



Cycle #1 Supplemental Structural Calculations For:

PATHAK REMODEL

8541 SE 82nd Street

Mercer Island, WA 98040



Prepared for: CAST Architecture

Job #: 00640-2023-02

Date: October 03, 2024



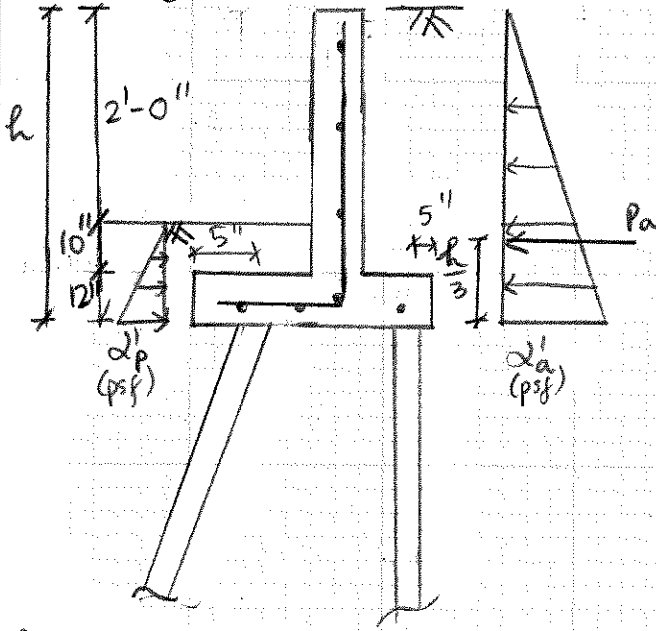
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RETAINING WALL: WORST CASE

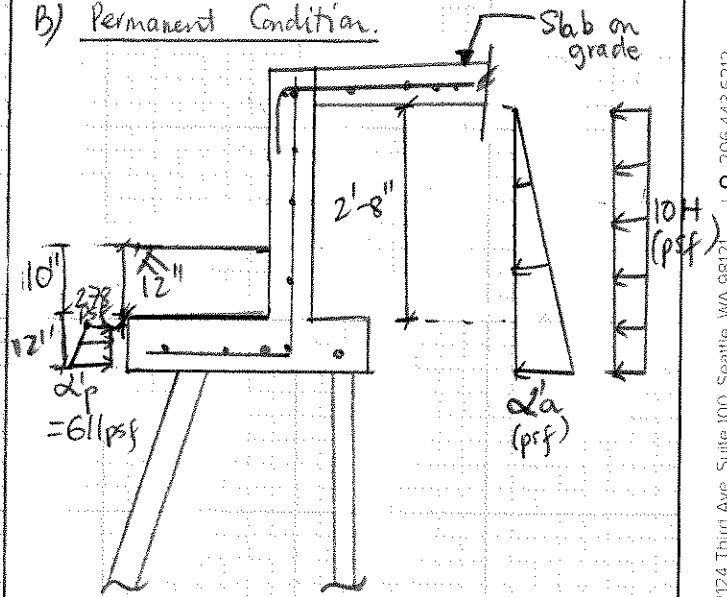
A) Temporary Condition:



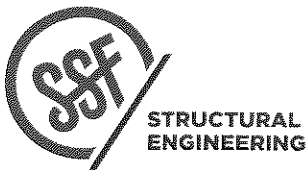
Overturning:

- Unrestrained Lateral Earth Pressure (Active) = 35 psf
- Passive Pressure = 250 psf (At toe, to be placed prior to backfilling wall)
- See Piles spreadsheet.

B) Permanent Condition:



- Restrained Active Lateral Earth Pressure = 50 psf
 $\rightarrow \alpha_a = 50 \text{ psf} \times 3'-8'' = 183 \text{ psf}$
- Seismic Surcharge = 10H
 $= 10 \times 3'-8'' = 37 \text{ psf}$
- Passive Pressure w/ transient loading
 $= 1.33 \times 250 \text{ psf} = 333 \text{ psf}$
 $\rightarrow \alpha_p = 333 \text{ psf} \times 1'-10'' = 611 \text{ psf}$ (at bot. of ftg.)
 $\alpha_p = 333 \text{ psf} \times 10'' = 278 \text{ psf}$ (@ 12'' below ground)



PROJECT: PATHAK REMODEL
 CYCLE 1

DATE: 09.16.24

PROJ #: LTN

DESIGN: 1/2

SHEET:

Pile Suported Retaining Wall (AT TEMPORARY CONDITION)

Stem

Stem Height	2.83	ft
Stem Thickness	8	in
Stem Surcharge	0	k/ft
Weight Stem	0.27	k/ft
e stem	1.08	ft

Soil Design Requirements

Soil Act. Pressure	35	pcf
Passive Pressure	250	pcf
Soil Weight	120	pcf
Soil over toe	-2	in
Surcharge	0	ft

Wall Loading

Mot Wall	304	ft-lbs/ft
V Wall	170	lbs/ft

Footing

L overall length	2.25	ft
L heel	0.75	ft
Footing Thickness	12	in
Weight Footing	0.3375	k/ft
e footing	1.125	ft

Front Pile

Pile Type	2-inch
Pile Spacing	6.0 ft
Required Batter	4.2 :1
Pile Edge Dist	5 in

Front Pile Loading

e pile front	1.42	ft
Pv front	4.3	k
Ph front	1.0	k
Pile Lat Cap	1.02	k
Pile Load	4.38	k
Pile Capacity	6	k

