft

Bracing
No Brace
No Brace

Column Stability Factor Calculation

	Strong Axis		Weak Axis	
Fce_1	1565	psi	Fce_2 466	psi
Fc^*_1	2376	psi	Fc^*_2 2376	psi
Fce_1/Fc^*_1	0.659		Fce_2/Fc^*_2 0.196	
Cp_1	0.535		Cp_2 0.187	

Column Design Values

F_b	900	psi
F_c	1350	psi
E'min	580	ksi
Fcperp	625	psi
cb	1.00	

Bearing
Area
Increase
No

Beam Stability Factor Calculation

	Strong Axis		Weak Axis	
Fbe_1	11864	psi	Fbe_2 40,613	psi
Fb'_1	1872	psi	Fb'_2 1872	psi
Fbe_1/Fb'_1	6.3		Fbe_2/Fb'_2 22	
le	8.0	ft		
CL_1	0.99			

Column Loading

P	2842	lbs
W_1	0	plf
M1	0	ft-lbs
W_2	6.875	plf
M2	55	ft-lbs

Adjusted Allowable Stresses

	Strong Axis		Weak Axis	
Fc'_1	1272	psi	Fc'_2 445	psi
Fb'_1	1855	psi	Fb'_2 1872	psi

Flexural Stress Adjustment Factors

Roof/EQ / Wind - C_D	1.60
Size Factor - C_F	1.30
Repetitive - C_r	1.00

Imposed Column Stresses

	Strong Axis		Weak Axis	
fc_1	172	psi	fc_2 172	psi
fb_1	0	psi	fb_2 80	psi

Compressive Parallel Adjustment Factors

Roof/EQ / Wind - C_D	1.60
Size Factor - C_F	1.10

Perpendicular to Grain Stress Check fcp/Fcp =	***172 / 625***	**OK**
Slenderness Check le/d	**17**	**OK**
Slenderness Check le/b	**32**	**OK**

Other Factors

Visually Graded Lumber	
c	0.8
Solid Column	
Kf	1
Column: Pinned Pinned	
Ke	1

(1) $$\left(\frac{f_c}{F_c'}\right)^2+\frac{f_{b1}}{F_{b1}'\left[1-f_c/F_{cE1}\right]}+\frac{f_{b2}}{F_{b2}'\left[1-f_c/F_{cE2}-\left(f_{b1}/F_{bE1}\right)\right]}\le 1.0$$

(2) $$\frac{f_c}{F_{cE2}}+\left(\frac{f_{b1}}{F_{bE}}\right)^2<1.0$$

(3) $$\frac{f_c}{F_{c'}},\frac{f_{b1}}{F_{b1}'},\frac{f_{b2}}{F_{b2}'}<1.0$$

Allowable Stress Interaction Formula	**0.39**	**OK**

SSF STRUCTURAL ENGINEERING

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Project: PATHAK REMODEL *Date:* *5/22/2024*

Project #:

UP3 Design: LTN

Sheet:

Column Buckling Calculations

NDS 2018

Column Geometry Data

Doug Fir - Larch #2 Studs		
Doug Fir Plates		
b	3	in
d	3.5	in
Le_1	8.00	ft
Le_2	8.00	ft
$le_{bending}$	8	ft

Bracing
No Brace
No Brace

Column Stability Factor Calculation

	Strong Axis		Weak Axis	
Fce_1	634	psi	Fce_2	466 psi
Fc^*_1	2484	psi	Fc^*_2	2484 psi
Fce_1/Fc^*_1	0.255		Fce_2/Fc^*_2	0.187
Cp_1	0.240		Cp_2	0.180

Column Design Values

F_b	900	psi
F_c	1350	psi
E'min	580	ksi
Fcperp	625	psi
cb	1.00	

Bearing
Area
Increase
No

Beam Stability Factor Calculation

	Strong Axis		Weak Axis	
Fbe_1	18643	psi	Fbe_2	16,447 psi
Fb'_1	2160	psi	Fb'_2	2160 psi
Fbe_1/Fb'_1	8.6		Fbe_2/Fb'_2	8
le	8.0	ft		
CL_1	0.99			

Column Loading

P	2856	lbs
W_1	0.0	plf
M1	0	ft-lbs
W_2	7	plf
M2	56	ft-lbs

Adjusted Allowable Stresses

	Strong Axis		Weak Axis	
Fc'_1	596	psi	Fc'_2	446 psi
Fb'_1	2146	psi	Fb'_2	2160 psi

Flexural Stress Adjustment Factors

Roof/EQ / Wind - C_D	1.60
Size Factor - C_F	1.50
Repetitive - C_r	1.00

Imposed Column Stresses

	Strong Axis		Weak Axis	
fc_1	272	psi	fc_2	272 psi
fb_1	0	psi	fb_2	128 psi

Compressive Parallel Adjustment Factors

Roof/EQ / Wind - C_D	1.60
Size Factor - C_F	1.15

Perpendicular to Grain Stress Check fcp/Fcp =	***272 / 625***	**OK**
Slenderness Check le/d	**27**	**OK**
Slenderness Check le/b	**32**	**OK**

Other Factors

Visually Graded Lumber	
c	0.8
Solid Column	
Kf	1
Column: Pinned Pinned	
Ke	1

(1) $$\left(\frac{f_c}{F_c'}\right)^2+\frac{f_{b1}}{F_{b1}'\left[1-f_c/F_{cE1}\right]}+\frac{f_{b2}}{F_{b2}'\left[1-f_c/F_{cE2}-\left(f_{b1}/F_{bE1}\right)\right]}\le 1.0$$

(2) $$\frac{f_c}{F_{cE2}}+\left(\frac{f_{b1}}{F_{bE}}\right)^2<1.0$$

(3) $$\frac{f_c}{F_{c'}},\frac{f_{b1}}{F_{b1}'},\frac{f_{b2}}{F_{b2}'}<1.0$$

Allowable Stress Interaction Formula	**0.61**	**OK**

STRUCTURAL ENGINEERING

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Project: PATHAK REMODEL *Date:* *5/22/2024*

Project #:

(2) (E) 2X4 STUDS Design: LTN

Sheet:

Spread Footing Soil Bearing Design

Service Loads Loading

Dead Load =	1.2 kips
Live Load =	6.6 kips
Wind/EQ Load =	0.0 kips
Wind/EQ Moment (M_Y) =	0 ft-kips
Gravity Load Eccentricity (±X)=	0.00 ft.
Footing Weight =	0.5 kips
Total Load =	8.3 kips
Total Moment =	0 ft-kips

Service Load Factors

DL	1
LL	1
EQ/Wind	1

Soil Properties

Allowable Soil Brg. (Qa) =	2.50 ksf
Overburdan Density (γs) =	120 psf
Net Ftg Wt? (γ_c-γ_s)	No

Column Dimensions and Location

Column Xc Dimension (Dx) =	10.00 in.
Column Yc Dimension (Dy) =	10.00 in.
Column Face from right (Cr) =	0.58 ft.
Column Face from left (Cl) =	0.58 ft.

Soil Bearing Check (Allowable)

Eccentricity =	0.00 ft.	
Leng. Soil Brg. Under Ftg.=	2.00 ft.	
qmax =	2.07 ksf	OK
qmin =	2.07 ksf	

Footing Dimensions

L Dimension (X) =	2.00 ft.
B Dimension (Y) =	2.00 ft.
Footing Thickness (t) =	10.00 in.
Ftg Overburden (Ot) =	0.00 ft.

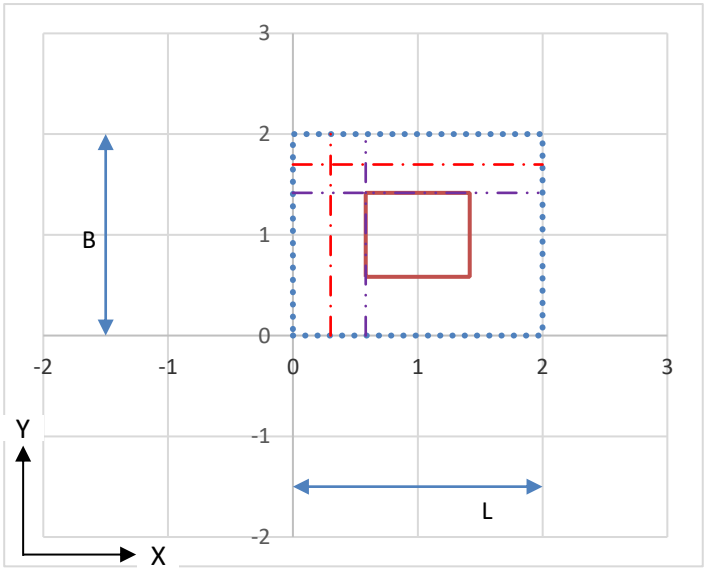
Soil Pressure Equations:

$e \le L/6$

$$qmax = \frac{Q}{LB}\left(1 + \frac{6e}{L}\right)$$

$e > L/6$

$$qmax = \frac{4Q}{3L(L-2e)}$$



PATHAK REMODEL

PROJECT MAIN RESIDENCE

UP1 & UP2 POST FOOTING

DATE 5/22/2024

PROJ. # LTN

DESIGN

SHEET

Spread Footing Concrete Design - ACI 318-14

Footing Properties

Concrete Strength (f'c) =	3000 psi
Rebar Yield Strength (f_y) =	60000 psi
Reinforcing Clear Cover (cvr) =	3.00 in.
Reinforcing Depth (d) =	6.75 in.

Strength Load Factors

DL	1.2
LL	1.6
EQ/Wind	1

Factored Loads

Factored Total Load =	12.6 kips
Factored Total moment =	0 ft-kips

Factored Moments and Shears

	Mu k-ft	Vu kips
X Right Side	1	2
X Left Side	1	2
Y Both Sides	1	2

Factored Bearing

Eccentricity =	0.00 ft.
Length of Soil Brg. Under Ftg. =	2.00 ft.
qmax =	3.15 ksf
qcolr =	3.15 ksf
qcoll =	3.15 ksf
qmin =	3.15 ksf

Flexural Design - X Direction (About Y-Axis)

Bar Size =	#4	
Bars =	2	
Mu =	1 ft-kips	
ØMn =	12 ft-kips	OK
ρ_{min} =	0.0018	*Controls*
ρ_{req} =	0.0002	
A_s Required =	0.29 sq. in.	
A_s Provided =	0.40 sq. in.	OK

Flexural Design - Y Direction (About X-Axis)

Bar Size =	#4	
Bars =	2	
Mu =	1 ft-kips	
ØMn =	12 ft-kips	OK
ρ_{min} =	0.0018	*Controls*
ρ_{req} =	0.0002	
A_s Required =	0.29 sq. in.	
A_s Provided =	0.40 sq. in.	OK

One-Way Shear Design - X Direction

Vu =	2 kips	
ØVn =	13 kips	OK

One-Way Shear Design - Y Direction

Vu =	2 kips	
ØVn =	13 kips	OK

β =	1.000
$\gamma_s = 2/(\beta+1)$ =	1.00
Provide $A_{s,req}\gamma_s$ =	0.29 sq. in.