Soil over Heel

Weight Soil	0.3	k/ft
e soil	0.375	ft

Rear Pile

Pile Type	2-inch
Pile Spacing	6.0 ft
Pile Edge Dist	5 in

Rear Pile Loading

e pile back	0.42	ft
pv back	0.1	k/ft
Ppile	0.9	k
Pile Capacity	6	k

Surcharge over Heel

Weight Surch	0.00	k/ft
e surcharge	0.375	ft

Front Pile Lat Failure	OK
Front Pile Capacity	OK
Back Pile Capacity	OK

Slab Restraint **No**

Totals

Wall/Soil Weight	0.9	k/ft
Wall Res. Moment	0.8	k-ft/ft
e total load	0.89	ft

Wall Loading

Active Pressure

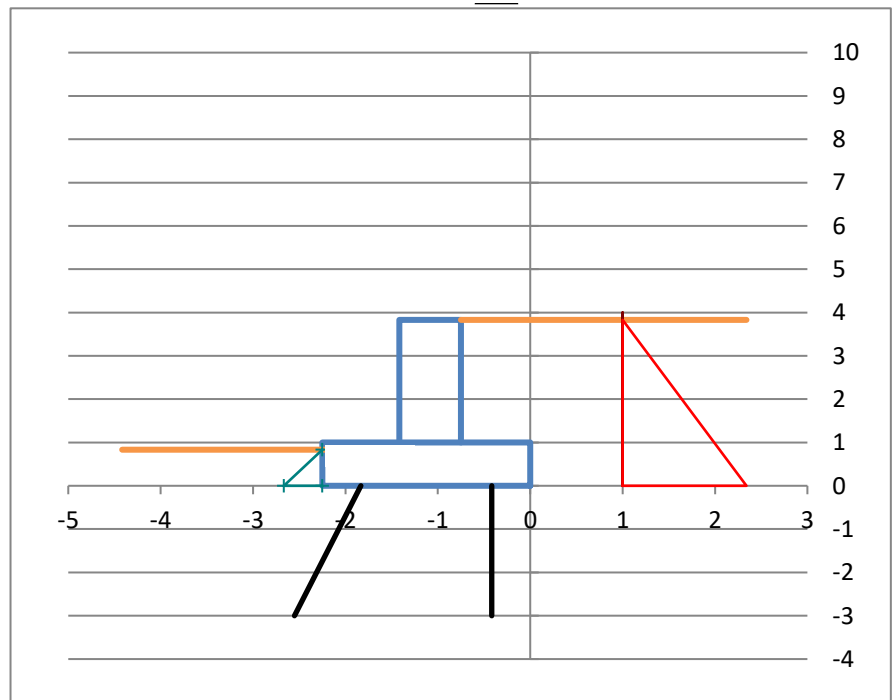
Heff act	3.8	ft
Psoil active	134	psf
Psoil active	257	lbs/ft
Mot act	328	ft-lbs/ft

Passive Pressure

H pas	0.83	ft
Psoil passive	208	psf
Ppas	-87	lbs/ft
Mot Pas	-24	ft-lbs/ft

Surcharge/Traffic Loads

Psoil sur	0	psf
Psur	0	lbs/ft
Mot sur	0	ft-lbs/ft

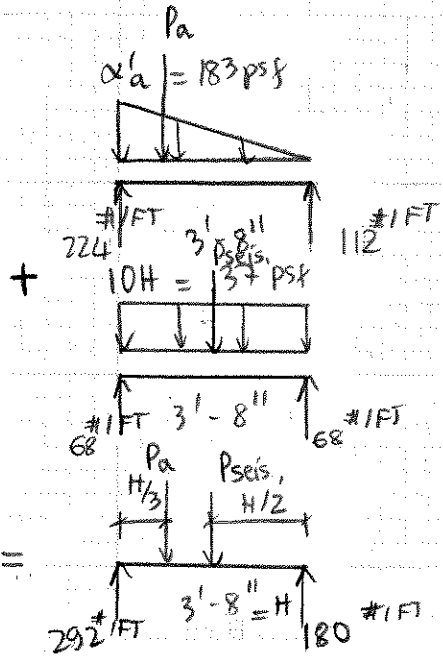


Geotech Report:

Pile	Pile Type	Minimum Wall Thickness/Shaft in	Minimum Hammer Size lbs/ft-k	Driving Time/Torque sec/in	Comp Cap k	Uplift Cap k
Front Pile	2-inch	80.000	90 (Jackhammer)	60	6	0
Rear Pile	2-inch	80.000	90 (Jackhammer)	60	6	0

RETAINING WALL (cont.):

B) Permanent Condition (cont.):



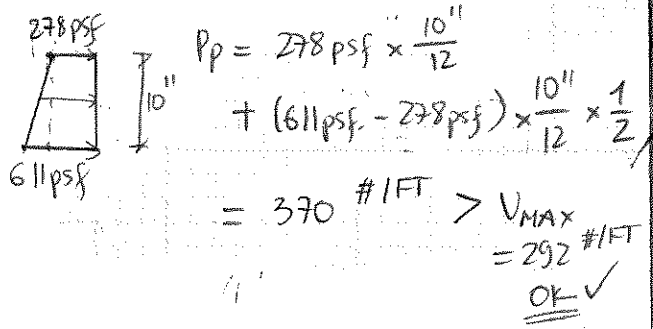
• $P_a = 183 \text{ psf} \times 3'-8'' \times \frac{1}{2} = 336 \text{ plf}$

• $P_{seis} = 37 \text{ psf} \times 3'-8'' = 136 \text{ plf}$

• $M_{MAX} = 360 \frac{\#-FT}{FT}$

• $V_{wall, MAX} = 292 \#/FT$
(At bottom of footing)

* Check Passive pressure:



$P_p = 278 \text{ psf} \times \frac{10''}{12}$
 $+ (611 \text{ psf} - 278 \text{ psf}) \times \frac{10''}{12} \times \frac{1}{2}$
 $= 370 \#/FT > V_{MAX} = 292 \#/FT$
OK ✓

* Wall Reinforcing:

$M_{MAX} = 630 \frac{\#-FT}{FT}$

• #4 @ 12" oc E.W. centered.

$\rightarrow d = \frac{8''}{2} - \frac{0.5''}{2} = 3.75''$

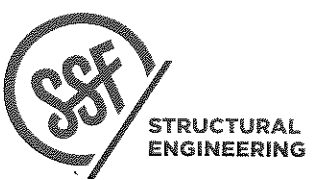
• $a = \frac{A_s f_y}{0.85 f_c b} = 0.47''$

• $\phi M_n = A_s f_y \times (d - \frac{a}{2}) \times 0.9$
 $= (0.2 \text{ in}^2 \times 60 \text{ ksi}) \times 3.5'' \times 0.9$
 $= 34 \frac{\text{K-in}}{\text{FT}} = 2.84 \frac{\text{K-FT}}{\text{FT}}$

• $M_{n, allow} = 0.7 \times \phi M_n$
 $= 1.99 \frac{\text{K-FT}}{\text{FT}} > 360 \frac{\#-FT}{FT}$
OK ✓

$V_{MAX} = 292 \#/FT$

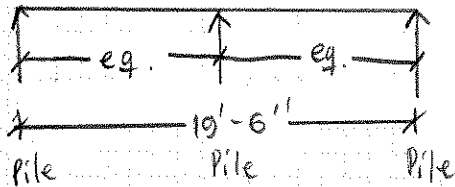
• $V_n, conc = 2 \sqrt{f_c} d \times b$
 $= 800 \#/FT$
 $> 292 \#/FT$
OK ✓



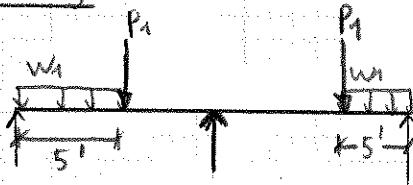
PATHIAK REMODEL
 CYCLE 1

DATE 09.16.24
 PROJ #
 DESIGN LTN
 SHEET 2/2

GRID A GRADE BEAM:



Gravity Only:



$w_1 = 1372 \text{ \#/5' } = 275 \text{ PLF}$

$w_1)_D = + 80 \text{ PLF (Dead)}$
 $+ 10 \text{ psf} \times 9' = 170 \text{ PLF}$

$w_1)_S = 195 \text{ PLF (Snow)}$

$P_1 = 1058 \text{ \#}$

$P_1)_D = 306 \text{ \# (Dead)}$

$P_1)_S = 750 \text{ \# (Snow)}$

Lateral Only:



$P_2 = \pm 1.5 \text{ K (Holdown Force)}$
 (Wind)

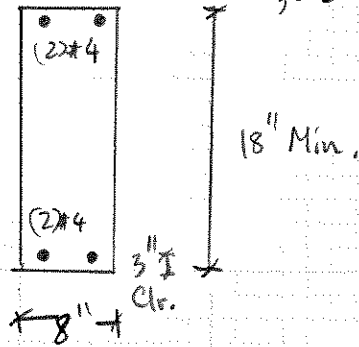
Load Combo: $1.2D + 1.6S + 0.5W$
 (controlling case)

$M_{MAX} = 5.9 \text{ K-FT}$

$V_{MAX} = 4.1 \text{ K}$

Grade Beam: Assumed effective section

$f_c = 2500 \text{ psi}$



$d = 18'' - 3'' - \frac{0.5''}{2} = 14.75''$

$\phi M_n = 0.9 A_s f_y (d - \frac{a}{2})$

$a = \frac{A_s f_y}{0.85 f_c b} = 1.41''$

$\rightarrow \phi M_n = 0.9 \times (0.4 \text{ in}^2) (60 \text{ ksi}) (14.75'' - \frac{1.41''}{2})$

$= 303 \text{ K-in} = 25.3 \text{ K-FT}$

$> 5.51 \text{ K-FT}$

OK ✓

$\phi V_n = 0.75 \times 2 \sqrt{f_c} b d$

$= 8850 \text{ \#} = 8.85 \text{ K} > 3.7 \text{ K}$

OK ✓

Pile:

Allowable Compression = $6 \text{ K} = P_{\text{pile}}$

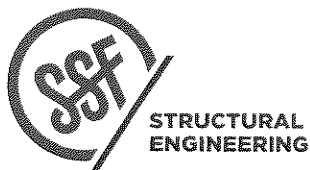
$P_{MAX, LRFD} = 4.1 \text{ K}$

$P_{MAX, ASD} = 0.7 \times 4.1 \text{ K}$

$= 2.9 \text{ K} < P_{\text{pile}}$

OK ✓

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PROJECT: PATHAK REMODEL
 CYCLE 1

DATE: 09.17.24

DATE

PROJ #

LTN

DESIGN

SHEET

Beam Analysis

Beam: GRID A GRADE BEAM - GRAVITY ONLY CASE							
Load	Dead	Live	Snow	Wind	Factored	Location	
Distributed (k/ft)	W ₁	0.170		0.195		0.516	0
	W ₂	-0.170		-0.195		-0.516	5
	W ₃	0.170		0.195		0.516	14.5
	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	0.306		0.750		1.567	5.00
	P ₂	0.306		0.750		1.567	14.50
	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	19.50
Left End Condition	Pinned
Right End Condition	Pinned
R ₁	2.099
R ₂	4.098
R ₃	2.099
R ₄	0.000
R ₅	0.000
R ₆	0.000
R ₇	0.000
R ₈	0.000
R ₉	0.000
R ₁₀	0.000

Load Factors	
Dead	1.20
Live	0.00
Snow	1.60
Wind	0.00

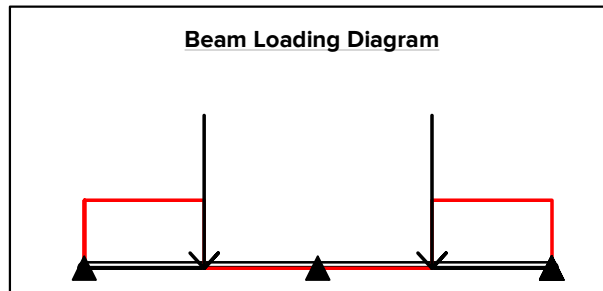
Stresses @ Input	
Location	
f _v (psi)	-26
f _b (psi)	-235