Provide evenly distributed bars in each direction.

Two-Way (Punching) Shear Design

b_o =	67 in	
vu =	6 kips	
Øvn =	72 kips	OK

Concrete Capacity Equations:

$$Mn = A_s F_y \left[d - \frac{1}{2}\left(\frac{A_s F_y}{0.85 f'c\, b} \right) \right]$$

$$vn = min \begin{pmatrix} 4\sqrt{f'c} \\ \left(2 + \frac{4}{\beta}\right)\sqrt{f'c} \\ \left(2 + \frac{\alpha_s d}{b_o}\right)\sqrt{f'c} \end{pmatrix} b_o d$$

$$Vn = 2\,\gamma\sqrt{f'c}\, b_w d$$

$$b_o = 2(Dx + d) + 2(Dy + d)$$

$$\beta = \max(Dx, Dy)/\min(Dx, Dy)$$

PROJECT	PATHAK REMODEL	DATE	5/22/2024
	MAIN RESIDENCE		
	UP1 & UP2 POST FOOTING	PROJ. #	LTN
		DESIGN	
		SHEET	

Spread Footing Soil Bearing Design

Service Loads Loading

Dead Load =	2.4 kips
Live Load =	0.0 kips
Wind/EQ Load =	0.8 kips
Wind/EQ Moment (M_Y) =	0 ft-kips
Gravity Load Eccentricity (±X)=	0.00 ft.
Footing Weight =	1.8 kips
Total Load =	5.0 kips
Total Moment =	0 ft-kips

Service Load Factors

DL	1
LL	1
EQ/Wind	1

Soil Properties

Allowable Soil Brg. (Qa) =	3.33 ksf
Overburdan Density (γs) =	120 psf
Net Ftg Wt? (γ_c-γ_s)	No

Column Dimensions and Location

Column Xc Dimension (Dx) =	5.00 in.
Column Yc Dimension (Dy) =	5.00 in.
Column Face from right (Cr) =	3.29 ft.
Column Face from left (Cl) =	3.29 ft.

Soil Bearing Check (Allowable)

Eccentricity =	0.00 ft.
Leng. Soil Brg. Under Ftg.=	7.00 ft.
qmax =	0.71 ksf
qmin =	0.71 ksf

OK

Footing Dimensions

L Dimension (X) =	7.00 ft.
B Dimension (Y) =	1.00 ft.
Footing Thickness (t) =	20.00 in.
Ftg Overburden (Ot) =	0.00 ft.

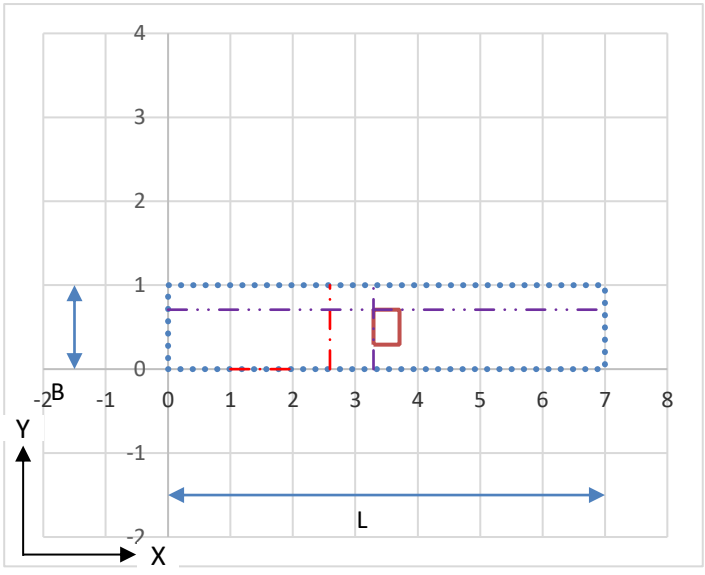
Soil Pressure Equations:

$e \le L/6$

$$qmax = \frac{Q}{LB}\left(1 + \frac{6e}{L}\right)$$

$e > L/6$

$$qmax = \frac{4Q}{3L(L-2e)}$$



STRUCTURAL ENGINEERING

PROJECT	PATHAK REMODEL
	MAIN RESIDENCE
	STRIP FOOTING ALONG GRID G
DATE	5/28/2024
PROJ. #	LTN
DESIGN	
SHEET	

Spread Footing Concrete Design - ACI 318-14

Footing Properties

Concrete Strength (f'c) =	3000 psi
Rebar Yield Strength (f_y) =	60000 psi
Reinforcing Clear Cover (cvr) =	3.00 in.
Reinforcing Depth (d) =	16.75 in.

Strength Load Factors

DL	1.2
LL	1.6
EQ/Wind	1

Factored Loads

Factored Total Load =	5.8 kips
Factored Total moment =	0 ft-kips

Factored Moments and Shears

	Mu k-ft	Vu kips
X Right Side	4	2
X Left Side	4	2
Y Both Sides	0	0

Factored Bearing

Eccentricity =	0.00 ft.
Length of Soil Brg. Under Ftg. =	7.00 ft.
qmax =	0.83 ksf
qcolr =	0.83 ksf
qcoll =	0.83 ksf
qmin =	0.83 ksf

Flexural Design - X Direction (About Y-Axis)

Bar Size =	#4	
Bars =	2	
Mu =	4 ft-kips	
ØMn =	29 ft-kips	OK
ρ_{min} =	0.0018	*Controls*
ρ_{req} =	0.0003	
A_s Required =	0.36 sq. in.	
A_s Provided =	0.40 sq. in.	OK

Flexural Design - Y Direction (About X-Axis)

Bar Size =	#4	
Bars =	14	
Mu =	0 ft-kips	
ØMn =	206 ft-kips	OK
ρ_{min} =	0.0018	*Controls*
ρ_{req} =	0.0000	
A_s Required =	2.53 sq. in.	
A_s Provided =	2.80 sq. in.	OK

One-Way Shear Design - X Direction

Vu =	2 kips	
ØVn =	17 kips	OK

β =	7.000
$\gamma_s = 2/(\beta+1)$ =	0.25
Provide $A_{s,req}\gamma_s$ =	0.63 sq. in.

Provide 4 bars in center 1 ft of the ftg

and the remainder outside of those extents

One-Way Shear Design - Y Direction

Vu =	0 kips	
ØVn =	116 kips	OK

Two-Way (Punching) Shear Design

b_o =	87 in	
vu =	3 kips	
Øvn =	236 kips	OK

Concrete Capacity Equations:

$$Mn = A_s F_y \left[d - \frac{1}{2}\left(\frac{A_s F_y}{0.85 f'c\, b} \right) \right]$$

$$vn = min \left(\begin{matrix} 4\sqrt{f'c} \\ \left(2 + \frac{4}{\beta}\right)\sqrt{f'c} \\ \left(2 + \frac{\alpha_s d}{b_o}\right)\sqrt{f'c} \end{matrix} \right) b_o d$$

$$Vn = 2\,\gamma\sqrt{f'c}\, b_w d$$

$$b_o = 2(Dx + d) + 2(Dy + d)$$

$$\beta = \max(Dx, Dy)/\min(Dx, Dy)$$

PROJECT	PATHAK REMODEL	DATE 5/28/2024
	MAIN RESIDENCE	
	STRIP FOOTING ALONG GRID G	PROJ. # LTN
		DESIGN
		SHEET

Criteria Sheet

Codes

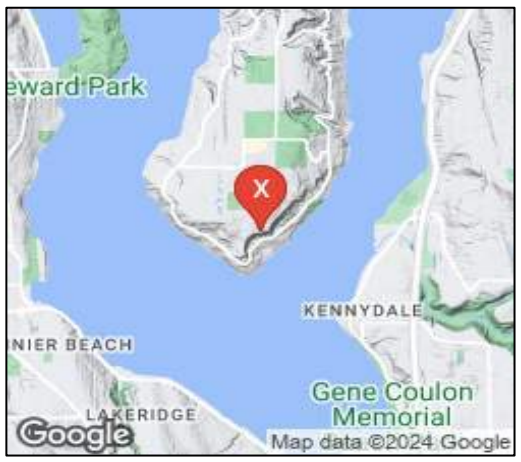
Structural	IBC 2021
Loading	ASCE 7-16
Wood:	NDS 2018 / SDPWS 2021
Steel:	AISC 360-16
Concrete:	ACI 318-19
Masonry:	TMS 402/602-16

Project Location

Street & Number	8541 SE 82nd Street		
City:	Mercer Island	State:	WA
ZIP:	98040		
Latitude:	47.5302	N	
Longitude:	-122.2242	W	
Ground Elevation	315	ft	

Occupancy Category

Risk Category: II — ASCE 7 Table 1.5-1



Seismic Load Summary:

Analysis Procedure:	Equivalent Lateral Force Procedure		
Lateral System:	Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance		
R:	6.50	C_d=	4
Base Shear V =	3 kips	Ω_o=	2.5
S_S=	1.463	S_1=	0.504
S_{DS}=	0.98	S_{D1}=	0.86
C_s=	0.150	I_E=	1.0

Story Information

# Stories Above Grade (Including Mezzanine Levels)	1

Horizontal and Vertical Irregularities:

Is the building a "Regular Structure"? (No horizontal or vertical irregularities)	Yes

Wind Load Summary:

V=	98	K_{ZT}=	1.19
Exposure =	C		

Dead Loads:

Roof			Floor		
Roofing	1	psf	Slab on Grade	50	psf
1/2" Sheathing	1.8	psf			
Joists	2.5	psf			
Misc./Mech.	1.5	psf			
Ceiling Finish	3	psf			
Solar Panels	0	psf			
	10	psf			
Use	10	psf			
Add'l Seismic Weight	5	psf			
Seismic Weight	15	psf			

Live Loads:

Roof	25	psf
Floor	40	psf

Snow Loading Criteria:

Ground Snow, p_g	25 psf	Flat Roof Snow Load, p_f	25.0 psf	Importance Factor, I_s	1.00
Exposure Factor, C_e	0.90	Sloped Roof Snow Load, p_s	25.0 psf		
Thermal Factor, C_t	1.00	Slope Factor, C_s	0.75		

Soils:

Allowable Bearing	2500 psf	Active	55/35	pcf (Restrained/Unrestrained)
Sliding, μ	0.3	Seismic Surcharge	8H	
Passive	250 pcf			

Soils Report Provided?	Yes
Site Specific Ground Motion Hazard Analysis Provided?	No

STRUCTURAL ENGINEERING

PATHAK REMODEL - Carport/Garage

Criteria

DATE 5/3/2024

PROJ. #

DESIGN LTN

SHEET 1

Seismic Design

ASCE 7-16 Seismic Analysis | Equivalent Lateral Force Procedure | Apply Section 12.8.1.3 (Where Applicable)? Yes

Seismic Force Resisting System Per Table 12.2-1		
	System:	Bearing Wall Systems
	Type:	Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance

Seismic Design Cat.	D	
Risk Category	II	I, II, or III, or IV per Table 1.5-1
Site Class	D	Per soils report.
Diaphragm Flexibility	Flexible	

Section 12.8.1.3

1. Regular Structure	Yes
2. ≤ 5 Stories above grade	Yes
3. T ≤ 0.5s	Yes
4. ρ = 1.0	Yes
5. Not Site Class E or F	Yes
6. Risk Category I or II	Yes

If all items above are met, S_{DS} may be taken as 1.0, but not less than 0.7*(Calculated S_{DS})

S_S	1.463 g	2% in 50 yr, Latitude & Longitude lookup
S_1	0.504 g	2% in 50 yr, Latitude & Longitude lookup
R	6.50	
C_d	4.0	
Ω_o	2.5	
I_e	1.00	Table 1.5-2
h_n	10.0 ft	
Ct	0.02	Table 12.8-2
x	0.75	Table 12.8-2
T_a	0.11 sec	
T	0.11 sec	Eq. 12.8-7
T_0	0.18 sec	
T_S	0.88 sec	
T_L	6.00 sec	
F_a	1.00	Table 11.4-1
F_v	1.70	Table 11.4-2
S_{MS}	1.46 g	Eq. 11.4-1
S_{M1}	1.29 g	Eq. 11.4-2
S_{DS}	0.975 g	Eq. 11.4-3
S_{D1}	0.857 g	Eq. 11.4-4
C_s	***0.150 Controls***	Eq. 12.8-2
	1.172	Eq. 12.8-3 need not exceed, T < T_L
	0.010	Eq. 12.8-5 or 12.8-6 minimum
C_s, design	0.150	
Bldg. Weight	16.9 k	
V = C_SW	2.5 k	Eq. 12.8-1, Strength Level Base Shear
V = C_{Sasd}W	1.8 k	Eq. 12.8-1 ASD Base Shear

Building Period Per Alternate Analysis

T (sec)	

Per Geotech Report

F_a	
F_v	

$T_a = C_t h_n^x$ Eq. 12.8.7

$S_{MS} = F_a S_S$ Eq. 11.4-1
$S_{M1} = F_v S_1$ Eq. 11.4-2
$S_{DS} = {}^2/_3\, S_{MS}$ Eq. 11.4-3
$S_{D1} = {}^2/_3\, S_{M1}$ Eq. 11.4-4

$C_S = \frac{S_{DS}}{(R/I_e)}$ Eq. 12.8-2
$C_S = \frac{S_{D1}}{T(R/I_e)}$ Eq. 12.8-3
$C_S = \frac{S_{D1} T_L}{T^2(R/I_e)}$ Eq. 12.8-4
$C_S \geq 0.044 S_{DS} I_e$ Eq. 12.8-5
$C_S \geq 0.01$ Eq. 12.8-5
$C_S > 0.5 \frac{S_1}{(R/I_e)}$ Eq. 12.8-6

$C_{VX} = w_x h_x^k / \sum_{i=1}^{n} w_x h_i^k$ Eq. 12.8-12

$F_{px} = {}^{\sum_{i=x}^{n} F_i}/_{\sum_{i=x}^{n} w_i}\, w_{px}$ Eq. 12.10-1
$F_{px} \geq 0.2 S_{DS} I_e w_{px}$ Eq. 12.10-2
$F_{px} \leq 0.4 S_{DS} I_e w_{px}$ Eq. 12.10-3

Vertical Distribution ASD ρ= 1 k= 1.000

Level	h_x (ft)	W_x (k)	h_x^k (ft)	$W_x h_x^k$	Story Shear ASD			Diaphragm Force (ρ not included)				
					C_{vx} (%)	F_x (k)	SV (k)	$F_{px,calc}$	$F_{px,min}$	$F_{px,max}$	$F_{px,design}$	$\gamma=F_{px}/F_x$
Roof	10.0	16.9	10.0	169	1.000	1.8	**1.8**	1.8	2.3	4.6	**2.3**	1.30
Σ		16.9		169		**1.8**						

PATHAK REMODEL - Carport/Garage
Seismic Criteria

DATE 5/3/2024
PROJ. #
DESIGN LTN
SHEET 2

Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method	ASD

Wind Coefficients

Exposure	C	
V=	98	mph
K_d=	0.85	Table 26.6-1
K_h=	0.85	Table 27.3-1
K_e=	0.99	Table 26.9-1
G=	0.85	26.9.4

Location and Building Dimensions

Calculate Kzt?	Yes	
Kzt	1.19	
Roof Type	Gable	
Roof Slope - Transverse Dir	22	degrees
Roof Slope - Long Dir	0	degrees
Ground to top of roof	18	ft
Bot of roof to top of roof	6.5	ft
Mean Roof Height, h	14.75	ft
Short Plan Dimension	19	ft
Long Plan Dimension	49	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft

Transverse Wind Pressures

L/B = 0.39 h/L = 0.78

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-0.5 / -0.02
Leeward Roof	-0.60

Velocity Pressure at Mean Roof Height, q_h =	20.8	psf

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	**P_{walls} (psf)**
0-15	0.85	20.86	14.19	8.85	**13.8**
15-20	0.9	22.09	15.02	8.85	**14.3**
20-25	0.94	23.07	15.69	8.85	**14.7**
25-30	0.98	24.05	16.36	8.85	**15.1**
30-40	1.04	25.53	17.36	8.85	**15.7**
41-50	1.09	26.75	18.19	8.85	**16.2**
51-60	1.13	27.73	18.86	8.85	**16.6**
61-70	1.17	28.72	19.53	8.85	**17.0**
71-80	1.21	29.70	20.19	8.85	**17.4**
81-90	1.24	30.43	20.70	8.85	**17.7**
91-100	1.26	30.93	21.03	8.85	**17.9**

Roof Pressures (Unfactored) ASD

Windward		Leeward	**Horiz Proj (psf)**
Max	Min		
-0.4	-8.9	-10.6	**6.12**

Longitudinal Wind Pressures

L/B = 2.58 h/L = 0.30

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.27
Windward Roof	-0.9 / -0.18
Leeward Roof	-0.50

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	**P_{walls} (psf)**
0-15	0.85	20.86	14.19	4.80	**11.39**
15-20	0.9	22.09	15.02	4.80	**11.89**
20-25	0.94	23.07	15.69	4.80	**12.29**
25-30	0.98	24.05	16.36	4.80	**12.69**
30-40	1.04	25.53	17.36	4.80	**13.29**
41-50	1.09	26.75	18.19	4.80	**13.80**
51-60	1.13	27.73	18.86	4.80	**14.20**
61-70	1.17	28.72	19.53	4.80	**14.60**
71-80	1.21	29.70	20.19	4.80	**15.00**
81-90	1.24	30.43	20.70	4.80	**15.30**
91-100	1.26	30.93	21.03	4.80	**15.50**

Roof Pressures (Unfactored) ASD

Windward		Leeward	**Horiz Proj (psf)**
Max	Min		
-3.2	-15.9	-8.9	**4.80**

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SEISMIC WEIGHT: CARPORT / GARAGE

ROOF:

Roofing	: 1 PSF
1/2" Sheathing	: 1.8 PSF
Joists	: 2.5 PSF
Misc.	: 1.5 PSF
Ceiling	: 3 PSF
Partitions	: 5 PSF
	15 PSF

$WT_{ROOF} = 15\ PSF \times (25' \times 45') = 16.9^{K}$

SEISMIC SHEAR:

$V_{SEISMIC}^{ROOF} = 1.8^{K}$

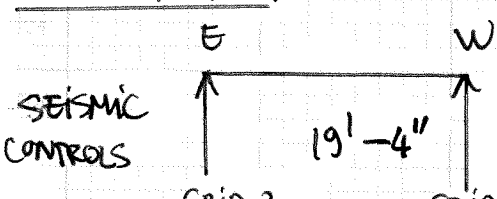
WIND SHEAR: $K_{zt} = 1.19$

$V_{N-S}^{WIND,ROOF} = 14.3\ PSF \times 140\ SF = 2.0^{K}$

$V_{E-W}^{WIND,ROOF} = 11.9\ PSF \times 400\ SF = 4.76^{K}$

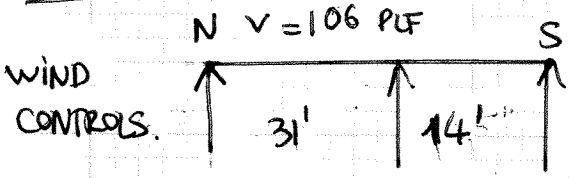
LATERAL DESIGN:

N-S DIRECTION:



	GRID 2	GRID 2.8
LOAD	1000 #	1000 #
LENGTH	4.5 FT	3 FT + 11.75 FT = 14.75 FT
SHEAR	222 PLF	68 PLF
WALL	W6	W6
OT	2 K	0.6 K
HOLDOWN	HDU2	HDU2

E-W DIRECTION:



	GRID A	GRID C	GRID D
LOAD	1.65 K	2.4 K	0.7 K
LENGTH	5 FT + 5 FT = 10 FT	8 FT + 8 FT = 16 FT	10.5 FT
SHEAR	165 PLF	150 PLF	67 PLF
WALL	W6	W6	W6
OT	1.5 K	1.4 K	0.6 K
HOLDOWN	HDU2	HDU2	HDU2

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SWENSON SAY FAGÉT

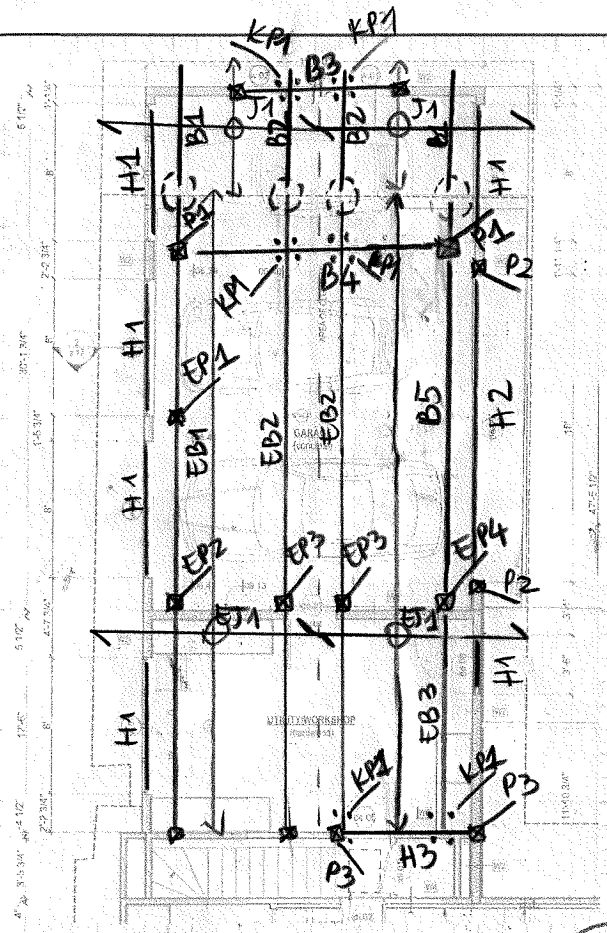
PROJECT: PATHAK REMODEL CARPORT / GARAGE