Max/Min Stresses	
f _v _MAX (psi)	27
f _v _MIN (psi)	-27
f _b _MAX (psi)	177
f _b _MIN (psi)	-235

Demand Output	
Location, ft	9.75
Shear, k	-2.05
Moment, k-ft	M = -5.69
Deflection, in	D = 0.00
Δ/Span	L/

Beam Properties	
E (ksi)	3605
b (in)	8
d (in)	14.75
I (in ⁴)	2139.4
S (in ³)	290.08
A (in ²)	118
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE
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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	2.1	-2.05	-5.69	4.27	-0.005 (↓)	4.1	L/23400	0	0	L/∞
Span 2	2.05	-2.1	-5.69	4.27	-0.005 (↓)	15.4	L/23306	0	9.8	L/∞

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PROJECT PATHAK REMODEL
 CYCLE 1

DATE 9/17/2024
 PROJ. #
 DESIGN LTN
 SHEET 2

Beam Analysis

Beam: GRID A GRADE BEAM - GRAVITY + LATERAL CASE							
Load	Dead	Live	Snow	Wind	Factored	Location	
Distributed (k/ft)	W ₁	0.170		0.195		0.516	0
	W ₂	-0.170		-0.195		-0.516	5
	W ₃	0.16975		0.19525		0.516	14.5
	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				1.5	0.750	0.00
	P ₂	0.306		0.750	-1.5	0.817	5.00
	P ₃	0.306		0.750	1.5	2.317	14.50
	P ₄				-1.5	-0.750	19.50
	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	19.50
Left End Condition	Pinned
Right End Condition	Pinned
R ₁	2.483 0.00
R ₂	4.098 9.75
R ₃	1.714 19.50
R ₄	0.000 19.50
R ₅	0.000 19.50
R ₆	0.000 19.50
R ₇	0.000 19.50
R ₈	0.000 19.50
R ₉	0.000 19.50
R ₁₀	0.000 19.50

Load Factors	
Dead	1.20
Live	0.00
Snow	1.60
Wind	0.50

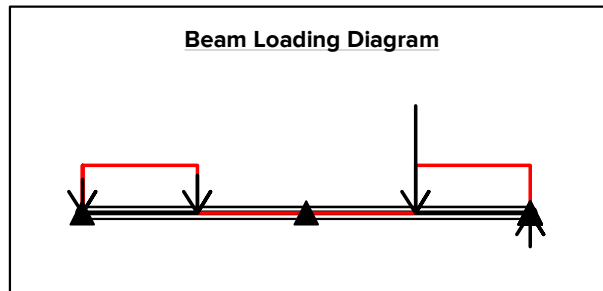
Stresses @ Input	
Location	
f _v (psi)	0
f _b (psi)	243

Max/Min Stresses	
f _v _MAX (psi)	32
f _v _MIN (psi)	-31
f _b _MAX (psi)	243
f _b _MIN (psi)	-235

Demand Output	
Location, ft	14.72
Shear, k	0.00
Moment, k-ft M =	5.88
Deflection, in D =	-0.01
Δ/Span	L/12200

Beam Properties	
E (ksi)	3605
b (in)	8
d (in)	14.75
I (in ⁴)	2139.4
S (in ³)	290.08
A (in ²)	118
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE
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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	2.48	-1.66	-5.69	2.91	0.002 (†)	6.7	L/58500	0	0	L/∞
Span 2	2.43	-2.46	-5.69	5.88	-0.008 (†)	15	L/14567	0	9.8	L/∞

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PROJECT PATHAK REMODEL
 CYCLE 1

DATE 9/17/2024
 PROJ. #
 DESIGN LTN
 SHEET 3

Beam Analysis

Beam: GRID A GRADE BEAM - GRAVITY + LATERAL CASE							
Load	Dead	Live	Snow	Wind	Factored	Location	
Distributed (k/ft)	W ₁	0.170		0.195		0.516	0
	W ₂	-0.170		-0.195		-0.516	5
	W ₃	0.16975		0.19525		0.516	14.5
	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				-1.5	-0.750	0.00
	P ₂	0.306		0.750	1.5	2.317	5.00
	P ₃	0.306		0.750	-1.5	0.817	14.50
	P ₄				1.5	0.750	19.50
	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	19.50
Left End Condition	Pinned
Right End Condition	Pinned
R ₁	1.714 0.00
R ₂	4.098 9.75
R ₃	2.483 19.50
R ₄	0.000 19.50
R ₅	0.000 19.50
R ₆	0.000 19.50
R ₇	0.000 19.50
R ₈	0.000 19.50
R ₉	0.000 19.50
R ₁₀	0.000 19.50

Load Factors	
Dead	1.20
Live	0.00
Snow	1.60
Wind	0.50

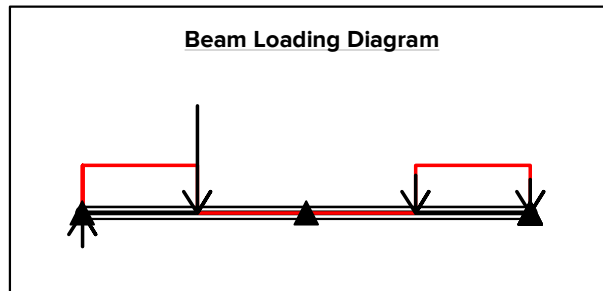
Stresses @ Input	
Location	
f _v (psi)	0
f _b (psi)	243

Max/Min Stresses	
f _v _MAX (psi)	31
f _v _MIN (psi)	-31
f _b _MAX (psi)	243
f _b _MIN (psi)	-235

Demand Output	
Location, ft	4.78
Shear, k	0.00
Moment, k-ft M =	5.88
Deflection, in D =	-0.01
Δ/Span	L/12200

Beam Properties	
E (ksi)	3605
b (in)	8
d (in)	14.75
I (in ⁴)	2139.4
S (in ³)	290.08
A (in ²)	118
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE
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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	2.46	-2.43	-5.69	5.88	-0.008 (†)	4.5	L/14625	0	0	L/∞
Span 2	1.66	-1.73	-5.69	2.91	0.002 (†)	12.8	L/58266	0	9.8	L/∞

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PROJECT PATHAK REMODEL
 CYCLE 1

DATE 9/17/2024
 PROJ. #
 DESIGN LTN
 SHEET 4

Beam Analysis

Beam: GRID A GRADE BEAM - GRAVITY + LATERAL CASE							
Load	Dead	Live	Snow	Wind	Factored	Location	
Distributed (k/ft)	W ₁	0.170		0.195		0.301	0
	W ₂	-0.170		-0.195		-0.301	5
	W ₃	0.16975		0.19525		0.301	14.5
	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				1.5	1.500	0.00
	P ₂	0.306		0.750	-1.5	-0.758	5.00
	P ₃	0.306		0.750	1.5	2.242	14.50
	P ₄				-1.5	-1.500	19.50
	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	19.50
Left End Condition	Pinned
Right End Condition	Pinned
R ₁	1.943
R ₂	2.150
R ₃	0.405
R ₄	0.000
R ₅	0.000
R ₆	0.000
R ₇	0.000
R ₈	0.000
R ₉	0.000
R ₁₀	0.000

Load Factors	
Dead	1.20
Live	0.00
Snow	0.50
Wind	1.00

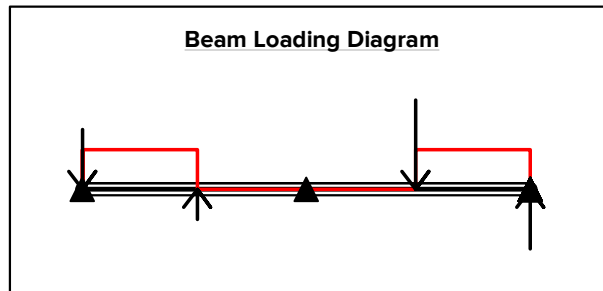
Stresses @ Input	
Location	
f _v (psi)	-5
f _b (psi)	238

Max/Min Stresses	
f _v _MAX (psi)	25
f _v _MIN (psi)	-24
f _b _MAX (psi)	238
f _b _MIN (psi)	-124

Demand Output	
Location, ft	14.51
Shear, k	-0.40
Moment, k-ft	5.75
Deflection, in	-0.01
Δ/Span	L/11970

Beam Properties	
E (ksi)	3605
b (in)	8
d (in)	14.75
I (in ⁴)	2139.4
S (in ³)	290.08
A (in ²)	118
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE
--------------------	------



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	1.94	-0.306	-3	0.326	0.002 (†)	6.7	L/58500	0	0	L/∞
Span 2	1.84	-1.9	-3	5.75	-0.008 (†)	15	L/14567	0	9.8	L/∞

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PROJECT PATHAK REMODEL
 CYCLE 1

DATE 9/17/2024
 PROJ. #
 DESIGN LTN
 SHEET 5

Beam Analysis

Beam: GRID A GRADE BEAM - GRAVITY + LATERAL CASE							
Load	Dead	Live	Snow	Wind	Factored	Location	
Distributed (k/ft)	W ₁	0.170		0.195		0.301	0
	W ₂	-0.170		-0.195		-0.301	5
	W ₃	0.16975		0.19525		0.301	14.5
	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				-1.5	-1.500	0.00
	P ₂	0.306		0.750	1.5	2.242	5.00
	P ₃	0.306		0.750	-1.5	-0.758	14.50
	P ₄				1.5	1.500	19.50
	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	19.50
Left End Condition	Pinned
Right End Condition	Pinned
R ₁	0.405 0.00
R ₂	2.150 9.75
R ₃	1.943 19.50
R ₄	0.000 19.50
R ₅	0.000 19.50
R ₆	0.000 19.50
R ₇	0.000 19.50
R ₈	0.000 19.50
R ₉	0.000 19.50
R ₁₀	0.000 19.50

Load Factors	
Dead	1.20
Live	0.00
Snow	0.50
Wind	1.00

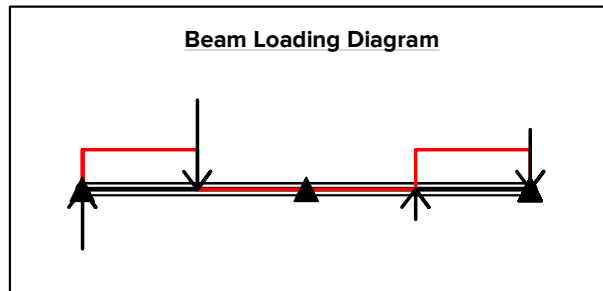
Stresses @ Input	
Location	
f _v (psi)	5
f _b (psi)	238

Max/Min Stresses	
f _v _MAX (psi)	24
f _v _MIN (psi)	-23
f _b _MAX (psi)	238
f _b _MIN (psi)	-124

Demand Output	
Location, ft	4.99
Shear, k	0.40
Moment, k-ft M =	5.75
Deflection, in D =	-0.01
Δ/Span	L/11970

Beam Properties	
E (ksi)	3605
b (in)	8
d (in)	14.75
I (in ⁴)	2139.4
S (in ³)	290.08
A (in ²)	118
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE
--------------------	------



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	1.9	-1.84	-3	5.75	-0.011 (†)	4.5	L/10636	0	0	L/∞
Span 2	0.306	-0.443	-3	0.326	0.003 (†)	12.8	L/38844	0	9.8	L/∞