DATE: 04.05.24

PROJ. #:

DESIGN: LTN

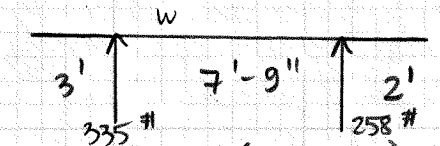
SHEET: 82/107



GARAGE PARTIAL KEY PLAN (TN)

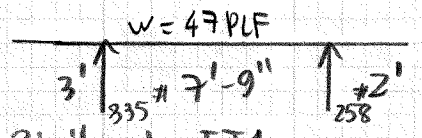
DL = 10 PSF
SL = 25 PSF

EJ1: (E) 2x6 @ 16"oc



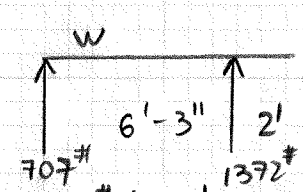
$w = w_D + w_S = (10 + 25\ PSF) \times 1.33'$
$= 47\ PLF$

J1: 2x6 @ 16"oc



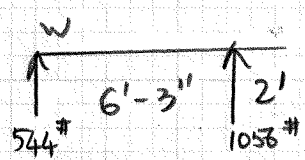
Similar to EJ1

B1: 4x12



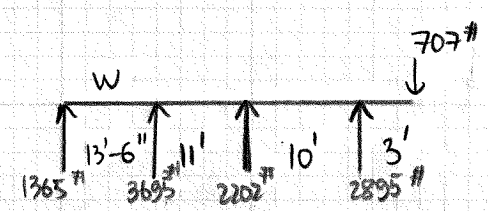
$w = 335\ \# / 1.33' = 252\ PLF$

B2: 4x12



$w = 258\ \# / 1.33' = 194\ PLF$

EB1: (E) 4x12



$w = 335\ \# / 1.33' = 252\ PLF$

$f_b = 736\ psi \quad < F_b'$ OK ✓

$F_b' = C_D \times C_F \times F_b = 1.15 \times 1.1 \times 1000\ psi$
$= 1265\ psi$

$f_v = 78\ psi \quad < F_v'$ OK ✓

$F_v' = C_D \times F_v = 1.15 \times 180\ psi = 207\ psi$

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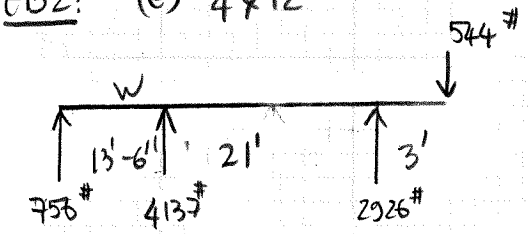
PROJECT: PATHAK REMODEL
CARPORT / GARAGE

DATE: 05.21.24
PROJ. #:
DESIGN: LTN
SHEET:

GARAGE (CONT.):

EB2: (E) 4 x 12

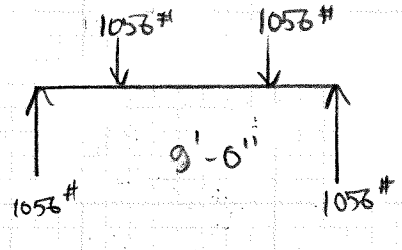


$w = 258^{\#} / 1.33' = 194$ PLF

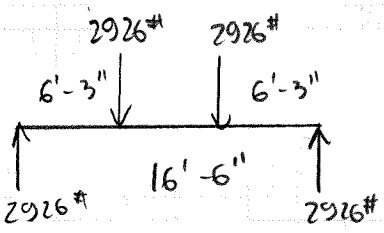
$f_b = 1216$ psi $< F'_b = 1265$ psi OK ✓

$f_v = 86$ psi $< F'_v = 207$ psi OK ✓

B3: (2) 2x10 HDR.

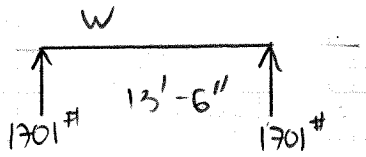


B4:



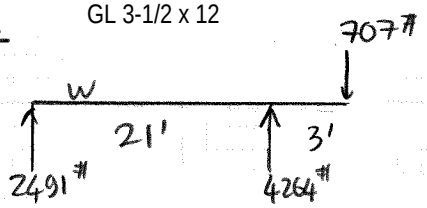
GL $5\frac{1}{2}$ x 12

EB3: (E) 4 x 12



$w = 335^{\#} / 1.33' = 252$ PLF

B5: GL 3-1/2 x 12



$w = 335^{\#} / 1.33' = 252$ PLF

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STRUCTURAL ENGINEERING

PROJECT: PATHAK REMODEL
CARPORT / GARAGE

DATE: 05.21.24

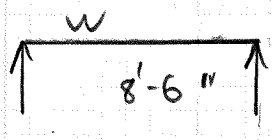
PROJ. #: LJN

DESIGN:

SHEET: 84/107

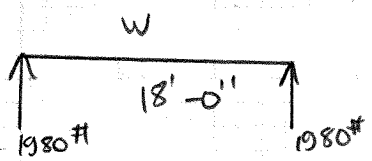
GARAGE / CARPORT (CONT.)

H1: (2) 2x8 HDR.



$w = (10 + 25\ PSF) \times (3' + 1'\ Trib)$
$= 140\ PLF$ (conservative)

H2:

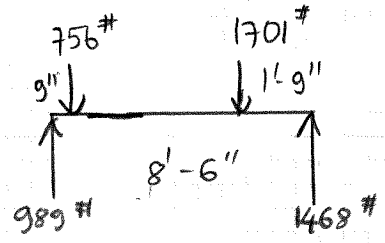


$w = (10 + 25\ PSF) \times (3' + 1'\ Trib)$
$+ 10\ PSF \times 8'$ [Garage Door Weight]

$= 220\ PLF$

GL $5\frac{1}{2} \times 9\frac{1}{2}$

H3:



$R_{EB2} = 1.8^k$

$R_{EB3} = 0.5^k$

$f_b = 668\ psi < F_b = 1000\ psi$ OK ✓

$f_v = 86\ psi < F_v = 180\ psi$ OK ✓

(2) 2x10 HDR.

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SSF STRUCTURAL ENGINEERING

PROJECT: PATHAK REMODEL
CARPORT / GARAGE

DATE: 05.21.24
PROJ. #: LTN
DESIGN:
SHEET: 85/107

Beam Analysis

Beam:		EJ1					
Load		Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.013**		**0.033**		0.047	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**12.75**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.335	**3.00**
R_2	0.258	**10.75**
R_3	0.000	**10.75**
R_4	0.000	**10.75**
R_5	0.000	**10.75**
R_6	0.000	**10.75**
R_7	0.000	**10.75**
R_8	0.000	**10.75**
R_9	0.000	**10.75**
R_{10}	0.000	**10.75**

Demand Output		
Location, ft		**7.20**
Shear, k	V	0.00
Moment, k-ft	M =	0.20
Deflection, in	D =	-0.06
Δ/Span		L/1595

Load Factors	
Dead	**1.00**
Live	**0.00**
Snow	**1.00**
Seismic	**1.00**

Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	318

Max/Min Stresses	
f_{v_MAX} (psi)	35
f_{v_MIN} (psi)	-30
f_{b_MAX} (psi)	319
f_{b_MIN} (psi)	-332

Beam Properties	
E (ksi)	**1500**
b (in)	**1.5**
d (in)	**5.5**
I (in^4)	20.797
S (in^3)	7.5625
A (in^2)	8.25
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram

Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Left Cantilver	-	-0.14	-0.209	-	0.014 (↑)	0	L/5114	0	0	L/∞
Span 1	0.195	-0.165	-0.209	0.201	-0.058 (↓)	7.1	L/1599	0	3	L/∞
Right Cantilever	0.093	-	-0.093	-	0.038 (↑)	12.8	L/1256	0	10.8	L/∞

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PROJECT PATHAK REMODEL
CARPORT/ GARAGE

DATE 5/21/2024
PROJ. #
DESIGN LTN
SHEET

Beam Analysis

Beam:		J1					
Load		Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.013**		**0.033**		0.047	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**12.75**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.335	**3.00**
R_2	0.258	**10.75**
R_3	0.000	**10.75**
R_4	0.000	**10.75**
R_5	0.000	**10.75**
R_6	0.000	**10.75**
R_7	0.000	**10.75**
R_8	0.000	**10.75**
R_9	0.000	**10.75**
R_{10}	0.000	**10.75**

Demand Output		
Location, ft		**7.20**
Shear, k	V	0.00
Moment, k-ft	M =	0.20
Deflection, in	D =	-0.06
Δ/Span		L/1595

Load Factors	
Dead	**1.00**
Live	**1.00**
Snow	**1.00**
Seismic	**1.00**

Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	318

Max/Min Stresses	
f_{v_MAX} (psi)	35
f_{v_MIN} (psi)	-30
f_{b_MAX} (psi)	319
f_{b_MIN} (psi)	-332

Beam Properties	
E (ksi)	**1500**
b (in)	**1.5**
d (in)	**5.5**
I (in^4)	20.797
S (in^3)	7.5625
A (in^2)	8.25
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram

Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Left Cantilver	-	-0.14	-0.209	-	0.014 (↑)	0	L/5114	0	0	L/∞
Span 1	0.195	-0.165	-0.209	0.201	-0.058 (↓)	7.1	L/1599	0	3	L/∞
Right Cantilever	0.093	-	-0.093	-	0.038 (↑)	12.8	L/1256	0	10.8	L/∞

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PROJECT PATHAK REMODEL
CARPORT/ GARAGE

DATE 5/21/2024
PROJ. #
DESIGN LTN
SHEET

Beam Analysis

Beam:		B1					
Load		Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.073**		**0.179**		0.252	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**8.25**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.707	**0.00**
R_2	1.372	**6.25**
R_3	0.000	**6.25**
R_4	0.000	**6.25**
R_5	0.000	**6.25**
R_6	0.000	**6.25**
R_7	0.000	**6.25**
R_8	0.000	**6.25**
R_9	0.000	**6.25**
R_{10}	0.000	**6.25**

Demand Output		
Location, ft		**2.81**
Shear, k	V	0.00
Moment, k-ft	M =	0.99
Deflection, in	D =	-0.01
Δ/Span		L/7176

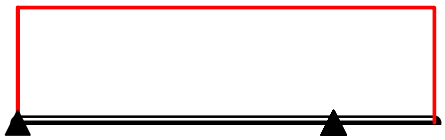
Load Factors	
Dead	**1.00**
Live	**1.00**
Snow	**1.00**
Seismic	**1.00**

Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	161

Max/Min Stresses	
f_{v_MAX} (psi)	27
f_{v_MIN} (psi)	-33
f_{b_MAX} (psi)	161
f_{b_MIN} (psi)	-82