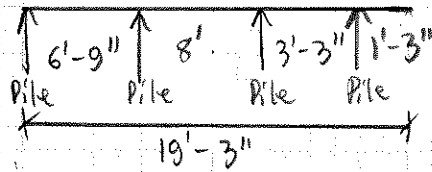
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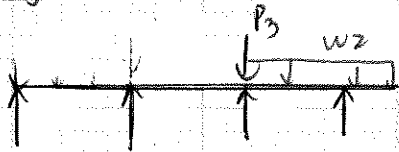
PROJECT PATHAK REMODEL
 CYCLE 1

DATE 9/17/2024
 PROJ. #
 DESIGN LTN
 SHEET 6

GRID 2.8 GRADE BEAM:



Gravity Only:



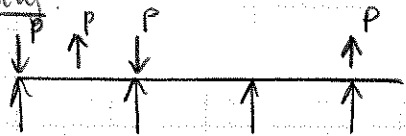
$P_{3, \text{DEAD}} = 426 \#$

$P_{3, \text{SNOW}} = 1042 \#$

$w_{2, \text{DEAD}} = 10 \text{ psf} \times \frac{2.5'}{2} \text{ Trib}$
 $+ 10 \text{ psf} \times 9' \text{ tall}$
 $= 103 \text{ PLF}$

$w_{2, \text{LIVE}} = 40 \text{ psf} \times \frac{2.5'}{2} \text{ Trib}$
 $= 50 \text{ PLF}$

Lateral Only:



$P_{\text{LATERAL}} = \pm 0.6 \text{ K (Seismic)}$

$P_{\text{LATERAL}} = 1.4 \times 0.6 \text{ K} = \pm 0.84 \text{ K}$

Load Combo: $1.2D + L + 0.2S + E$

$M_{\text{MAX}} = 1.1 \text{ K-FT}$

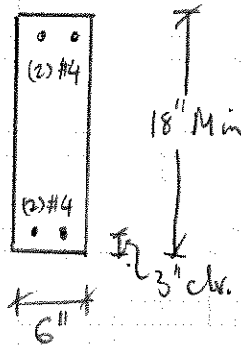
$V_{\text{MAX}} = 1.4 \text{ K}$

Load Combo: $1.2D + L + 1.6S$

$M_{\text{MAX}} = 0.14 \text{ K-FT}$

$V_{\text{MAX}} = 2.4 \text{ K}$

Grade Beam:



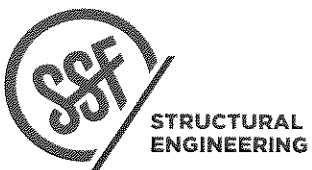
$d = 14.75''$

$a = 1.9''$

$\phi M_n = 0.9 A_s f_y \left(d - \frac{a}{2} \right)$
 $= 0.9 (0.4 \text{ in}^2) (60 \text{ ksi}) \left(14.75'' - \frac{1.9''}{2} \right)$
 $= 297 \text{ K-in} = 24.75 \text{ K-FT}$
 $> 1.1 \text{ K-FT}$
OK ✓

$\phi V_n = 0.75 \times 2 \sqrt{f'_c} b d$
 $= 6638 \# = 6.64 \text{ K} > 2.4 \text{ K}$
OK ✓

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PATAK REMODEL
 CYCLE 1

DATE 09.17.24
 PROJ. # LTN
 DESIGN
 SHEET

PROJECT _____

Beam Analysis

Beam:		GRID 2.8 GRADE BEAM - GRAVITY					
Load	Dead	Live	Snow	Wind	Factored	Location	
Distributed (k/ft)	W ₁	0.103	0.050		0.204	14.75	
	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				0.000		
	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	0.00	
	P ₂				0.000	3.75	
	P ₃				0.000	6.75	
	P ₄	0.426		1.042	1.032	14.75	
	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	19.25
Left End Condition	Pinned
Right End Condition	Pinned
R ₁	0.002 0.00
R ₂	-0.012 6.75
R ₃	1.342 14.75
R ₄	0.616 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

Load Factors	
Dead	1.20
Live	1.60
Snow	0.50
Wind	0.00

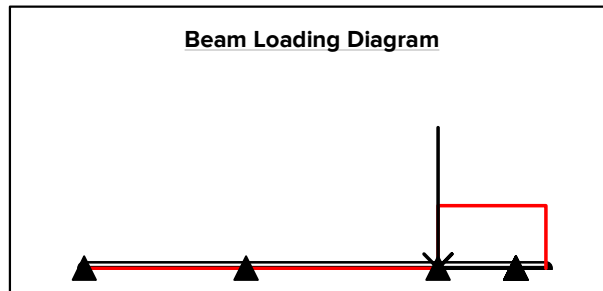
Stresses @ Input	
Location	
f _v (psi)	-6
f _b (psi)	-9

Max/Min Stresses	
f _v _MAX (psi)	5
f _v _MIN (psi)	-6
f _b _MAX (psi)	9
f _b _MIN (psi)	-9

Demand Output	
Location, ft	18.00
Shear, k	V = -0.36
Moment, k-ft	M = -0.16
Deflection, in	D = 0.00
Δ/Span	#####

Beam Properties	
E (ksi)	3605
b (in)	6
d (in)	14.75
I (in ⁴)	1604.5
S (in ³)	217.56
A (in ²)	88.5
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE
--------------------	------



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	0.002	0.002	-	0.016	0 (+)	3.9	L/∞	0 (+)	3.9	L/∞
Span 2	-0.01	-0.01	-0.061	0.016	0 (+)	11.7	L/∞	0 (+)	11.7	L/∞
Span 3	0.301	-0.361	-0.159	0.161	0 (+)	16.3	L/∞	0 (+)	16.3	L/∞
Right Cantilever	0.254	-	-0.159	-	0 (+)	19.3	L/∞	0 (+)	19.3	L/∞

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PROJECT PATHAK REMODEL
 CYCLE 1

DATE 9/17/2024
 PROJ. #
 DESIGN LTN
 SHEET 7

Beam Analysis

Beam:		GRID 2.8 GRADE BEAM - GRAVITY					
Load	Dead	Live	Snow	Wind	Factored	Location	
Distributed (k/ft)	W ₁	0.103	0.050			0.174	14.75
	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					0.000	
	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	0.00
	P ₂					0.000	3.75
	P ₃					0.000	6.75
	P ₄	0.426		1.042		2.178	14.75
	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	19.25
Left End Condition	Pinned
Right End Condition	Pinned
R ₁	0.002 0.00
R ₂	-0.010 6.75
R ₃	2.443 14.75
R ₄	0.525 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

Load Factors	
Dead	1.20
Live	1.00
Snow	1.60
Wind	0.00

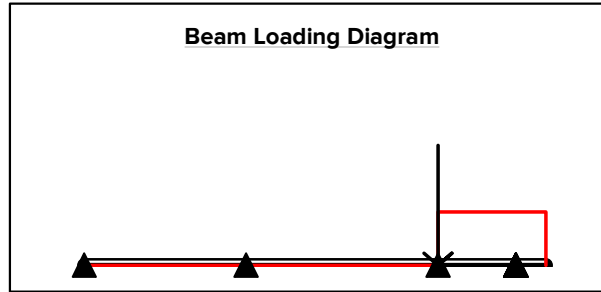
Stresses @ Input	
Location	
f _v (psi)	-5
f _b (psi)	-7

Max/Min Stresses	
f _v _MAX (psi)	4
f _v _MIN (psi)	-5
f _b _MAX (psi)	8
f _b _MIN (psi)	-8

Demand Output	
Location, ft	18.00
Shear, k	V = -0.31
Moment, k-ft	M = -0.14
Deflection, in	D = 0.00
Δ/Span	#####

Beam Properties	
E (ksi)	3605
b (in)	6
d (in)	14.75
I (in ⁴)	1604.5
S (in ³)	217.56
A (in ²)	88.5
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE
--------------------	------



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	0.002	0.002	-	0.014	0 (+)	3.9	L/∞	0 (+)	3.9	L/∞
Span 2	-0.008	-0.008	-0.052	0.014	0 (+)	11.7	L/∞	0 (+)	11.7	L/∞
Span 3	0.256	-0.308	-0.136	0.137	0 (+)	16.3	L/∞	0 (+)	16.3	L/∞
Right Cantilever	0.217	-	-0.136	-	0 (+)	19.3	L/∞	0 (+)	19.3	L/∞

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PROJECT PATHAK REMODEL
 CYCLE 1

DATE 9/17/2024
 PROJ. #
 DESIGN LTN
 SHEET 8

Beam Analysis

Beam: GRID 2.8 GRADE BEAM - GRAVITY + LATERAL						
Load	Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	W ₁	0.103	0.050		0.174	14.75
	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				0.000	
	t ₂				0.000	
	t ₃				0.000	
	t ₄				0.000	
	t ₅				0.000	
	t ₆				0.000	
Point (k)	P ₁			0.84	0.840	0.00
	P ₂			-0.84	-0.840	3.75
	P ₃			0.84	0.840	6.75
	P ₄	0.426		1.042	0.720	14.75
	P ₅			-0.84	-0.840	18
	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	19.25
Left End Condition	Pinned
Right End Condition	Pinned
R ₁	0.550 0.00
R ₂	0.188 6.75
R ₃	1.138 14.75
R ₄	-0.375 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

Load Factors	
Dead	1.20
Live	1.00
Snow	0.20
Seismic	1.00

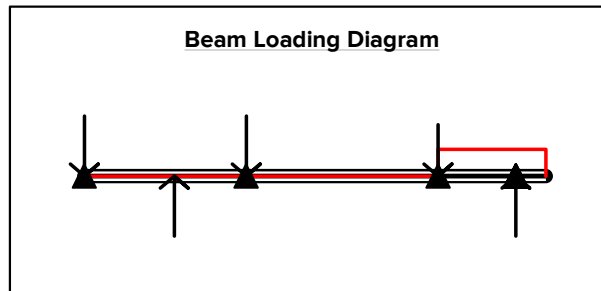
Stresses @ Input	
Location	
f _v (psi)	9
f _b (psi)	-60

Max/Min Stresses	
f _v _MAX (psi)	9
f _v _MIN (psi)	-4
f _b _MAX (psi)	31
f _b _MIN (psi)	-60

Demand Output	
Location, ft	3.75
Shear, k	0.55
Moment, k-ft M =	-1.08
Deflection, in D =	0.00
Δ/Span	L/75333

Beam Properties	
E (ksi)	3605
b (in)	6
d (in)	14.75
I (in ⁴)	1604.5
S (in ³)	217.56
A (in ²)	88.5
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section NONE



Span	V _L (kips)	V _R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ _{TL} (in)	@ x =	L/	Δ _{TL} (in)	@ x =	L/
Span 1	0.55	0.55	-1.08	0.565	0.001 (+)	3.3	L/80850	0 (+)	3.9	L/∞
Span 2	-0.102	-0.102	-0.248	0.565	0 (+)	9.5	L/∞	0 (+)	11.7	L/∞
Span 3	0.317	-0.248	-0.248	0.041	0 (+)	15.4	L/∞	0 (+)	16.3	L/∞
Right Cantilever	0.217	-	-0.136	-	0 (+)	19.3	L/∞	0 (+)	19.3	L/∞

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PROJECT PATHAK REMODEL
 CYCLE 1

DATE 9/17/2024
 PROJ. #
 DESIGN LTN
 SHEET 9

Beam Analysis

Beam: GRID 2.8 GRADE BEAM - GRAVITY + LATERAL						
Load	Dead	Live	Snow	Seismic	Factored	Location
Distributed (k/ft)	W ₁	0.103	0.050		0.174	14.75
	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				0.000	
	t ₂				0.000	
	t ₃				0.000	
	t ₄				0.000	
	t ₅				0.000	
	t ₆				0.000	
Point (k)	P ₁			-0.84	-0.840	0.00
	P ₂			0.84	0.840	3.75
	P ₃			-0.84	-0.840	6.75
	P ₄	0.426		1.042	0.720	14.75
	P ₅			0.84	0.840	18
	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	19.25
Left End Condition	Pinned
Right End Condition	Pinned
R ₁	-0.546 0.00
R ₂	-0.208 6.75
R ₃	0.830 14.75
R ₄	1.425 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