Beam Properties	
E (ksi)	**1500**
b (in)	**3.5**
d (in)	**11.25**
I (in^4)	415.28
S (in^3)	73.828
A (in^2)	39.375
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	0.707	-0.868	-0.504	0.991	-0.01 (↓)	3	L/7484	0	0	L/∞
Right Cantilever	0.504	-	-0.504	-	0.007 (↑)	8.3	L/6846	0	6.3	L/∞

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SEATTLE TACOMA
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PROJECT PATHAK REMODEL
CARPORT/ GARAGE

DATE 5/21/2024
PROJ. #
DESIGN LTN
SHEET

Beam Analysis

Beam:		B2					
Load		Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.056**		**0.138**		0.194	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**8.25**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.544	**0.00**
R_2	1.056	**6.25**
R_3	0.000	**6.25**
R_4	0.000	**6.25**
R_5	0.000	**6.25**
R_6	0.000	**6.25**
R_7	0.000	**6.25**
R_8	0.000	**6.25**
R_9	0.000	**6.25**
R_{10}	0.000	**6.25**

Demand Output		
Location, ft		**2.99**
Shear, k	V	-0.04
Moment, k-ft	M =	0.76
Deflection, in	D =	-0.01
Δ/Span		L/9278

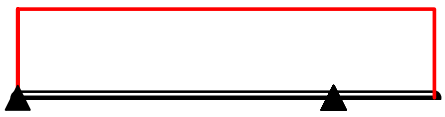
Load Factors	
Dead	**1.00**
Live	**1.00**
Snow	**1.00**
Seismic	**1.00**

Stresses @ Input Location	
f_v (psi)	-1
f_b (psi)	123

Max/Min Stresses	
f_{v_MAX} (psi)	21
f_{v_MIN} (psi)	-25
f_{b_MAX} (psi)	124
f_{b_MIN} (psi)	-63

Beam Properties	
E (ksi)	**1500**
b (in)	**3.5**
d (in)	**11.25**
I (in^4)	415.28
S (in^3)	73.828
A (in^2)	39.375
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	0.544	-0.668	-0.388	0.763	-0.008 (↓)	3	L/9356	0	0	L/∞
Right Cantilever	0.388	-	-0.388	-	0.005 (↑)	8.3	L/9584	0	6.3	L/∞

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CARPORT/ GARAGE

DATE 5/21/2024
PROJ. #
DESIGN LTN
SHEET

Beam Analysis

Beam:		EB1					
Load		Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.073**		**0.179**		0.252	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1			**0.707**		0.707	**37.50**
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		4
Total Beam Length		**37.50**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	1.365	**0.00**
R_2	3.695	**13.50**
R_3	2.202	**24.50**
R_4	2.895	**34.50**
R_5	0.000	**34.50**
R_6	0.000	**34.50**
R_7	0.000	**34.50**
R_8	0.000	**34.50**
R_9	0.000	**34.50**
R_{10}	0.000	**34.50**

Demand Output		
Location, ft		**5.44**
Shear, k	V	0.00
Moment, k-ft	M =	3.70
Deflection, in	D =	-0.16
Δ/Span		L/1013

Load Factors	
Dead	**1.00**
Live	**1.00**
Snow	**1.00**
Seismic	**1.00**

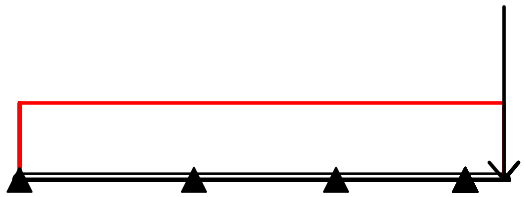
Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	601

Max/Min Stresses	
f_{v_MAX} (psi)	63
f_{v_MIN} (psi)	-78
f_{b_MAX} (psi)	601
f_{b_MIN} (psi)	-736

Beam Properties	
E (ksi)	**1500**
b (in)	**3.5**
d (in)	**11.25**
I (in^4)	415.28
S (in^3)	73.828
A (in^2)	39.375
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	1.37	-2.04	-4.53	3.7	-0.162 (↓)	6	L/1000	0	0	L/∞
Span 2	1.66	-1.11	-4.53	0.926	0.011 (↑)	15.2	L/11864	0	13.6	L/∞
Span 3	1.09	-1.43	-3.26	0.814	-0.009 (↓)	28.6	L/13300	0	24.5	L/∞
Right Cantilever	1.46	-	-3.26	-	-0.049 (↓)	37.5	L/1432	0	34.6	L/∞

PROJECT PATHAK REMODEL
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DATE 5/21/2024
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Beam Analysis

Beam:		EB2					
Load		Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.056**		**0.138**		0.194	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1			**0.544**		0.544	**37.50**
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		3
Total Beam Length		**37.50**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.756	**0.00**
R_2	4.137	**13.50**
R_3	2.926	**34.50**
R_4	0.000	**34.50**
R_5	0.000	**34.50**
R_6	0.000	**34.50**
R_7	0.000	**34.50**
R_8	0.000	**34.50**
R_9	0.000	**34.50**
R_{10}	0.000	**34.50**

Demand Output		
Location, ft		**24.75**
Shear, k	V	0.09
Moment, k-ft	M =	5.83
Deflection, in	D =	-0.60
Δ/Span		L/417

Load Factors	
Dead	**1.00**
Live	**1.00**
Snow	**1.00**
Seismic	**1.00**

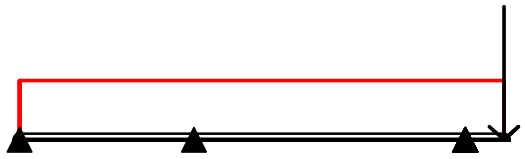
Stresses @ Input Location	
f_v (psi)	3
f_b (psi)	947

Max/Min Stresses	
f_{v_MAX} (psi)	86
f_{v_MIN} (psi)	-71
f_{b_MAX} (psi)	951
f_{b_MIN} (psi)	-1216

Beam Properties	
E (ksi)	**1500**
b (in)	**3.5**
d (in)	**11.25**
I (in^4)	415.28
S (in^3)	73.828
A (in^2)	39.375
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	0.756	-1.86	-7.48	1.47	0.043 (↑)	10.9	L/3767	0	0	L/∞
Span 2	2.27	-1.8	-7.48	5.85	-0.604 (↓)	24.8	L/416	0	13.6	L/∞
Right Cantilever	1.13	-	-2.5	-	0.24 (↑)	37.5	L/292	0	34.6	L/∞

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Beam Analysis

Beam:		B3					
Load		Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	w_1					0.000	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1	**0.31**		**0.75**		1.056	**2.75**
	P_2	**0.31**		**0.75**		1.056	**6.25**
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**9.00**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	1.056	**0.00**
R_2	1.056	**9.00**
R_3	0.000	**9.00**
R_4	0.000	**9.00**
R_5	0.000	**9.00**
R_6	0.000	**9.00**
R_7	0.000	**9.00**
R_8	0.000	**9.00**
R_9	0.000	**9.00**
R_{10}	0.000	**9.00**

Demand Output		
Location, ft		**4.50**
Shear, k	V	0.00
Moment, k-ft	M =	2.90
Deflection, in	D =	-0.15
Δ/Span		L/721

Load Factors	
Dead	**1.00**
Live	**1.00**
Snow	**1.00**
Seismic	**1.00**

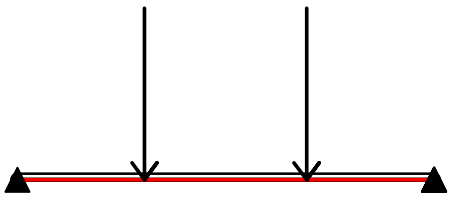
Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	815

Max/Min Stresses	
f_{v_MAX} (psi)	57
f_{v_MIN} (psi)	-57
f_{b_MAX} (psi)	813
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1500**
b (in)	**3**
d (in)	**9.25**
I (in^4)	197.86
S (in^3)	42.781
A (in^2)	27.75
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	1.06	-1.06	-	2.9	-0.15 (↓)	4.5	L/720	0	0	L/∞

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Beam Analysis

Beam:		B4					
Load		Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	w_1					0.000	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1	**0.8**		**2.1**		2.926	**6.25**
	P_2	**0.8**		**2.1**		2.926	**10.25**
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**16.50**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	2.926	**0.00**
R_2	2.926	**16.50**
R_3	0.000	**16.50**
R_4	0.000	**16.50**
R_5	0.000	**16.50**
R_6	0.000	**16.50**
R_7	0.000	**16.50**
R_8	0.000	**16.50**
R_9	0.000	**16.50**
R_{10}	0.000	**16.50**

Demand Output		
Location, ft		**8.25**
Shear, k	V	0.00
Moment, k-ft	M =	18.29
Deflection, in	D =	-0.61
Δ/Span		L/325

Load Factors	
Dead	**1.00**
Live	**1.00**
Snow	**1.00**
Seismic	**1.00**

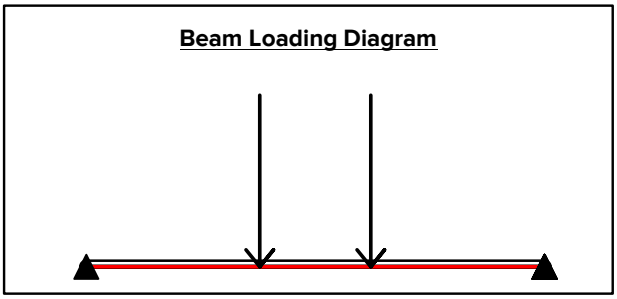
Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	1663

Max/Min Stresses	
f_{v_MAX} (psi)	67
f_{v_MIN} (psi)	-67
f_{b_MAX} (psi)	1664
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1800**
b (in)	**5.5**
d (in)	**12**
I (in^4)	792
S (in^3)	132
A (in^2)	66
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	2.93	-2.93	-	18.3	-0.61 (↓)	8.3	L/325	0.0000	0	L/∞

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Beam Analysis

Beam:		EB3					
Load		Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.073**		**0.179**		0.252	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**13.50**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	1.701	**0.00**
R_2	1.701	**13.50**
R_3	0.000	**13.50**
R_4	0.000	**13.50**
R_5	0.000	**13.50**
R_6	0.000	**13.50**
R_7	0.000	**13.50**
R_8	0.000	**13.50**
R_9	0.000	**13.50**
R_{10}	0.000	**13.50**

Demand Output		
Location, ft		**6.75**
Shear, k	V	0.00
Moment, k-ft	M =	5.74
Deflection, in	D =	-0.30
Δ/Span		L/536

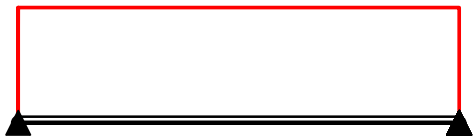
Load Factors	
Dead	**1.00**
Live	**1.00**
Snow	**1.00**
Seismic	**1.00**

Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	933

Max/Min Stresses	
f_{v_MAX} (psi)	65
f_{v_MIN} (psi)	-65
f_{b_MAX} (psi)	933
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1500**
b (in)	**3.5**
d (in)	**11.25**
I (in^4)	415.28
S (in^3)	73.828
A (in^2)	39.375
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	1.7	-1.7	0	5.74	-0.302 (↓)	6.8	L/536	0.0000	0	L/∞

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PROJECT PATHAK REMODEL
CARPORT/ GARAGE

DATE 5/21/2024
PROJ. #
DESIGN LTN
SHEET

Beam Analysis

Beam:		B5					
Load		Dead	Live	Snow	Wind	Factored	Location
Distributed (k/ft)	w_1	**0.073**		**0.179**		0.252	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1	**0.2**		**0.502**		0.707	**24.00**
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**24.00**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	2.491	**0.00**
R_2	4.264	**21.00**
R_3	0.000	**21.00**
R_4	0.000	**21.00**
R_5	0.000	**21.00**
R_6	0.000	**21.00**
R_7	0.000	**21.00**
R_8	0.000	**21.00**
R_9	0.000	**21.00**
R_{10}	0.000	**21.00**

Demand Output		
Location, ft		**9.89**
Shear, k	V	0.00
Moment, k-ft	M =	12.31
Deflection, in	D =	-1.04
Δ/Span		L/241

Load Factors	
Dead	**1.00**
Live	**1.00**
Snow	**1.00**
Wind	**1.00**

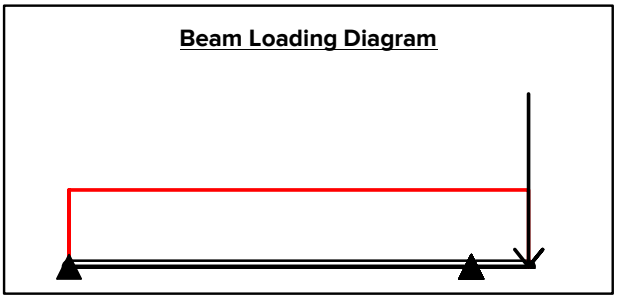
Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	1759

Max/Min Stresses	
f_{v_MAX} (psi)	89
f_{v_MIN} (psi)	-100
f_{b_MAX} (psi)	1757
f_{b_MIN} (psi)	-466

Beam Properties	
E (ksi)	**1800**
b (in)	**3.5**
d (in)	**12**
I (in^4)	504
S (in^3)	84
A (in^2)	42
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	2.49	-2.8	-3.26	12.3	-1.05 (↓)	10.3	L/240	0.0000	0	L/∞
Right Cantilever	1.46	-	-3.26	-	0.408 (↑)	24	L/176	0	21	L/∞

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STRUCTURAL ENGINEERING

PROJECT PATHAK REMODEL
CARPORT/ GARAGE

DATE 5/21/2024
PROJ. #
DESIGN LTN
SHEET

Beam Analysis

Beam:		H1					
Load		Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.041**		**0.099**		0.140	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**8.50**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.595	**0.00**
R_2	0.595	**8.50**
R_3	0.000	**8.50**
R_4	0.000	**8.50**
R_5	0.000	**8.50**
R_6	0.000	**8.50**
R_7	0.000	**8.50**
R_8	0.000	**8.50**
R_9	0.000	**8.50**
R_{10}	0.000	**8.50**

Demand Output		
Location, ft		**4.25**
Shear, k	V	0.00
Moment, k-ft	M =	1.26
Deflection, in	D =	-0.12
Δ/Span		L/886

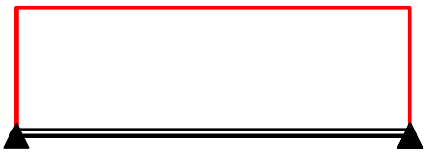
Load Factors	
Dead	**1.00**
Live	**1.00**
Snow	**1.00**
Seismic	**1.00**

Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	577

Max/Min Stresses	
f_{v_MAX} (psi)	41
f_{v_MIN} (psi)	-41
f_{b_MAX} (psi)	575
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1500**
b (in)	**3**
d (in)	**7.25**
I (in^4)	95.27
S (in^3)	26.281
A (in^2)	21.75
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	0.595	-0.595	-	1.26	-0.115 (↓)	4.3	L/887	0.0000	0	L/∞

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STRUCTURAL ENGINEERING

PROJECT PATHAK REMODEL
CARPORT/ GARAGE

DATE 5/21/2024
PROJ. #
DESIGN LTN
SHEET

Beam Analysis

Beam:		H2					
Load		Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.121**		**0.099**		0.220	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1					0.000	
	P_2					0.000	
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**18.00**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	1.980	**0.00**
R_2	1.980	**18.00**
R_3	0.000	**18.00**
R_4	0.000	**18.00**
R_5	0.000	**18.00**
R_6	0.000	**18.00**
R_7	0.000	**18.00**
R_8	0.000	**18.00**
R_9	0.000	**18.00**
R_{10}	0.000	**18.00**

Demand Output		
Location, ft		**9.00**
Shear, k	V	0.00
Moment, k-ft	M =	8.91
Deflection, in	D =	-0.73
Δ/Span		L/294

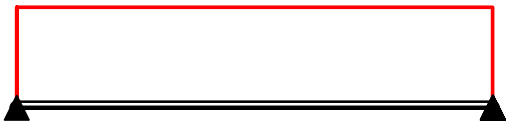
Load Factors	
Dead	**1.00**
Live	**1.00**
Snow	**1.00**
Seismic	**1.00**

Stresses @ Input Location	
f_v (psi)	0
f_b (psi)	1292

Max/Min Stresses	
f_{v_MAX} (psi)	57
f_{v_MIN} (psi)	-57
f_{b_MAX} (psi)	1292
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1800**
b (in)	**5.5**
d (in)	**9.5**
I (in^4)	392.96
S (in^3)	82.729
A (in^2)	52.25
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	1.98	-1.98	-	8.91	-0.735 (↓)	9	L/294	0.0000	0	L/∞

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PROJECT PATHAK REMODEL
CARPORT/ GARAGE

DATE 5/21/2024
PROJ. #
DESIGN LTN
SHEET

Beam Analysis

Beam:		H3					
Load		Dead	Live	Snow	Wind	Factored	Location
Distributed (k/ft)	w_1					0.000	
	w_2					0.000	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1	**0.2**		**0.537**		0.756	**0.75**
	P_2	**0.5**		**1.2**		1.701	**7.00**
	P_3					0.000	
	P_4					0.000	
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**8.50**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	0.989	**0.00**
R_2	1.468	**8.50**
R_3	0.000	**8.50**
R_4	0.000	**8.50**
R_5	0.000	**8.50**
R_6	0.000	**8.50**
R_7	0.000	**8.50**
R_8	0.000	**8.50**
R_9	0.000	**8.50**
R_{10}	0.000	**8.50**

Demand Output		
Location, ft		**7.00**
Shear, k	V	0.23
Moment, k-ft	M =	2.20
Deflection, in	D =	-0.05
Δ/Span		L/2053

Load Factors	
Dead	**1.00**
Live	**1.00**
Snow	**1.00**
Wind	**1.00**

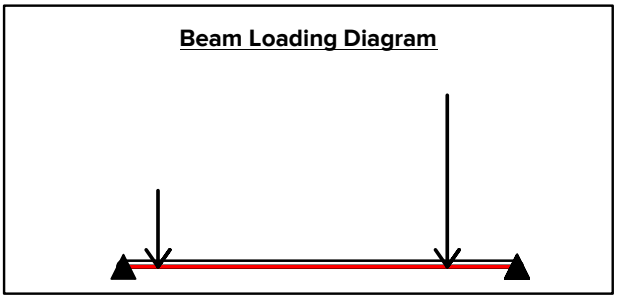
Stresses @ Input Location	
f_v (psi)	13
f_b (psi)	617

Max/Min Stresses	
f_{v_MAX} (psi)	53
f_{v_MIN} (psi)	-79
f_{b_MAX} (psi)	617
f_{b_MIN} (psi)	0

Beam Properties	
E (ksi)	**1500**
b (in)	**3**
d (in)	**9.25**
I (in^4)	197.86
S (in^3)	42.781
A (in^2)	27.75
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	0.989	-1.47	0	2.2	-0.08 (↓)	4.6	L/1275	0.0000	0	L/∞

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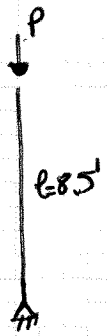
PROJECT PATHAK REMODEL
CARPORT/ GARAGE

DATE 5/21/2024
PROJ. #
DESIGN LTN
SHEET

GARAGE / CAR PORT FRAMING (CONT.)

EP1:



$P_{ORIGINAL} = 2527^{\#}$

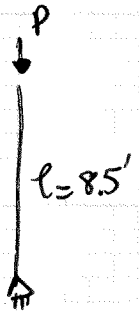
$P_{NEW} = 2202^{\#}$

$P_{ORIGINAL} > P_{NEW}$

→ No Increase in Loading OK ✓

→ Verify Min 4x4 Post

EP2:



$P_{ORIGINAL} = 3626^{\#}$

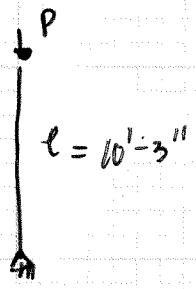
$P_{NEW} = 3695^{\#}$

$\frac{P_{NEW}}{P_{ORIGINAL}} = \frac{3695}{3626} = 1.02 < 1.05$

→ less than 5% Increase in Loading → OK ✓

→ Verify Min 4x4 Post

EP3:



$P_{ORIGINAL} = 4275^{\#}$

$P_{NEW} = 4137^{\#}$

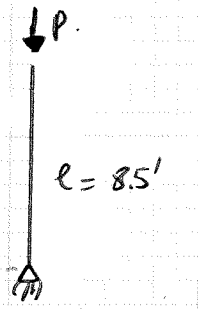
$P_{ORIGINAL} > P_{NEW}$

→ No increase in Loading

OK ✓

→ Verify Min. 4x4 Post

EP4:



$P_{ORIGINAL} = 3626^{\#}$

$P_{NEW} = 1701^{\#} + 2491^{\#}$

$= 4192^{\#}$

Check (E) 4x4 POST OK ✓

$A_{FTG.,REQ.} = \frac{4192^{\#}}{2500\,psf\ [Allow.\ Soil\ Bearing]} = 1.67\ sf$

→ Verify (E) Ftg Min. 1'-4" sq.

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PROJECT: PATHAK REMODEL
CARPORT / GARAGE

DATE: 05.21.24

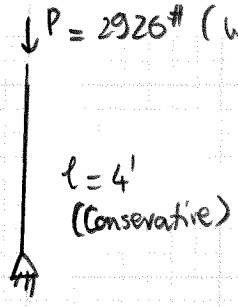
PROJ. #: LTN

DESIGN:

SHEET: 99/107

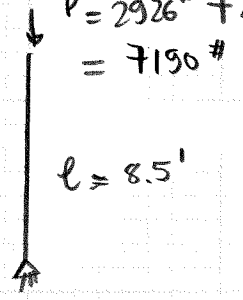
GARAGE (CONT.):

KP1:



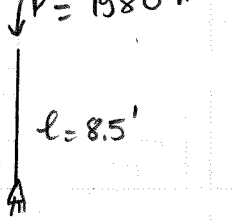
4 x 4 K.P.

P1:



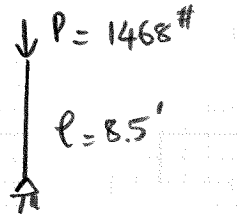
4 x 6 POST

P2:



(2) 2x6 STUDS

P3:



(2) 2x4 STUDS

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SSF STRUCTURAL ENGINEERING

PROJECT: PATHAK REMODEL CARPORT / GARAGE

DATE: 05.21.24

PROJ. #: UN

DESIGN:

SHEET: 100/107

Column Buckling Calculations

NDS 2018

Column Geometry Data

4X Posts Doug Fir - Larch #2		
Doug Fir Plates		
b	3.5	in
d	3.5	in
Le_1	4.00	ft
Le_2	4.00	ft
$le_{bending}$	4	ft

Bracing
No Brace
No Brace

Column Design Values

F_b	900	psi
F_c	1350	psi
E'min	580	ksi
Fcperp	625	psi
cb	1.00	

Bearing
Area
Increase
No

Column Loading

P	3000	lbs
W_1	0	plf
M1	0	ft-lbs
W_2	0	plf
M2	0	ft-lbs

Flexural Stress Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.50
Repetitive - C_r	1.00

Compressive Parallel Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.15

Other Factors

Visually Graded Lumber	
c	0.8
Solid Column	
Kf	1
Column: Pinned Pinned	
Ke	1

Column Stability Factor Calculation

Strong Axis			Weak Axis		
Fce_1	2535	psi	Fce_2	2535	psi
Fc^*_1	1785	psi	Fc^*_2	1785	psi
Fce_1/Fc^*_1	1.420		Fce_2/Fc^*_2	1.420	
Cp_1	0.796		Cp_2	0.796	

Beam Stability Factor Calculation

Strong Axis			Weak Axis		
Fbe_1	50750	psi	Fbe_2	28,194	psi
Fb'_1	1553	psi	Fb'_2	1553	psi
Fbe_1/Fb'_1	32.7		Fbe_2/Fb'_2	18	
le	4.0	ft			
CL_1	1.00				

Adjusted Allowable Stresses

Strong Axis			Weak Axis		
Fc'_1	1422	psi	Fc'_2	1422	psi
Fb'_1	1553	psi	Fb'_2	1553	psi

Imposed Column Stresses

Strong Axis			Weak Axis		
fc_1	245	psi	fc_2	245	psi
fb_1	0	psi	fb_2	0	psi

Perpendicular to Grain Stress Check fcp/Fcp =	***245 / 625***	**OK**
Slenderness Check le/d	**14**	**OK**
Slenderness Check le/b	**14**	**OK**

(1) $$\left(\frac{f_c}{F_c'}\right)^2+\frac{f_{b1}}{F_{b1}'\left[1-f_c/F_{cE1}\right]}+\frac{f_{b2}}{F_{b2}'\left[1-f_c/F_{cE2}-\left(f_{b1}/F_{bE1}\right)\right]}\le 1.0$$

(2) $$\frac{fc}{F_{cE2}}+\left(\frac{f_{b1}}{F_{bE}}\right)^2<1.0$$

(3) $$\frac{f_c}{F_{c'}},\frac{f_{b1}}{F_{b1}'},\frac{f_{b2}}{F_{b2}'}<1.0$$

Allowable Stress Interaction Formula	**0.17**	**OK**

STRUCTURAL ENGINEERING

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Project: PATHAK REMODEL — *Date:* *5/21/2024*

GARAGE/ CARPORT — Project #:

4X4 KING POST — Design: LTN

Sheet:

Column Buckling Calculations

NDS 2018

Column Geometry Data

4X Posts Doug Fir - Larch #2		
Other		
b	3.5	in
d	3.5	in
Le_1	8.50	ft
Le_2	8.50	ft
$le_{bending}$	8.5	ft

Bracing

No Brace
No Brace

Column Design Values

F_b	900	psi
F_c	1350	psi
E'min	580	ksi
Fcperp	650	psi
cb	1.00	

Bearing
Area
Increase
No

Column Loading

P	4192	lbs
W_1	0	plf
M1	0	ft-lbs
W_2	0	plf
M2	0	ft-lbs

Flexural Stress Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.50
Repetitive - C_r	1.00

Compressive Parallel Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.15

Other Factors

Visually Graded Lumber	
c	0.8
Solid Column	
Kf	1
Column: Pinned Pinned	
Ke	1

Column Stability Factor Calculation

Strong Axis			Weak Axis		
Fce_1	561	psi	Fce_2	561	psi
Fc^*_1	1785	psi	Fc^*_2	1785	psi
Fce_1/Fc^*_1	0.314		Fce_2/Fc^*_2	0.314	
Cp_1	0.291		Cp_2	0.291	

Beam Stability Factor Calculation

Strong Axis			Weak Axis		
Fbe_1	23882	psi	Fbe_2	13,268	psi
Fb'_1	1553	psi	Fb'_2	1553	psi
Fbe_1/Fb'_1	15.4		Fbe_2/Fb'_2	9	
le	8.5	ft			
CL_1	1.00				

Adjusted Allowable Stresses

Strong Axis			Weak Axis		
Fc'_1	519	psi	Fc'_2	519	psi
Fb'_1	1553	psi	Fb'_2	1553	psi

Imposed Column Stresses

Strong Axis			Weak Axis		
fc_1	342	psi	fc_2	342	psi
fb_1	0	psi	fb_2	0	psi

Perpendicular to Grain Stress Check fcp/Fcp =	***342 / 650***	**OK**
Slenderness Check le/d	**29**	**OK**
Slenderness Check le/b	**29**	**OK**

(1) $$\left(\frac{f_c}{F_c'}\right)^2+\frac{f_{b1}}{F_{b1}'\left[1-f_c/F_{cE1}\right]}+\frac{f_{b2}}{F_{b2}'\left[1-f_c/F_{cE2}-\left(f_{b1}/F_{bE1}\right)\right]}\le 1.0$$

(2) $$\frac{fc}{F_{cE2}}+\left(\frac{f_{b1}}{F_{bE}}\right)^2<1.0$$

(3) $$\frac{f_c}{F_{c'}},\frac{f_{b1}}{F_{b1}'},\frac{f_{b2}}{F_{b2}'}<1.0$$

Allowable Stress Interaction Formula	**0.66**	**OK**

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Project: PATHAK REMODEL *Date:* *5/21/2024*

GARAGE/ CARPORT Project #:

EP4 Design: LTN

Sheet:

Column Buckling Calculations

NDS 2018

Column Geometry Data

4X Posts Doug Fir - Larch #2		
Other		
b	3.5	in
d	3.5	in
Le_1	10.25	ft
Le_2	10.25	ft
$le_{bending}$	10.25	ft

Bracing

No Brace
No Brace

Column Design Values

F_b	900	psi
F_c	1350	psi
E'min	580	ksi
Fcperp	650	psi
cb	1.00	

Bearing
Area
Increase
No

Column Loading

P	4137	lbs
W_1	0	plf
M1	0	ft-lbs
W_2	0	plf
M2	0	ft-lbs

Flexural Stress Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.50
Repetitive - C_r	1.00

Compressive Parallel Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.15

Other Factors

Visually Graded Lumber	
c	0.8
Solid Column	
Kf	1
Column: Pinned Pinned	
Ke	1

Column Stability Factor Calculation

Strong Axis			Weak Axis		
Fce_1	386	psi	Fce_2	386	psi
Fc^*_1	1785	psi	Fc^*_2	1785	psi
Fce_1/Fc^*_1	0.216		Fce_2/Fc^*_2	0.216	
Cp_1	0.206		Cp_2	0.206	

Beam Stability Factor Calculation

Strong Axis			Weak Axis		
Fbe_1	19805	psi	Fbe_2	11,003	psi
Fb'_1	1553	psi	Fb'_2	1553	psi
Fbe_1/Fb'_1	12.8		Fbe_2/Fb'_2	7	
le	10.3	ft			
CL_1	1.00				

Adjusted Allowable Stresses

Strong Axis			Weak Axis		
Fc'_1	367	psi	Fc'_2	367	psi
Fb'_1	1553	psi	Fb'_2	1553	psi

Imposed Column Stresses

Strong Axis			Weak Axis		
fc_1	338	psi	fc_2	338	psi
fb_1	0	psi	fb_2	0	psi

Perpendicular to Grain Stress Check fcp/Fcp =	***338 / 650***	**OK**
Slenderness Check le/d	**35**	**OK**
Slenderness Check le/b	**35**	**OK**

(1) $$\left(\frac{f_c}{F_c'}\right)^2+\frac{f_{b1}}{F_{b1}'\left[1-f_c/F_{cE1}\right]}+\frac{f_{b2}}{F_{b2}'\left[1-f_c/F_{cE2}-\left(f_{b1}/F_{bE1}\right)\right]}\le 1.0$$

(2) $$\frac{fc}{F_{cE2}}+\left(\frac{f_{b1}}{F_{bE}}\right)^2<1.0$$

(3) $$\frac{f_c}{F_{c'}},\frac{f_{b1}}{F_{b1}'},\frac{f_{b2}}{F_{b2}'}<1.0$$

Allowable Stress Interaction Formula	**0.92**	**OK**

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Project: PATHAK REMODEL *Date:* *5/21/2024*

GARAGE/ CARPORT Project #:

4X4 Design: LTN

Sheet:

Column Buckling Calculations

NDS 2018

Column Geometry Data

4X Posts Doug Fir - Larch #2		
Other		
b	3.5	in
d	5.5	in
Le_1	8.50	ft
Le_2	8.50	ft
$le_{bending}$	8.5	ft

Bracing

No Brace	
No Brace	

Column Design Values

F_b	900	psi
F_c	1350	psi
E'min	580	ksi
Fcperp	650	psi
cb	1.00	

Bearing
Area
Increase
No

Column Loading

P	7200	lbs
W_1	0	plf
M1	0	ft-lbs
W_2	0	plf
M2	0	ft-lbs

Flexural Stress Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.30
Repetitive - C_r	1.00

Compressive Parallel Adjustment Factors

Roof/EQ / Wind - C_D	1.15
Size Factor - C_F	1.10

Other Factors

Visually Graded Lumber	
c	0.8
Solid Column	
Kf	1
Column: Pinned Pinned	
Ke	1

Column Stability Factor Calculation

Strong Axis			Weak Axis		
Fce_1	1386	psi	Fce_2	561	psi
Fc^*_1	1708	psi	Fc^*_2	1708	psi
Fce_1/Fc^*_1	0.812		Fce_2/Fc^*_2	0.329	
Cp_1	0.615		Cp_2	0.302	

Beam Stability Factor Calculation

Strong Axis			Weak Axis		
Fbe_1	15198	psi	Fbe_2	32,764	psi
Fb'_1	1346	psi	Fb'_2	1346	psi
Fbe_1/Fb'_1	11.3		Fbe_2/Fb'_2	24	
le	8.5	ft			
CL_1	1.00				

Adjusted Allowable Stresses

Strong Axis			Weak Axis		
Fc'_1	1050	psi	Fc'_2	517	psi
Fb'_1	1339	psi	Fb'_2	1346	psi

Imposed Column Stresses

Strong Axis			Weak Axis		
fc_1	374	psi	fc_2	374	psi
fb_1	0	psi	fb_2	0	psi

Perpendicular to Grain Stress Check fcp/Fcp =	***374 / 650***	**OK**
Slenderness Check le/d	**19**	**OK**
Slenderness Check le/b	**29**	**OK**

(1) $$\left(\frac{f_c}{F_c'}\right)^2+\frac{f_{b1}}{F_{b1}'\left[1-f_c/F_{cE1}\right]}+\frac{f_{b2}}{F_{b2}'\left[1-f_c/F_{cE2}-\left(f_{b1}/F_{bE1}\right)\right]}\le 1.0$$

(2) $$\frac{fc}{F_{cE2}}+\left(\frac{f_{b1}}{F_{bE}}\right)^2<1.0$$

(3) $$\frac{f_c}{F_{c'}},\frac{f_{b1}}{F_{b1}'},\frac{f_{b2}}{F_{b2}'}<1.0$$

Allowable Stress Interaction Formula	**0.72**	**OK**

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Project: PATHAK REMODEL *Date:* 5/21/2024

GARAGE/ CARPORT Project #:

4X6 POST Design: LTN

Sheet:

Column Buckling Calculations

NDS 2018

Column Geometry Data

Doug Fir - Larch #2 Studs		
Doug Fir Plates		
b	3	in
d	3.5	in
Le_1	8.50	ft
Le_2	8.50	ft
$le_{bending}$	8.50	ft

Bracing

No Brace
No Brace

Column Design Values

F_b	900	psi
F_c	1350	psi
E'min	580	ksi
Fcperp	625	psi
cb	1.00	

Bearing
Area
Increase
No

Column Loading

P	2000	lbs
W_1	0	plf
M1	0	ft-lbs
W_2	5	plf
M2	45	ft-lbs

Flexural Stress Adjustment Factors

Roof/EQ / Wind - C_D	1.60
Size Factor - C_F	1.30
Repetitive - C_r	1.00

Compressive Parallel Adjustment Factors

Roof/EQ / Wind - C_D	1.60
Size Factor - C_F	1.10

Other Factors

Visually Graded Lumber	
c	0.8
Solid Column	
Kf	1
Column: Pinned Pinned	
Ke	1

Column Stability Factor Calculation

Strong Axis			Weak Axis		
Fce_1	561	psi	Fce_2	412	psi
Fc^*_1	2376	psi	Fc^*_2	2376	psi
Fce_1/Fc^*_1	0.236		Fce_2/Fc^*_2	0.174	
Cp_1	0.223		Cp_2	0.167	

Beam Stability Factor Calculation

Strong Axis			Weak Axis		
Fbe_1	17546	psi	Fbe_2	15,479	psi
Fb'_1	1872	psi	Fb'_2	1872	psi
Fbe_1/Fb'_1	9.4		Fbe_2/Fb'_2	8	
le	8.5	ft			
CL_1	0.99				

Adjusted Allowable Stresses

Strong Axis			Weak Axis		
Fc'_1	531	psi	Fc'_2	397	psi
Fb'_1	1861	psi	Fb'_2	1872	psi

Imposed Column Stresses

Strong Axis			Weak Axis		
fc_1	190	psi	fc_2	190	psi
fb_1	0	psi	fb_2	103	psi

Perpendicular to Grain Stress Check fcp/Fcp =	***190 / 625***	**OK**
Slenderness Check le/d	**29**	**OK**
Slenderness Check le/b	**34**	**OK**

(1) $$\left(\frac{f_c}{F_c'}\right)^2+\frac{f_{b1}}{F_{b1}'\left[1-f_c/F_{cE1}\right]}+\frac{f_{b2}}{F_{b2}'\left[1-f_c/F_{cE2}-\left(f_{b1}/F_{bE1}\right)\right]}\le 1.0$$

(2) $$\frac{fc}{F_{cE2}}+\left(\frac{f_{b1}}{F_{bE}}\right)^2<1.0$$

(3) $$\frac{f_c}{F_{c'}},\frac{f_{b1}}{F_{b1}'},\frac{f_{b2}}{F_{b2}'}<1.0$$

Allowable Stress Interaction Formula	**0.48**	**OK**

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Project: PATHAK REMODEL — *Date:* *5/22/2024*

GARAGE/ CARPORT — Project #:

(2) 2X4 STUDS — Design: LTN

Sheet:

Spread Footing Soil Bearing Design

Service Loads Loading

Dead Load =	2.1 kips
Live Load =	5.1 kips
Wind/EQ Load =	0.0 kips
Wind/EQ Moment (M_Y) =	0 ft-kips
Gravity Load Eccentricity (±X)=	0.00 ft.
Footing Weight =	0.4 kips
Total Load =	7.6 kips
Total Moment =	0 ft-kips

Service Load Factors

DL	1
LL	1
EQ/Wind	1

Soil Properties

Allowable Soil Brg. (Qa) =	2.50 ksf
Overburdan Density (γs) =	120 psf
Net Ftg Wt? (γ_c-γ_s)	No

Column Dimensions and Location

Column Xc Dimension (Dx) =	3.50 in.
Column Yc Dimension (Dy) =	5.50 in.
Column Face from right (Cr) =	0.73 ft.
Column Face from left (Cl) =	0.73 ft.

Soil Bearing Check (Allowable)

Eccentricity =	0.00 ft.	
Leng. Soil Brg. Under Ftg.=	1.75 ft.	
qmax =	2.48 ksf	OK
qmin =	2.48 ksf	

Footing Dimensions

L Dimension (X) =	1.75 ft.
B Dimension (Y) =	1.75 ft.
Footing Thickness (t) =	10.00 in.
Ftg Overburden (Ot) =	0.00 ft.

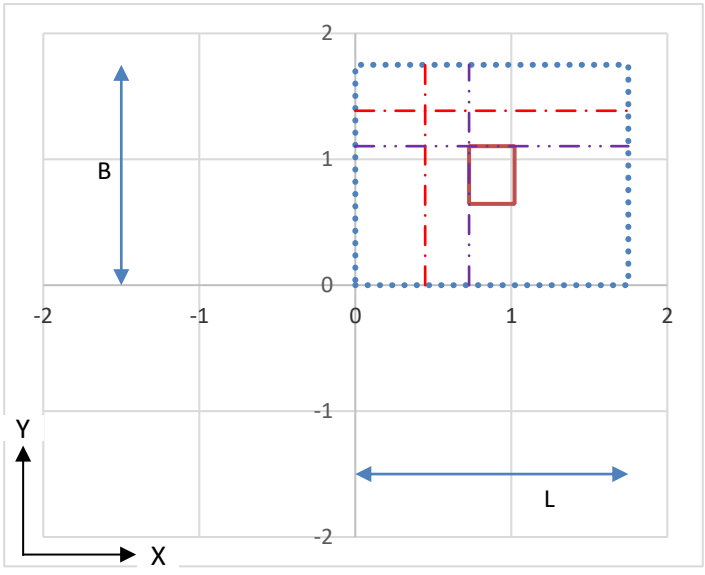
Soil Pressure Equations:

$e \le L/6$

$$qmax = \frac{Q}{LB}\left(1 + \frac{6e}{L}\right)$$

$e > L/6$

$$qmax = \frac{4Q}{3L(L-2e)}$$



PROJECT: PATHAK REMODEL
CARPORT/ GARAGE
P1 POST FOOTING

DATE: 5/21/2024
PROJ. #: LTN
DESIGN:
SHEET:

STRUCTURAL ENGINEERING

Spread Footing Concrete Design - ACI 318-14

Footing Properties

Concrete Strength (f'c) =	3000 psi
Rebar Yield Strength (f_y) =	60000 psi
Reinforcing Clear Cover (cvr) =	3.00 in.
Reinforcing Depth (d) =	6.75 in.

Strength Load Factors

DL	1.2
LL	1.6
EQ/Wind	1

Factored Loads

Factored Total Load =	11.1 kips
Factored Total moment =	0 ft-kips

Factored Moments and Shears

	Mu k-ft	Vu kips
X Right Side	2	3
X Left Side	2	3
Y Both Sides	1	2

Factored Bearing

Eccentricity =	0.00 ft.
Length of Soil Brg. Under Ftg. =	1.75 ft.
qmax =	3.64 ksf
qcolr =	3.64 ksf
qcoll =	3.64 ksf
qmin =	3.64 ksf

Flexural Design - X Direction (About Y-Axis)

Bar Size =	#4	
Bars =	2	
Mu =	2 ft-kips	
ØMn =	12 ft-kips	OK
ρ_{min} =	0.0018	*Controls*
ρ_{req} =	0.0004	
A_s Required =	0.26 sq. in.	
A_s Provided =	0.40 sq. in.	OK

Flexural Design - Y Direction (About X-Axis)

Bar Size =	#4	
Bars =	2	
Mu =	1 ft-kips	
ØMn =	12 ft-kips	OK
ρ_{min} =	0.0018	*Controls*
ρ_{req} =	0.0003	
A_s Required =	0.26 sq. in.	
A_s Provided =	0.40 sq. in.	OK

One-Way Shear Design - X Direction

Vu =	3 kips	
ØVn =	12 kips	OK

One-Way Shear Design - Y Direction

Vu =	2 kips	
ØVn =	12 kips	OK

β =	1.000
$\gamma_s = 2/(\beta+1)$ =	1.00
Provide $A_{s,req}\gamma_s$ =	0.26 sq. in.

Provide evenly distributed bars in each direction.

Two-Way (Punching) Shear Design

b_o =	45 in	
vu =	8 kips	
Øvn =	48 kips	OK

Concrete Capacity Equations:

$$Mn = A_s F_y \left[d - \frac{1}{2}\left(\frac{A_s F_y}{0.85 f'c\, b} \right) \right]$$

$$vn = min \begin{pmatrix} 4\sqrt{f'c} \\ \left(2 + \frac{4}{\beta}\right)\sqrt{f'c} \\ \left(2 + \frac{\alpha_s d}{b_o}\right)\sqrt{f'c} \end{pmatrix} b_o d$$

$$Vn = 2\,\gamma\sqrt{f'c}\; b_w d$$

$$b_o = 2(Dx + d) + 2(Dy + d)$$

$$\beta = \max(Dx, Dy)/\min(Dx, Dy)$$

PROJECT	PATHAK REMODEL	DATE	5/21/2024
	CARPORT/ GARAGE		
	P1 POST FOOTING	PROJ. #	LTN
		DESIGN	
		SHEET	