Load Factors	
Dead	1.20
Live	1.00
Snow	0.20
Seismic	1.00

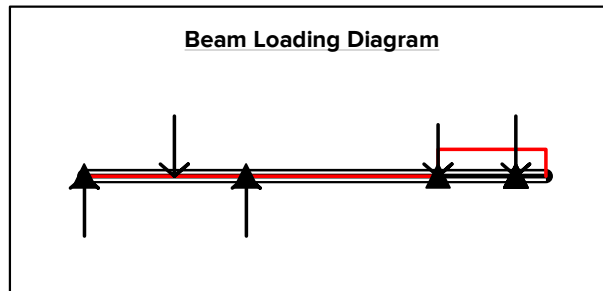
Stresses @ Input	
Location	
f _v (psi)	-9
f _b (psi)	61

Max/Min Stresses	
f _v _MAX (psi)	4
f _v _MIN (psi)	-9
f _b _MAX (psi)	61
f _b _MIN (psi)	-30

Demand Output	
Location, ft	3.75
Shear, k	-0.55
Moment, k-ft M =	1.10
Deflection, in D =	0.00
Δ/Span	L/73662

Beam Properties	
E (ksi)	3605
b (in)	6
d (in)	14.75
I (in ⁴)	1604.5
S (in ³)	217.56
A (in ²)	88.5
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE
--------------------	------



Span	V _L (kips)	V _R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ _{TL} (in)	@ x =	L/	Δ _{TL} (in)	@ x =	L/
Span 1	-0.546	-0.546	-0.537	1.1	-0.001 (+)	3.4	L/80850	0 (+)	3.9	L/∞
Span 2	0.085	0.196	-0.537	0.144	0 (+)	9.8	L/∞	0 (+)	11.7	L/∞
Span 3	0.196	-0.368	-0.136	0.255	0 (+)	16.2	L/∞	0 (+)	16.3	L/∞
Right Cantilever	0.217	-	-0.136	-	0 (+)	19.3	L/∞	0 (+)	19.3	L/∞

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PROJECT PATHAK REMODEL
 CYCLE 1

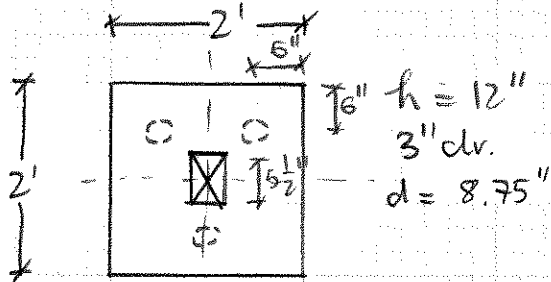
DATE 9/17/2024
 PROJ. #
 DESIGN LTN
 SHEET 10

PILE CAP: $f'_c = 2500$ psi
w/ (3) #4 Bot. E. W.

Axial Demand:

$$P_D = \frac{10}{70} \times 7793 \# = 1092 \#$$

$$P_L = \frac{60}{70} \times 7793 \# = 6702 \#$$



Punching Shear at Column:

$$V_u = 1.2 P_D + 1.6 P_L = 12,034 \# = 12 \text{ K}$$

$$\phi V_c = 0.75 \times 4 \sqrt{f'_c} b_o d$$

$$b_o = 2(c_1 + c_2) \text{ [Pile located within critical section]} = 2(3.5" + 15.5") = 18"$$

$$\rightarrow \phi V_c = 0.75 \times 4 \times \sqrt{2500} \times 18" \times 8.75" = 23.6 \text{ K} > V_u \text{ OK } \checkmark$$

Punching Shear at Pile:

$$V_{u,pile} = \frac{V_u}{3 \text{ piles}} = \frac{12 \text{ K}}{3} = 4 \text{ K}$$

$$d_p = 2" \text{ (pile diameter)}$$

$$b_o = 4d_p + \frac{\pi}{4}(d_p + d) = 16.44"$$

$$\phi V_c = 0.75 \times 4 \sqrt{2500} \times 16.44" \times 8.75" = 21.5 \text{ K} > V_{u,pile} = 4 \text{ K} \text{ OK } \checkmark$$

Oneway shear: $b = 2' =$ width of pile cap

$$\phi V_c = \phi 2 \sqrt{f'_c} b d$$

$$= 0.75 \times 2 \sqrt{2500} \times 24" \times 8.75"$$

$$= 15.75 \text{ K}$$

All piles are located within critical section (locate @ distance d from column face)

\rightarrow the reaction from these piles are not considered.

\rightarrow OK \checkmark

(ACI 318-19 13.4.6.5.(b))

Flexure: (3) #4 Bot. E. W.

$e =$ distance from center of pile group to column face (critical section)

$$= 5.5" / 2 \text{ (worst case)}$$

$$= 2.75"$$

$$M = (3 \times 4 \text{ K}) \times 2.75"$$

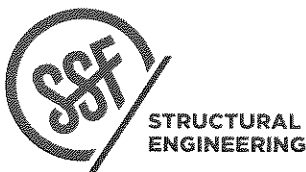
$$= 33 \text{ K-in}$$

$$\phi M_n = 0.9 A_s f_y (d - \frac{a}{2})$$

$$= 0.9 (3 \times 0.2 \text{ in}^2) \times 60 \text{ ksi} \times 7.645"$$

$$= 248 \text{ K-in} > M = 33 \text{ K-in}$$

OK \checkmark



PROJECT: PATHAK REMODEL
CYCLE 1

DATE: 09.18.24
PROJ.#:
DESIGN: LTV
SHEET: