KL&A Engineers & Builders

Steamboat Basecamp Phase Ia
1901 Curve Plaza
Steamboat Springs, CO 80487

Structural Calculations

Prepared by: Andrew Smith, PE, SE
Date: 11/11/2022

TABLE OF CONTENTS

100. BASIS OF DESIGN

Calculation Package

100 Basis of Design Calculation Index:

Calculation Package

100. NARRATIVE

The project is an existing 1-story mixed use building located at the intersection of Shield Drive and Curve Court in Steamboat Springs, CO. The existing roof framing is plywood sheathing spanning to wood roof trusses and girders bearing on steel girders, wood stud bearing walls and steel columns. The existing foundation system is continuous shallow footings under bearing walls and isolated shallow spread footings under columns. The existing lateral resisting system consists of light framed wood walls sheathed with structural panels.

The structural scope of this project includes the removal of two wood shear walls; one wood shear wall will be replaced with a steel moment frame, the other will be replaced with a new wood framed shear wall in-like-kind.

The following sections provide detailed calculations and descriptions of the structural systems for this project.

This project was designed in accordance with the 2018 International Building Code and Routt County Regional Building Department 2018 IBC Code Amendments.

The following is an overview of the loading used in the design of the structure and the key parameters used to derive the loads.

A. Dead Loads
   Detailed information regarding self-weight and superimposed dead load (e.g. MEP, Finishes, insulation, etc.) for each loading case can be found in Section 101. A graphical summary of the extents of applied dead loads can be found in the load keys in the drawing documents.

B. Roof Live Loads
   Detailed information regarding roof live loads for each loading case can be found in Section 101. A graphical summary of the extents of applied live loads can be found in the load keys in the drawing documents. The following typical roof live loads were used in the design of the structure.

Roofs	20 psf

C. Snow Loads
   Detailed information regarding snow loading, including flat roof snow loading, drifting, sliding, and unbalanced snow loading] can be found in Section 102. All snow loads on the structure have been calculated in accordance with the 2018 International Building Code and ASCE7-16. The ground snow load value of 105psf used for design is in accordance with

the local building department. The loads keys in the drawing documents show a graphical summary of the design snow loading used for the project.

D. Wind Loads:

Detailed information regarding wind loading, including MWFRS loads as well as Components and Cladding pressures can be found in Section 103. Ultimate Level Wind speed for design is in accordance with the 2018 Amendments to the Building and Fire Code for Routt County. Wind loads on the structure have been calculated in accordance with the 2018 International Building Code and ASCE 7-16 based on the following criteria:

Enclosure classification	Enclosed
Risk category	II
Wind speed	115 mph (Ultimate)
Wind directionality factor, Kd	0.85
Exposure category	C
Topographic factor, Kzt	1.0
Building flexibility	Flexible
Gust effect factor, G	0.85
Internal pressure coefficient	±0.18

E. Seismic Loads:

Detailed information regarding seismic loads can be found in Section 104. Seismic loads on the structure have been calculated based on the Routt County Building Department 2018 IBC Code Amendments. The Routt County Building Department has specified design parameters, Sds = 0.333 and Sd1 = 0.133, designating all of Routt County as Seismic Design Category C. The seismic loads for the new steel moment frame have been determined based on following criteria:

S_S	0.384
S_1	0.103
Site class	C
Period	0.390 seconds
Period determination	Approx per ASCE 7
Long period, T_L	4 seconds
Seismic force resisting system	Steel Systems no specifically detailed for Seismic Resistance
Response modification factor, R	3
Overstrength factor, Ω_o	3
Deflection amplification factor	3
Importance factor, I_e	1.00

Calculation Package

F. Soil Loads and Capacities
   Geotechnical criteria for design is based on the report provided by Timothy S. Travis, P.E. (PE#25750) of North West Colorado Consultants, Inc., dated March 15, 2021. A complete copy of the geotechnical report can be found in appendix A-100 of this calculation package. Minimum frost depth per Routt County Regional Building Department 2018 IBC Code Amendments is 48 inches. The following is a summary of the geotechnical design parameters:

   Spread Footings:

Allowable bearing pressure	3 ksf
Allowable passive lateral resistance	250 psf/ft
Coefficient of soil friction	0.40

Calculation Package

101. DEAD AND LIVE LOADS

KL&A Engineers & Builders

Title	Basecamp Phase 1a	Date	10/19/22	Job no.	21304
Subject	Flat Loads	By	APS	Sheet	of

Load Key

Load #	Description of Load	Self Weight	Superimposed Loads			Live Load Reduction?	Notes
			Dead Load	Live Load	Snow Load		
1	Roof	10	15	20	75	No	
2	Roof w/RTU	10	55	20	75	No	

KL&A Engineers & Builders

Title	Basecamp Phase 1a	Date	10/19/22	Job No.	21304
Subject	Loads	By	APS	Sheet	

Roof

Total Superimposed Dead Load: 15 PSF
Total Self Weight Dead Load: 10 PSF

Live Load: Roof = 20 PSF

Snow Load:

Balanced Snow Load or Roof Live Load 75 PSF
Do you want to use the snow load to calculate the seismic story weight? yes
Seismic Snow 15

Special Load: = PSF

Note - this does not appear on the Load Key Summary

Superimposed Dead Load:

	Category	Material	Thickness (in)	PSF
	Ceiling Finishes	Typical Mechanical Duct Allowance		4.0
				0.0
				0.0
				0.0
				0.0
User Input Load	Misc			11.0
User Input Load				

Deck/Slab Self Weight:

	Category	Type	Thickness (in)	PSF
	Wood	Plywood Floor Sheathing	0.625	1.9
				0.0
User Input Load				

Framing Self Weight:

	Category	Member	Spacing (in)	PSF
	Open Web Truss	TJM Open Web Truss	12	8.5
				0.0
User Input Load				

Custom Self Weight:

Description	PSF

KL&A Engineers & Builders

Title	Basecamp Phase 1a	Date	10/19/22	Job No.	21304
Subject	Loads	By	APS	Sheet	

Roof w/RTU

Total Superimposed Dead Load: 55 PSF
Total Self Weight Dead Load: 10 PSF

Live Load: Roof = 20 PSF

Snow Load:

Balanced Snow Load or Roof Live Load: 75 PSF
Do you want to use the snow load to calculate the seismic story weight? yes
Seismic Snow: 15

Special Load: = PSF

Note - this does not appear on the Load Key Summary

Superimposed Dead Load:

	Category	Material	Thickness (in)	PSF
	Ceiling Finishes	Typical Mechanical Duct Allowance		4.0
				0.0
				0.0
				0.0
				0.0
User Input Load	Misc			11.0
User Input Load	RTU			40.0

Deck/Slab Self Weight:

	Category	Type	Thickness (in)	PSF
	Wood	Plywood Floor Sheathing	0.625	1.9
				0.0
User Input Load				

Framing Self Weight:

	Category	Member	Spacing (in)	PSF
	Open Web Truss	TJM Open Web Truss	12	8.5
				0.0
User Input Load				

Custom Self Weight:

Description	PSF

Title	Basecamp Phase 1a	Date	10/19/22	Job no.	21304
Subject	Flat Loads	By	APS	Sheet	of

Wall Summary

Load #	Description of Load	Self Weight (psf)	Superimposed Dead Load (psf)	Notes
1	2x6 Wall	3	8	

2x6 Wall

Total Superimposed Dead Load: 8 PSF
Total Self Weight Dead Load: 3 PSF

Superimposed Dead Load:

	Category	Material	Thickness (in)	PSF
	Covered Finishes	Rigid Insulation	2	3.0
	Covered Finishes	Gypsum Board	0.625	2.8
				0.0
				0.0
				0.0
User Input Load	Misc			2.2
User Input Load				

Framing Self Weight:

	Category	Member	Spacing (in)	PSF
	DFL	2x6	16	1.7
				0.0
User Input Loads				

Solid Wall/Sheathing Self Weight:

Category	Type	Thickness (in)	PSF
Wood Sheathing	Wood Sheathing	0.5	1.5

	Type	Grout Spacing	Block Size	PSF
CMU				0.0

	Category	Type	Thickness (in)	PSF
User Input Loads				

Custom Self Weight:

Description	PSF

102. SNOW LOADS

Snow Loads : ASCE 7- 16

Nominal Snow Forces

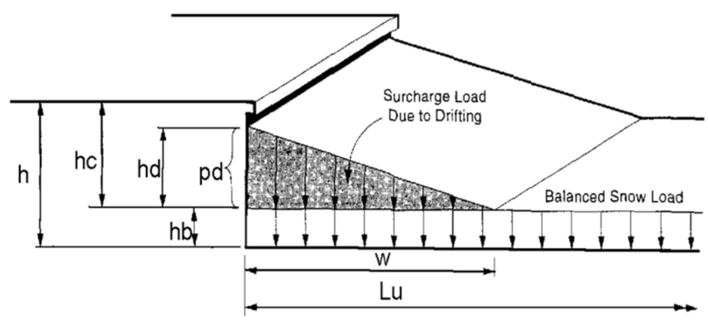
Roof slope	=	14.0 deg	
Horiz. eave to ridge dist (W)	=	136.0 ft	
Roof length parallel to ridge (L)	=	96.0 ft	
Type of Roof		Monoslope	
Ground Snow Load	Pg =	105.0 psf	
Risk Category	=	II	
Importance Factor	I =	1.0	
Thermal Factor	Ct =	1.00	
Exposure Factor	Ce =	1.0	
Pf = 0.7*Ce*Ct*I*Pg	=	73.5 psf	
Unobstructed Slippery Surface		no	
Sloped-roof Factor	Cs =	1.00	
Balanced Snow Load	**=**	**73.5 psf**	
Rain on Snow Surcharge Angle		2.72 deg	
Code Maximum Rain Surcharge		5.0 psf	
Rain on Snow Surcharge	=	0.0 psf	
Ps plus rain surcharge	=	73.5 psf	
Minimum Snow Load	Pm =	20.0 psf	
Uniform Roof Design Snow Load	=	**73.5 psf**	use 75.0

Near ground level surface balanced snow load = **105.0 psf**

NOTE: Alternate spans of continuous beams shall be loaded with half the design roof snow load so as to produce the greatest possible effect - see code for loading diagrams and exceptions for gable roofs..

Windward Snow Drifts 1 - Against walls, parapets, etc

Up or downwind fetch	lu =	107.0 ft
Projection height	h =	4.0 ft
Projection width/length	lp =	10.0 ft
Snow density	g =	27.7 pcf
Balanced snow height	hb =	2.66 ft
	hd =	3.89 ft
	hc =	1.34 ft
hc/hb >0.2 = 0.5	**lp <15', drift not req'd**	
Drift height (hc)	=	1.34 ft
Drift width	w =	10.73 ft
Surcharge load:	pd = γ*hd =	**37.1 psf**
Balanced Snow load:	=	73.5 psf
		110.6 psf



Note: If bottom of projection is at least 2 feet above hb then snow drift is not required.

Windward Snow Drifts 2 - Against walls, parapets, etc

Up or downwind fetch	lu =	52.0 ft
Projection height	h =	10.0 ft
Projection width/length	lp =	20.0 ft
Snow density	g =	27.7 pcf
Balanced snow height	hb =	2.66 ft
	hd =	2.82 ft
	hc =	7.34 ft
hc/hb >0.2 = 2.8	**Therefore, design for drift**	
Drift height (hd)	=	2.82 ft
Drift width	w =	11.27 ft
Surcharge load:	pd = γ*hd =	**77.9 psf**
Balanced Snow load:	=	73.5 psf
		151.4 psf

Calculation Package

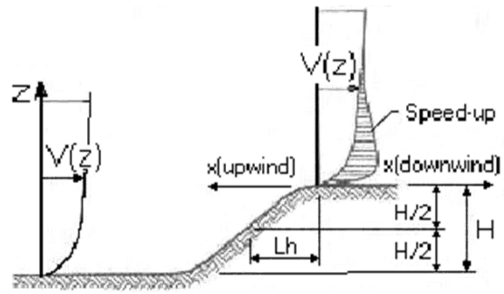
103. WIND LOADS

Wind Loads : ASCE 7- 16

Ultimate Wind Speed	115 mph
Nominal Wind Speed	89.1 mph
Risk Category	II
Exposure Category	C
Enclosure Classif.	Enclosed Building
Internal pressure	+/-0.18
Directionality (Kd)	0.85
Kh case 1	0.968
Kh case 2	0.968
Type of roof	Gable

Topographic Factor (Kzt)

Topography	Flat	
Hill Height (H)	10.0 ft	H< 15ft;exp C
Half Hill Length (Lh)	10.0 ft	∴ Kzt=1.0
Actual H/Lh =	0.00	
Use H/Lh =	0.00	
Modified Lh =	10.0 ft	
From top of crest: x =	10.0 ft	
Bldg up/down wind?	downwind	

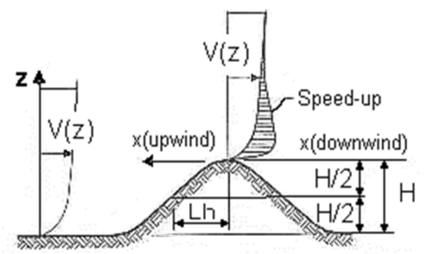


ESCARPMENT

H/Lh= 0.00	K_1 = 0.000
x/Lh = 1.00	K_2 = 0.333
z/Lh = 2.80	K_3 = 1.000

At Mean Roof Ht:

$Kzt = (1+K_1K_2K_3)^2$ = 1.00



2D RIDGE or 3D AXISYMMETRICAL HILL

Gust Effect Factor

h =	28.0 ft
B =	136.0 ft
/z (0.6h) =	16.8 ft

Flexible structure if natural frequency < 1 Hz (T > 1 second).
If building h/B>4 then may be flexible and should be investigated.
h/B = 0.21 Rigid structure (low rise bldg)

G = 0.85 Using rigid structure formula

Rigid Structure

ē =	0.20
ℓ =	500 ft
z_{min} =	15 ft
c =	0.20
g_Q, g_v =	3.4
L_z =	436.8 ft
Q =	0.86
I_z =	0.22
G =	**0.85** use G = 0.85

Flexible or Dynamically Sensitive Structure

Natural Frequency (η_1) =	0.0 Hz				
Damping ratio (β) =	0				
/b =	0.65				
/α =	0.15				
Vz =	98.8				
N_1 =	0.00				
R_n =	0.000				
R_h =	28.282	η =	0.000	h =	28.0 ft
R_B =	28.282	η =	0.000		
R_L =	28.282	η =	0.000		
g_R =	0.000				
R =	0.000				
Gf =	0.000				

Enclosure Classification

Test for Enclosed Building: Ao < 0.01Ag or 4 sf, whichever is smaller

Test for Open Building: All walls are at least 80% open.
Ao ≥ 0.8Ag

Test for Partially Enclosed Building: Predominately open on one side only

	Input			Test	
Ao	500.0	sf	Ao ≥ 1.1Aoi	NO	
Ag	600.0	sf	Ao > 4' or 0.01Ag	YES	
Aoi	1000.0	sf	Aoi / Agi ≤ 0.20	YES	Building is NOT
Agi	10000.0	sf			Partially Enclosed

Conditions to qualify as Partially Enclosed Building. Must satisfy all of the following:
- Ao ≥ 1.1Aoi
- Ao > smaller of 4' or 0.01 Ag
- Aoi / Agi ≤ 0.20

Where:
Ao = the total area of openings in a wall that receives positive external pressure.
Ag = the gross area of that wall in which Ao is identified.
Aoi = the sum of the areas of openings in the building envelope (walls and roof) not including Ao.
Agi = the sum of the gross surface areas of the building envelope (walls and roof) not including Ag.

Test for Partially Open Building: A building that does not qualify as open, enclosed or partially enclosed.
(This type building will have same wind pressures as an enclosed building.

Reduction Factor for large volume partially enclosed buildings (Ri) :

If the partially enclosed building contains a single room that is unpartitioned , the internal pressure coefficient may be multiplied by the reduction factor Ri.

Total area of all wall & roof openings (Aog):		0 sf
Unpartitioned internal volume (Vi) :		0 cf
	Ri =	1.00

Ground Elevation Factor (Ke)

Grd level above sea level =	6680.0 ft			Ke =	0.7852
Constant =	0.00256	Adj Constant =	0.00201		

KL&A Inc.
1717 Washington Ave, Suite 100
Golden, Colorado 80401
303-384-9910

Wind Loads - MWFRS all h (Except for Open Buildings)

Kh (case 2) =	0.97			GCpi =	+/-0.18
Base pressure (q_h) =	**21.9 psf**	Bldg dim parallel to ridge =	96.0 ft	G =	0.85
Roof Angle (θ) =	14.0 deg	Bldg dim normal to ridge =	136.0 ft	qi = qh	
Roof tributary area:		h =	28.0 ft		
Wind normal to ridge =(h/2)*L:	1344 sf	ridge ht =	36.5 ft		
Wind parallel to ridge =(h/2)*L:	1904 sf				

Ultimate Wind Surface Pressures (psf)

Surface	Wind Normal to Ridge				Wind Parallel to Ridge				
	L/B = 1.42		h/L = 0.21			L/B = 0.71		h/L = 0.29	
	Cp	q_hGC_p	w/+q_iGC_{pi}	w/-q_hGC_{pi}	Dist.*	Cp	q_hGC_p	w/ +q_iGC_{pi}	w/ -q_hGC_{pi}
Windward Wall (WW)	0.80	14.9	see table below			0.80	14.9	see table below	
Leeward Wall (LW)	-0.42	-7.7	-11.7	-3.8		-0.50	-9.3	-13.2	-5.4
Side Wall (SW)	-0.70	-13.0	-17.0	-9.1		-0.70	-13.0	-17.0	-9.1
Leeward Roof (LR)	-0.46	-8.6	-12.5	-4.6		Included in windward roof			
Neg Windward Roof pressure	-0.54	-10.0	-14.0	-6.1	0 to h/2*	-0.90	-16.7	-20.7	-12.8
Pos/min Windward Roof press.	-0.03	-0.6	-4.6	3.3	h/2 to h*	-0.90	-16.7	-20.7	-12.8
					h to 2h*	-0.50	-9.3	-13.2	-5.4
					> 2h*	-0.30	-5.6	-9.5	-1.6
					Min press.	-0.18	-3.3	-7.3	0.6

*Horizontal distance from windward edge

Parapet

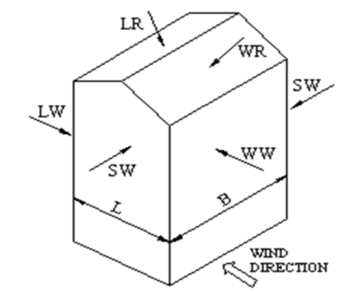
z	Kz	Kzt	qp (psf)
2.0 ft	0.85	1.00	19.2

Windward parapet:	28.8 psf	(GCpn = +1.5)
Leeward parapet:	-19.2 psf	(GCpn = -1.0)

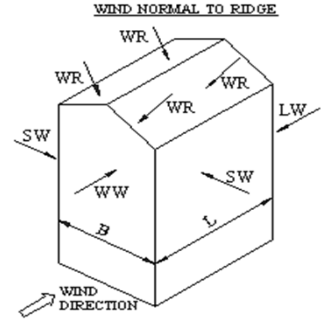
Windward roof overhangs : 14.9 psf (upward - add to windward roof pressure)

Windward Wall Pressures at "z" (psf)

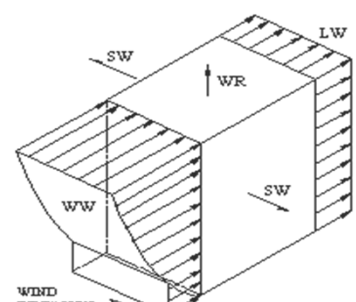
	z	Kz	Kzt	q_zGC_p	Windward Wall w/+q_iGC_{pi}	Windward Wall w/-q_hGC_{pi}	Combined WW + LW Wind Normal to Ridge	Combined WW + LW Wind Parallel to Ridge
	0 to 15'	0.85	1.00	13.0	9.1	17.0	20.8	22.3
h=	28.0 ft	0.97	1.00	14.9	10.9	18.8	22.6	24.2
	25.0 ft	0.95	1.00	14.5	10.6	18.5	22.3	23.8
h=	28.0 ft	0.97	1.00	14.9	10.9	18.8	22.6	24.2
ridge =	36.5 ft	1.02	1.00	15.7	11.8	19.7	23.5	25.0



WIND NORMAL TO RIDGE



WIND PARALLEL TO RIDGE



TYPICAL WIND LOADING

Ultimate Wind Pressures

Wind Loads - Components & Cladding : h ≤ 60'

Kh (case 2) =	0.97	h =	28.0 ft
Base pressure (qh) =	**21.9 psf**	a =	9.6 ft
Minimum parapet ht =	2.0 ft	GCpi =	+/-0.18
Roof Angle (θ) =	14.0 deg	qi = qh =	21.9 psf
Type of roof =	Gable		

Roof

	Surface Pressure (psf)								User input	
Area	2 sf	10 sf	20 sf	50 sf	75 sf	100 sf	200 sf	250 sf	50 sf	100 sf
Negative Zone 1 & 2e	-47.7	-47.7	-47.7	-29	-20.7	-16.0	-16.0	-16.0	-29.0	-16.0
Negative Zone 2n, 2r &3e	-69.6	-69.6	-60.1	-47.7	-42.2	-38.3	-28.8	-25.8	-47.7	-38.3
Negative Zone 3r	-82.7	-82.7	-70.8	-55.2	-48.2	-43.3	-43.3	-43.3	-55.2	-43.3
Positive All Zones	19.3	16	16	16	16.0	16.0	16.0	16.0	16.0	16.0
Overhang Zone 1 & 2e	-54.7	-54.7	-54.7	-42.2	-36.7	-32.8	-32.8	-32.8	-42.2	-32.8
Overhang Zone 2n & 2r	-76.6	-76.6	-69.5	-60.2	-56.0	-53.1	-46.0	-43.8	-60.2	-53.1
Overhang Zone 3e	-89.7	-89.7	-77.4	-61.3	-54.1	-49.0	-36.8	-32.8	-61.3	-49.0
Overhang Zone 3r	-102.8	-102.8	-87	-66.1	-56.9	-50.3	-50.3	-50.3	-66.1	-50.3

Overhang pressures in the table above assume an internal pressure coefficient (Gcpi) of 0.0
Overhang soffit pressure equals adj wall pressure (which includes internal pressure of 3.9 psf)

Parapet

qp = 19.2 psf

	Surface Pressure (psf)						User input
Solid Parapet Pressure	10 sf	20 sf	50 sf	100 sf	250 sf	500 sf	108 sf
CASE A: Zone 2e :	57.5	56.5	38.8	25.4	24.0	23.0	25.3
Zone 2n, 2r & 3e :	76.7	67.4	55.2	45.9	33.6	32.6	44.9
Zone 3r :	88.2	76.8	61.7	50.3	49.0	48.0	50.2
CASE B: Interior zone :	-40.3	-38.2	-35.5	-33.5	-30.8	-28.8	-33.3
Corner zone :	-46.0	-43.0	-38.9	-35.9	-31.8	-28.8	-35.5

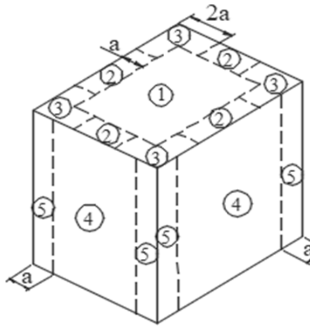
Walls

	GCp +/- GCpi				Surface Pressure at h				User input	
Area	10 sf	100 sf	200 sf	500 sf	10 sf	100 sf	200 sf	500 sf	108 sf	50 sf
Negative Zone 4	-1.28	-1.10	-1.05	-0.98	-28.0	-24.1	-23.0	-21.4	-24.0	-25.3
Negative Zone 5	-1.58	-1.23	-1.12	-0.98	-34.6	-26.8	-24.5	-21.4	-26.6	-29.2
Positive Zone 4 & 5	1.18	1.00	0.95	0.88	25.8	21.9	20.8	19.3	21.8	23.1

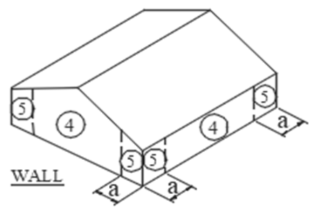
KL&A Inc.
1717 Washington Ave, Suite 100
Golden, Colorado 80401
303-384-9910

JOB TITLE	Basecamp Phase 1a		
JOB NO.	21304	SHEET NO.	
CALCULATED BY	APS	DATE	10/19/22
CHECKED BY		DATE	

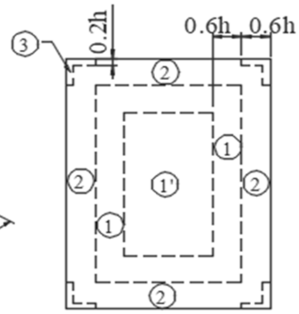
Location of C&C Wind Pressure Zones - ASCE 7-16



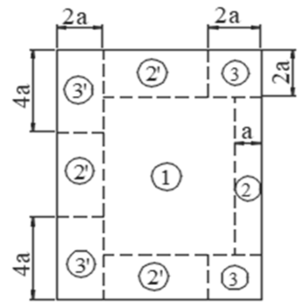
Roofs w/ θ ≤ 10°
and all walls
h > 60'



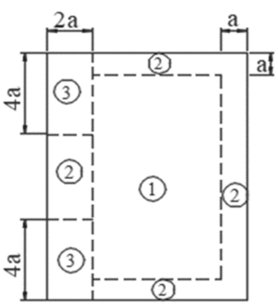
Walls h ≤ 60'
& alt design h<90'



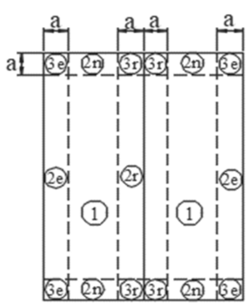
Gable, Sawtooth and
Multispan Gable θ ≤ 7 degrees &
Monoslope ≤ 3 degrees
h ≤ 60' & alt design h<90'



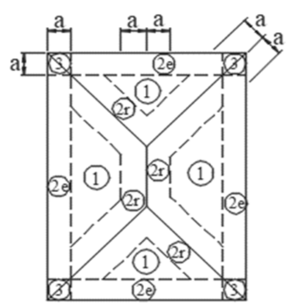
Monoslope roofs
3° < θ ≤ 10°
h ≤ 60' & alt design h<90'



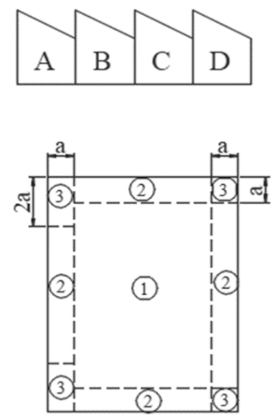
Monoslope roofs
10° < θ ≤ 30°
h ≤ 60' & alt design h<90'



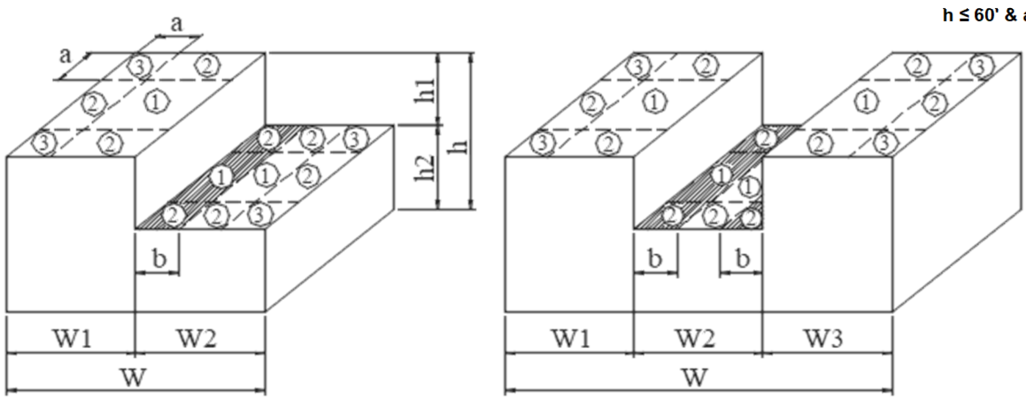
Multispan Gable &
Gable 7° < θ ≤ 45°



Hip 7° < θ ≤ 27°



Sawtooth 10° < θ ≤ 45°
h ≤ 60' & alt design h<90'



Stepped roofs θ ≤ 3°
h ≤ 60' & alt design h<90'

Note: The stepped roof zones above are as shown in ASCE 7-16 (except the upper roof zones 1 and 2 are shown at the inside edge per the notes). Prior editions didn't show zones, but the notes sent you to the low slope gable figure. The note in ASCE 7-16 still sends you to the low slope gable figure, but for some reasons the zones shown are per editions prior to ASCE 7-16. Therefore, the above zones may be a code mistake and the correct zone locations may be per the low slope gable roof shown at the top of this page.

104. SEISMIC LOADS

ATC Hazards by Location

Search Information

Address: 1901 Curve Plaza, Steamboat Springs, CO 80487, USA

Coordinates: 40.5005622, -106.8562806

Elevation: 6673 ft

Timestamp: 2021-06-18T17:49:19.019Z

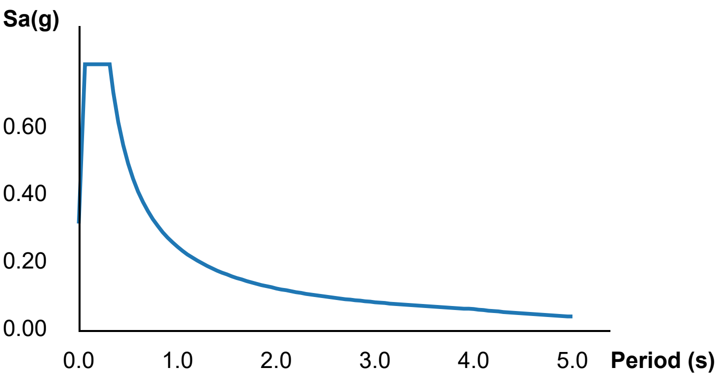
Hazard Type: Seismic

Reference Document: ASCE7-16

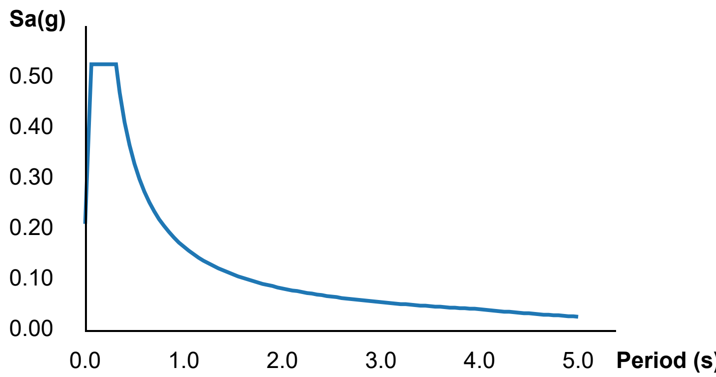
Risk Category: II

Site Class: D-default

MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.596	MCE_R ground motion (period=0.2s)
S_1	0.103	MCE_R ground motion (period=1.0s)
S_{MS}	0.789	Site-modified spectral acceleration value
S_{M1}	0.247	Site-modified spectral acceleration value
S_{DS}	0.526	Numeric seismic design value at 0.2s SA
S_{D1}	0.165	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	D	Seismic design category
F_a	1.323	Site amplification factor at 0.2s
F_v	2.394	Site amplification factor at 1.0s

CR_S	0.906	Coefficient of risk (0.2s)
CR_1	0.946	Coefficient of risk (1.0s)
PGA	0.418	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.502	Site modified peak ground acceleration
T_L	4	Long-period transition period (s)
SsRT	0.596	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.658	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.103	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.109	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.

Seismic Loads:

IBC 2018 *NORTH–SOUTH DIRECTION* Strength Level Forces

Risk Category : II
Importance Factor (Ie) : 1.00
Site Class : C

NOTE: Ss AND S1 ADJUSTED TO SET Sds AND Sd1 TO COUNTY PRESCRIBED VALUES

Ss (0.2 sec) = 38.40 %g
S1 (1.0 sec) = 10.30 %g

Site specific ground motion analysis performed:

Fa =	1.300	Sms =	0.499	S_{DS} =	0.333	Design Category =	C
Fv =	1.500	Sm1 =	0.155	S_{D1} =	0.103	Design Category =	B

Seismic Design Category = **C**
Redundancy Coefficient ρ = 1.00
Number of Stories: 1
Structure Type: Light Frame
Horizontal Struct Irregularities: No plan Irregularity
Vertical Structural Irregularities: No vertical Irregularity
Flexible Diaphragms: Yes
Building System: **Structural steel systems not specifically detailed for seismic resistance**
Seismic resisting system: **Structural steel systems not specifically detailed for seismic resistance**
System Structural Height Limit: **Height not limited**
Actual Structural Height (hn) = 36.5 ft

DESIGN COEFFICIENTS AND FACTORS

Response Modification Coefficient (R) = 3
Over-Strength Factor (Ωo) = 2.5
Deflection Amplification Factor (Cd) = 3
S_{DS} = 0.333
S_{D1} = 0.103

Seismic Load Effect (E) = Eh +/-Ev = ρQ_E +/- $0.2S_{DS}$ D = Qe +/- 0.067D Q_E = horizontal seismic force
Special Seismic Load Effect (Em) = Emh +/- Ev = $\Omega o\ Q_E$ +/- $0.2S_{DS}$ D = 2.5Qe +/ 0.067D D = dead load

PERMITTED ANALYTICAL PROCEDURES

Simplified Analysis - Use Equivalent Lateral Force Analysis

Equivalent Lateral-Force Analysis - Permitted

Building period coef. (C_T) = 0.020 Cu = 1.69
Approx fundamental period (Ta) = $C_T h_n$^ = 0.297 sec x= 0.75 Tmax = CuTa = 0.503 sec
User calculated fundamental period = T = 0.297 sec
Long Period Transition Period (TL) = ASCE7 map = 4 sec
Seismic response coef. (Cs) = SdsI/R = 0.111
need not exceed Cs = Sd1 I /RT = 0.116
but not less than Cs = 0.044SdsI = 0.015
USE Cs = 0.111

Design Base Shear V = 0.111W

Model & Seismic Response Analysis - Permitted (see code for procedure)

ALLOWABLE STORY DRIFT

Structure Type: All other structures
Allowable story drift Δa = 0.020hsx where hsx is the story height below level x

3. Agricultural storage structures intended only for incidental human occupancy.
4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.

Routt County Building Department Local Policy Amendment to Section 1613 Earth quake Loads: All properties within Routt County Incorporated and Unincorporated Jurisdictions have been adopted and approved to be a Seismic Design Category C designation through our Building Code Adoption Approval Processes. Structures shall be designed in accordance with our local amendment policy using a Seismic Design Category C designation as the base level design standard. When approved by the Structural Engineer of Record through review of the Geotechnical Soils Report and Soils Site Class, the Seismic Category may be reduced by the Engineer of Record based on the known Soils Site Class and in accordance with ASCE-7 and Chapter 16 of the IBC.

Structural Engineers Acceptable Design Parameters Local Routt County Building Department Policy: The Routt County Building Department has developed these design parameters to align with our Local Code Adoptions that were approved designating all of Routt County a Seismic Design Category C. This Policy has been created to provide maximum values for SDS and SD1 respectively to be used in the mapped areas throughout Routt County that have been designated Seismic Category D in accordance ASCE 7-16 USGS Seismic Design Data Map found at https://seismicmaps.org/. The parameters below may be used by Structural Engineers based on the Risk Factor of the Building to perform calculations to determine structural designs. The below parameters may be used with Site Class D- Default (See Section 11.4.3) being set on the ASCE 7-16 USGS Seismic Design Data Map found at https://seismicmaps.org/. Lower values may be used if justified by soil Site Class and resulting site-specific ground motion parameters set forth in ASCE 7-16 and USGS Seismic Design Data Map and approved by the Code Official.

- **Risk Category I, II, and II Building: SDS = 0.333 and SD1 = 0.133**
- **Risk Category IV Building: SDS = 0.499 and SD1 = 0.199**

The intent of setting these parameters and values is to help support Structural Engineers in designing buildings within the spirt of our Locally Approved Code Adoptions designating a standard Seismic Design Category C throughout all of Routt County, to avoid conflicts in what data would otherwise be provided through ASCE 7-16 USGS Seismic Design Data Map found at https://seismicmaps.org/.

Routt County Regional Building Department 2018 IRC Code Adoption

Table R301.2(1) CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA, is completed as follows:

- Ground Snow Load – Case Study Area contact the Building Department for Ground Snow Load Valuations per site.
- Climate Zone 7
- Wind Speed – 115 MPH (ultimate design wind speed)
- Topographic Effects – No
- Seismic Design Category – C Note: When approved by the Structural Engineer of Record through review of the Geotechnical Soils Report and Soils Site Class, the Seismic Category may be reduced

KL&A Inc.
1717 Washington Ave, Suite 100
Golden, Colorado 80401
303-384-9910

JOB TITLE	Basecamp Phase 1a		
JOB NO.	21304	**SHEET NO.**	
CALCULATED BY	APS	**DATE**	10/19/22
CHECKED BY		**DATE**	

Seismic Loads: IBC 2018 *EAST–WEST DIRECTION* Strength Level Forces

Risk Category : II
Importance Factor (Ie) : 1.00

Site Class : C

NOTE: Ss AND S1 ADJUSTED TO SET Sds AND Sd1 TO COUNTY PRESCRIBED VALUES

Ss (0.2 sec) = 38.40 %g
S1 (1.0 sec) = 10.30 %g

Site specific ground motion analysis performed:

Fa =	1.300	Sms =	0.499	S_{DS} =	0.333	Design Category =	C
Fv =	1.500	Sm1 =	0.155	S_{D1} =	0.103	Design Category =	B

Seismic Design Category = **C**
Redundancy Coefficient ρ = 1.00
Number of Stories: 1
Structure Type: Light Frame
Horizontal Struct Irregularities: No plan Irregularity
Vertical Structural Irregularities: No vertical Irregularity
Flexible Diaphragms: Yes
Building System: **Bearing Wall Systems**
Seismic resisting system: **Light frame (wood) walls with structural wood shear panels**
System Structural Height Limit: **Height not limited**
Actual Structural Height (hn) = 36.5 ft

DESIGN COEFFICIENTS AND FACTORS

Response Modification Coefficient (R) = 6.5
Over-Strength Factor (Ωo) = 2.5
Deflection Amplification Factor (Cd) = 4
S_{DS} = 0.333
S_{D1} = 0.103

Seismic Load Effect (E) = Eh +/-Ev = ρ Q_E +/- $0.2S_{DS}$ D = Qe +/- 0.067D Q_E = horizontal seismic force
Special Seismic Load Effect (Em) = Emh +/- Ev = Ωo Q_E +/- $0.2S_{DS}$ D = 2.5Qe +/ 0.067D   D = dead load

PERMITTED ANALYTICAL PROCEDURES

Simplified Analysis - Use Equivalent Lateral Force Analysis

Equivalent Lateral-Force Analysis - Permitted

Building period coef. (C_T) = 0.020   Cu = 1.69
Approx fundamental period (Ta) = $C_T h_n$^ = 0.297 sec x= 0.75   Tmax = CuTa = 0.503 sec
User calculated fundamental period =   T = 0.297 sec
Long Period Transition Period (TL) = ASCE7 map = 4 sec
Seismic response coef. (Cs) = SdsI/R = 0.051
need not exceed Cs = Sd1 I /RT = 0.053
but not less than Cs = 0.044SdsI = 0.015
USE Cs = 0.051

Design Base Shear V = 0.051W

Model & Seismic Response Analysis - Permitted (see code for procedure)

ALLOWABLE STORY DRIFT

Structure Type: All other structures

Allowable story drift Δa = 0.020hsx where hsx is the story height below level x

200. FOUNDATIONS

Calculation Package

200 Foundation Calculation Index:

200. NARRATIVE

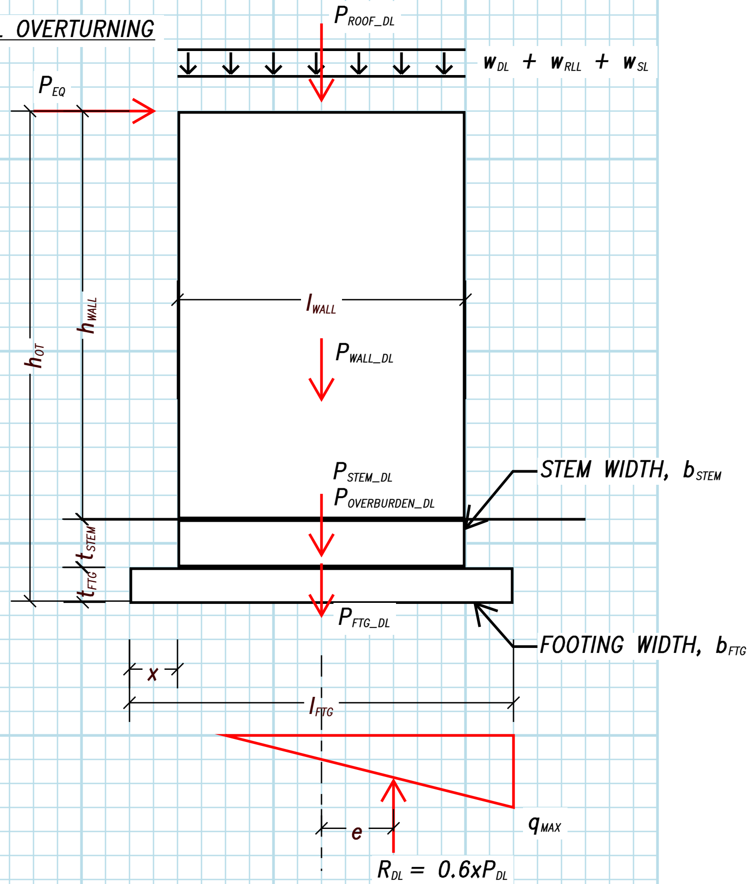
The foundation system for this structure is shallow spread footings for both the gravity and lateral systems based on the criteria summarized in Section 100, and shown in detail in the Geotechnical report included in Appendix A-100.

Gravity loads to the foundation were determined using Risa 3D based on loads as prescribed in section 100. A summary of gravity foundation demands is included in Section 201 of these calculations.

Lateral loads to the foundation were determined using Risa3D based on loads as prescribed in section 100. A summary of lateral foundation demands is included in Section 201 of these calculations.

201. SHEAR WALL CONTINUOUS FOOTING

CONTINUOUS FOOTING BEARING & SLIDING AT SHEAR WALL OVERTURNING



SOIL DESIGN PROPERTIES

PASSIVE = 250 psf/ft
FRICTION COEFF = 0.4
BEARING = 3000 psf

DIMENSIONS

h_{WALL} = 17'–0"
l_{WALL} = 12'–0"
t_{STEM} = 2'–0"
b_{STEM} = 0'–10"
t_{FTG} = 1'–6"
b_{FTG} = 3'–6"
x = 2'–0" (FTG EXTENSION)
$l_{FTG} = l_{WALL} + 2x$ = 16'–0"
$h_{OT} = h_{WALL} + t_{STEM} + t_{FTG}$ = 20'–6"

APPLIED LOADS

P_{EQ} = 5,552 lbs
w_{ROOF_DL} = 0 plf
w_{RLL} = 0 plf
w_{SL} = 0 plf
DL_{WALL} = 10 psf
DL_{CONC} = 145 pcf
DL_{SOIL} = 110 pcf

P_{ROOF_DL} = 0 lbs
P_{WALL_DL} = 2,040 lbs
P_{STEM_DL} = 2,900 lbs
$P_{OVERBURDEN\_DL}$ = 10,656 lbs
P_{FTG_DL} = 12,180 lbs
P_{DL} = 27,776 lbs
$0.6xP_{DL}$ = 16,666 lbs

CALCULATION CONTINUES FOLLOWING PAGES

CONTINUOUS FOOTING BEARING AT SHEAR WALL OVERTURNING (CONT)

SOIL DESIGN PROPERTIES

PASSIVE, q_P = 250 psf/ft

FRICTION COEFF, c_F = 0.4

BEARING = 3000 psf

SOIL LOADING

BEARING CHECK

FOR: $e = P_{EQ} x h_{OT} / 0.6xP_{DL} < l_{FTG}/6$, TRAPAZOIDAL LOADING

$e = P_{EQ} x h_{OT} / 0.6xP_{DL} > l_{FTG}/6$, TRIANGULAR LOADING

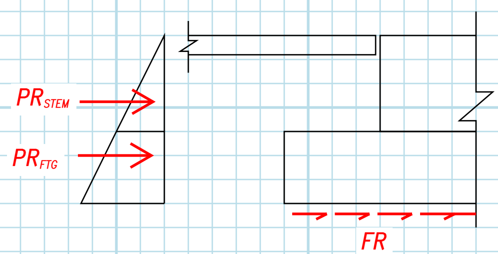
$l_{FTG}/6 = 2.67$ ft

$e = P_{EQ} x h_{OT} / 0.6xP_{DL} = 6.83$ ft, $> l_{FTG}/6$, TRIANGULAR LOADING

TRAPAZOIDAL LOADING: $q_{MAX} = 0.6xP_{DL} / l_{FTG} b_{FTG} + 6P_{EQ} h_{OT} / l_{FTG}^2 b_{FTG}$ = N/A

TRIANGULAR LOADING: $q_{MAX} = 2(0.6xP_{DL}) / 3(l_{FTG}/2 - e) b_{FTG}$ = 2,711 psf < 4/3x BEARING = 4,000 psf, OKAY

SLIDING CHECK



FRICTION RESISTANCE, FR = c_F x $0.6xP_{DL}$ = 6,666 lbs

PASSIVE SOIL RESISTANCE, PR = $PR_{STEM} + PR_{FTG}$

$PR_{STEM} = q_P \times d_{STEM}^2 /2 \times b_{STEM}$ = 417 lbs

$PR_{FTG} = q_P \times t_{FTG} \times b_{FTG} \times (b_{STEM} + t_{FTG}/2)$ = 3,609 lbs

PASSIVE SOIL RESISTANCE, PR = $PR_{STEM} + PR_{FTG}$ = 4,026 lbs

SLIDING RESISTANCE, SR = FR + PR = 10,692 lbs

SLIDING DEMAND, P_{EQ} = 5,552 lbs, 1.5x P_{EQ} = 8,328 lbs < SR = 10,692 lbs, SLIDING OKAY

PROVDE 3'-6" WIDE x 1'-6" THICK CONTINUOUS FOOTING

EXTEND FOOTING 2'-0" MIN BEYOND EXTENTS OF WALL

DROP TOP OF FOOTING 2'-0" BELOW TOP OF SLAB

202. MOMENT FRAME SPREAD FOOTINGS

SPREAD FOOTING AT MOMENT FRAME COLUMN & (E) TUBE STEEL COLUMN

(E) COLUMN BASE REACTIONS (UNFACTORED)

ROOF LOADING
DL = 25 psf
RLL = 20 psf
SL = 75 psf

SUPPORTED BEAM SPAN, l = 12'–8"

SUPPORTED BEAM TRIBUTARY, s = 1/2(29'–10 + 15'–6") = 22'–8"

COLUMN TRIBUTARY, l x s = 288 sf

P_{DL} = 7,200 lbs

P_{RLL} = 5,760 lbs

P_{SL} = 21,600 lbs

MOMENT FRAME COLUMN BASE REACTIONS (UNFACTORED)

Load Combinations

Combinations | Design

LC Generator | RSA Scaling Factor | Solve Current LC | Solve Batch + Envelope

	Description	Solve	P-Delta	SRSS	BLC	Factor	BLC
33		☐					
34	Basic Load Cases	☐					
35	SW	☐	Y		1	1	
36	DL	☐	Y		2	1	
37	SW+DL	☑	Y		DL	1	
38	LL	☐	Y		LL	1	
39	RLL	☑	Y		RLL	1	
40	SL	☑	Y		SL	1	
41	WL	☑	Y		WL	1	
42	EL	☑	Y		EL	1	

Node Reactions (By Combination)

	LC	Node Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	37	N1	0.674	6.47	0	0	0	0
2	37	N2	-0.674	6.47	0	0	0	0
3	37	Totals:	0	12.94	0			
4	37	COG (ft):	X: 10.5	Y: 13.42	Z: 15.5			
5	39	N1	0.476	3.851	0	0	0	0
6	39	N2	-0.476	3.85	0	0	0	0
7	39	Totals:	0	7.701	0			
8	39	COG (ft):	X: 10.5	Y: 14.625	Z: 15.5			
9	40	N1	1.788	14.45	0	0	0	0
10	40	N2	-1.788	14.45	0	0	0	0
11	40	Totals:	0	28.9	0			
12	40	COG (ft):	X: 10.5	Y: 14.625	Z: 15.5			
13	41	N1	-3.52	-6.297	0	0	0	0
14	41	N2	-3.48	6.297	0	0	0	0
15	41	Totals:	-7	0	0			
16	41	COG (ft):	NC	NC	NC			
17	42	N1	-7.081	-12.593	0	0	0	0
18	42	N2	-6.919	12.593	0	0	0	0
19	42	Totals:	-14	0	0			
20	42	COG (ft):	NC	NC	NC			

SEE ENERCALC OUTPUT FOLLOWING PAGES

SPREAD FOOTING AT MOMENT FRAME COLUMN & (E) TUBE STEEL COLUMN

LOADING IS THE SAME AS FRAME COLUMN RISA 3D OUTPUT ABOVE

SEE ENERCALC OUTPUT FOLLOWING PAGES

Combined Footing

Project File: 21304_Basecamp_Phase-1a_Enercalc.ec6

LIC# : KW-06017163, Build:20.22.10.25 KL&A, INC. (c) ENERCALC INC 1983-2022

DESCRIPTION: Spread Footing at MF and (E)Tube Col

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Material Properties

f'c : Concrete 28 day strength		4.0	ksi
fy : Rebar Yield		60.0	ksi
Ec : Concrete Elastic Modulus		3,122.0	ksi
Concrete Density		145.0	pcf
ϕ : Phi Values	Flexure :	0.90	
	Shear :	0.750	

Analysis/Design Settings

Calculate footing weight as dead load ?	Yes
Calculate Pedestal weight as dead load ?	No
Min Steel % Bending Reinf (based on 'd')	
Min Allow % Temp Reinf (based on thick)	0.00180
Min. Overturning Safety Factor	1.0: 1
Min. Sliding Safety Factor	1.0: 1

Soil Information

Allowable Soil Bearing	3.0	ksf
Increase Bearing By Footing Weight	No	
Soil Passive Sliding Resistance	250.0	pcf

(Uses entry for "Footing base depth below soil surface" for force)

Coefficient of Soil/Concrete Friction	0.40

Soil Bearing Increase

Footing base depth below soil surface	3.50 ft
Increases based on footing Depth	
Allowable pressure increase per foot	ksf
when base of footing is below	ft
Increases based on footing Width . . .	
Allowable pressure increase per foot	ksf
when maximum length or width is greater tha	ft
Maximum Allowed Bearing Pressure	10.0 ksf
(A value of zero implies no limit)	
Adjusted Allowable Soil Bearing	3.0 ksf

(Allowable Soil Bearing adjusted for footing weight and depth & width increases as specified by user.)

Dimensions & Reinforcing

Distance Left of Column #1	=	2.177 ft
Between Columns	=	2.146 ft
Distance Right of Column #2	=	2.177 ft
Total Footing Length	=	6.50 ft
Footing Width	=	6.50 ft
Footing Thickness	=	18.0 in
Rebar Center to Concrete Edge @ Top	=	2.0 in
Rebar Center to Concrete Edge @ Bottom	=	3.0 in

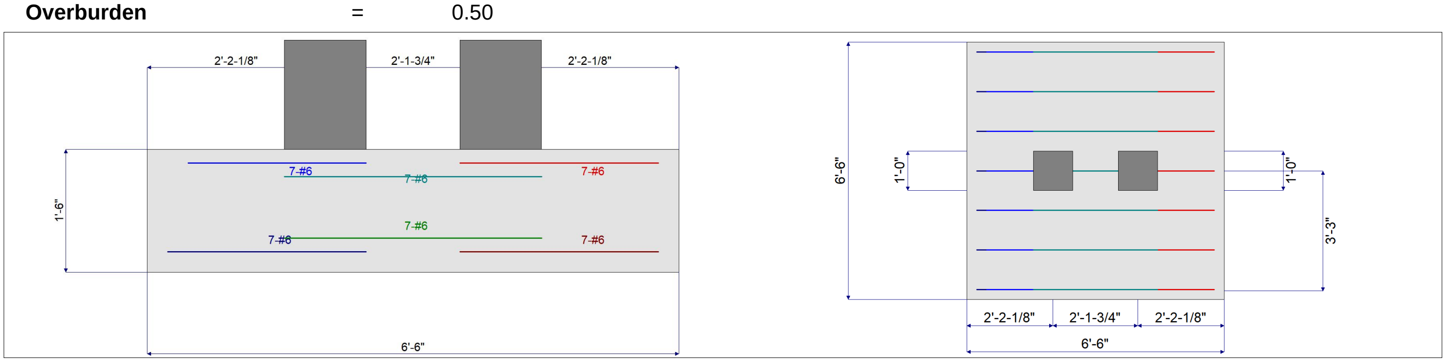
Pedestal dimensions...

		Col #1	Col #2
Sq. Dim.	=	12.0	12.0 in
Height	=	16.0	16.0 in

	Count	Size #	As Provided	As Req'd
Bars left of Col #1				
Bottom Bars	7.0	6	3.080	2.527 in^2
Top Bars	7.0	6	3.080	0.0 in^2
Bars Btwn Cols				
Bottom Bars	7.0	6	3.080	2.527 in^2
Top Bars	7.0	6	3.080	2.527 in^2
Bars Right of Col #2				
Bottom Bars	7.0	6	3.080	2.527 in^2
Top Bars	7.0	6	3.080	0.0 in^2

Applied Loads

		D	Lr	L	S	W	E	H	
Applied @ Left Column									
Axial Load Downward	=	7.20	5.760		21.60				k
Moment (+CW)	=								k-ft
Shear (+X)	=								k
Applied @ Right Column									
Axial Load Downward	=	6.470	3.850		14.450	-6.30	-12.60		k
Moment (+CW)	=								k-ft
Shear (+X)	=	0.70	0.50		1.80	3.530	7.10		k
Overburden	=	0.50							



Combined Footing

Project File: 21304_Basecamp_Phase-1a_Enercalc.ec6

LIC# : KW-06017163, Build:20.22.10.25 KL&A, INC.

DESCRIPTION: Spread Footing at MF and (E)Tube Col

DESIGN SUMMARY

Design OK

	Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	2.445	Overturning	34.473 k-ft	84.290 k-ft	+0.60D+0.70E
PASS	2.503	Sliding	5.390 k	13.491 k	+0.60D+0.70E
PASS	2.924	Uplift	8.820 k	25.791 k	+0.60D+0.70E

	Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.6335	Soil Bearing	1.901 ksf	3.0 ksf	+D+S
PASS	0.09020	1-way Shear - Col #1	8.557 psi	94.868 psi	+1.20D+0.70S+E
PASS	0.09020	1-way Shear - Col #2	8.557 psi	94.868 psi	+1.20D+0.70S+E
PASS	0.09883	2-way Punching - Col #1	18.752 psi	189.737 psi	+1.20D+1.60S+0.50W
PASS	0.09907	2-way Punching - Col #2	18.798 psi	189.737 psi	+1.20D+1.60S+0.50W
PASS	0.007020	Flexure - Left of Col #1 - Top	-1.523 k-ft	216.931 k-ft	+0.90D+E
PASS	0.07951	Flexure - Left of Col #1 - Bottom	16.147 k-ft	203.071 k-ft	+1.20D+1.60S
PASS	0.07412	Flexure - Between Cols - Top	-16.078 k-ft	216.931 k-ft	+0.90D+E
PASS	0.09757	Flexure - Between Cols - Bottom	19.814 k-ft	203.071 k-ft	+1.20D+1.60S
PASS	No Bending	Flexure - Right of Col #2 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS	0.07517	Flexure - Right of Col #2 - Bottom	15.265 k-ft	203.071 k-ft	+1.20D+1.60S

Soil Bearing

		Eccentricity	Actual Soil Bearing Stress			Actual / Allow
Load Combination...	Total Bearing	from Ftg CL	@ Left Edge	@ Right Edge	Allowable	Ratio
D Only	42.98 k	0.028 ft	0.99 ksf	1.04 ksf	3.00 ksf	0.348
+D+Lr	52.59 k	0.011 ft	1.23 ksf	1.26 ksf	3.00 ksf	0.419
+D+S	79.03 k	-0.017 ft	1.90 ksf	1.84 ksf	3.00 ksf	0.634
+D+0.750Lr	50.19 k	0.014 ft	1.17 ksf	1.20 ksf	3.00 ksf	0.401
+D+0.750S	70.02 k	-0.010 ft	1.67 ksf	1.64 ksf	3.00 ksf	0.558
+D+0.60W	39.20 k	0.080 ft	0.86 ksf	1.00 ksf	3.00 ksf	0.332
+D+0.70E	34.16 k	0.170 ft	0.68 ksf	0.94 ksf	3.00 ksf	0.312
+D+0.750Lr+0.450W	47.36 k	0.046 ft	1.07 ksf	1.17 ksf	3.00 ksf	0.389
+D+0.750S+0.450W	67.19 k	0.011 ft	1.57 ksf	1.61 ksf	3.00 ksf	0.535
+D+0.750S+0.5250E	63.41 k	0.043 ft	1.44 ksf	1.56 ksf	3.00 ksf	0.520
+0.60D+0.60W	22.01 k	0.121 ft	0.46 ksf	0.58 ksf	3.00 ksf	0.193
+0.60D+0.70E	16.97 k	0.315 ft	0.29 ksf	0.52 ksf	3.00 ksf	0.173

Overturning Stability

	Moments about Left Edge k-ft			Moments about Right Edge k-ft		
Load Combination...	Overturning	Resisting	Ratio	Overturning	Resisting	Ratio
D Only	0.00	0.00	999.000	1.98	140.48	70.832
+D+Lr	0.00	0.00	999.000	3.40	173.76	51.107
+D+S	0.00	0.00	999.000	7.08	265.32	37.457
+D+0.750Lr	0.00	0.00	999.000	3.05	165.44	54.318
+D+0.750S	0.00	0.00	999.000	5.81	234.11	40.306
+D+0.60W	16.34	146.90	8.990	16.21	140.48	8.665
+D+0.70E	38.13	154.98	4.065	35.27	140.48	3.983
+D+0.750Lr+0.450W	12.26	168.35	13.736	13.72	165.44	12.060
+D+0.750S+0.450W	12.26	231.34	18.876	16.48	234.11	14.205
+D+0.750S+0.5250E	28.60	237.40	8.302	30.77	234.11	7.608
+0.60D+0.60W	16.34	90.54	5.541	15.42	84.29	5.466
+0.60D+0.70E	38.13	98.62	2.587	34.47	84.29	2.445

Sliding Stability

Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio
D Only	0.70 k	23.90 k	34.138
+D+Lr	1.20 k	27.74 k	23.117
+D+S	2.50 k	38.32 k	15.327
+D+0.750Lr	1.08 k	26.78 k	24.912
+D+0.750S	2.05 k	34.71 k	16.933
+D+0.60W	2.82 k	22.38 k	7.944
+D+0.70E	5.67 k	20.37 k	3.592
+D+0.750Lr+0.450W	2.66 k	25.65 k	9.629

Combined Footing

Project File: 21304_Basecamp_Phase-1a_Enercalc.ec6

LIC# : KW-06017163, Build:20.22.10.25 KL&A, INC.

DESCRIPTION: Spread Footing at MF and (E)Tube Col

Sliding Stability

Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio
+D+0.750S+0.450W	3.64 k	33.58 k	9.228
+D+0.750S+0.5250E	5.78 k	32.07 k	5.55
+0.60D+0.60W	2.54 k	15.51 k	6.11
+0.60D+0.70E	5.39 k	13.49 k	2.503

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+0.60D+0.70E	0.000	0.000	0	0.000	0	0.000	0.000	0.000
+0.60D+0.70E	0.000	0.016	0	0.000	0	0.000	0.000	0.000
+0.60D+0.70E	0.000	0.033	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60S	0.014	0.049	Bottom	2.527	Min Temp %	3.080	203.071	0.000
+1.20D+1.60S	0.024	0.065	Bottom	2.527	Min Temp %	3.080	203.071	0.000
+1.20D+1.60S	0.038	0.081	Bottom	2.527	Min Temp %	3.080	203.071	0.000
+1.20D+1.60S	0.055	0.098	Bottom	2.527	Min Temp %	3.080	203.071	0.000
+1.20D+1.60S	0.075	0.114	Bottom	2.527	Min Temp %	3.080	203.071	0.000
+1.20D+1.60S	0.098	0.130	Bottom	2.527	Min Temp %	3.080	203.071	0.000
+1.20D+1.60S	0.124	0.146	Bottom	2.527	Min Temp %	3.080	203.071	0.001
+1.20D+1.60S	0.153	0.163	Bottom	2.527	Min Temp %	3.080	203.071	0.001
+1.20D+1.60S	0.185	0.179	Bottom	2.527	Min Temp %	3.080	203.071	0.001
+1.20D+1.60S	0.220	0.195	Bottom	2.527	Min Temp %	3.080	203.071	0.001
+1.20D+1.60S	0.258	0.211	Bottom	2.527	Min Temp %	3.080	203.071	0.001
+1.20D+1.60S	0.300	0.228	Bottom	2.527	Min Temp %	3.080	203.071	0.001
+1.20D+1.60S	0.344	0.244	Bottom	2.527	Min Temp %	3.080	203.071	0.002
+1.20D+1.60S	0.391	0.260	Bottom	2.527	Min Temp %	3.080	203.071	0.002
+1.20D+1.60S	0.442	0.276	Bottom	2.527	Min Temp %	3.080	203.071	0.002
+1.20D+1.60S	0.495	0.293	Bottom	2.527	Min Temp %	3.080	203.071	0.002
+1.20D+1.60S	0.552	0.309	Bottom	2.527	Min Temp %	3.080	203.071	0.003
+1.20D+1.60S	0.612	0.325	Bottom	2.527	Min Temp %	3.080	203.071	0.003
+1.20D+1.60S	0.674	0.341	Bottom	2.527	Min Temp %	3.080	203.071	0.003
+1.20D+1.60S	0.740	0.358	Bottom	2.527	Min Temp %	3.080	203.071	0.004
+1.20D+1.60S	0.809	0.374	Bottom	2.527	Min Temp %	3.080	203.071	0.004
+1.20D+1.60S	0.880	0.390	Bottom	2.527	Min Temp %	3.080	203.071	0.004
+1.20D+1.60S	0.955	0.406	Bottom	2.527	Min Temp %	3.080	203.071	0.005
+1.20D+1.60S	1.033	0.423	Bottom	2.527	Min Temp %	3.080	203.071	0.005
+1.20D+1.60S	1.114	0.439	Bottom	2.527	Min Temp %	3.080	203.071	0.005
+1.20D+1.60S	1.198	0.455	Bottom	2.527	Min Temp %	3.080	203.071	0.006
+1.20D+1.60S	1.285	0.471	Bottom	2.527	Min Temp %	3.080	203.071	0.006
+1.20D+1.60S	1.375	0.488	Bottom	2.527	Min Temp %	3.080	203.071	0.007
+1.20D+1.60S	1.468	0.504	Bottom	2.527	Min Temp %	3.080	203.071	0.007
+1.20D+1.60S	1.565	0.520	Bottom	2.527	Min Temp %	3.080	203.071	0.008
+1.20D+1.60S	1.664	0.536	Bottom	2.527	Min Temp %	3.080	203.071	0.008
+1.20D+1.60S	1.766	0.553	Bottom	2.527	Min Temp %	3.080	203.071	0.009
+1.20D+1.60S	1.871	0.569	Bottom	2.527	Min Temp %	3.080	203.071	0.009
+1.20D+1.60S	1.980	0.585	Bottom	2.527	Min Temp %	3.080	203.071	0.010
+1.20D+1.60S	2.091	0.601	Bottom	2.527	Min Temp %	3.080	203.071	0.010
+1.20D+1.60S	2.206	0.618	Bottom	2.527	Min Temp %	3.080	203.071	0.011
+1.20D+1.60S	2.323	0.634	Bottom	2.527	Min Temp %	3.080	203.071	0.011
+1.20D+1.60S	2.444	0.650	Bottom	2.527	Min Temp %	3.080	203.071	0.012
+1.20D+1.60S	2.567	0.666	Bottom	2.527	Min Temp %	3.080	203.071	0.013
+1.20D+1.60S	2.694	0.683	Bottom	2.527	Min Temp %	3.080	203.071	0.013
+1.20D+1.60S	2.823	0.699	Bottom	2.527	Min Temp %	3.080	203.071	0.014
+1.20D+1.60S	2.956	0.715	Bottom	2.527	Min Temp %	3.080	203.071	0.015
+1.20D+1.60S	3.092	0.731	Bottom	2.527	Min Temp %	3.080	203.071	0.015
+1.20D+1.60S	3.231	0.748	Bottom	2.527	Min Temp %	3.080	203.071	0.016
+1.20D+1.60S	3.372	0.764	Bottom	2.527	Min Temp %	3.080	203.071	0.017
+1.20D+1.60S	3.517	0.780	Bottom	2.527	Min Temp %	3.080	203.071	0.017
+1.20D+1.60S	3.665	0.796	Bottom	2.527	Min Temp %	3.080	203.071	0.018
+1.20D+1.60S	3.816	0.813	Bottom	2.527	Min Temp %	3.080	203.071	0.019
+1.20D+1.60S	3.970	0.829	Bottom	2.527	Min Temp %	3.080	203.071	0.020
+1.20D+1.60S	4.127	0.845	Bottom	2.527	Min Temp %	3.080	203.071	0.020
+1.20D+1.60S	4.287	0.861	Bottom	2.527	Min Temp %	3.080	203.071	0.021
+1.20D+1.60S	4.450	0.878	Bottom	2.527	Min Temp %	3.080	203.071	0.022
+1.20D+1.60S	4.616	0.894	Bottom	2.527	Min Temp %	3.080	203.071	0.023

Combined Footing

Project File: 21304_Basecamp_Phase-1a_Enercalc.ec6

LIC# : KW-06017163, Build:20.22.10.25 KL&A, INC. (c) ENERCALC INC 1983-2022

DESCRIPTION: Spread Footing at MF and (E)Tube Col

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.20D+1.60S	4.785	0.910	Bottom	2.527	Min Temp %	3.080	203.071	0.024
+1.20D+1.60S	4.957	0.926	Bottom	2.527	Min Temp %	3.080	203.071	0.024
+1.20D+1.60S	5.133	0.943	Bottom	2.527	Min Temp %	3.080	203.071	0.025
+1.20D+1.60S	5.311	0.959	Bottom	2.527	Min Temp %	3.080	203.071	0.026
+1.20D+1.60S	5.492	0.975	Bottom	2.527	Min Temp %	3.080	203.071	0.027
+1.20D+1.60S	5.676	0.991	Bottom	2.527	Min Temp %	3.080	203.071	0.028
+1.20D+1.60S	5.864	1.008	Bottom	2.527	Min Temp %	3.080	203.071	0.029
+1.20D+1.60S	6.054	1.024	Bottom	2.527	Min Temp %	3.080	203.071	0.030
+1.20D+1.60S	6.247	1.040	Bottom	2.527	Min Temp %	3.080	203.071	0.031
+1.20D+1.60S	6.444	1.056	Bottom	2.527	Min Temp %	3.080	203.071	0.032
+1.20D+1.60S	6.643	1.073	Bottom	2.527	Min Temp %	3.080	203.071	0.033
+1.20D+1.60S	6.846	1.089	Bottom	2.527	Min Temp %	3.080	203.071	0.034
+1.20D+1.60S	7.051	1.105	Bottom	2.527	Min Temp %	3.080	203.071	0.035
+1.20D+1.60S	7.260	1.121	Bottom	2.527	Min Temp %	3.080	203.071	0.036
+1.20D+1.60S	7.471	1.138	Bottom	2.527	Min Temp %	3.080	203.071	0.037
+1.20D+1.60S	7.686	1.154	Bottom	2.527	Min Temp %	3.080	203.071	0.038
+1.20D+1.60S	7.903	1.170	Bottom	2.527	Min Temp %	3.080	203.071	0.039
+1.20D+1.60S	8.124	1.186	Bottom	2.527	Min Temp %	3.080	203.071	0.040
+1.20D+1.60S	8.348	1.203	Bottom	2.527	Min Temp %	3.080	203.071	0.041
+1.20D+1.60S	8.574	1.219	Bottom	2.527	Min Temp %	3.080	203.071	0.042
+1.20D+1.60S	8.804	1.235	Bottom	2.527	Min Temp %	3.080	203.071	0.043
+1.20D+1.60S	9.037	1.251	Bottom	2.527	Min Temp %	3.080	203.071	0.045
+1.20D+1.60S	9.273	1.268	Bottom	2.527	Min Temp %	3.080	203.071	0.046
+1.20D+1.60S	9.511	1.284	Bottom	2.527	Min Temp %	3.080	203.071	0.047
+1.20D+1.60S	9.753	1.300	Bottom	2.527	Min Temp %	3.080	203.071	0.048
+1.20D+1.60S	9.998	1.316	Bottom	2.527	Min Temp %	3.080	203.071	0.049
+1.20D+1.60S	10.246	1.333	Bottom	2.527	Min Temp %	3.080	203.071	0.050
+1.20D+1.60S	10.497	1.349	Bottom	2.527	Min Temp %	3.080	203.071	0.052
+1.20D+1.60S	10.750	1.365	Bottom	2.527	Min Temp %	3.080	203.071	0.053
+1.20D+1.60S	11.007	1.381	Bottom	2.527	Min Temp %	3.080	203.071	0.054
+1.20D+1.60S	11.267	1.398	Bottom	2.527	Min Temp %	3.080	203.071	0.055
+1.20D+1.60S	11.530	1.414	Bottom	2.527	Min Temp %	3.080	203.071	0.057
+1.20D+1.60S	11.796	1.430	Bottom	2.527	Min Temp %	3.080	203.071	0.058
+1.20D+1.60S	12.065	1.446	Bottom	2.527	Min Temp %	3.080	203.071	0.059
+1.20D+1.60S	12.337	1.463	Bottom	2.527	Min Temp %	3.080	203.071	0.061
+1.20D+1.60S	12.612	1.479	Bottom	2.527	Min Temp %	3.080	203.071	0.062
+1.20D+1.60S	12.890	1.495	Bottom	2.527	Min Temp %	3.080	203.071	0.063
+1.20D+1.60S	13.171	1.511	Bottom	2.527	Min Temp %	3.080	203.071	0.065
+1.20D+1.60S	13.455	1.528	Bottom	2.527	Min Temp %	3.080	203.071	0.066
+1.20D+1.60S	13.742	1.544	Bottom	2.527	Min Temp %	3.080	203.071	0.068
+1.20D+1.60S	14.032	1.560	Bottom	2.527	Min Temp %	3.080	203.071	0.069
+1.20D+1.60S	14.325	1.576	Bottom	2.527	Min Temp %	3.080	203.071	0.071
+1.20D+1.60S	14.621	1.593	Bottom	2.527	Min Temp %	3.080	203.071	0.072
+1.20D+1.60S	14.920	1.609	Bottom	2.527	Min Temp %	3.080	203.071	0.073
+1.20D+1.60S	15.223	1.625	Bottom	2.527	Min Temp %	3.080	203.071	0.075
+1.20D+1.60S	15.528	1.641	Bottom	2.527	Min Temp %	3.080	203.071	0.076
+1.20D+1.60S	15.836	1.658	Bottom	2.527	Min Temp %	3.080	203.071	0.078
+1.20D+1.60S	16.147	1.674	Bottom	2.527	Min Temp %	3.080	203.071	0.080
+1.20D+1.60S	16.457	1.690	Bottom	2.527	Min Temp %	3.080	203.071	0.081
+1.20D+1.60S	16.760	1.706	Bottom	2.527	Min Temp %	3.080	203.071	0.083
+1.20D+1.60S	17.054	1.723	Bottom	2.527	Min Temp %	3.080	203.071	0.084
+1.20D+1.60S	17.340	1.739	Bottom	2.527	Min Temp %	3.080	203.071	0.085
+1.20D+1.60S	17.618	1.755	Bottom	2.527	Min Temp %	3.080	203.071	0.087
+1.20D+1.60S	17.888	1.771	Bottom	2.527	Min Temp %	3.080	203.071	0.088
+1.20D+1.60S	18.149	1.788	Bottom	2.527	Min Temp %	3.080	203.071	0.089
+1.20D+1.60S	18.402	1.804	Bottom	2.527	Min Temp %	3.080	203.071	0.091
+1.20D+1.60S	18.647	1.820	Bottom	2.527	Min Temp %	3.080	203.071	0.092
+1.20D+1.60S	18.884	1.836	Bottom	2.527	Min Temp %	3.080	203.071	0.093
+1.20D+1.60S	19.112	1.853	Bottom	2.527	Min Temp %	3.080	203.071	0.094
+1.20D+1.60S	19.332	1.869	Bottom	2.527	Min Temp %	3.080	203.071	0.095
+1.20D+1.60S	19.544	1.885	Bottom	2.527	Min Temp %	3.080	203.071	0.096
+1.20D+1.60S	19.748	1.901	Bottom	2.527	Min Temp %	3.080	203.071	0.097
+1.20D+1.60S	19.943	1.918	Bottom	2.527	Min Temp %	3.080	203.071	0.098

Combined Footing

Project File: 21304_Basecamp_Phase-1a_Enercalc.ec6

LIC# : KW-06017163, Build:20.22.10.25 KL&A, INC. (c) ENERCALC INC 1983-2022

DESCRIPTION: Spread Footing at MF and (E)Tube Col

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.20D+1.60S	20.130	1.934	Bottom	2.527	Min Temp %	3.080	203.071	0.099
+1.20D+1.60S	20.309	1.950	Bottom	2.527	Min Temp %	3.080	203.071	0.100
+1.20D+1.60S	20.480	1.966	Bottom	2.527	Min Temp %	3.080	203.071	0.101
+1.20D+1.60S	20.642	1.983	Bottom	2.527	Min Temp %	3.080	203.071	0.102
+1.20D+1.60S	20.796	1.999	Bottom	2.527	Min Temp %	3.080	203.071	0.102
+1.20D+1.60S	20.942	2.015	Bottom	2.527	Min Temp %	3.080	203.071	0.103
+1.20D+1.60S	21.080	2.031	Bottom	2.527	Min Temp %	3.080	203.071	0.104
+1.20D+1.60S	21.209	2.048	Bottom	2.527	Min Temp %	3.080	203.071	0.104
+1.20D+1.60S	21.330	2.064	Bottom	2.527	Min Temp %	3.080	203.071	0.105
+1.20D+1.60S	21.443	2.080	Bottom	2.527	Min Temp %	3.080	203.071	0.106
+1.20D+1.60S	21.548	2.096	Bottom	2.527	Min Temp %	3.080	203.071	0.106
+1.20D+1.60S	21.644	2.113	Bottom	2.527	Min Temp %	3.080	203.071	0.107
+1.20D+1.60S	21.732	2.129	Bottom	2.527	Min Temp %	3.080	203.071	0.107
+1.20D+1.60S	21.812	2.145	Bottom	2.527	Min Temp %	3.080	203.071	0.107
+1.20D+1.60S	21.884	2.161	Bottom	2.527	Min Temp %	3.080	203.071	0.108
+1.20D+1.60S	21.947	2.178	Bottom	2.527	Min Temp %	3.080	203.071	0.108
+1.20D+1.60S	22.002	2.194	Bottom	2.527	Min Temp %	3.080	203.071	0.108
+1.20D+1.60S	22.049	2.210	Bottom	2.527	Min Temp %	3.080	203.071	0.109
+1.20D+1.60S	22.087	2.226	Bottom	2.527	Min Temp %	3.080	203.071	0.109
+1.20D+1.60S	22.118	2.243	Bottom	2.527	Min Temp %	3.080	203.071	0.109
+1.20D+1.60S	22.140	2.259	Bottom	2.527	Min Temp %	3.080	203.071	0.109
+1.20D+1.60S	22.154	2.275	Bottom	2.527	Min Temp %	3.080	203.071	0.109
+1.20D+1.60S	22.159	2.291	Bottom	2.527	Min Temp %	3.080	203.071	0.109
+1.20D+1.60S	22.157	2.308	Bottom	2.527	Min Temp %	3.080	203.071	0.109
+1.20D+1.60S	22.146	2.324	Bottom	2.527	Min Temp %	3.080	203.071	0.109
+1.20D+1.60S	22.126	2.340	Bottom	2.527	Min Temp %	3.080	203.071	0.109
+1.20D+1.60S	22.099	2.356	Bottom	2.527	Min Temp %	3.080	203.071	0.109
+1.20D+1.60S	22.063	2.373	Bottom	2.527	Min Temp %	3.080	203.071	0.109
+1.20D+1.60S	22.019	2.389	Bottom	2.527	Min Temp %	3.080	203.071	0.108
+1.20D+1.60S	21.967	2.405	Bottom	2.527	Min Temp %	3.080	203.071	0.108
+1.20D+1.60S	21.906	2.421	Bottom	2.527	Min Temp %	3.080	203.071	0.108
+1.20D+1.60S	21.838	2.438	Bottom	2.527	Min Temp %	3.080	203.071	0.108
+1.20D+1.60S	21.761	2.454	Bottom	2.527	Min Temp %	3.080	203.071	0.107
+1.20D+1.60S	21.675	2.470	Bottom	2.527	Min Temp %	3.080	203.071	0.107
+1.20D+1.60S	21.582	2.486	Bottom	2.527	Min Temp %	3.080	203.071	0.106
+1.20D+1.60S	21.480	2.503	Bottom	2.527	Min Temp %	3.080	203.071	0.106
+1.20D+1.60S	21.370	2.519	Bottom	2.527	Min Temp %	3.080	203.071	0.105
+1.20D+1.60S	21.251	2.535	Bottom	2.527	Min Temp %	3.080	203.071	0.105
+1.20D+1.60S	21.125	2.551	Bottom	2.527	Min Temp %	3.080	203.071	0.104
+1.20D+1.60S	20.990	2.568	Bottom	2.527	Min Temp %	3.080	203.071	0.103
+1.20D+1.60S	20.847	2.584	Bottom	2.527	Min Temp %	3.080	203.071	0.103
+1.20D+1.60S	20.695	2.600	Bottom	2.527	Min Temp %	3.080	203.071	0.102
+1.20D+1.60S	20.536	2.616	Bottom	2.527	Min Temp %	3.080	203.071	0.101
+1.20D+1.60S	20.368	2.633	Bottom	2.527	Min Temp %	3.080	203.071	0.100
+1.20D+1.60S	20.191	2.649	Bottom	2.527	Min Temp %	3.080	203.071	0.099
+1.20D+1.60S	20.007	2.665	Bottom	2.527	Min Temp %	3.080	203.071	0.099
+1.20D+1.60S	19.814	2.681	Bottom	2.527	Min Temp %	3.080	203.071	0.098
+1.20D+1.60S	19.622	2.698	Bottom	2.527	Min Temp %	3.080	203.071	0.097
+1.20D+1.60S	19.432	2.714	Bottom	2.527	Min Temp %	3.080	203.071	0.096
+1.20D+1.60S	19.246	2.730	Bottom	2.527	Min Temp %	3.080	203.071	0.095
+1.20D+1.60S	19.062	2.746	Bottom	2.527	Min Temp %	3.080	203.071	0.094
+1.20D+1.60S	18.882	2.763	Bottom	2.527	Min Temp %	3.080	203.071	0.093
+1.20D+1.60S	18.704	2.779	Bottom	2.527	Min Temp %	3.080	203.071	0.092
+1.20D+1.60S	18.530	2.795	Bottom	2.527	Min Temp %	3.080	203.071	0.091
+1.20D+1.60S	18.358	2.811	Bottom	2.527	Min Temp %	3.080	203.071	0.090
+1.20D+1.60S	18.189	2.828	Bottom	2.527	Min Temp %	3.080	203.071	0.090
+1.20D+1.60S	18.023	2.844	Bottom	2.527	Min Temp %	3.080	203.071	0.089
+1.20D+1.60S	17.861	2.860	Bottom	2.527	Min Temp %	3.080	203.071	0.088
+1.20D+1.60S	17.701	2.876	Bottom	2.527	Min Temp %	3.080	203.071	0.087
+1.20D+1.60S	17.544	2.893	Bottom	2.527	Min Temp %	3.080	203.071	0.086
+1.20D+1.60S	17.390	2.909	Bottom	2.527	Min Temp %	3.080	203.071	0.086
+1.20D+1.60S	17.240	2.925	Bottom	2.527	Min Temp %	3.080	203.071	0.085
+1.20D+1.60S	17.092	2.941	Bottom	2.527	Min Temp %	3.080	203.071	0.084

Combined Footing

Project File: 21304_Basecamp_Phase-1a_Enercalc.ec6

LIC# : KW-06017163, Build:20.22.10.25 KL&A, INC.

DESCRIPTION: Spread Footing at MF and (E)Tube Col

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.20D+1.60S	16.947	2.958	Bottom	2.527	Min Temp %	3.080	203.071	0.083
+1.20D+1.60S	16.805	2.974	Bottom	2.527	Min Temp %	3.080	203.071	0.083
+1.20D+1.60S	16.666	2.990	Bottom	2.527	Min Temp %	3.080	203.071	0.082
+1.20D+1.60S	16.530	3.006	Bottom	2.527	Min Temp %	3.080	203.071	0.081
+1.20D+1.60S	16.397	3.023	Bottom	2.527	Min Temp %	3.080	203.071	0.081
+1.20D+1.60S	16.267	3.039	Bottom	2.527	Min Temp %	3.080	203.071	0.080
+1.20D+1.60S	16.140	3.055	Bottom	2.527	Min Temp %	3.080	203.071	0.079
+1.20D+1.60S	16.016	3.071	Bottom	2.527	Min Temp %	3.080	203.071	0.079
+1.20D+1.60S	15.894	3.088	Bottom	2.527	Min Temp %	3.080	203.071	0.078
+1.20D+1.60S	15.776	3.104	Bottom	2.527	Min Temp %	3.080	203.071	0.078
+1.20D+1.60S	15.661	3.120	Bottom	2.527	Min Temp %	3.080	203.071	0.077
+1.20D+1.60S	15.549	3.136	Bottom	2.527	Min Temp %	3.080	203.071	0.077
+1.20D+1.60S	15.440	3.153	Bottom	2.527	Min Temp %	3.080	203.071	0.076
+1.20D+1.60S	15.333	3.169	Bottom	2.527	Min Temp %	3.080	203.071	0.076
+1.20D+1.60S	15.230	3.185	Bottom	2.527	Min Temp %	3.080	203.071	0.075
+1.20D+1.60S	15.129	3.201	Bottom	2.527	Min Temp %	3.080	203.071	0.075
+1.20D+1.60S	15.032	3.218	Bottom	2.527	Min Temp %	3.080	203.071	0.074
+1.20D+1.60S	14.938	3.234	Bottom	2.527	Min Temp %	3.080	203.071	0.074
+1.20D+1.60S	14.846	3.250	Bottom	2.527	Min Temp %	3.080	203.071	0.073
+1.20D+1.60S	14.757	3.266	Bottom	2.527	Min Temp %	3.080	203.071	0.073
+1.20D+1.60S	14.672	3.283	Bottom	2.527	Min Temp %	3.080	203.071	0.072
+1.20D+1.60S	14.589	3.299	Bottom	2.527	Min Temp %	3.080	203.071	0.072
+1.20D+1.60S	14.510	3.315	Bottom	2.527	Min Temp %	3.080	203.071	0.071
+1.20D+1.60S	14.433	3.331	Bottom	2.527	Min Temp %	3.080	203.071	0.071
+1.20D+1.60S	14.359	3.348	Bottom	2.527	Min Temp %	3.080	203.071	0.071
+1.20D+1.60S	14.288	3.364	Bottom	2.527	Min Temp %	3.080	203.071	0.070
+1.20D+1.60S	14.220	3.380	Bottom	2.527	Min Temp %	3.080	203.071	0.070
+1.20D+1.60S	14.156	3.396	Bottom	2.527	Min Temp %	3.080	203.071	0.070
+1.20D+1.60S	14.094	3.413	Bottom	2.527	Min Temp %	3.080	203.071	0.069
+1.20D+1.60S	14.035	3.429	Bottom	2.527	Min Temp %	3.080	203.071	0.069
+1.20D+1.60S	13.979	3.445	Bottom	2.527	Min Temp %	3.080	203.071	0.069
+1.20D+1.60S	13.926	3.461	Bottom	2.527	Min Temp %	3.080	203.071	0.069
+1.20D+1.60S	13.875	3.478	Bottom	2.527	Min Temp %	3.080	203.071	0.068
+1.20D+1.60S	13.828	3.494	Bottom	2.527	Min Temp %	3.080	203.071	0.068
+1.20D+1.60S	13.784	3.510	Bottom	2.527	Min Temp %	3.080	203.071	0.068
+1.20D+1.60S	13.743	3.526	Bottom	2.527	Min Temp %	3.080	203.071	0.068
+1.20D+1.60S	13.705	3.543	Bottom	2.527	Min Temp %	3.080	203.071	0.067
+1.20D+1.60S	13.669	3.559	Bottom	2.527	Min Temp %	3.080	203.071	0.067
+1.20D+1.60S	13.637	3.575	Bottom	2.527	Min Temp %	3.080	203.071	0.067
+1.20D+1.60S	13.607	3.591	Bottom	2.527	Min Temp %	3.080	203.071	0.067
+1.20D+1.60S	13.581	3.608	Bottom	2.527	Min Temp %	3.080	203.071	0.067
+1.20D+1.60S	13.557	3.624	Bottom	2.527	Min Temp %	3.080	203.071	0.067
+0.90D+E	-14.568	3.640	Top	2.527	Min Temp %	3.080	216.931	0.067
+0.90D+E	-14.705	3.656	Top	2.527	Min Temp %	3.080	216.931	0.068
+0.90D+E	-14.842	3.673	Top	2.527	Min Temp %	3.080	216.931	0.068
+0.90D+E	-14.980	3.689	Top	2.527	Min Temp %	3.080	216.931	0.069
+0.90D+E	-15.117	3.705	Top	2.527	Min Temp %	3.080	216.931	0.070
+0.90D+E	-15.254	3.721	Top	2.527	Min Temp %	3.080	216.931	0.070
+0.90D+E	-15.392	3.738	Top	2.527	Min Temp %	3.080	216.931	0.071
+0.90D+E	-15.529	3.754	Top	2.527	Min Temp %	3.080	216.931	0.072
+0.90D+E	-15.666	3.770	Top	2.527	Min Temp %	3.080	216.931	0.072
+0.90D+E	-15.804	3.786	Top	2.527	Min Temp %	3.080	216.931	0.073
+0.90D+E	-15.941	3.803	Top	2.527	Min Temp %	3.080	216.931	0.073
+0.90D+E	-16.078	3.819	Top	2.527	Min Temp %	3.080	216.931	0.074
+0.90D+E	-16.215	3.835	Top	2.527	Min Temp %	3.080	216.931	0.075
+0.90D+E	-16.350	3.851	Top	2.527	Min Temp %	3.080	216.931	0.075
+0.90D+E	-16.483	3.868	Top	2.527	Min Temp %	3.080	216.931	0.076
+0.90D+E	-16.614	3.884	Top	2.527	Min Temp %	3.080	216.931	0.077
+0.90D+E	-16.743	3.900	Top	2.527	Min Temp %	3.080	216.931	0.077
+0.90D+E	-16.871	3.916	Top	2.527	Min Temp %	3.080	216.931	0.078
+0.90D+E	-16.996	3.933	Top	2.527	Min Temp %	3.080	216.931	0.078
+0.90D+E	-17.120	3.949	Top	2.527	Min Temp %	3.080	216.931	0.079
+0.90D+E	-17.241	3.965	Top	2.527	Min Temp %	3.080	216.931	0.079

Combined Footing

Project File: 21304_Basecamp_Phase-1a_Enercalc.ec6

LIC# : KW-06017163, Build:20.22.10.25 KL&A, INC.

DESCRIPTION: Spread Footing at MF and (E)Tube Col

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+0.90D+E	-17.361	3.981	Top	2.527	Min Temp %	3.080	216.931	0.080
+0.90D+E	-17.478	3.998	Top	2.527	Min Temp %	3.080	216.931	0.081
+0.90D+E	-17.594	4.014	Top	2.527	Min Temp %	3.080	216.931	0.081
+0.90D+E	-17.708	4.030	Top	2.527	Min Temp %	3.080	216.931	0.082
+0.90D+E	-17.820	4.046	Top	2.527	Min Temp %	3.080	216.931	0.082
+0.90D+E	-17.930	4.063	Top	2.527	Min Temp %	3.080	216.931	0.083
+0.90D+E	-18.038	4.079	Top	2.527	Min Temp %	3.080	216.931	0.083
+0.90D+E	-18.144	4.095	Top	2.527	Min Temp %	3.080	216.931	0.084
+0.90D+E	-18.248	4.111	Top	2.527	Min Temp %	3.080	216.931	0.084
+0.90D+E	-18.350	4.128	Top	2.527	Min Temp %	3.080	216.931	0.085
+0.90D+E	-18.451	4.144	Top	2.527	Min Temp %	3.080	216.931	0.085
+0.90D+E	-18.549	4.160	Top	2.527	Min Temp %	3.080	216.931	0.086
+0.90D+E	-18.645	4.176	Top	2.527	Min Temp %	3.080	216.931	0.086
+0.90D+E	-18.740	4.193	Top	2.527	Min Temp %	3.080	216.931	0.086
+0.90D+E	-18.832	4.209	Top	2.527	Min Temp %	3.080	216.931	0.087
+0.90D+E	-18.923	4.225	Top	2.527	Min Temp %	3.080	216.931	0.087
+0.90D+E	-19.012	4.241	Top	2.527	Min Temp %	3.080	216.931	0.088
+0.90D+E	-19.098	4.258	Top	2.527	Min Temp %	3.080	216.931	0.088
+0.90D+E	-19.183	4.274	Top	2.527	Min Temp %	3.080	216.931	0.088
+0.90D+E	-19.266	4.290	Top	2.527	Min Temp %	3.080	216.931	0.089
+0.90D+E	-19.347	4.306	Top	2.527	Min Temp %	3.080	216.931	0.089
+0.90D+E	-19.426	4.323	Top	2.527	Min Temp %	3.080	216.931	0.090
+1.20D+1.60S	21.946	4.339	Bottom	2.527	Min Temp %	3.080	203.071	0.108
+1.20D+1.60S	21.797	4.355	Bottom	2.527	Min Temp %	3.080	203.071	0.107
+1.20D+1.60S	21.643	4.371	Bottom	2.527	Min Temp %	3.080	203.071	0.107
+1.20D+1.60S	21.484	4.388	Bottom	2.527	Min Temp %	3.080	203.071	0.106
+1.20D+1.60S	21.320	4.404	Bottom	2.527	Min Temp %	3.080	203.071	0.105
+1.20D+1.60S	21.150	4.420	Bottom	2.527	Min Temp %	3.080	203.071	0.104
+1.20D+1.60S	20.976	4.436	Bottom	2.527	Min Temp %	3.080	203.071	0.103
+1.20D+1.60S	20.796	4.453	Bottom	2.527	Min Temp %	3.080	203.071	0.102
+1.20D+1.60S	20.611	4.469	Bottom	2.527	Min Temp %	3.080	203.071	0.101
+1.20D+1.60S	20.422	4.485	Bottom	2.527	Min Temp %	3.080	203.071	0.101
+1.20D+1.60S	20.227	4.501	Bottom	2.527	Min Temp %	3.080	203.071	0.100
+1.20D+1.60S	20.027	4.518	Bottom	2.527	Min Temp %	3.080	203.071	0.099
+1.20D+1.60S	19.822	4.534	Bottom	2.527	Min Temp %	3.080	203.071	0.098
+1.20D+1.60S	19.612	4.550	Bottom	2.527	Min Temp %	3.080	203.071	0.097
+1.20D+1.60S	19.397	4.566	Bottom	2.527	Min Temp %	3.080	203.071	0.096
+1.20D+1.60S	19.177	4.583	Bottom	2.527	Min Temp %	3.080	203.071	0.094
+1.20D+1.60S	18.952	4.599	Bottom	2.527	Min Temp %	3.080	203.071	0.093
+1.20D+1.60S	18.721	4.615	Bottom	2.527	Min Temp %	3.080	203.071	0.092
+1.20D+1.60S	18.486	4.631	Bottom	2.527	Min Temp %	3.080	203.071	0.091
+1.20D+1.60S	18.246	4.648	Bottom	2.527	Min Temp %	3.080	203.071	0.090
+1.20D+1.60S	18.000	4.664	Bottom	2.527	Min Temp %	3.080	203.071	0.089
+1.20D+1.60S	17.749	4.680	Bottom	2.527	Min Temp %	3.080	203.071	0.087
+1.20D+1.60S	17.494	4.696	Bottom	2.527	Min Temp %	3.080	203.071	0.086
+1.20D+1.60S	17.233	4.713	Bottom	2.527	Min Temp %	3.080	203.071	0.085
+1.20D+1.60S	16.967	4.729	Bottom	2.527	Min Temp %	3.080	203.071	0.084
+1.20D+1.60S	16.696	4.745	Bottom	2.527	Min Temp %	3.080	203.071	0.082
+1.20D+1.60S	16.420	4.761	Bottom	2.527	Min Temp %	3.080	203.071	0.081
+1.20D+1.60S	16.139	4.778	Bottom	2.527	Min Temp %	3.080	203.071	0.079
+1.20D+1.60S	15.853	4.794	Bottom	2.527	Min Temp %	3.080	203.071	0.078
+1.20D+1.60S	15.562	4.810	Bottom	2.527	Min Temp %	3.080	203.071	0.077
+1.20D+1.60S	15.265	4.826	Bottom	2.527	Min Temp %	3.080	203.071	0.075
+1.20D+1.60S	14.970	4.843	Bottom	2.527	Min Temp %	3.080	203.071	0.074
+1.20D+1.60S	14.677	4.859	Bottom	2.527	Min Temp %	3.080	203.071	0.072
+1.20D+1.60S	14.387	4.875	Bottom	2.527	Min Temp %	3.080	203.071	0.071
+1.20D+1.60S	14.099	4.891	Bottom	2.527	Min Temp %	3.080	203.071	0.069
+1.20D+1.60S	13.815	4.908	Bottom	2.527	Min Temp %	3.080	203.071	0.068
+1.20D+1.60S	13.534	4.924	Bottom	2.527	Min Temp %	3.080	203.071	0.067
+1.20D+1.60S	13.256	4.940	Bottom	2.527	Min Temp %	3.080	203.071	0.065
+1.20D+1.60S	12.980	4.956	Bottom	2.527	Min Temp %	3.080	203.071	0.064
+1.20D+1.60S	12.708	4.973	Bottom	2.527	Min Temp %	3.080	203.071	0.063
+1.20D+1.60S	12.438	4.989	Bottom	2.527	Min Temp %	3.080	203.071	0.061

Combined Footing

Project File: 21304_Basecamp_Phase-1a_Enercalc.ec6

LIC# : KW-06017163, Build:20.22.10.25 KL&A, INC.

DESCRIPTION: Spread Footing at MF and (E)Tube Col

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.20D+1.60S	12.171	5.005	Bottom	2.527	Min Temp %	3.080	203.071	0.060
+1.20D+1.60S	11.907	5.021	Bottom	2.527	Min Temp %	3.080	203.071	0.059
+1.20D+1.60S	11.646	5.038	Bottom	2.527	Min Temp %	3.080	203.071	0.057
+1.20D+1.60S	11.388	5.054	Bottom	2.527	Min Temp %	3.080	203.071	0.056
+1.20D+1.60S	11.133	5.070	Bottom	2.527	Min Temp %	3.080	203.071	0.055
+1.20D+1.60S	10.881	5.086	Bottom	2.527	Min Temp %	3.080	203.071	0.054
+1.20D+1.60S	10.632	5.103	Bottom	2.527	Min Temp %	3.080	203.071	0.052
+1.20D+1.60S	10.385	5.119	Bottom	2.527	Min Temp %	3.080	203.071	0.051
+1.20D+1.60S	10.142	5.135	Bottom	2.527	Min Temp %	3.080	203.071	0.050
+1.20D+1.60S	9.901	5.151	Bottom	2.527	Min Temp %	3.080	203.071	0.049
+1.20D+1.60S	9.663	5.168	Bottom	2.527	Min Temp %	3.080	203.071	0.048
+1.20D+1.60S	9.429	5.184	Bottom	2.527	Min Temp %	3.080	203.071	0.046
+1.20D+1.60S	9.197	5.200	Bottom	2.527	Min Temp %	3.080	203.071	0.045
+1.20D+1.60S	8.968	5.216	Bottom	2.527	Min Temp %	3.080	203.071	0.044
+1.20D+1.60S	8.742	5.233	Bottom	2.527	Min Temp %	3.080	203.071	0.043
+1.20D+1.60S	8.518	5.249	Bottom	2.527	Min Temp %	3.080	203.071	0.042
+1.20D+1.60S	8.298	5.265	Bottom	2.527	Min Temp %	3.080	203.071	0.041
+1.20D+1.60S	8.081	5.281	Bottom	2.527	Min Temp %	3.080	203.071	0.040
+1.20D+1.60S	7.866	5.298	Bottom	2.527	Min Temp %	3.080	203.071	0.039
+1.20D+1.60S	7.655	5.314	Bottom	2.527	Min Temp %	3.080	203.071	0.038
+1.20D+1.60S	7.446	5.330	Bottom	2.527	Min Temp %	3.080	203.071	0.037
+1.20D+1.60S	7.240	5.346	Bottom	2.527	Min Temp %	3.080	203.071	0.036
+1.20D+1.60S	7.037	5.363	Bottom	2.527	Min Temp %	3.080	203.071	0.035
+1.20D+1.60S	6.837	5.379	Bottom	2.527	Min Temp %	3.080	203.071	0.034
+1.20D+1.60S	6.640	5.395	Bottom	2.527	Min Temp %	3.080	203.071	0.033
+1.20D+1.60S	6.446	5.411	Bottom	2.527	Min Temp %	3.080	203.071	0.032
+1.20D+1.60S	6.254	5.428	Bottom	2.527	Min Temp %	3.080	203.071	0.031
+1.20D+1.60S	6.066	5.444	Bottom	2.527	Min Temp %	3.080	203.071	0.030
+1.20D+1.60S	5.880	5.460	Bottom	2.527	Min Temp %	3.080	203.071	0.029
+1.20D+1.60S	5.698	5.476	Bottom	2.527	Min Temp %	3.080	203.071	0.028
+1.20D+1.60S	5.518	5.493	Bottom	2.527	Min Temp %	3.080	203.071	0.027
+1.20D+1.60S	5.341	5.509	Bottom	2.527	Min Temp %	3.080	203.071	0.026
+1.20D+1.60S	5.167	5.525	Bottom	2.527	Min Temp %	3.080	203.071	0.025
+1.20D+1.60S	4.996	5.541	Bottom	2.527	Min Temp %	3.080	203.071	0.025
+1.20D+1.60S	4.828	5.558	Bottom	2.527	Min Temp %	3.080	203.071	0.024
+1.20D+1.60S	4.663	5.574	Bottom	2.527	Min Temp %	3.080	203.071	0.023
+1.20D+1.60S	4.500	5.590	Bottom	2.527	Min Temp %	3.080	203.071	0.022
+1.20D+1.60S	4.341	5.606	Bottom	2.527	Min Temp %	3.080	203.071	0.021
+1.20D+1.60S	4.184	5.623	Bottom	2.527	Min Temp %	3.080	203.071	0.021
+1.20D+1.60S	4.030	5.639	Bottom	2.527	Min Temp %	3.080	203.071	0.020
+1.20D+1.60S	3.879	5.655	Bottom	2.527	Min Temp %	3.080	203.071	0.019
+1.20D+1.60S	3.731	5.671	Bottom	2.527	Min Temp %	3.080	203.071	0.018
+1.20D+1.60S	3.586	5.688	Bottom	2.527	Min Temp %	3.080	203.071	0.018
+1.20D+1.60S	3.444	5.704	Bottom	2.527	Min Temp %	3.080	203.071	0.017
+1.20D+1.60S	3.305	5.720	Bottom	2.527	Min Temp %	3.080	203.071	0.016
+1.20D+1.60S	3.168	5.736	Bottom	2.527	Min Temp %	3.080	203.071	0.016
+1.20D+1.60S	3.035	5.752	Bottom	2.527	Min Temp %	3.080	203.071	0.015
+1.20D+1.60S	2.904	5.769	Bottom	2.527	Min Temp %	3.080	203.071	0.014
+1.20D+1.60S	2.776	5.785	Bottom	2.527	Min Temp %	3.080	203.071	0.014
+1.20D+1.60S	2.651	5.801	Bottom	2.527	Min Temp %	3.080	203.071	0.013
+1.20D+1.60S	2.529	5.817	Bottom	2.527	Min Temp %	3.080	203.071	0.012
+1.20D+1.60S	2.410	5.834	Bottom	2.527	Min Temp %	3.080	203.071	0.012
+1.20D+1.60S	2.294	5.850	Bottom	2.527	Min Temp %	3.080	203.071	0.011
+1.20D+1.60S	2.180	5.866	Bottom	2.527	Min Temp %	3.080	203.071	0.011
+1.20D+1.60S	2.070	5.882	Bottom	2.527	Min Temp %	3.080	203.071	0.010
+1.20D+1.60S	1.962	5.899	Bottom	2.527	Min Temp %	3.080	203.071	0.010
+1.20D+1.60S	1.858	5.915	Bottom	2.527	Min Temp %	3.080	203.071	0.009
+1.20D+1.60S	1.756	5.931	Bottom	2.527	Min Temp %	3.080	203.071	0.009
+1.20D+1.60S	1.657	5.947	Bottom	2.527	Min Temp %	3.080	203.071	0.008
+1.20D+1.60S	1.561	5.964	Bottom	2.527	Min Temp %	3.080	203.071	0.008
+1.20D+1.60S	1.467	5.980	Bottom	2.527	Min Temp %	3.080	203.071	0.007
+1.20D+1.60S	1.377	5.996	Bottom	2.527	Min Temp %	3.080	203.071	0.007
+1.20D+1.60S	1.290	6.012	Bottom	2.527	Min Temp %	3.080	203.071	0.006

Combined Footing

DESCRIPTION: Spread Footing at MF and (E)Tube Col

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.20D+1.60S	1.205	6.029	Bottom	2.527	Min Temp %	3.080	203.071	0.006
+1.20D+1.60S	1.123	6.045	Bottom	2.527	Min Temp %	3.080	203.071	0.006
+1.20D+1.60S	1.044	6.061	Bottom	2.527	Min Temp %	3.080	203.071	0.005
+1.20D+1.60S	0.968	6.077	Bottom	2.527	Min Temp %	3.080	203.071	0.005
+1.20D+1.60S	0.895	6.094	Bottom	2.527	Min Temp %	3.080	203.071	0.004
+1.20D+1.60S	0.825	6.110	Bottom	2.527	Min Temp %	3.080	203.071	0.004
+1.20D+1.60S	0.758	6.126	Bottom	2.527	Min Temp %	3.080	203.071	0.004
+1.20D+1.60S	0.693	6.142	Bottom	2.527	Min Temp %	3.080	203.071	0.003
+1.20D+1.60S	0.632	6.159	Bottom	2.527	Min Temp %	3.080	203.071	0.003
+1.20D+1.60S	0.573	6.175	Bottom	2.527	Min Temp %	3.080	203.071	0.003
+1.20D+1.60S	0.517	6.191	Bottom	2.527	Min Temp %	3.080	203.071	0.003
+1.20D+1.60S	0.464	6.207	Bottom	2.527	Min Temp %	3.080	203.071	0.002
+1.20D+1.60S	0.414	6.224	Bottom	2.527	Min Temp %	3.080	203.071	0.002
+1.20D+1.60S	0.366	6.240	Bottom	2.527	Min Temp %	3.080	203.071	0.002
+1.20D+1.60S	0.322	6.256	Bottom	2.527	Min Temp %	3.080	203.071	0.002
+1.20D+1.60S	0.281	6.272	Bottom	2.527	Min Temp %	3.080	203.071	0.001
+1.20D+1.60S	0.242	6.289	Bottom	2.527	Min Temp %	3.080	203.071	0.001
+1.20D+1.60S	0.206	6.305	Bottom	2.527	Min Temp %	3.080	203.071	0.001
+1.20D+1.60S	0.173	6.321	Bottom	2.527	Min Temp %	3.080	203.071	0.001
+1.20D+1.60S	0.143	6.337	Bottom	2.527	Min Temp %	3.080	203.071	0.001
+1.20D+1.60S	0.116	6.354	Bottom	2.527	Min Temp %	3.080	203.071	0.001
+1.20D+1.60S	0.092	6.370	Bottom	2.527	Min Temp %	3.080	203.071	0.000
+1.20D+1.60S	0.070	6.386	Bottom	2.527	Min Temp %	3.080	203.071	0.000
+1.20D+1.60S	0.052	6.402	Bottom	2.527	Min Temp %	3.080	203.071	0.000
+1.20D+1.60S	0.036	6.419	Bottom	2.527	Min Temp %	3.080	203.071	0.000
+1.20D+1.60S	0.023	6.435	Bottom	2.527	Min Temp %	3.080	203.071	0.000
+1.20D+1.60S	0.013	6.451	Bottom	2.527	Min Temp %	3.080	203.071	0.000
+1.20D+1.60S	0.000	6.467	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60S	0.000	6.484	0	0.000	0	0.000	0.000	0.000
+1.20D+1.60S	0.000	6.500	0	0.000	0	0.000	0.000	0.000

One Way Shear / Punching Shear

Load Combination...	One Way Shear: Phi Vn	vu @ Col #1	vu @ Col #2	Punching Shear: Phi Vn	vu @ Col #1	vu @ Col #2
+1.40D	94.87 psi	0.72 psi	0.80 psi	189.74 psi	4.01 psi	3.93 psi
+1.20D+0.50Lr	94.87 psi	0.94 psi	0.94 psi	189.74 psi	4.69 psi	4.64 psi
+1.20D+0.50S	94.87 psi	1.81 psi	1.81 psi	189.74 psi	8.14 psi	8.13 psi
+1.20D+1.60Lr	94.87 psi	1.65 psi	1.65 psi	189.74 psi	7.45 psi	7.43 psi
+1.20D+1.60Lr+0.50W	94.87 psi	3.22 psi	3.22 psi	189.74 psi	7.71 psi	7.62 psi
+1.20D+1.60S	94.87 psi	4.44 psi	4.44 psi	189.74 psi	18.49 psi	18.61 psi
+1.20D+1.60S+0.50W	94.87 psi	6.00 psi	6.00 psi	189.74 psi	18.75 psi	18.80 psi
+1.20D+0.50Lr+W	94.87 psi	4.06 psi	4.06 psi	189.74 psi	5.21 psi	5.02 psi
+1.20D+0.50S+W	94.87 psi	4.94 psi	4.94 psi	189.74 psi	8.66 psi	8.51 psi
+1.20D+0.70S+E	94.87 psi	8.56 psi	8.56 psi	189.74 psi	11.07 psi	10.80 psi
+0.90D+W	94.87 psi	3.59 psi	3.59 psi	189.74 psi	3.10 psi	2.91 psi
+0.90D+E	94.87 psi	6.73 psi	6.73 psi	189.74 psi	3.62 psi	3.29 psi

General Footing

Project File: 21304_Basecamp_Phase-1a_Enercalc.ec6

LIC# : KW-06017163, Build:20.22.10.25 KL&A, INC. (c) ENERCALC INC 1983-2022

DESCRIPTION: Spread Footing at MF Column on Grid B/3

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Material Properties

f'c : Concrete 28 day strength	=	4.0	ksi
fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=		
Min Allow % Temp Reinf.	=	0.00180	
Min. Overturning Safety Factor	=	1.0	: 1
Min. Sliding Safety Factor	=	1.0	: 1
Add Ftg Wt for Soil Pressure	:	Yes	
Use ftg wt for stability, moments & shears	:	Yes	
Add Pedestal Wt for Soil Pressure	:	No	
Use Pedestal wt for stability, mom & shear	:	No	

Soil Design Values

Allowable Soil Bearing	=	3.0	ksf
Soil Density	=	110.0	pcf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.40	

Increases based on footing Depth

Footing base depth below soil surface	=	4.670	ft
Allow press. increase per foot of depth	=		ksf
when footing base is below	=		ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=		ksf
when max. length or width is greater than	=		ft

Dimensions

Width parallel to X-X Axis	=	6.50	ft
Length parallel to Z-Z Axis	=	6.50	ft
Footing Thickness	=	18.0	in

Load location offset from footing center...

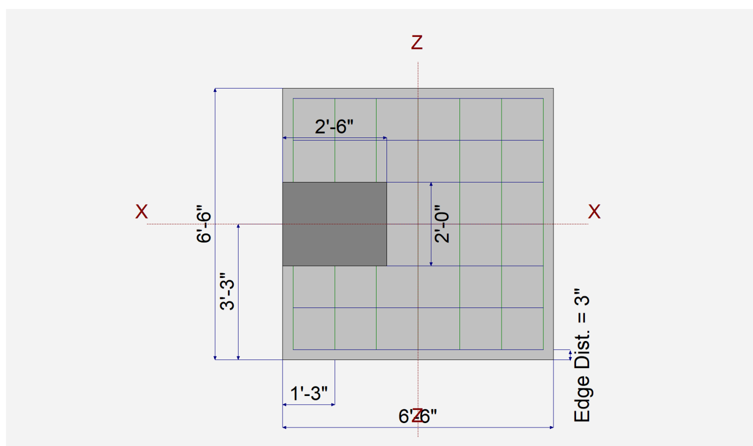
ex : Prll to X-X Axis	=	-24	in
	=		in

Pedestal dimensions...

px : parallel to X-X Axis	=	30.0	in
pz : parallel to Z-Z Axis	=	24.0	in
Height	=	30.0	in

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0	in



Reinforcing

Bars parallel to X-X Axis

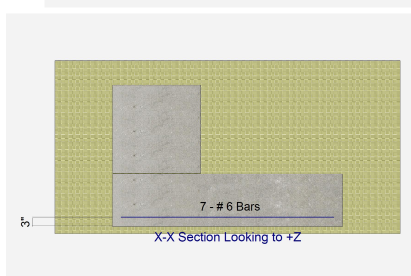
Number of Bars	=		7.0
Reinforcing Bar Size	=	#	6

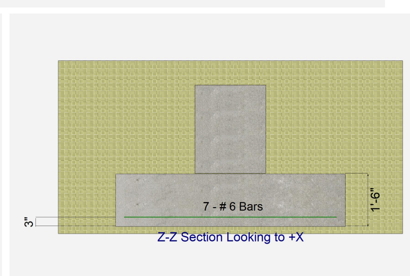
Bars parallel to Z-Z Axis

Number of Bars	=		7.0
Reinforcing Bar Size	=	#	6

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	6.50	3.90		14.50	-6.30	-12.60		k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=								k-ft
V-x	=	0.70	0.50		1.80	-3.520	-7.10		k
V-z	=								k

General Footing

Project File: 21304_Basecamp_Phase-1a_Enercalc.ec6

LIC# : KW-06017163, Build:20.22.10.25 KL&A, INC. (c) ENERCALC INC 1983-2022

DESCRIPTION: Spread Footing at MF Column on Grid B/3

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.5463	Soil Bearing	1.639 ksf	3.0 ksf	+D+S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	1.611	Overturning - Z-Z	30.905 k-ft	49.803 k-ft	+0.60D+0.70E
PASS	2.837	Sliding - X-X	4.550 k	12.910 k	+0.60D+0.70E
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	1.951	Uplift	-8.820 k	17.207 k	+0.60D+0.70E
PASS	0.08091	Z Flexure (+X)	2.528 k-ft/ft	31.242 k-ft/ft	+0.90D+E
PASS	0.0	Z Flexure (-X)	0.0 k-ft/ft	0.0 k-ft/ft	No Moment
PASS	0.05543	X Flexure (+Z)	1.732 k-ft/ft	31.242 k-ft/ft	+1.20D+1.60S
PASS	0.05543	X Flexure (-Z)	1.732 k-ft/ft	31.242 k-ft/ft	+1.20D+1.60S
PASS	0.05020	1-way Shear (+X)	4.763 psi	94.868 psi	+0.90D+E
PASS	n/a	1-way Shear (-X)	0.0 psi	94.868 psi	n/a
PASS	0.03907	1-way Shear (+Z)	3.706 psi	94.868 psi	+1.20D+1.60S
PASS	0.03907	1-way Shear (-Z)	3.706 psi	94.868 psi	+1.20D+1.60S
PASS	n/a	2-way Punching	0.0 psi	94.868 psi	n/a

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location: Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	3.0	n/a	0.0	0.6788	0.6788	n/a	n/a	0.226
X-X, +D+Lr	3.0	n/a	0.0	0.7711	0.7711	n/a	n/a	0.257
X-X, +D+S	3.0	n/a	0.0	1.022	1.022	n/a	n/a	0.341
X-X, +D+0.750Lr	3.0	n/a	0.0	0.7480	0.7480	n/a	n/a	0.249
X-X, +D+0.750S	3.0	n/a	0.0	0.9362	0.9362	n/a	n/a	0.312
X-X, +D+0.60W	3.0	n/a	0.0	0.5893	0.5893	n/a	n/a	0.196
X-X, +D+0.70E	3.0	n/a	0.0	0.470	0.470	n/a	n/a	0.157
X-X, +D+0.750Lr+0.450W	3.0	n/a	0.0	0.6809	0.6809	n/a	n/a	0.227
X-X, +D+0.750S+0.450W	3.0	n/a	0.0	0.8691	0.8691	n/a	n/a	0.290
X-X, +D+0.750S+0.5250E	3.0	n/a	0.0	0.7796	0.7796	n/a	n/a	0.260
X-X, +0.60D+0.60W	3.0	n/a	0.0	0.3178	0.3178	n/a	n/a	0.106
X-X, +0.60D+0.70E	3.0	n/a	0.0	0.1985	0.1985	n/a	n/a	0.066
Z-Z, D Only	3.0	-2.809	n/a	n/a	n/a	0.8240	0.5336	0.275
Z-Z, +D+Lr	3.0	-4.609	n/a	n/a	n/a	1.042	0.5004	0.347
Z-Z, +D+S	3.0	-7.924	n/a	n/a	n/a	1.639	0.4053	0.546
Z-Z, +D+0.750Lr	3.0	-4.201	n/a	n/a	n/a	0.9873	0.5087	0.329
Z-Z, +D+0.750S	3.0	-6.997	n/a	n/a	n/a	1.435	0.4373	0.478
Z-Z, +D+0.60W	3.0	-3.663	n/a	n/a	n/a	0.7537	0.4249	0.251
Z-Z, +D+0.70E	3.0	-5.410	n/a	n/a	n/a	0.6637	0.2764	0.221
Z-Z, +D+0.750Lr+0.450W	3.0	-4.892	n/a	n/a	n/a	0.9346	0.4272	0.312
Z-Z, +D+0.750S+0.450W	3.0	-7.755	n/a	n/a	n/a	1.382	0.3558	0.461
Z-Z, +D+0.750S+0.5250E	3.0	-9.014	n/a	n/a	n/a	1.315	0.2444	0.438
Z-Z, +0.60D+0.60W	3.0	-4.393	n/a	n/a	n/a	0.4241	0.2115	0.141
Z-Z, +0.60D+0.70E	3.0	-8.968	n/a	n/a	n/a	0.3341	0.06294	0.111

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
X-X, D Only	None	0.0 k-ft	Infinity	OK
X-X, +D+Lr	None	0.0 k-ft	Infinity	OK
X-X, +D+S	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750Lr	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S	None	0.0 k-ft	Infinity	OK
X-X, +D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.70E	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750Lr+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S+0.5250E	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.70E	None	0.0 k-ft	Infinity	OK

General Footing

Project File: 21304_Basecamp_Phase-1a_Enercalc.ec6

LIC# : KW-06017163, Build:20.22.10.25 KL&A, INC.

DESCRIPTION: Spread Footing at MF Column on Grid B/3

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Z-Z, D Only	2.80 k-ft	106.205 k-ft	37.930	OK
Z-Z, +D+Lr	4.80 k-ft	126.680 k-ft	26.392	OK
Z-Z, +D+S	10.0 k-ft	182.330 k-ft	18.233	OK
Z-Z, +D+0.750Lr	4.30 k-ft	121.561 k-ft	28.270	OK
Z-Z, +D+0.750S	8.20 k-ft	163.299 k-ft	19.914	OK
Z-Z, +D+0.60W	13.173 k-ft	83.005 k-ft	6.301	OK
Z-Z, +D+0.70E	30.905 k-ft	83.005 k-ft	2.686	OK
Z-Z, +D+0.750Lr+0.450W	9.880 k-ft	88.161 k-ft	8.923	OK
Z-Z, +D+0.750S+0.450W	23.084 k-ft	169.635 k-ft	7.349	OK
Z-Z, +D+0.750S+0.5250E	23.179 k-ft	101.999 k-ft	4.401	OK
Z-Z, +0.60D+0.60W	13.173 k-ft	49.803 k-ft	3.781	OK
Z-Z, +0.60D+0.70E	30.905 k-ft	49.803 k-ft	1.611	OK

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
X-X, D Only	0.70 k	21.026 k	30.038	OK
X-X, +D+Lr	1.20 k	22.586 k	18.822	OK
X-X, +D+S	2.50 k	26.826 k	10.731	OK
X-X, +D+0.750Lr	1.075 k	22.196 k	20.648	OK
X-X, +D+0.750S	2.050 k	25.376 k	12.379	OK
X-X, +D+0.60W	-1.412 k	19.514 k	13.820	OK
X-X, +D+0.70E	-4.270 k	17.498 k	4.098	OK
X-X, +D+0.750Lr+0.450W	-0.5090 k	21.062 k	41.380	OK
X-X, +D+0.750S+0.450W	0.4660 k	24.242 k	52.022	OK
X-X, +D+0.750S+0.5250E	-1.678 k	22.730 k	13.550	OK
X-X, +0.60D+0.60W	-1.692 k	14.926 k	8.821	OK
X-X, +0.60D+0.70E	-4.550 k	12.910 k	2.837	OK
Z-Z, D Only	0.0 k	21.026 k	No Sliding	OK
Z-Z, +D+Lr	0.0 k	22.586 k	No Sliding	OK
Z-Z, +D+S	0.0 k	26.826 k	No Sliding	OK
Z-Z, +D+0.750Lr	0.0 k	22.196 k	No Sliding	OK
Z-Z, +D+0.750S	0.0 k	25.376 k	No Sliding	OK
Z-Z, +D+0.750S+0.5250E	0.0 k	22.730 k	No Sliding	OK
Z-Z, +0.60D+0.60W	0.0 k	14.926 k	No Sliding	OK
Z-Z, +0.60D+0.70E	0.0 k	12.910 k	No Sliding	OK
Z-Z, +D+0.60W	0.0 k	19.514 k	No Sliding	OK
Z-Z, +D+0.70E	0.0 k	17.498 k	No Sliding	OK
Z-Z, +D+0.750Lr+0.450W	0.0 k	21.062 k	No Sliding	OK
Z-Z, +D+0.750S+0.450W	0.0 k	24.242 k	No Sliding	OK

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.3989	+Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.40D	0.3989	-Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+0.50Lr	0.4587	+Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+0.50Lr	0.4587	-Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+0.50S	0.7762	+Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+0.50S	0.7762	-Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+1.60Lr	0.7157	+Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+1.60Lr	0.7157	-Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+1.60Lr+0.50W	0.5270	+Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+1.60Lr+0.50W	0.5270	-Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+1.60S	1.732	+Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+1.60S	1.732	-Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+1.60S+0.50W	1.543	+Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+1.60S+0.50W	1.543	-Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+0.50Lr+W	0.08134	+Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+0.50Lr+W	0.08134	-Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+0.50S+W	0.3988	+Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+0.50S+W	0.3988	-Z	Bottom	0.3888	AsMin	0.4738	31.242	OK

General Footing

Project File: 21304_Basecamp_Phase-1a_Enercalc.ec6

LIC# : KW-06017163, Build:20.22.10.25 KL&A, INC.

DESCRIPTION: Spread Footing at MF Column on Grid B/3

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.20D+0.70S+E	0.1952	+Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +1.20D+0.70S+E	0.1952	-Z	Bottom	0.3888	AsMin	0.4738	31.242	OK
X-X, +0.90D+W	0.1210	+Z	Top	0.3888	AsMin	0.4738	31.242	OK
X-X, +0.90D+W	0.1210	-Z	Top	0.3888	AsMin	0.4738	31.242	OK
X-X, +0.90D+E	0.4983	+Z	Top	0.3888	AsMin	0.4738	31.242	OK
X-X, +0.90D+E	0.4983	-Z	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.40D	0.0	-X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.40D	0.2921	+X	Bottom	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+0.50Lr	0.0	-X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+0.50Lr	0.3207	+X	Bottom	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+0.50S	0.0	-X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+0.50S	0.4996	+X	Bottom	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+1.60Lr	0.0	-X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+1.60Lr	0.4754	+X	Bottom	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+1.60Lr+0.50W	0.0	-X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+1.60Lr+0.50W	0.1973	+X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+1.60S	0.0	-X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+1.60S	1.048	+X	Bottom	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+1.60S+0.50W	0.0	-X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+1.60S+0.50W	0.3753	+X	Bottom	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+0.50Lr+W	0.0	-X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+0.50Lr+W	1.025	+X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+0.50S+W	0.0	-X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+0.50S+W	0.8457	+X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+0.70S+E	0.0	-X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +1.20D+0.70S+E	2.116	+X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +0.90D+W	0.0	-X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +0.90D+W	1.158	+X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +0.90D+E	0.0	-X	Top	0.3888	AsMin	0.4738	31.242	OK
Z-Z, +0.90D+E	2.528	+X	Top	0.3888	AsMin	0.4738	31.242	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.00 psi	0.58 psi	0.85 psi	0.85 psi	0.85 psi	94.87 psi	0.01	OK
+1.20D+0.50Lr	0.00 psi	0.64 psi	0.98 psi	0.98 psi	0.98 psi	94.87 psi	0.01	OK
+1.20D+0.50S	0.00 psi	1.01 psi	1.66 psi	1.66 psi	1.66 psi	94.87 psi	0.02	OK
+1.20D+1.60Lr	0.00 psi	0.96 psi	1.53 psi	1.53 psi	1.53 psi	94.87 psi	0.02	OK
+1.20D+1.60Lr+0.50W	0.00 psi	0.32 psi	1.13 psi	1.13 psi	1.13 psi	94.87 psi	0.01	OK
+1.20D+1.60S	0.00 psi	2.13 psi	3.71 psi	3.71 psi	3.71 psi	94.87 psi	0.04	OK
+1.20D+1.60S+0.50W	0.00 psi	0.85 psi	3.30 psi	3.30 psi	3.30 psi	94.87 psi	0.03	OK
+1.20D+0.50Lr+W	0.00 psi	1.90 psi	0.17 psi	0.17 psi	1.90 psi	94.87 psi	0.02	OK
+1.20D+0.50S+W	0.00 psi	1.54 psi	0.85 psi	0.85 psi	1.54 psi	94.87 psi	0.02	OK
+1.20D+0.70S+E	0.00 psi	3.93 psi	0.42 psi	0.42 psi	3.93 psi	94.87 psi	0.04	OK
+0.90D+W	0.00 psi	2.17 psi	0.26 psi	0.26 psi	2.17 psi	94.87 psi	0.02	OK
+0.90D+E	0.00 psi	4.76 psi	1.07 psi	1.07 psi	4.76 psi	94.87 psi	0.05	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	0.00 psi	189.74 psi	0	OK
+1.20D+0.50Lr	0.00 psi	189.74 psi	0	OK
+1.20D+0.50S	0.00 psi	189.74 psi	0	OK
+1.20D+1.60Lr	0.00 psi	189.74 psi	0	OK
+1.20D+1.60Lr+0.50W	0.00 psi	189.74 psi	0	OK
+1.20D+1.60S	0.00 psi	189.74 psi	0	OK
+1.20D+1.60S+0.50W	0.00 psi	189.74 psi	0	OK
+1.20D+0.50Lr+W	0.00 psi	189.74 psi	0	OK
+1.20D+0.50S+W	0.00 psi	189.74 psi	0	OK
+1.20D+0.70S+E	0.00 psi	189.74 psi	0	OK
+0.90D+W	0.00 psi	189.74 psi	0	OK
+0.90D+E	0.00 psi	189.74 psi	0	OK

500. LATERAL SYSTEM

Calculation Package

500 Lateral System Calculation Index:

500. NARRATIVE

Seismic:
The seismic force resisting system was designed per ASCE 7-16. The equivalent lateral force procedure was used to determine design seismic forces. The seismic base shear was calculated using the parameters as indicated in section 100. The building period was determined by the approximate period calculation per ASCE7.

Wind:
The wind force resisting system was designed per ASCE 7-16. The directional procedure for buildings of all heights was used to determine design wind forces. The wind base shear was calculated using the parameters as indicated in section 100.

Proposed alterations to the existing building do not change the existing diaphragm configuration. Controlling base shear has been determined using an in-house spreadsheet. Reference Section 501 of these calculations for detailed information regarding calculation of base shear.

The lateral system consists of existing wood walls sheathed with panels rated for shear. The scope of this project includes the removal of (2) existing shear walls. One wall to be replaced with a steel moment frame, and the other shear wall will be replaced with a new shear wall aligned with the wall to be removed. The existing roof diaphragm consists of wood panels rated for shear applied over roof truss framing

The main lateral force resisting system was analyzed using in house spreadsheets and Risa 3D, a 3D analysis/Design software program. Reference Section 502 for detailed calculations regarding lateral system.

501. WIND AND SEISMIC BASE SHEARS AND STORY FORCES

KL&A
Engineers & Builders

Title	Basecamp Phase 1a	Date	10/19/22	Job no.	21304
Subject	Seismic Story Weights	By	APS	Sheet	of

Story Weights Based on Load Key Summary Sheet

Story	Seismic Story Weight	Area A Load #	Area A (ft^2)	Area B Load #	Area B (ft^2)	Area C Load #	Area C (ft^2)	Wall A Wall #	Wall A Length (ft)	Wall A Height (ft)	Wall B Wall #	Wall B Length (ft)	Wall B Height (ft)
Roof	814 Kips	1	10570.00	2	4000.00	None		1	491.00	12.00	None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		
	0 Kips	None		None		None		None			None		

Title	Basecamp Phase 1a	Date	10/19/22	Job No.	21304
Subject	Base Shears	By	APS	Sheet	of

Wind and Seismic Data

Associated Struware Project File: 221019_Basecamp-Phase-1a_Code-Search_2021_APS.xlsx

Building Code: 2018 International Building Code

Building Data

Levels and Diaphragms

Level ID	Level/Diaphragm Name	Height above ground	Windward Pressure (WW) North/South	Windward Pressure (WW) East/West
Roof	Roof	28.0 ft	15.7 psf	15.7 psf
L1	GROUND	0 ft		

Wind Loading Data

	Parallel to Ridge North/South			Normal to Ridge East/West		
Leeward Pressure	LW	9.3	psf	LW	7.7	psf
Interior Pressure	$q_i(GC_{pi})$	3.9	psf	$q_i(GC_{pi})$	3.9	psf
Parapet Windward Pressure	PWW		psf	PWW		psf
Parapet Leeward Pressure	PLW		psf	PLW		psf

Seismic Loading Data

	North/South			East/West		
Seismic Response Coefficient	Cs	0.111		Cs	0.051	
Building Period	T	0.297	sec	T	0.297	sec
Spectral Response acceleration parameters		S_{DS}	0.334	g		
		S_{D1}	0.133	g		

Seismic Importance Factor I_e 1.00

Load Reporting

**User to select global reporting method*

Allowable or Ultimate? **Ultimate** 501-3

Seismic Load Calculation - Equivalent Lateral Force Procedure

All forces are shown as 1.0E

Selected T	T_x	0.30	sec	T_z	0.30	sec
Seismic Response Coefficient	C_s_x=	0.111		C_s_z=	0.051	
Structure Period Exponent	k =	1.00		k =	1.00	

North/South

Diaph Number	Story Elevation h, ft	Story Weight w_i, K	Story Force F_i, k	Story Shear V_i, k	Story Moment K-ft
Roof	28	814	**90.4**	90.4	0
--					
--					
--					
--					
--					
--					
--					
--					
--					
--					
--					
L1	0		GROUND LEVEL		2530
Total Bldg Weight		814	K		
N/S Base Shear		(1.0E)	**90 K**		
		(0.7E)	**63 K**		

East/West

Diaph Number	Story Elevation h, ft	Story Weight w_i, K	Story Force F_i, k	Story Shear V_i, k	Story Moment K-ft
Roof	28	814	**41.5**	41.5	0
--					
--					
--					
--					
--					
--					
--					
--					
--					
--					
--					
L1	0		GROUND LEVEL		1162
Total Bldg Weight		814	K		
E/W Base Shear		(1.0E)	**42 K**		
		(0.7E)	**29 K**		

Seismic Load Calculation - Diaphragm Forces

S_{DS} 0.33 g   Ie 1.00

North/South

Diaph Number	Calc'd Dipah Force K	Min. Diaph. Force K	Max Diaph. Force K	Control Diaph. Force K	Diaph. Ampl. Factor
Roof	90.4	54.4	108.8	**90.4**	1.00
--					
--					
--					
--					
--					
--					
--					
--					
--					
--					
--					
L1			GROUND LEVEL		

Engineer Comments:

East/West

Diaph Number	Calc'd Dipah Force K	Min. Diaph. Force K	Max Diaph. Force K	Control Diaph. Force K	Diaph. Ampl. Factor
Roof	41.5	54.4	108.8	**54.4**	1.31
--					
--					
--					
--					
--					
--					
--					
--					
--					
--					
--					
L1			GROUND LEVEL		

Engineer Comments:

WIND LOAD CALCULATION - DIRECTIONAL PROCEDURE FOR BUILDINGS OF ALL HEIGHTS

All forces are shown as 1.0W

Parallel to Ridge North/South

Diaph Number	Sub Region	Length ft	Height ft	1.0W Pressure psf		Force K
Roof	1	95	17.5	WW	15.7	**26.1**
	2	95	17.5	LW	9.3	**15.5**
	3					
	4					
	5					
				Roof	Story Force	**41.6**
--	1					
	2					
	3					
	4					
	5					
				--	Story Force	
--	1					
	2					
	3					
	4					
	5					
				--	Story Force	
--	1					
	2					
	3					
	4					
	5					
				--	Story Force	
L1		GROUND LEVEL				

N/S Base Shear **(1.0W)** **41.6 K**

Normal to Ridge East/West

Diaph Number	Sub Region	Length ft	Height ft	1.0W Pressure psf		Force K
Roof	1	136	12.25	WW	15.7	**26.2**
	2	136	12.25	LW	7.7	**12.8**
	3					
	4					
	5					
				Roof	Story Force	**39.0**
--	1					
	2					
	3					
	4					
	5					
				--	Story Force	
--	1					
	2					
	3					
	4					
	5					
				--	Story Force	
--	1					
	2					
	3					
	4					
	5					
				--	Story Force	
L1		GROUND LEVEL				

E/W Base Shear **(1.0W)** **39.0 K**

Engineer Comments:

Engineer Comments:

WIND FORCES SUMMARY

All forces are shown as 1.0W

North/South						**East/West**					
Diaph Number	Story Elevation h, ft	Story Height ft	Story Force F_i, k	Story Shear V_i, k	Story Moment K-ft	Diaph Number	Story Elevation h, ft	Story Height ft	Story Force F_i, k	Story Shear V_i, k	Story Moment K-ft
Roof	28	N/A	**41.6**	41.6	0	Roof	28	N/A	**39.0**	39.0	0
--						--					
--						--					
--						--					
--						--					
--						--					
--						--					
--						--					
--						--					
--						--					
--						--					
--						--					
L1	0	28	GROUND LEVEL			L1	0	28	GROUND LEVEL		
N/S Base Shear		(1.0W)	**42 K**			E/W Base Shear		(1.0W)	**39 K**		

Story Forces and Diaphragm Loads Comparisons

All forces are shown as Ultimate

North/South

Level	Roof		
Seismic	ELF Story Force	90.4	K
	Diaphragm	90.4	K
Wind	Story Force	41.6	K
Controlling Force		**90.4**	**K**
		(1.0E)	

East/West

Level	Roof		
Seismic	ELF Story Force	41.5	K
	Diaphragm	54.4	K
Wind	Story Force	39.0	K
Controlling Force		**54.4**	**K**
		(1.0E)D	

GLOBAL BASE SHEAR COMPARISONS

North/South

Wind Base Shear	(1.0W)	42	K
	(0.6W)	25	K
Seismic Base Shear	(1.0E)	90	K
	(0.7E)	63	K

Controlling North/South Base Shear

SEISMIC

1.0E 90 K

0.7E 63 K

East/West

Wind Base Shear	(1.0W)	39	K
	(0.6W)	23	K
Seismic Base Shear	(1.0E)	42	K
	(0.7E)	29	K

Controlling East/West Base Shear

SEISMIC

1.0E 42 K

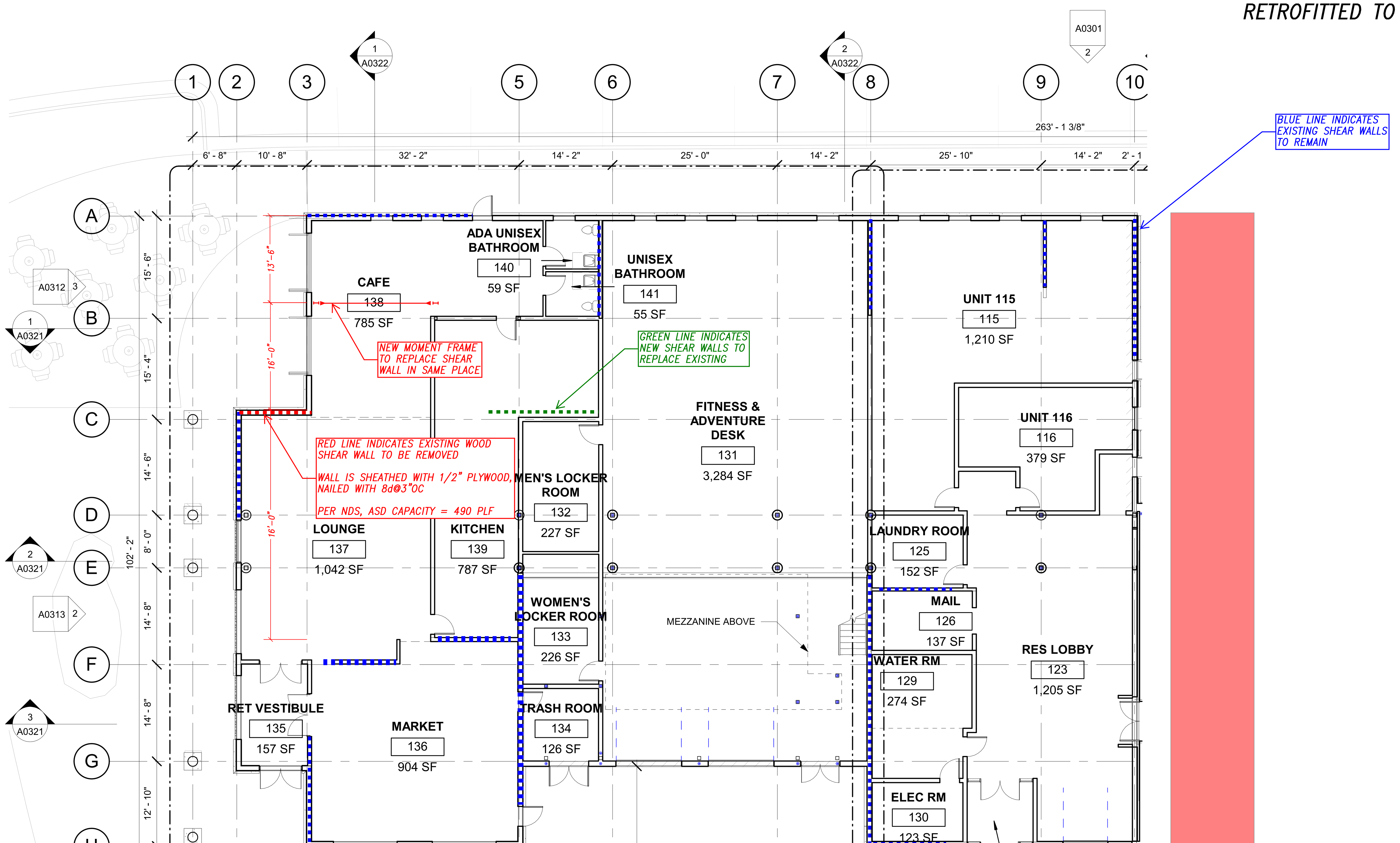
0.7E 29 K

502. MAIN LATERAL FORCE RESISTING SYSTEM DESIGN

SEISMIC LATERAL LOADS ON (E) BUILDING BASED ON:
N/S DIRECTION: R = 3.0 (STEEL NOT SPECIFICALLY DETAILED FOR SEISMIC RESISTANCE).
E/W DIRECTION: R = 6.5 (WOOD SHEAR WALLS)
SHEAR WALL LOADS ARE ALLOWABLE LEVEL.
MOMENT FRAME LOADS ARE STRENGTH LEVEL.

ROOF DIAPHRAGM IS FLEXIBLE, THEREFORE DETERMINATION OF LATEARL LOAD ON CRITICAL LINES OF RESISTANCE CAN BE DETERMINED BY TRIBUTARY AREA

LINES OF RESISTANCE WHERE SHEAR WALLS ARE ALTERED AND NEED TO BE RETROFITTED TO CURRENT IBC LEVEL LOADS ARE HIGHLIGHTED IN GREEN



GRID LINE B MOMENT FRAME LOAD

$P_W = 0.442k/ft * (13.5'+16.0')/2 = 6.520k$
$P_E = 0.947k/ft * (13.5'+16.0')/2 = 13.973k$

SEE FOLLOWING PAGES FOR MOMENT FRAME DESIGN

GRID LINE C SHEAR WALL LOAD
EXISTING SHEAR WALL:
WALL LENGTH, L = 11'-4"

NDS SHEAR CAPACITIES:
$v_E = 490plf$

$P_E = v_E * L = 5.552k$

NEW SHEAR WALL:
SHEAR WALL LENGTH, L = 12'-0"
$F_E = P_E = 5.552k$

SHEAR DEMAND:
$v_E = F_E / L = 463plf$

Use Type '3' shear wall (v_E = 490plf, v_W = 685plf)

Holdown forces
EQ T/C = 5,552 lbs * 17' / (12'-0" - 3"-7.5") = 8,484lbs

SIMPSON HDU11 GOOD FOR 11,175lbs UPLIFT

SEE FOLLOWING PAGES FOR BOUNDARY POST DESIGN

PROVIDE (5)2x6 BOUNDARY POST STUDS W/ SIMPSON HDU11 EACH END AT SHEAR WALL

ASD N/S LOADS:
WIND STORY FORCE = 25k
$W_w = 25k/95' = 0.263\ k/ft$

SEISMIC STORY FORCE = 63k
$W_E = 63k/95' = 0.663\ k/ft$

LRFD N/S LOADS:
WIND STORY FORCE = 42k
$W_w = 42k/95' = 0.442\ k/ft$

SEISMIC STORY FORCE = 90k
$W_E = 90k/95' = 0.947\ k/ft$

E/W LOADS:
WIND STORY FORCE = 23k
Ww = 23k/136' = 0.169 k/ft

E/W LOADS (ZONE 1):
SEISMIC STORY FORCE = 42k
$W_E = 42k/10{,}500sf*95 = 0.380\ k/ft$

E/W LOADS (ZONE 2):
SEISMIC STORY FORCE = 42k
$W_E = 42k/10{,}500sf*56 = 0.224\ k/ft$

E/W LOADS (ZONE 3):
SEISMIC STORY FORCE = 42k
$W_E = 42k/10{,}500sf*95 = 0.380\ k/ft$

1 GROUND LEVEL PLAN
A0301 A0201 3/32" = 1'-0"

7/24/2021 12:22:00 AM

502-2

APPROVAL STAMPS:

NOT FOR CONSTRUCTION

No.	Date	Description
1	07.23.21	DESIGN DEVELOPMENT

SUBMISSIONS & REVISIONS

OWNER
MAY REIGLER PROPERTIES
2201 Wisconsin Ave NW Suite 200
Washington, DC 20007
www.mayriegler.com

ARCHITECT
KASA
KEVIN & ASAKO SPERRY ARCHITECTURE
3318 N. Columbus Street
Arlington, VA 22207
T.312.636.3248 / 312.636.4252
www.kasa-arch.com

GENERAL CONTRACTOR
CALCON CONSTRUCTIONS, INC.
2270 W. Bates Ave.
Englewood, CO 80110
T.303.762.1554

CIVIL ENGINEER
LANDMARK ENGINEERING
141 9th Street, PO Box 774943
Steamboat Springs, Colorado 80477
T.970.871.9494

LANDSCAPE ARCHITECT
MGC DESIGN, INC.
PO Box 773522
Steamboat Springs, Colorado 80477
T.970.879.7740

STRUCTURAL ENGINEER
KL&A ENGINEERS & BUILDERS
1717 Washington Ave.
Golden, Colorado 80401
T. 303.384.9910

M.E.P. & F.P. ENGINEERS
BOULDER ENGINEERING
1717 15th Street
Boulder, CO 80302
T. 303.444.6038

INTERIOR DESIGNER:
JOHNSON NATHAN STROHE
1600 Wynkoop St., Suite 100
Denver, CO 80202
T.303.892.7062

PROJECT LOCATION
STEAMBOAT BASECAMP
1901 CURVE PLAZA
STEAMBOAT SPRINGS, CO 80487

DRAWING TITLE
GROUND LEVEL PLAN

SEAL
DATE: 07/23/21
DRAWN BY:
CHECKED BY:
PROJECT NO:

DRAWING NO:
A0201

Project: Basecamp Phase 1a
Subject Shear Wall Boundary Check
Date: 10/19/2022
Engineer: APS

Basic Data (reset on Basic Data Sheet)
Species dfl-No2
Basic Allowable Stress F_c 1350 psi
Basic Allowable Stress $F_{c\perp}$ 625 psi
Effective Column Length 204 in.

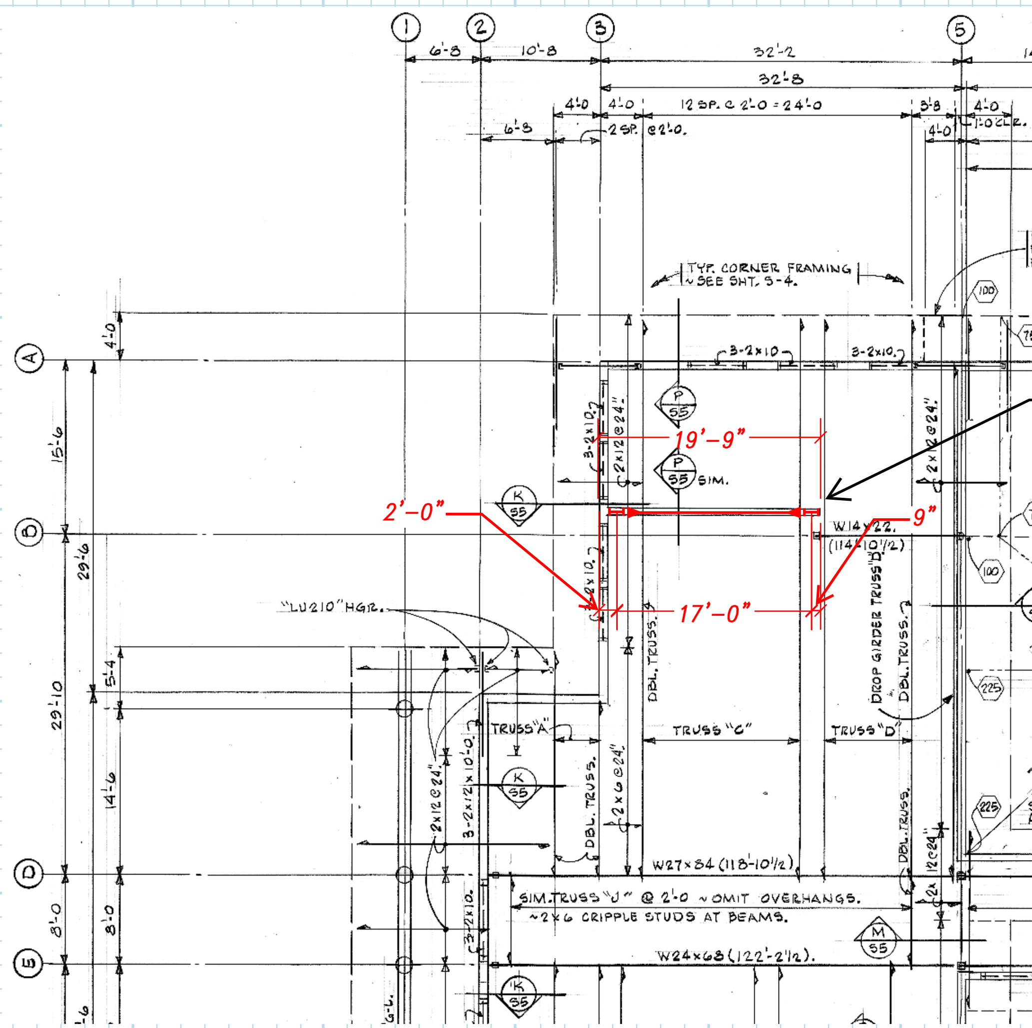
WOOD COLUMN DESIGN SCHEDULE - SINGLE PIECE

Square Single Members						Allowable Load		
Size	Area in^2	d	FcE	FcE/Fc*	F'c	Column Action	Perp to Grain	Check
3x3	6.25	2.50	72	0.03	72	447	3,906	NG
4x4	12.25	3.50	141	0.07	139	1,707	7,656	NG
6x6	30.25	5.50	349	0.16	336	10,179	18,906	OK
8x8	52.56	7.25	606	0.28	566	29,753	32,852	OK
10x10	85.56	9.25	987	0.46	870	74,410	53,477	OK
12x12	126.56	11.25	1460	0.68	1178	149,030	79,102	OK

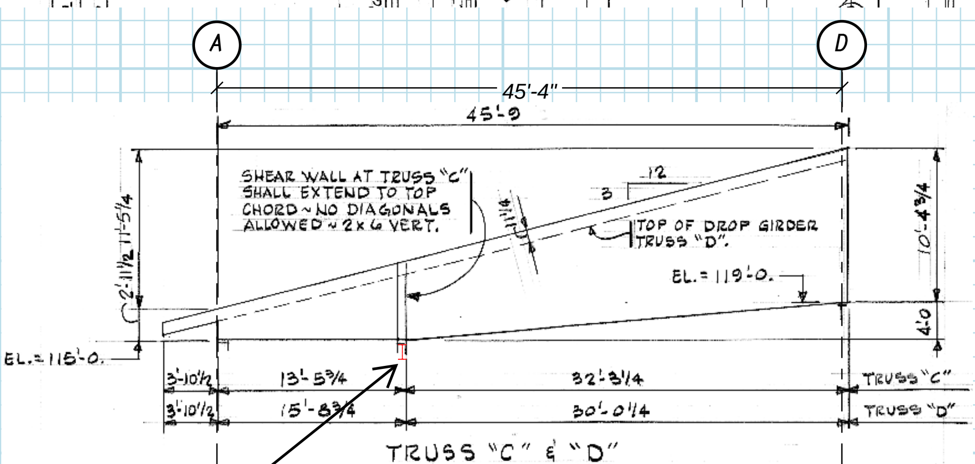
Rectanglar Single Member			**Weak Axis Governs**							**Strong Axis Governs**						
Width	Depth	Area in^2	d	FcE	FcE/Fc*	F'c	Column Action	Perp to Grain	Check	d	FcE	FcE/Fc*	F'c	Column Action	Perp to Grain	Check
1.5	5.5	8.25	1.50	26	0.01	26	214	5,156	NG	5.50	349	0.16	336	2,776	5,156	NG
3	5.5	16.50	3.00	104	0.05	103	1,696	10,313	NG	5.50	349	0.16	336	5,552	10,313	NG
4.5	5.5	24.75	4.50	234	0.11	228	5,647	15,469	NG	5.50	349	0.16	336	8,328	15,469	NG
6	5.5	33.00	5.50	349	0.16	336	11,104	20,625	OK	6.00	415	0.19	397	13,111	20,625	OK
7.5	5.5	41.25	5.50	349	0.16	336	13,880	25,781	OK	7.50	649	0.30	602	24,842	25,781	OK

PROVIDE (4)2x6 BOUNDARY STUDS AT SHEAR WALL

GRID B – NEW MOMENT FRAME – GRAVITY LOADING



NEW MOMENT FRAME



NEW FRAME BEAM SUPPORTING TRUSS

ROOF LOADING
DL = 25 psf
RLL = 20 psf
SL = 75 psf

TRIB WIDTH = 1/2(45'–4") = 22'–8"

w_{DL} = 567 plf
w_{RLL} = 453 plf
w_{SL} = 1700 plf

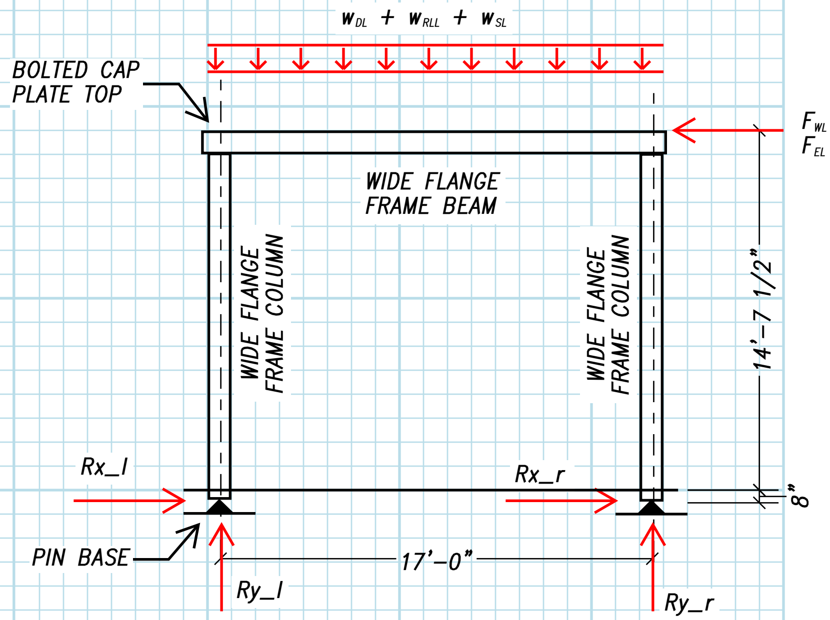
GRID B NEW MOMENT FRAME – LATERAL LOADING

ROOF LOADING

$DL = 25$ psf
$RLL = 20$ psf
$SL = 75$ psf

TRIB WIDTH = 1/2(45'–4") = 22'–8"

$w_{DL} = 567$ plf
$w_{RLL} = 453$ plf
$w_{SL} = 1700$ plf



LATERAL LOADING (LRFD)

$F_{WL} = 6.520k$ –> 7.0k
$F_{EL} = 13.973k$ –> 14.0k

SEISMIC DRIFT LIMIT

$h_{sx} = 14'\text{–}7.5" = 175.5"$
$\Delta_a = 0.020\ h_{sx} = 3.51"$
$C_d = 3.0$
$I_e = 1.0$
$d_M = Cd\ d_{MAX} / I_e$
$d_M \leq \Delta_a$
$d_{MAX} \leq \Delta_a\ I_e / C_d = 1.17"$, LIMIT ELASTIC DISPLACEMENT TO 1.17"

SEE RISA 3D OUTPUT FOLLOWING PAGES
FOR MOMENT FRAME MEMBER DESIGN

BEAM–COLUMN CONNECTION FORCES

$P_u = 34.2$ kips

$M_u = 1510$ kip–in

$V_u = 3.7$ kips

Envelope Member End Reactions

Sections | Maximums | End Reactions | 2nd/1st Moment Ratios

	Member	Member End		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-i...	LC	y-y Moment[k-i...	LC	z-z Moment[k-i...	LC
1	Column 1	I	max	30.884	6	6.429	13	0	13	0	13	0	13	0	13
2			min	-6.831	13	-3.669	6	0	2	0	2	0	2	0	2
3		J	max	29.66	6	6.429	13	0	13	0	13	0	13	673.221	6
4			min	-7.749	13	-3.669	6	0	2	0	2	0	2	-1179.707	13
5	Column 2	I	max	34.119	8	8.228	11	0	13	0	13	0	13	0	13
6			min	9.058	2	0.944	2	0	2	0	2	0	2	0	2
7		J	max	32.896	8	8.228	11	0	13	0	13	0	13	-173.184	2
8			min	7.63	2	0.944	2	0	2	0	2	0	2	-1509.772	11
9	Beam	I	max	3.671	6	29.66	6	0	13	0	13	0	13	647.155	6
10			min	0.525	13	-7.749	13	0	2	0	2	0	2	-1183.435	13
11		J	max	3.671	6	-7.63	2	0	13	0	13	0	13	1502.074	11
12			min	0.525	13	-32.896	8	0	2	0	2	0	2	166.482	2

SEE CONNECTION DESIGN
FOLLOWING PAGES

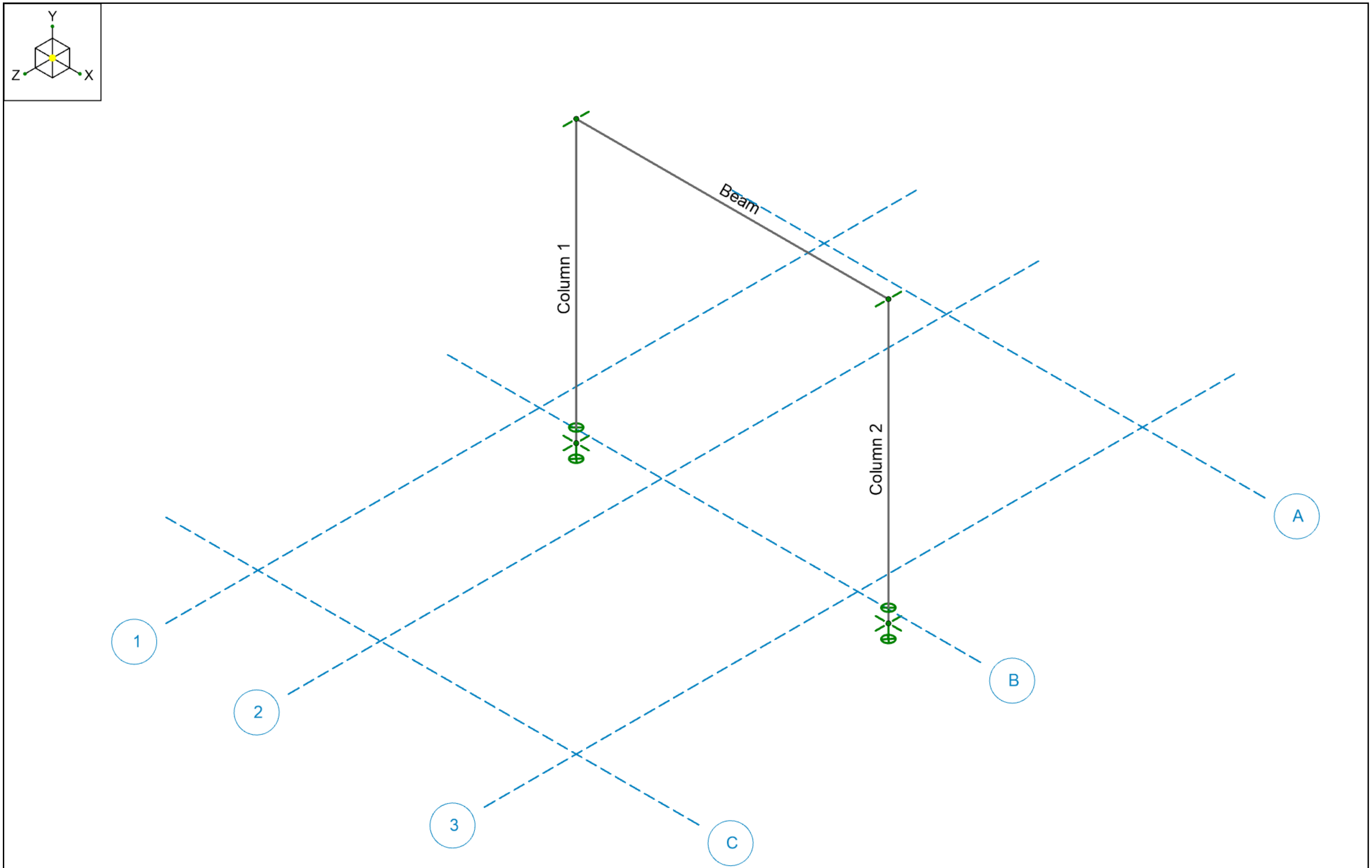
BASE REACTIONS

Envelope Node Reactions

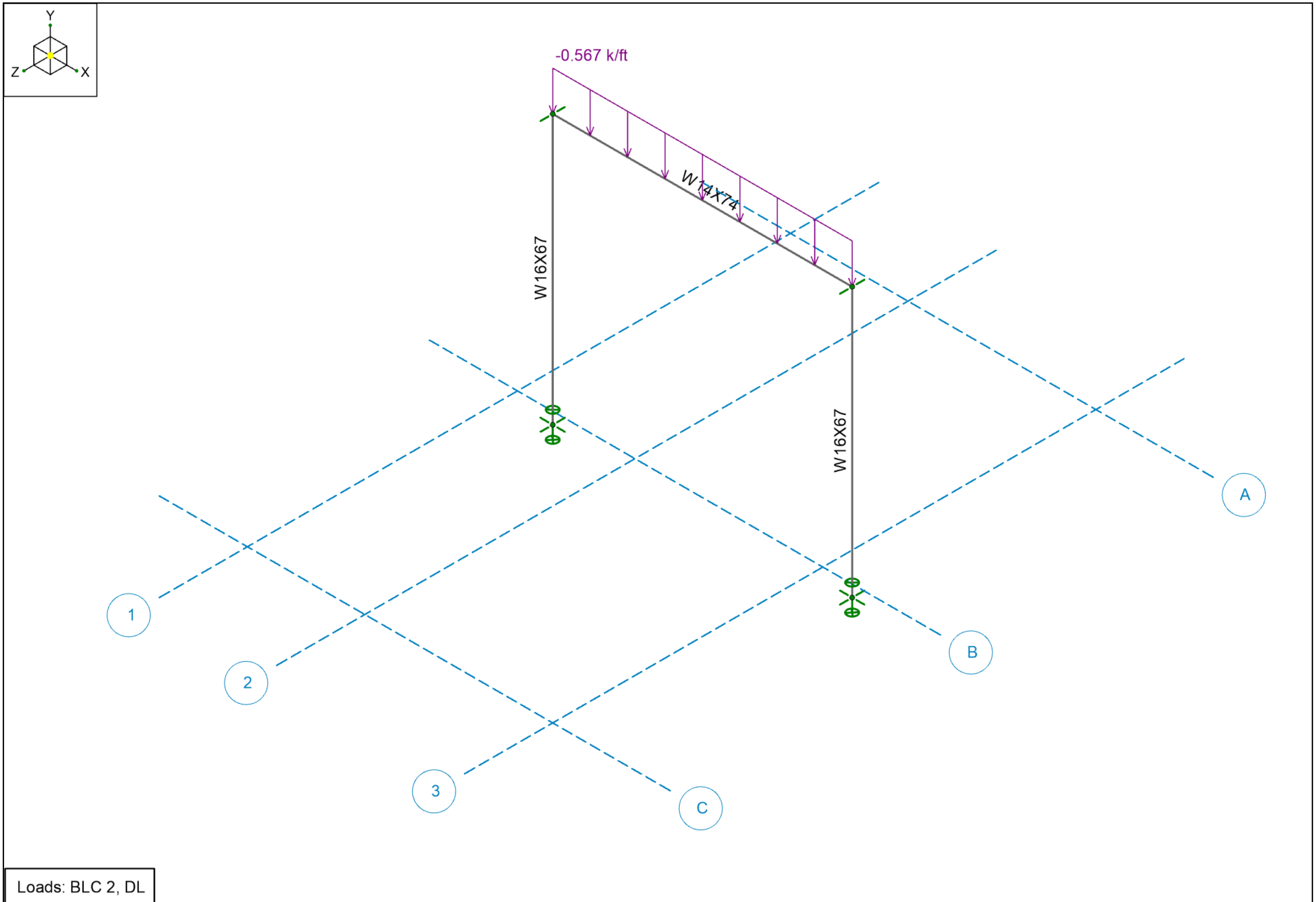
	Nod...		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-in]	LC	MY [k-in]	LC	MZ [k-in]	LC
1	N1	max	3.671	6	30.884	6	0	13	0	13	0	13	0	13
2		min	-6.475	13	-6.831	13	0	2	0	2	0	2	0	2
3	N2	max	-0.944	2	34.119	8	0	13	0	13	0	13	0	13
4		min	-8.084	11	9.058	2	0	2	0	2	0	2	0	2
5	Totals:	max	0	6	61.768	6	0	13						
6		min	-14	13	11.646	13	0	2						

SEE BASE PLATE DESIGN FOLLOWING PAGES

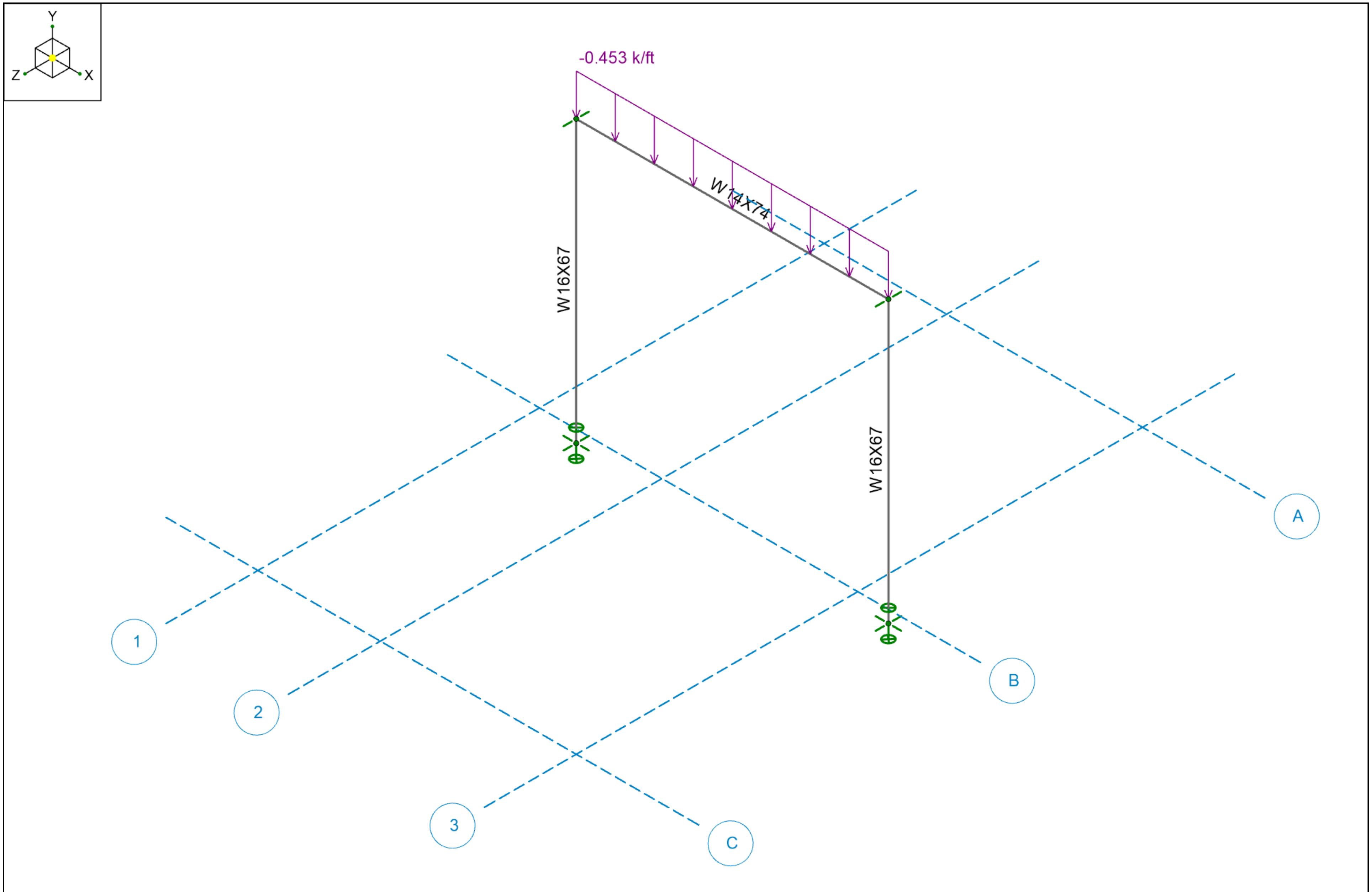
SEE HILIT PROFIS ANCHORAGE DESIGN FOLLOWING PAGES



KL&A, Inc.		SK-1
APS		Oct 31, 2022
	Member Labels	221019_Basecamp-Phase-1a_Moment-Frame....

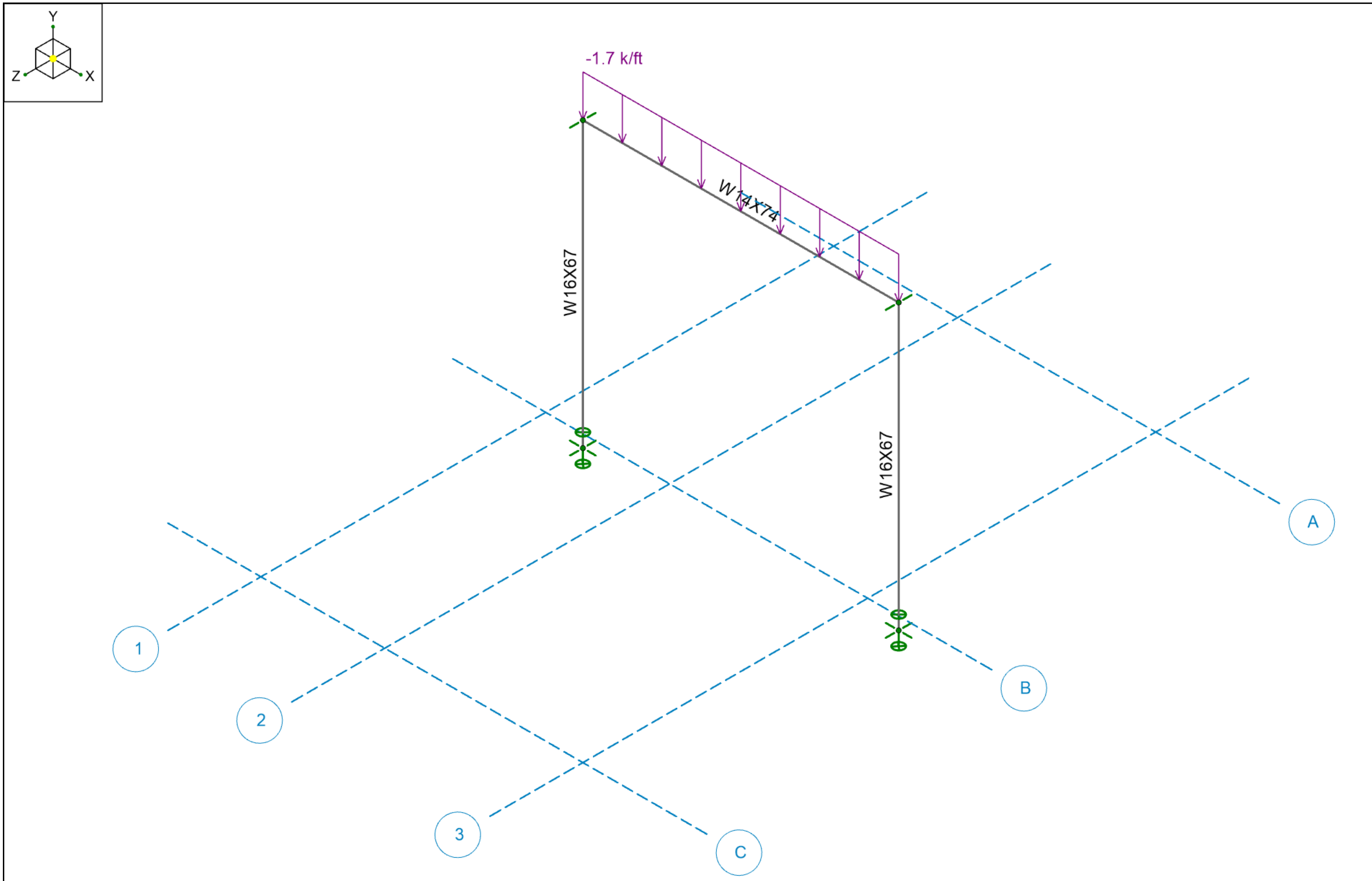


KL&A, Inc.		SK-2
APS		Oct 31, 2022
	Dead Loads	221019_Basecamp-Phase-1a_Moment-Frame....



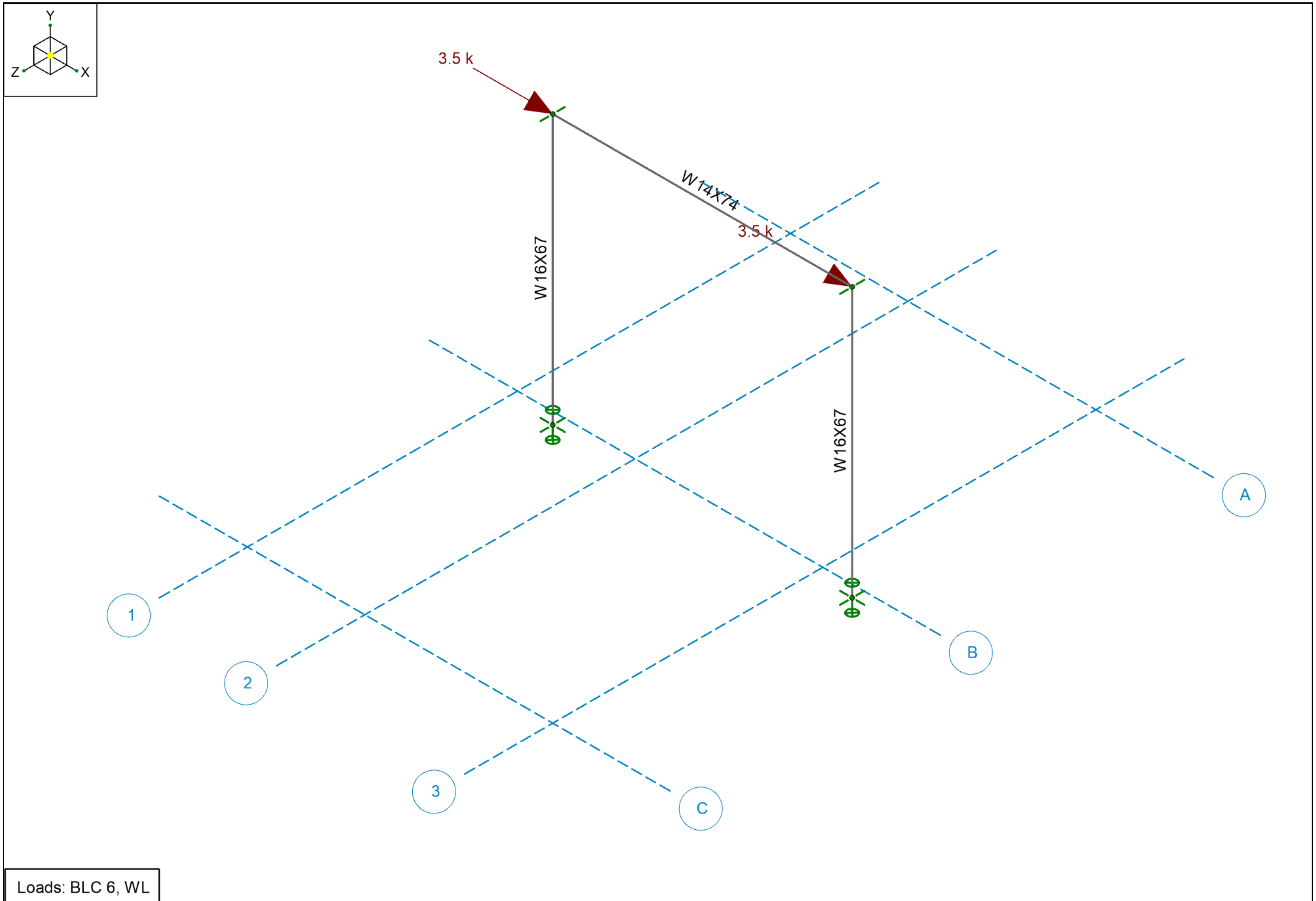
Loads: BLC 4, RLL

KL&A, Inc.		SK-4
APS		Oct 31, 2022
	Roof Live Loads	221019_Basecamp-Phase-1a_Moment-Frame....

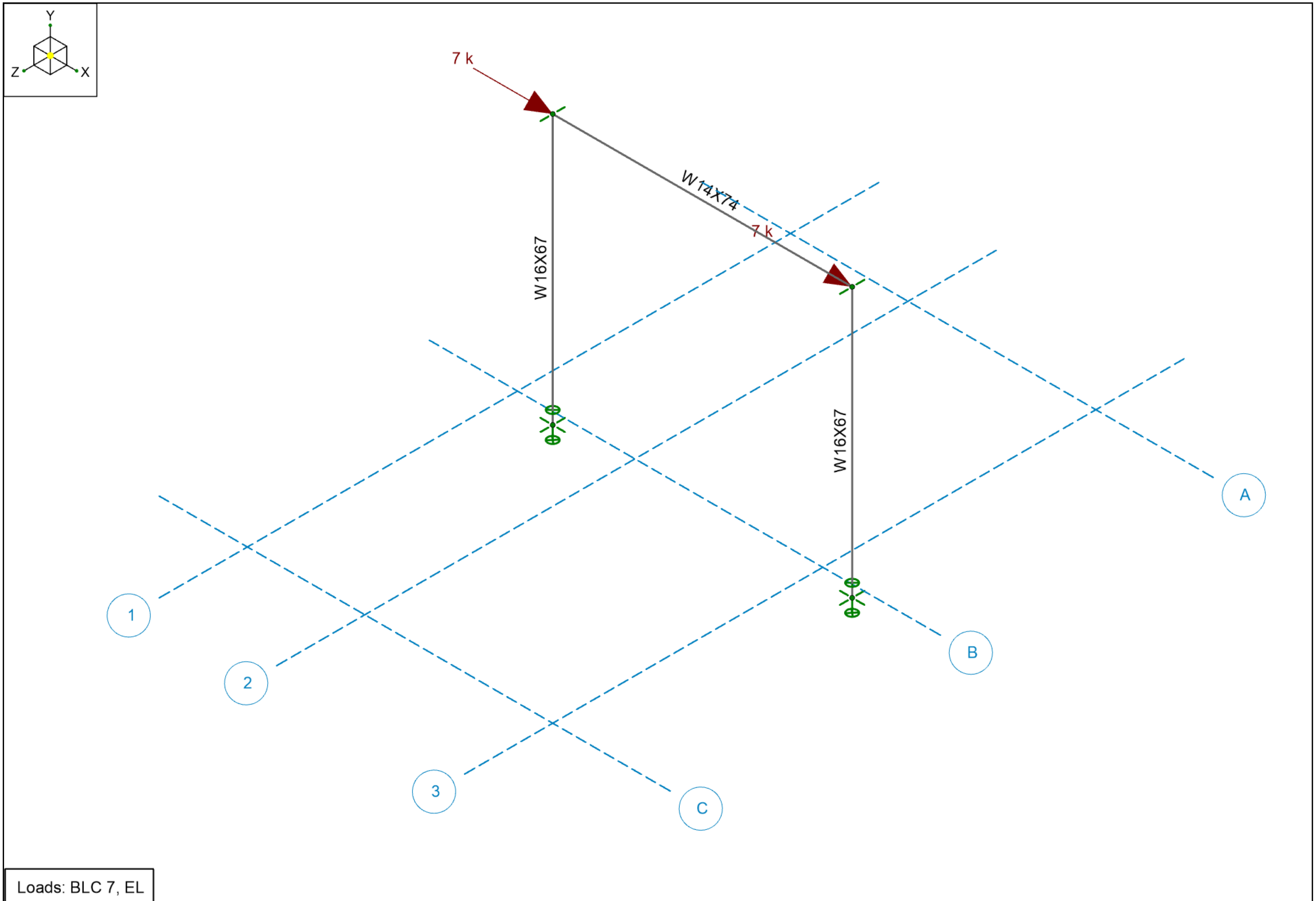


Loads: BLC 5, SL

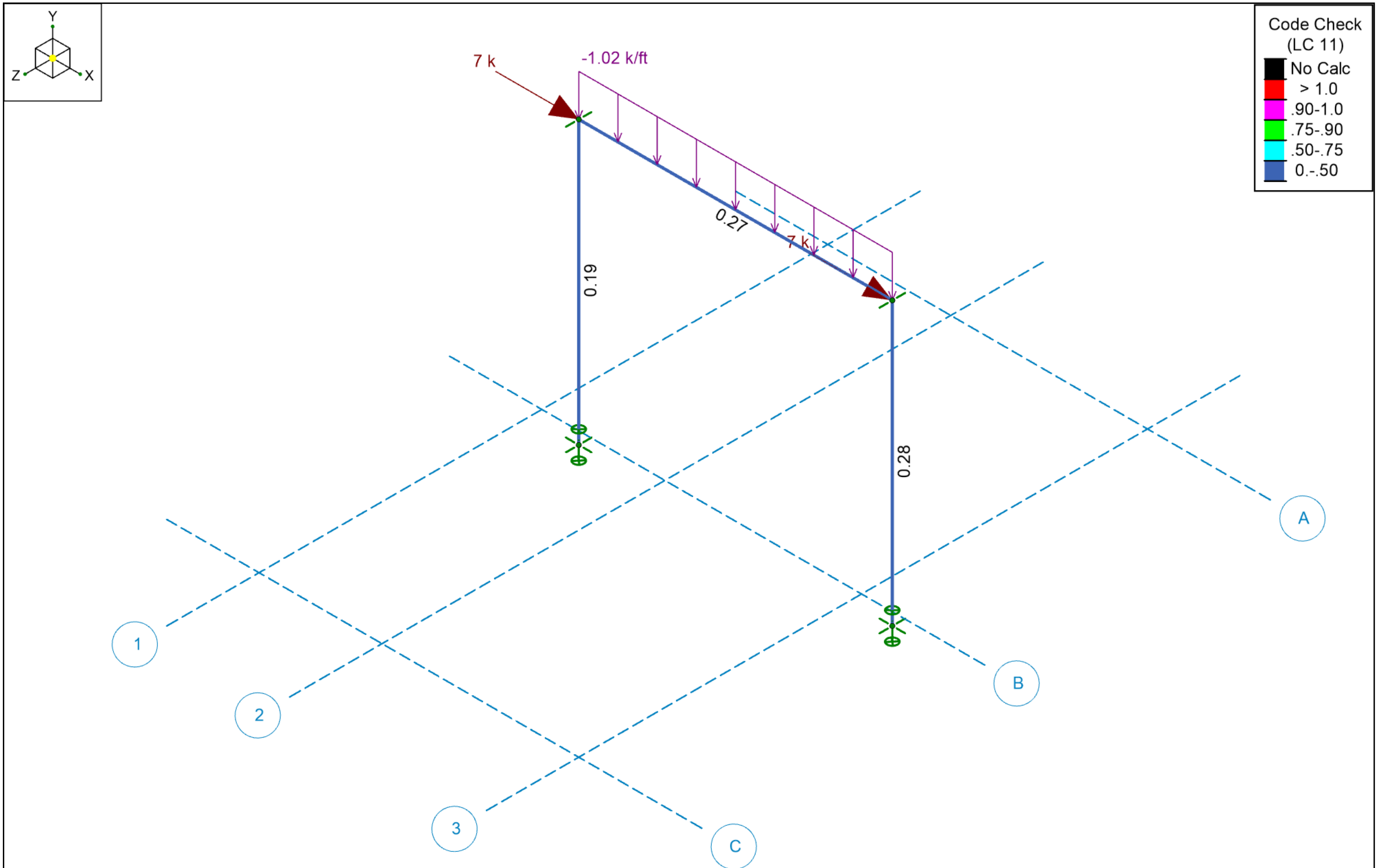
KL&A, Inc.		SK-6
APS		Oct 31, 2022
	Snow Loads	221019_Basecamp-Phase-1a_Moment-Frame....



KL&A, Inc.		SK-7
APS		Oct 31, 2022
	Wind Loads	221019_Basecamp-Phase-1a_Moment-Frame....



KL&A, Inc.		SK-8
APS		Oct 31, 2022
	Seismic Loads	221019_Basecamp-Phase-1a_Moment-Frame....



Member Code Checks Displayed
Loads: LC 11, 16-5
Results for LC 11, 16-5

KL&A, Inc.		SK-9
APS		Oct 31, 2022
	Unity Check	221019_Basecamp-Phase-1a_Moment-Frame....

Envelope Member Section Forces

	Member	Sec		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-ft]	LC	y-y Moment[k-ft]	LC	z-z Moment[k-ft]	LC
1	Column 1	1	max	30.884	6	6.429	13	0	13	0	13	0	13	0	13
2			min	-6.831	13	-3.669	6	0	2	0	2	0	2	0	2
3		2	max	30.578	6	6.429	13	0	13	0	13	0	13	14.025	6
4			min	-7.06	13	-3.669	6	0	2	0	2	0	2	-24.577	13
5		3	max	30.272	6	6.429	13	0	13	0	13	0	13	28.051	6
6			min	-7.29	13	-3.669	6	0	2	0	2	0	2	-49.154	13
7		4	max	29.966	6	6.429	13	0	13	0	13	0	13	42.076	6
8			min	-7.519	13	-3.669	6	0	2	0	2	0	2	-73.732	13
9		5	max	29.66	6	6.429	13	0	13	0	13	0	13	56.102	6
10			min	-7.749	13	-3.669	6	0	2	0	2	0	2	-98.309	13
11	Column 2	1	max	34.119	8	8.228	11	0	13	0	13	0	13	0	13
12			min	9.058	2	0.944	2	0	2	0	2	0	2	0	2
13		2	max	33.813	8	8.228	11	0	13	0	13	0	13	-3.608	2
14			min	8.701	2	0.944	2	0	2	0	2	0	2	-31.454	11
15		3	max	33.508	8	8.228	11	0	13	0	13	0	13	-7.216	2
16			min	8.344	2	0.944	2	0	2	0	2	0	2	-62.907	11
17		4	max	33.202	8	8.228	11	0	13	0	13	0	13	-10.824	2
18			min	7.987	2	0.944	2	0	2	0	2	0	2	-94.361	11
19		5	max	32.896	8	8.228	11	0	13	0	13	0	13	-14.432	2
20			min	7.63	2	0.944	2	0	2	0	2	0	2	-125.814	11
21	Beam	1	max	3.671	6	29.66	6	0	13	0	13	0	13	53.93	6
22			min	0.525	13	-7.749	13	0	2	0	2	0	2	-98.62	13
23		2	max	3.671	6	14.83	6	0	13	0	13	0	13	-10.447	2
24			min	0.525	13	-10.201	13	0	2	0	2	0	2	-66.898	11
25		3	max	3.671	6	0	6	0	13	0	13	0	13	-11.91	13
26			min	0.525	13	-12.707	11	0	2	0	2	0	2	-72.126	6
27		4	max	3.671	6	-3.815	2	0	13	0	13	0	13	47.08	13
28			min	0.525	13	-18.066	8	0	2	0	2	0	2	-40.612	6
29		5	max	3.671	6	-7.63	2	0	13	0	13	0	13	125.173	11
30			min	0.525	13	-32.896	8	0	2	0	2	0	2	13.874	2

STRENGTH DESIGN LOAD COMBINATIONS

Node Reactions

	LC	Node Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	2	N1	0.944	9.058	0	0	0	0
2	2	N2	-0.944	9.058	0	0	0	0
3	2	Totals:	0	18.116	0			
4	2	COG (ft):	X: 10.5	Y: 13.42	Z: 15.5			
5	3	N1	1.047	9.689	0	0	0	0
6	3	N2	-1.047	9.689	0	0	0	0
7	3	Totals:	0	19.378	0			
8	3	COG (ft):	X: 10.5	Y: 13.659	Z: 15.5			
9	4	N1	1.703	14.989	0	0	0	0
10	4	N2	-1.703	14.989	0	0	0	0
11	4	Totals:	0	29.978	0			
12	4	COG (ft):	X: 10.5	Y: 14.001	Z: 15.5			
13	5	N1	1.571	13.925	0	0	0	0
14	5	N2	-1.571	13.925	0	0	0	0
15	5	Totals:	0	27.849	0			
16	5	COG (ft):	X: 10.5	Y: 13.953	Z: 15.5			
17	6	N1	3.671	30.884	0	0	0	0
18	6	N2	-3.671	30.884	0	0	0	0
19	6	Totals:	0	61.768	0			
20	6	COG (ft):	X: 10.5	Y: 14.322	Z: 15.5			
21	7	N1	-0.184	10.739	0	0	0	0
22	7	N2	-3.316	17.111	0	0	0	0
23	7	Totals:	-3.5	27.849	0			
24	7	COG (ft):	X: 10.5	Y: 13.953	Z: 15.5			
25	8	N1	1.916	27.648	0	0	0	0
26	8	N2	-5.416	34.119	0	0	0	0
27	8	Totals:	-3.5	61.768	0			
28	8	COG (ft):	X: 10.5	Y: 14.322	Z: 15.5			
29	9	N1	-2.473	3.341	0	0	0	0
30	9	N2	-4.527	16.037	0	0	0	0
31	9	Totals:	-7	19.378	0			
32	9	COG (ft):	X: 10.5	Y: 13.659	Z: 15.5			
33	10	N1	-1.818	8.611	0	0	0	0
34	10	N2	-5.182	21.367	0	0	0	0
35	10	Totals:	-7	29.978	0			
36	10	COG (ft):	X: 10.5	Y: 14.001	Z: 15.5			
37	11	N1	-5.916	-2.053	0	0	0	0
38	11	N2	-8.084	23.361	0	0	0	0
39	11	Totals:	-14	21.308	0			
40	11	COG (ft):	X: 10.5	Y: 13.747	Z: 15.5			
41	12	N1	-2.914	-0.504	0	0	0	0
42	12	N2	-4.086	12.15	0	0	0	0
43	12	Totals:	-7	11.646	0			
44	12	COG (ft):	X: 10.5	Y: 13.42	Z: 15.5			
45	13	N1	-6.475	-6.831	0	0	0	0
46	13	N2	-7.525	18.477	0	0	0	0
47	13	Totals:	-14	11.646	0			
48	13	COG (ft):	X: 10.5	Y: 13.42	Z: 15.5			

$C_{MAX}, V_{@CMAX}$

$V_{MAX}, C_{@VMAX}$

$T_{MAX}, V_{@TMAX}$

Node Reactions

	LC	Node Label	X [k]	Y [k]	Z [k]	[illegible]-ft]	MY [k-ft]	MZ [k-ft]
1	15	N1	-20.575	-27.467	0	0	0	0
2	15	N2	-21.425	48.775	0	[illegible]	0	0
3	15	Totals:	-42	21.308	0			
4	15	COG (ft):	X: 10.5	Y: 13.747	Z: 15.5			
5	16	N1	-21.129	-32.138	0	0	0	0
6	16	N2	-20.871	43.784	0	0	0	0
7	16	Totals:	-42	11.646	0			
8	16	COG (ft):	X: 10.5	Y: 13.42	Z: 15.5			

V_{MAX}, $C_{@VMAX}$

T_{MAX}, $V_{@TMAX}$

ALLOWABLE STRESS DESIGN LOAD COMBINATIONS

Node Reactions

	LC	Node Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	19	N1	0.674	6.47	0	0	0	0
2	19	N2	-0.674	6.47	0	0	0	0
3	19	Totals:	0	12.94	0			
4	19	COG (ft):	X: 10.5	Y: 13.42	Z: 15.5			
5	20	N1	1.151	10.32	0	0	0	0
6	20	N2	-1.151	10.32	0	0	0	0
7	20	Totals:	0	20.641	0			
8	20	COG (ft):	X: 10.5	Y: 13.869	Z: 15.5			
9	21	N1	2.463	20.92	0	0	0	0
10	21	N2	-2.463	20.92	0	0	0	0
11	21	Totals:	0	41.84	0			
12	21	COG (ft):	X: 10.5	Y: 14.252	Z: 15.5			
13	22	N1	-1.433	2.672	0	0	0	0
14	22	N2	-2.767	10.268	0	0	0	0
15	22	Totals:	-4.2	12.94	0			
16	22	COG (ft):	X: 10.5	Y: 13.42	Z: 15.5			
17	23	N1	-4.266	-2.392	0	0	0	0
18	23	N2	-5.534	15.332	0	0	0	0
19	23	Totals:	-9.8	12.94	0			
20	23	COG (ft):	X: 10.5	Y: 13.42	Z: 15.5			
21	24	N1	-0.548	6.502	0	0	0	0
22	24	N2	-2.602	12.214	0	0	0	0
23	24	Totals:	-3.15	18.716	0			
24	24	COG (ft):	X: 10.5	Y: 13.792	Z: 15.5			
25	25	N1	0.436	14.431	0	0	0	0
26	25	N2	-3.586	20.184	0	0	0	0
27	25	Totals:	-3.15	34.615	0			
28	25	COG (ft):	X: 10.5	Y: 14.174	Z: 15.5			
29	26	N1	-2.666	2.694	0	0	0	0
30	26	N2	-4.684	16.022	0		0	0
31	26	Totals:	-7.35	18.716	0			
32	26	COG (ft):	X: 10.5	Y: 13.792	Z: 15.5			
33	27	N1	-1.683	10.595	0	0	0	0
34	27	N2	-5.667	24.019	0	0	0	0
35	27	Totals:	-7.35	34.615	0			
36	27	COG (ft):	X: 10.5	Y: 14.174	Z: 15.5			
37	28	N1	-1.703	0.092	0	0	0	0
38	28	N2	-2.497	7.672	0		0	0
39	28	Totals:	-4.2	7.764	0			
40	28	COG (ft):	X: 10.5	Y: 13.42	Z: 15.5			
41	29	N1	-4.535	-4.961	0	0	0	0
42	29	N2	-5.265	12.725	0	0	0	0
43	29	Totals:	-9.8	7.764	0			
44	29	COG (ft):	X: 10.5	Y: 13.42	Z: 15.5			

V_{MAX}, $C_{@VMAX}$
C_{MAX}, $V_{@CMAX}$

T_{MAX}, $V_{@TMAX}$

End Plate Drag/Moment Connection to Column Flange - LRFD 15th ed.

Connection Description: WF Beam over top of WF Column Cap Plate

Applied Forces

Beam Vertical Shear	V_u =	3.7	kip
Beam Axial Tension	H_{ut} =	7.8	kip
Beam Axial Comp.	H_{uc} =	34.2	kip
Beam Moment	M_u =	126	kip-ft
Column Axial Load	P_u =	7	kip

☐ Adjacent Beam w/ a Moment Connection is present

Material Properties

	F_y	F_u	
Wide Flange Beam	50	65	ksi
Wide Flange Column	50	65	ksi
Plate	50	65	ksi

Design Data

Bolt Type		A490-N Fully Tensioned	
Bolt Diameter	d_{bolt} =	1	in
Hole Type in End PL		STD	
Hole Type in Column		STD	
Bolt pitch (see note 1 below)	p_f =	1 1/2	in
Vertical Bolt Spacing	s_v =	3	in
Bolt Gage	GA =	5.5	in
End Plate Thickness	t_p =	1	in
Column Stiffener Plate Thickness	t_{sp} =	3/8	in
Column Flange Cover Plate Thickness	t_{cp} =	0	in
Column Web Doubler Plate Thickness	t_{dp} =	0	in
Number of Add Bolt Rows Below Beam	N_{bb} =	0	
Number of 'Stitch' Bolt Rows	N_{br} =	0	
Vertical Edge Distance	L_{ev} =	1.5	in
Horizontal Edge Distance	L_{eh} =	1.5	in
End Plate Width	b_p =	8.5	in
Weld Thickness, Beam Web to End PL	W_{bw} =	1/4	in
Weld Thickness, Beam Flange to End PL	W_{bf} =	5/16	in
Weld Thickness, Stiffener PL to Column	W_{sp} =	1/4	in
Weld Thickness, Cover PL to Column	W_{cp} =	0	in

Member Sizes

Beam Size		W16X67	
Depth	d_{bm} =	16.3	in
Flange Width	b_{fb} =	10.20	in
Flange Thickness	t_{fb} =	0.665	in
Web Thickness	t_{wb} =	0.395	in
k dimension	k_{b1} =	1	in
Column Size		W14X74	
Depth	d_c =	14.2	in
Flange Width	b_{fc} =	10.10	in
Flange Thickness	t_{fc} =	0.785	in
Web Thickness	t_{wc} =	0.450	in
T dimension	T_c =	10.95	in
k dimension	k_c =	1.38	in
k1 dimension	k_{1c}=	1.0625	in
Adjacent Beam Size		W16X67	
Depth	d_{abm} =	16.3	in
Flange Thickness	t_{fab} =	0.665	in

Analysis Design Options / Requirements

Shear Load is taken to the face of the column

Bolts are Fully Tensioned

Connection is at the top of a column

Stitch Bolts do not contribute to shear strength

Axial Load is distributed by Area

Weld from beam to end plate develops min 60% of moment capacity

	END PLATE TYPE			
	4 Bolt Extended Unstiffened	4 Bolt Extended Stiffened	2 Bolt Flush Unstiffened	8 Bolt Extended Stiffened
Limit State Summary	**Ru/ϕRn**	**Ru/ϕRn**	**Ru/ϕRn**	**Ru/ϕRn**
End Plate Yielding	0.27	0.21	0.42	0.16
Column Flange Yielding	0.27	0.27	0.61	0.23
Bolt Rupture	0.38	0.38	0.86	0.24
End Plate Shear Yielding from Tension	0.20	0.20	0.39	0.20
End Plate Shear Rupture from Tension	0.20	0.20	0.40	0.20
Beam Flange Weld Rupture	0.97	0.97	0.97	0.97
End Plate Shear Yielding	0.00	0.00	0.00	0.00
End Plate Shear Rupture	0.00	0.02	0.00	0.00
Beam Web Shear Yielding	0.02	0.02	0.02	0.02
Beam Web Weld Rupture	0.02	0.02	0.02	0.02
Bolt Rupture	0.02	0.02	0.05	0.01
Bolt Bearing at End Plate	0.01	0.01	0.02	0.00
Bolt Bearing at Column Flange	0.01	0.01	0.02	0.01
Column Web Yielding **	0.80	0.80	0.80	0.80
Column Web Buckling **	N/A	N/A	N/A	N/A
Column Web Crippling **	0.93	0.93	0.93	0.93
Column Flange Bending (if unstiff) **	1.70	1.70	1.70	1.70
Stiffener PL Yielding	0.31	0.31	0.31	0.31
Stiffener PL Weld	0.16	0.16	0.16	0.16
Cover Plate Weld	0.00	0.00	0.00	0.00
Column Panel Zone Failure	0.58	0.58	0.58	0.58
Max Ru / ϕRn	**1.70**	**1.70**	**1.70**	**1.70**

** If the Demand/Capacity of these Limit States is above 1.0 and stiffener plates are provided, the stiffener plates are designed to take the balance of the overstress. Therefore, the D/C is acceptable if the stiffeners are provided and the stiffener plates are within the D/C limits.

End Plate Drag/Moment Connection to Column Flange - LRFD 14th ed.

Connection Description: WF Beam over top of WF Column Cap Plate

Applied Forces

Beam Vertical Shear	V_u =	3.7	kip
Beam Axial Tension	H_{ut} =	7.8	kip
Beam Axial Comp.	H_{uc} =	34.2	kip
Beam Moment	M_u =	1512	kip-in
Column Axial Load	P_u =	7	kip

Material Properties

	F_y	F_u	
Wide Flange Beam	50	65	ksi
Wide Flange Column	50	65	ksi
Plate	50	65	ksi

Design Data Bolts are Fully Tensioned

Bolt Type		A490-N Fully Tensioned	
Bolt Diameter	d_{bolt} =	1	in
Hole Type in End PL		STD	
Hole Type in Column		STD	
Number of Bolt Columns at Flanges	N_{bc} =	2	
Number of Bolt Rows Outside Flanges	N_{bbt} =	1	
Number of Bolt Rows Insides Flanges	N_{bab} =	1	
Number of Bolt Rows Above Beam	N_{ba} =	1	
Number of Add Bolt Rows Below Beam	N_{bb} =	0	
Number of Stitch Bolt Rows within beam	N_{br} =	0	
Bolt pitch (see note 1 below)	p_f =	1 1/2	in
Vertical Edge Distance	L_{ev} =	1.5	in
Horizontal Edge Distance	L_{eh} =	1.5	in
Minimum Vertical Bolt Spacing	s_v =	3	in
Minimum Bolt Gage (interior columns)	GA =	5.5	in
End Plate Thickness	t_p =	1	in
Column Stiffener Plate Thickness	t_{sp} =	3/8	in
Column Web Doubler Plate Thickness	t_{dp} =	0	in
Cover Plate Thickness	t_{cp} =	0	in
End Plate Width	b_p =	8.5	in
Triangular Stiffener Plate Thickness	t_{spt} =	1/2	in
Weld Thickness, Beam Web to End PL	W_{bw} =	1/4	in
Weld Thickness, Beam Flange to End PL	W_{bf} =	5/16	in
Weld Thickness, Stiffener PL to Column	W_{sp} =	1/4	in
Weld Thickness, Cover PL to Column	W_{cp} =	0	in
Weld Thickness, Triangular Stiffener	W_{spt} =	3/8	in

Member Sizes

Beam Size		W16X67	
Depth	d_{bm} =	16.3	in
Flange Width	b_{fb} =	10.20	in
Flange Thickness	t_{fb} =	0.665	in
Web Thickness	t_{wb} =	0.395	in
k dimension	k_{b1} =	1	in
Column Size		W14X74	
Depth	d_c =	14.2	in
Flange Width	b_{fc} =	10.10	in
Flange Thickness	t_{fc} =	0.785	in
Web Thickness	t_{wc} =	0.450	in
T dimension	T_c =	10.95	in
k dimension	k_c =	1.38	in

Analysis / Design Assumptions

1) Shear Load is taken to the face of the column
2) Bolts are Fully Tensioned
3) Connection is at the top of a column
4) Stitch Bolts do not contribute to shear strength
5) Axial Load is distributed by Area
6) Weld from beam to end plate develops min 60% of moment capacity

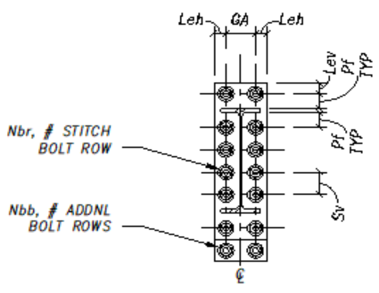
KL&A Engineers & Builders

Title	Basecamp Phase 1a	Date	10/31/22	Job No.	21304
Subject	Moment Frame	By	APS	Sheet	2

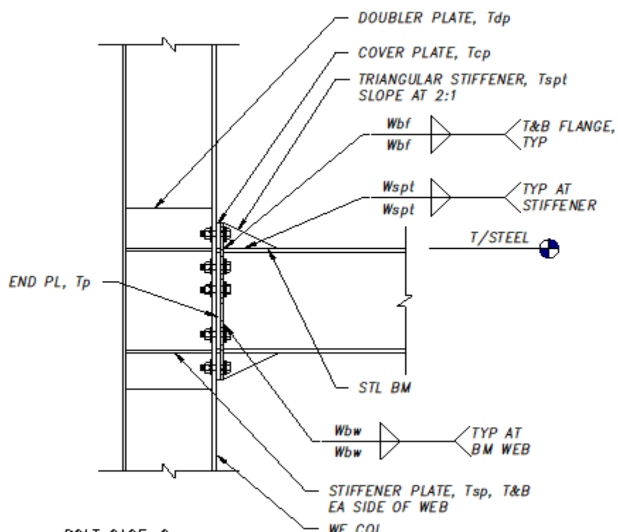
Limit State Summary

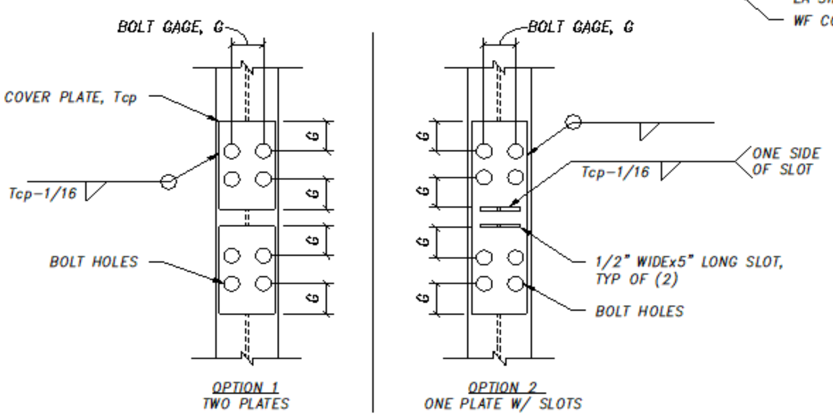
	Ru / ϕRn	
End PL Moment Strengths		
End Plate Yielding	0.21	OK
Column Flange Yielding	0.27	OK
Bolt Rupture	0.38	OK
End PL at the Tension Flange		
End Plate Shear Yielding	0.20	OK
End Plate Shear Rupture	0.20	OK
Beam Flange Weld Rupture	0.97	OK
Direct Shear Checks		
End Plate Shear Yielding	0.00	OK
End Plate Shear Rupture	0.00	OK
Beam Web Shear Yielding	0.02	OK
Weld Rupture	0.02	OK
Bolt Rupture	0.02	OK
Bolt Bearing at End Plate	0.01	OK
Bolt Bearing at Column Flange	0.01	OK

	Ru / ϕRn	
Column Checks		
Column Web Yielding	0.80	OK
Column Web Buckling	N/A	OK
Column Web Crippling	0.93	OK
Column Flange Bending (if unstiff)	1.70	**
Therefore, Stiffeners Required		
**** OK, Stiffeners take the balance of the design load**		
Stiffener PL Yielding	0.31	OK
Stiffener PL Weld	0.16	OK
Cover Plate Weld	0.00	OK
Column Panel Zone Failure	0.58	OK



END PLATE MOMENT CONNECTION





COVER PLATE OPTIONS

End Plate Global Forces

Shear	= V_u =	3.7	kip	Direct Moment	=	M_u (+)	=	1512.0	kip-in
Tension	= H_{ut} =	7.8	kip	Moment from Tensior	=	$H_{ut}/2 * (d_{bm} - t_f)$	=	61.0	kip-in
Compression	= H_{uc} =	34.2	kip	Eccentric Moment	=	N/A	=	0.0	kip-in
				Total Moment (+)	=	M_u (+) + Eccentric	=	1573.0	kip-in

Beam Forces

The analysis distributes the axial load in the beam by area (web and flanges both contribute).

H_{uft}	=	Concentric Tension Load in Each Beam Flange	=	3.9	kip
H_{ufc}	=	Concentric Compression Load in Each Beam Flange	=	17.1	kip
H_{uwt}	=	Concentric Tension Load in Beam Web	=	0.0	kip
H_{uwc}	=	Concentric Compression Load in Beam Web	=	0.0	kip

The moment is resolved into an effective tension-compression couple with axial forces at the beam flanges.

P_{uf} = $+/- M_u / (h - t_f)$

		Tension	Compression	
Top Flange Force, P_{uf}, from moment	=	100.6	0.0	kip
Bottom Flange Force, P_{uf}, from moment	=	0.0	100.6	kip

Bolt Group Loading

Number of Bolts at the Beam Tension Flange	N_{btf}	=	4	bolts
Number of Bolts at the Beam Compression Flange	N_{bcf}	=	4	bolts
Number of 'Stitch' Bolts (btwn Tens. & Comp. Bolts)	N_{br}	=	0	bolts
Number of 'Stitch' Bolts considered as Comp. Bolts	N_{brc}	=	0	bolts
Number of 'Stitch' Bolts considered as Tens. Bolts	N_{brt}	=	0	bolts

				Load Per Bolt	
Concentric Tension Load at					
Top Flange Bolts	=	100.6	kip	25.2	kip/bolt
Shear Load at					
Compression Bolts	=	3.7	kip	0.9	kip/bolt
Comp. Stitch Bolts (below beam mid-height)	=	0.0	kip	0.0	kip/bolt

End-Plate Yielding near the Tension Flange Bolts

M_{pl} = $F_{py}'t_p^2Y$

where

$Y = b_p/2\,[h_1\,(1/p_{fi} + 1/s) + h_0\,(1/pfo + 1/s)] + 2/g\,[h_1\,(p_f + s) + h_0\,(s + pfo)]$

b_p	=	design end plate width; min(actual width, b_{fb} + 1")	=	8.50	in
h_0	=	compression side of beam to top bolt row above flange	=	17.8	in
h_1	=	compression side of beam to top bolt row below flange	=	14.14	in
p_f	=	distance from tension flange to bolt row	=	1.50	in
s	=	$1/2\,[b_pg]^{1/2}$	=	3.42	in
		Y	=	163.82	in

M_{pl} = 50.00 x 1 ^{2} x 163.82 = 8191.0 kip-in

Column Flange Yielding near the Tension Flange Bolts

M_{cf} = $F_{yc}'t_{cf}^2Y$

(unstiffened) $Y = b_{cf}/2\,[h_1\,(1/s) + h0\,(1/s)] + 2/g\,[h_1\,(s + 3c/4)\,h0\,(s + c/4) + c^2/4] + g/2$

(stiffened) $Y = b_{cf}/2\,[h_1\,(1/s + 1/p_s) + h0\,(1/s + 1/ps)] + 2/g\,[h_1\,(s + p_s) + h0\,(s + ps)]$ Controls

s	=	$1/2\,[b_{cf}g]^{1/2}$	=	3.73	in
c	=	h0 - h1	=	3.67	in
		Y	=	211.49	in

M_{cf} = 50.00 x 0.785 ^{2} x 211.49 = 6516.1 kip-in

Bolt Rupture (No Prying Action)

M_{np} = $[\,2\,P_t\,(\Sigma d_n)\,]$

where	Pt	=	$A_b\,F_t$ = B	=	88.7	kip
	d_n	=	dist.from CL of comp. flange to nth bolt row d_0	=	17.47	in
			d_1	=	13.80	in
			M_{np}	=	5550.4	kip-in

t_{nopry} = $((1.11*.75*M_{np})/(.9*F_y*Yp))^{\wedge}.5$

End Plate	t_{nopry} =	0.79	**No prying action**
Column Flange	t_{nopry} =	0.70	**No prying action**

Bolt Prying Force for Inside & Outside Bolts at End Plate N/A

$Q_{max,i}$ = $w't_p^2/4a_i * [\,F_{py}^2 - 3\,(F_i'/w't_p)^2\,]^{1/2}$

where

w'	=	$b_p/2 - (d_b + 1/16)$	=	3.19	
a_i	=	$3.682\,(t_p/d_b)^3 - 0.085$	=	3.60	
F_i'	=	$[t_p^2F_{py}\,[0.85(b_p/2) + 0.80w'] + \pi d_b^3F_t/8] / 4p_{f,i}$	=	58.75	
		$Q_{max,i}$	=	0.00	kip
a_o	=	$\min(3.682\,(t_p/d_b)^3 - 0.085,\,L_{ev})$	=	1.50	
		$Q_{max,o}$	=	0.00	kip

Bolt Prying Force for Inside & Outside Bolts at Column Flange with Stiffener Plates N/A

$Q_{max,i}$ = $w't_{cf}^2/4a_i * [\,F_{py}^2 - 3\,(F_i'/w't_{cf})^2\,]^{1/2}$

where

w'	=	$b_p/2 - (d_b + 1/16)$	=	3.19	
a_i	=	$3.682\,(t_{cf}/d_b)^3 - 0.085$	=	1.696	
F_i'	=	$[t_{cf}^2F_{py}\,[0.85(b_p/2) + 0.80w'] + \pi d_b^3F_t/8] / 4p_{f,i}$	=	39.04	
		$Q_{max,i\,\&\,o}$	=	0.00	kip

Bolt Prying Force for Inside & Outside Bolts at Unstiffened Column Flange N/A RE: Ch 9

t_{min}	=	$[4.44Tb'/(pF_u(1+\delta\alpha'))]^{1/2}$	=	0.52	in
t	=	actual thickness (t_p or $t_{cf}+t_{cp}$)	=	0.79	in
a	=	dist. from the bolt CL to the edge of the fitting	=	1.50	in
a'	=	$(a + d_b/2)$	=	2.00	in
b	=	min (p_f , GA/2 - t_{wb}/2) @ End PL; (GA/2 - t_{wc}/2) @ Col Flg	=	1.50	in
b'	=	$b - d_b/2$	=	1.00	in
d_b	=	Bolt diameter	=	1	in
d_b'	=	width of hole along the edge of the fitting	=	1 1/16	in
p	=	min ($2p_f$+Tbf) or 3.5b	=	3.67	in
δ	=	1 - d' / p	=	0.710	in
ρ	=	b'/a'	=	0.500	in
B	=	ϕr_{nt} = $0.75 \times F_nA_b$	=	66.6	kip / bolt
t_c	=	$[4.44Bb'/ pF_u]^{1/2}$ thickness to develop the bolt	=	1.11	in
T	=	r_{ut} = Max axial tension / 4 bolts	=	25.15	kip / bolt
α	=	$1/\delta\ [\ T/B\ (t_c/t)^2 - 1] \geq 0$	=	0.00	
α'	=	min(1, 1/δ (β/(1-β)) if β < 1, 1	=	1.00	
β	=	1/ρ (B/T - 1)	=	3.293	
$Q_{max,\ I\ \&\ o}$	=	$B\ [\delta\ \alpha\ \rho\ (t/t_c)^2]$ (prying force per bolt)	=	0.00	kip / bolt

Bolt Rupture (no Prying Action)

M_q	=	max	$[2(P_t - Q_{max,o})d0 + 2(Pt-Q_{max,i})d1)]$	=	5550.4	kip-in
			$[2(P_t - Q_{max,o})d0 + 2(Tb)d1)]$	=	4867.2	kip-in
			$[2(Tb)d0 + 2(Pt-Q_{max,i})d1)]$	=	4685.8	kip-in
			$[\ 2\ T_b\ (\Sigma d_n)\ ]$	=	4002.6	kip-in

End Plate Moment Strength

ϕM_n	=	min	ϕM_{np} or ϕM_q	=	0.75	x	5550.4		=	4162.8	kip-in
			$\phi M_{pl} / \gamma_r$	=	0.90	x	8191.0	/ 1.0	=	7371.9	kip-in
			$\phi M_{cf} / \gamma_r$	=	0.90	x	6516.1	/ 1.0	=	5864.5	kip-in
								ϕM_n	**=**	**4162.8**	**kip-in**

END PLATE AT THE BEAM FLANGE

Beam Flange Tension P_u = 100.61 kip

Shear Yielding of the End Plate from Flange Tension

$\phi R_n = \phi\, 0.6\, F_{yp} b_p t_p$

= 1.0 x 0.6 x 50 x 8.5 x 1 x 2 = 510.0 kip

Shear Rupture of the End Plate from Flange Tension

$\phi R_n = \phi\, 0.6\, F_{up} b_p t_p$

= 0.75 x 0.6 x 65 x 8.5 x 1 x 2 = 497.3 kip

Weld Rupture Strength at Flange

$\phi R_w = 1.392\,(1 + 0.5\sin(90°)^{1.5})\, D\, L$

= 1.392 x 1.5 x 5 x 20.0 = 208.9 kip

At minimum, 60% of the yield strength of the beam flange must be developed (RE: 2.5.3.8, Design Guide 16)

= 0.6 x 50 x 10.20 x 0.665 = 203.5 kip

END PLATE DIRECT SHEAR DESIGN

Shear Yielding of the End Plate

$\phi R_n = \phi\, 0.6\, F_{yp} d_p t_p$

= 1.0 x 0.6 x 50 x 22.30 x 1 x 2 = 1338.0 kip

Shear Rupture of the End Plate

$\phi R_n = \phi\, 0.6\, F_{up} d_e t_p$

= 0.75 x 0.6 x 65 x 17.8 x 1 x 2 = 1041.3 kip

Shear Yielding of the Beam (Consider the web only)

$\phi R_n = \phi\, 0.6\, F_{yb} d t_w$

= 1.0 x 0.6 x 50 x 16.3 x 0.40 = 193.2 kip

Shear Capacity of the Beam to End Plate Weld

$\phi R_w = 1.392\, D\, L\, kc$ Maximum Effective Throat Factor, kc = 1.00

= 1.392 x 4 x 14.30 x 2 x 1.00 = 159.2 kip

Compression Bolt Shear Rupture Strength

$\phi R_n = n_b \phi F_v A_b$

= 4 bolts x 40.06 k/bolt = 160.2 kip

Stitch Web Bolt Rupture Under Tension

$\phi R_n = n_b \phi F_t A_b$

= 0 bolts x 66.56 k/bolt = 0.0 kip

Ru = 0.0 kips

Combined Shear and Tension D/C = 0.000

Bolt Bearing Strength of End Plate

$\phi R_n = \phi 2.4 d_b F_u t_p n_b$

= 0.75 x 2.40 x 1 x 65 x 1.00 x 4 = 468.00 kip

Bolt Bearing Strength of Column Flange

$\phi R_n = \phi 2.4 d_b F_u t_{cf} n_b$

= 0.75 x 2.40 x 1 x 65 x 0.79 x 4 = 367.38 kip

By inspection, Block Shear is not an applicable failure mode.

COLUMN CHECKS

Factored Beam Flange Forces = 100.6 kip

Column Web Yielding

$\phi R_n = \phi(C_t(6k_c + 2t_p) + N)F_{yc}t_{wc}$ — Design Guide 13 (2.2-11), Design Guide 4 (3.24)

where

ϕ	=	resistance factor	=	1.0	
C_t	=	1.0 if not at the top of a column, 0.5 if at the top of a column	=	0.5	
k_c	=		=	1.38	in
N	=	t_{fb} + 2 (groove weld reinforcement leg size)	=	1.290	in
		ϕR_n	=	125.3	kip

Column Web Compression Buckling (if applicable) — J10-8

$\phi R_n = \phi\ 24\ C_t\ t_{wc}^3\ [E\ F_{yc}]^{1/2} / h$

where

ϕ	=	resistance factor	=	0.9	
h	=	$d_c - 2k_c$ = 14.2 - 2.760	=	11.4	in
		ϕR_n	=	103.6	kip

Column Web Crippling

$\phi R_n = \phi\ 0.80\ C_t\ t_{wc}^2\ [1 + 3(N/d_c)(t_{wc}/t_{fc})^{1.5}] \times [EF_{yc}t_{fc}/t_{wc}]^{1/2}$

where capacity is reduced 50% since at the top of the column

ϕ	=	resistance factor	=	0.75	
		ϕR_n	=	108.0	kip

Column Flange Local Bending (unstiffened column)

$\phi R_n = 0.9\ (b_s / \alpha_m p_e)\ t_f^2\ Fy\ Ct$ — Design Guide 13 (2.2-9)

$b_s = 2.5\ (2\ p_f + t_{fb})$

$= 2.5 \times (2 \times 1.50 + 0.67) = 9.1625$ in

$\alpha_m = 1.36 \times (p_e / d_b)^{1/4}$

$p_e = g/2 - d_b/4 - k_1$

$= 5.5 / 2 - 1 / 4 - 1.0625 = 1.44$ in

$\alpha_m = 1.36 \times (1.44 / 1)^{1/4} = 1.49$ in

t_f = 0.785 in Fy = 50 ksi Ct = 0.5

ϕR_n = 59.3 kips

Stiffener Design Force

$F_{cu} = F_{fu} - \min \phi Rn$

= 100.6 - min | 125.3 108.0 / 103.6 59.3 | = 41.3 kip

Stiffener Checks (full height stiffener assumed)

Width at Flange = $b_{cf} / 2 - k_c$ = 10.10 / 2 - 1.0625 = 3.9875 in

Length at Web = $d_c - 2k$ = 14.2 - 2 x 1.38 = 11.44 in

Shear $t_{s\ min} \geq Ru / (1.0 * 0.6\ Fy\ (L - clip) \times 2)$

= 41.3 / 1.0 x 0.6 x 50 x 11.44 x 2 = 0.06 in

Axial $A_{st\ min} = Ru / \phi Fy$ = 41.3 / 0.90 x 50 = 0.92 in^2

$t_{s\ min} = A_{st\ min}$ / (Width * 2) = 0.11 in

$t_{st\ provided}$ = 3/8 in

Stiffener Plate Weld Rupture

ϕR_w = 1.392 D L kc   Maximum Effective Throat Factor, kc = 1.00

= 1.392 x 4 x 45.76 x 1.00 = 254.8 kip

Column Panel Zone Shear Strength

Concentrated Force = $(P_{uf})_1 + (P_{uf})_2$

where

$P_{uf,1}$ = Concentrated load from Beam Flange = 100.6

Column Axial Load Pu = 7.0 kip

Py = FyAg column   Py = 1090 kip

Pu/Py = 0.01

ϕR_v = $\phi\ 0.6 F_y d_c (t_w + t_{dp})$ if Pu ≤ 0.4 Pc

= 0.9 * 0.6 x 50 x 14.2 x 0.450 = 172.5 kip **Controls**

ϕR_v = $\phi\ 0.6 F_y d_c (t_w + t_{dp}) (1.4 - P_u/P_y)$ if Pu > 0.4 Pc

= 172.5 x (1.4 - 0.01) = 240.4 kip

<u>Cover Plate Weld</u>

Cover plate designed to act composite with beam flange

Horizontal Shear Stress

v_u =VQ/I_x = 0.00 kips/in

Total Horizontal Shear Stress Along Plate Interface = vu*(g/2-tw/2) = 0.0 kips

Where

V = Bolt Tension = 50.30 kips

Q = tcp*(tf+tcp/2-ybar) 0 in^3/in

Ybar = $(t_f*t_f/2+t_{cp}*(t_f+t_{cp}/2))/(t_f+t_{cp})$ = 0.3925 in From Bottom Flange

I_x = $((t_f+t_{cp})^3)/12$ 0.04031 in^4/in

Neutral Axis In Bottom Flange

Available Fillet Weld Length, 3 sides of plate

L = 2g+g/2*2+2*Leh+(2*Pf+Tf) = 23 1/6 in

Horiz Shear per unit length = 0.00 k/in

Vert Shear per unit length, V (Bolt tension) / [(g/2)+leh]*2 = 0.00 k/in

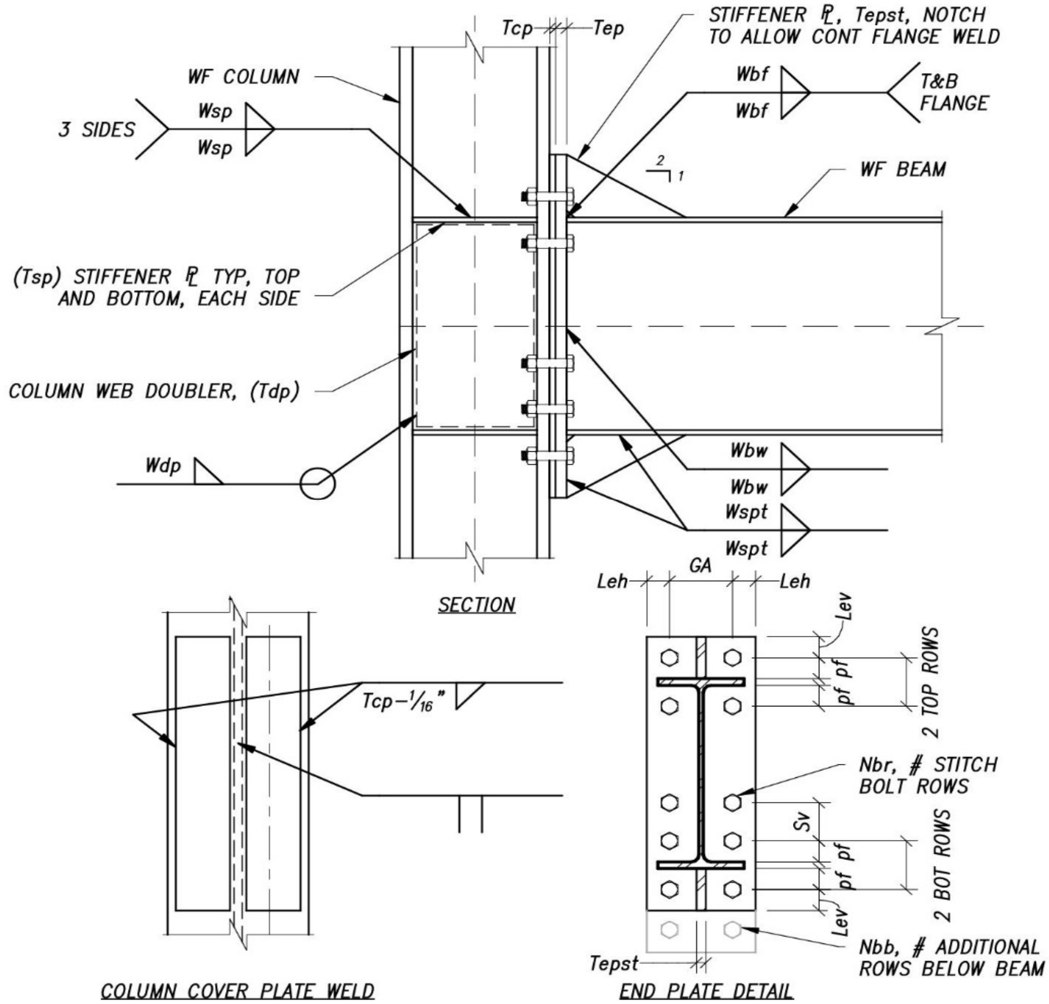
Resultant = 0.00 k/in

Weld ϕRn = $(tcp-1/16)*1.39\ kips/16th*16*(1+\sin(\theta))^{1.5}$

= 0 x 1.394 x 16 x #DIV/0! = #DIV/0! kips/in

Ru / ϕRn = 0.00

Connection Description: WF Beam over top of WF Column Cap Plate



Bolt (Quantity)Type	=	8	A490-N Fully Tensi	Vertical Edge Dist., L_{ev}	=	1.5	in
Bolt Diameter	=	1	in	Horizontal Edge Dist., L_{eh}	=	1.5	in
Bolt Hole Type	=	STD		Bolt Columns, N_{bc}	=	2	
Bolt Pitch, p_f	=	1 1/2	in	Stitch Bolts Rows, N_{br}	=	0	
Bolt spacing, S_v, S_h	=	3.0	in	Add Bolt Rows Below, N_{bb}	=	0	
Bolt Gage, GA	=	5.5	in	Weld, W_{bw}	=	1/4	in
End Plate, t_{ep}	=	1	in	Weld, W_{bf}	=	5/16	in
End Plate Width	=	8.50	in	Weld, W_{sp}	=	1/4	in
Col. Flg Plate, t_{cp}	=	0	in	Weld, W_{cp}	=	0	in
Col. Web Doubler, T_{dp}	=	0	in	Weld, W_{spt}	=	3/8	in
Column Stiffeners, t_{sp}	=	3/8	in	Weld, W_{dp}	=	0	in

www.hilti.com

Company:
Address:
Phone I Fax: |
Design: Moment Frame with Overstrength Loads
Fastening point:

Specifier:
E-Mail:
Date: 11/8/2022

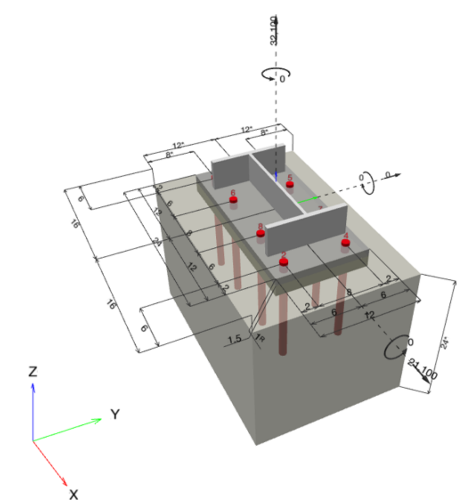
Specifier's comments:

1 Input data

Anchor type and diameter:	**Heavy Hex Head ASTM F 1554 GR. 105 1**
Item number:	not available
Additional plate or washer (17.4.2.8):	d_{plate} = 2.000 in., t_{plate} = 0.250 in.
Effective embedment depth:	h_{ef} = 12.000 in., $h_{ef,17.4.2.8}$ = 0.000 in.
Material:	ASTM F 1554
Evaluation Service Report:	Hilti Technical Data
Issued I Valid:	- | -
Proof:	Design Method ACI 318-14 / CIP
Stand-off installation:	without clamping (anchor); restraint level (anchor plate): 2.00; e_b = 1.500 in.; t = 1.000 in.
	Hilti Grout: CB-G EG, epoxy, $f_{c,Grout}$ = 14,939 psi
Anchor plate^R :	l_x x l_y x t = 24.000 in. x 12.000 in. x 1.000 in.;
Profile:	W shape (AISC), W16X67; (L x W x T x FT) = 16.300 in. x 10.200 in. x 0.395 in. x 0.665 in.
Base material:	cracked concrete, 4000, f_c' = 4,000 psi; h = 24.000 in.
Reinforcement:	tension: condition A, shear: condition A; anchor reinforcement: tension, shear
	edge reinforcement: > No. 4 bar with stirrups
	Corner reinforcement acc. to ACI 318-14 Section 17.5.2.3 (c) present
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.2.3.4.3 (d))
	Shear load: yes (17.2.3.5.3 (c))

^{R} - The anchor calculation is based on a rigid anchor plate assumption.

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



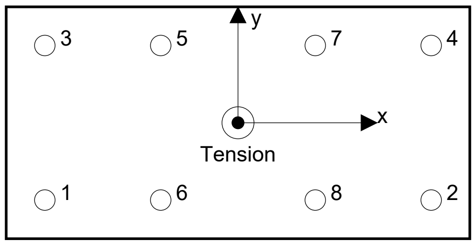
Company:		Page:	2
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Moment Frame with Overstrength Loads	Date:	11/8/2022
Fastening point:			

1.1 Load combination and design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Tmax, V_	N = -48,800; V_x = 21,400; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	yes	55
2	Vmax, C_	N = 32,100; V_x = 21,100; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	yes	58

2 Load case/Resulting anchor forces

Controlling load case: 2 Vmax, C_



Anchor reactions [lb]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	4,012	2,638	2,638	0
2	4,012	2,638	2,638	0
3	4,012	2,638	2,638	0
4	4,012	2,638	2,638	0
5	4,012	2,638	2,638	0
6	4,012	2,638	2,638	0
7	4,012	2,638	2,638	0
8	4,012	2,638	2,638	0

max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [psi]
resulting tension force in (x/y)=(0.000/0.000): 32,100 [lb]
resulting compression force in (x/y)=(0.000/0.000): 0 [lb]

Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	4,012	56,812	8	OK
Pullout Strength*	4,012	25,217	16	OK
Concrete Breakout Failure**[1]	N/A	N/A	N/A	N/A
Concrete Side-Face Blowout, direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (anchors in tension)
[1] Tension Anchor Reinforcement has been selected!

Company:		Page:	3
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Moment Frame with Overstrength Loads	Date:	11/8/2022
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]
0.61	125,001

Calculations

N_{sa} [lb]
75,750

Results

N_{sa} [lb]	ϕ_{steel}	ϕN_{sa} [lb]	N_{ua} [lb]
75,750	0.750	56,812	4,012

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	1.50	1.000	4,000

Calculations

N_p [lb]
48,032

Results

N_{pn} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{pn} [lb]	N_{ua} [lb]
48,032	0.700	0.750	1.000	25,217	4,012

4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi\ V_n$	Status
Steel Strength*	2,638	23,634	12	OK
Steel failure (with lever arm)*	2,638	4,601	58	OK
Pryout Strength**	21,100	72,632	30	OK
Concrete edge failure in direction **[1]	N/A	N/A	N/A	N/A

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

[1] Shear Anchor Reinforcement has been selected!

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]
0.61	125,001

Calculations

V_{sa} [lb]
45,450

Results

V_{sa} [lb]	ϕ_{steel}	ϕ_{eb}	$\phi\ V_{sa,eq}$ [lb]	V_{ua} [lb]
45,450	0.650	0.800	23,634	2,638

Company:		Page:	5
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Moment Frame with Overstrength Loads	Date:	11/8/2022
Fastening point:			

4.2 Steel failure (with lever arm)

V_s^M	$= \frac{\alpha_M \cdot M_s}{L_b}$	bending equation for stand-off
M_s	$= M_s^0 \left(1 - \frac{N_{ua}}{\phi N_{sa}}\right)$	resultant flexural resistance of anchor
M_s^0	$= (1.2)\ (S)\ (f_{u,min})$	characteristic flexural resistance of anchor
$\left(1 - \frac{N_{ua}}{\phi N_{sa}}\right)$		reduction for tensile force acting simultaneously with a shear force on the anchor
S	$= \frac{\pi (d)^3}{32}$	elastic section modulus of anchor bolt at concrete surface
L_b	$= z + (n)(d_0)$	internal lever arm adjusted for spalling of the surface concrete
ϕV_s^M	$\geq V_{ua}$	ACI 318-14 Table 17.3.1.1

Variables

α_M	$f_{u,min}$ [psi]	N_{ua} [lb]	ϕN_{sa} [lb]	z [in.]	n	d_0 [in.]
2.00	125,001	4,012	56,812	2.000	0.500	1.000

Calculations

M_s^0 [in.lb]	$\left(1 - \frac{N_{ua}}{\phi N_{sa}}\right)$	M_s [in.lb]	L_b [in.]
9,521	0.929	8,849	2.500

Results

V_s^M [lb]	ϕ_{steel}	ϕV_s^M [lb]	V_{ua} [lb]
7,079	0.650	4,601	2,638

4.3 Pryout Strength

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

$\phi\ V_{cpg} \geq V_{ua}$ 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)

$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2\ e'_N}{3\ h_{ef}}} \right) \leq 1.0$ ACI 318-14 Eq. (17.4.2.4)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5h_{ef}} \right) \leq 1.0$ 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

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	5.333	0.000	0.000	6.000

$\psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f'_c [psi]
1.000	∞	24	1.000	4,000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
768.00	256.00	1.000	1.000	0.925	1.000	18,696

Results

V_{cpg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	$\phi\ V_{cpg}$ [lb]	V_{ua} [lb]
103,761	0.700	1.000	1.000	72,632	21,100

5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.159	0.573	5/3	45	OK

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

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!
- User is responsible for evaluating the hole bearing capacity in case of shear forces.
- 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.
- ACI 318 does not specifically address anchor bending when a stand-off condition exists. PROFIS Engineering calculates a shear load corresponding to anchor bending when stand-off exists and includes the results as a shear Design Strength!
- For additional information about ACI 318 strength design provisions, please go to https://submittals.us.hilti.com/PROFISAnchorDesignGuide/
- An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-14, Chapter 17, Section 17.2.3.4.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Section 17.2.3.4.3 (b), Section 17.2.3.4.3 (c), or Section 17.2.3.4.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.2.3.5.3 (a), Section 17.2.3.5.3 (b), or Section 17.2.3.5.3 (c).
- Section 17.2.3.4.3 (b) / Section 17.2.3.5.3 (a) require the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength. Section 17.2.3.4.3 (c) / Section 17.2.3.5.3 (b) waive the ductility requirements and require the anchors to be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment. Section 17.2.3.4.3 (d) / Section 17.2.3.5.3 (c) waive the ductility requirements and require the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by ω_0.
- The design of Anchor Reinforcement is beyond the scope of PROFIS Engineering. Refer to ACI 318-14, Section 17.4.2.9 for information about Anchor Reinforcement.
- The design of Anchor Reinforcement is beyond the scope of PROFIS Engineering. Refer to ACI 318-14, Section 17.5.2.9 for information about Anchor Reinforcement.
- Anchor Reinforcement has been selected as a design option, calculations should be compared with PROFIS Engineering calculations.

Fastening meets the design criteria!

7 Anchor plate and concrete bearing stress check

	Load	Capacity	Utilization [%]	Status
Concentric Compression	N/A	N/A	N/A	N/A
Concrete bearing	N/A	N/A	N/A	N/A
Tension Interface	4,742.62 [in.lb/in.]	8,099.99 [in.lb/in.]	59	OK
Uniaxial Moment (Strong Axis)	N/A	N/A	N/A	N/A
Uniaxial Moment (Weak Axis)	N/A	N/A	N/A	N/A

7.1 Plate bending, tension (per AISC DG1, sections 3.2, 3.3)

$$m = \frac{N-0.95d}{2}$$

$$n = \frac{B-0.80b_f}{2}$$

$$M_{pl} = \frac{T_{u1} \cdot x_1}{b_{eff1}} + \frac{T_{u2} \cdot x_2}{b_{eff2}}$$

$$\phi M_n = \phi \cdot F_y \cdot \frac{t_p^2}{4}$$

$$M_{pl} \leq \phi M_n$$

Variables

B [in.]	N [in.]	d [in.]	b_f [in.]	F_y [psi]
12.000	24.000	16.300	10.200	36,000

ϕ	t_p [in.]	P_u [lb]	M_u [in.lb]
0.900	1.000	32,100	0

Calculations

m [in.]	n [in.]
4.257	1.920

T_{u1} [lb]	x_1 [in.]	b_{eff1} [in.]
4,012	3.742	5.742

T_{u2} [lb]	x_2 [in.]	b_{eff2} [in.]
4,012	2.258	4.257

Results

M_n [in.lb/in.]	ϕ	ϕM_n [in.lb/in.]	M_{pl} [in.lb/in.]
8,999.99	0.900	8,099.99	4,742.62

8 Installation data

Profile: W shape (AISC), W16X67; (L x W x T x FT) = 16.300 in. x 10.200 in. x 0.395 in. x 0.665 in.

Hole diameter in the fixture: d_f = 1.062 in.

Plate thickness (input): 1.000 in.

Anchor type and diameter: Heavy Hex Head ASTM F 1554 GR. 105 1

Item number: not available

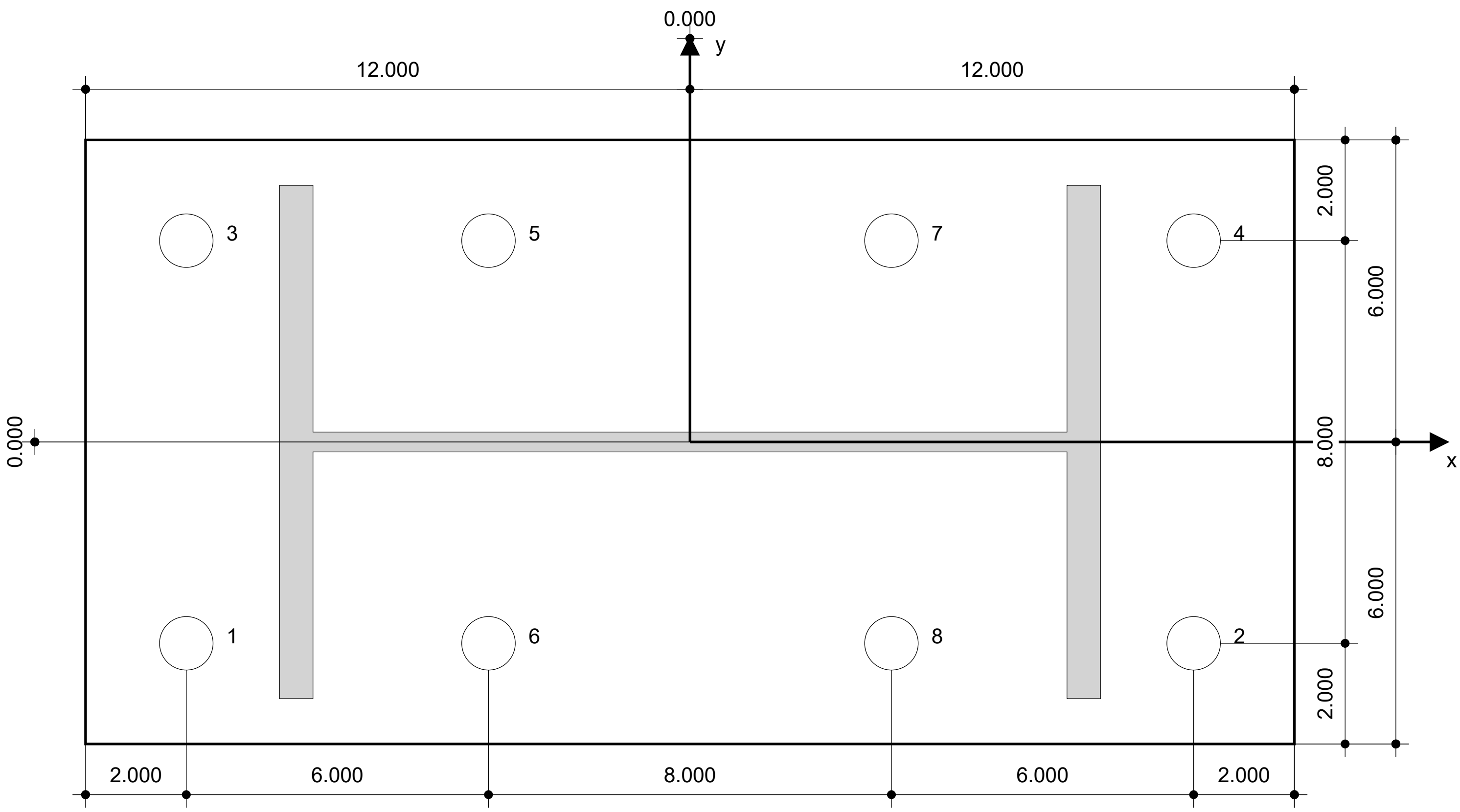
Maximum installation torque: -

Hole diameter in the base material: - in.

Hole depth in the base material: 12.000 in.

Minimum thickness of the base material: 13.172 in.

Hilti Heavy Hex Head headed stud anchor with 12 in embedment, 1, Steel galvanized, installation per instruction for use



Coordinates Anchor in.

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-10.000	-4.000	6.000	26.000	8.000	16.000
2	10.000	-4.000	26.000	6.000	8.000	16.000
3	-10.000	4.000	6.000	26.000	16.000	8.000
4	10.000	4.000	26.000	6.000	16.000	8.000

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
5	-4.000	4.000	12.000	20.000	16.000	8.000
6	-4.000	-4.000	12.000	20.000	8.000	16.000
7	4.000	4.000	20.000	12.000	16.000	8.000
8	4.000	-4.000	20.000	12.000	8.000	16.000

Company:		Page:	10
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Moment Frame with Overstrength Loads	Date:	11/8/2022
Fastening point:			

9 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.

A-100 GEOTECHNICAL REPORT

NorthWest Colorado Consultants, Inc.
Geotechnical / Environmental Engineering • Materials Testing

February 7, 2022

FV Basecamp, LLC
c/o May Riegler Properties
2201 Wisconsin Ave., Suite 200
Washington DC 20007

Attn: Gaby Riegler

Job Number: 20-11961

Subject: Additional Geotechnical Recommendations, Steamboat Basecamp, Lots 1 and 2, Worldwest Subdivision, Steamboat Springs, Colorado.

Gaby,

As requested, NWCC, Inc. (NWCC) has completed this Additional Geotechnical Recommendations report for the proposed Steamboat Basecamp to be constructed within Lots 1 and 2 of the Worldwest Subdivision in Steamboat Springs, Colorado. A Subsoil Investigation report was prepared for a proposed retail building under NWCC's Job Number 95-2241, dated June 27, 1995 within Lot 3, Block 1 of the Curve Subdivision. A Subsoil and Foundation Investigation report was prepared for a proposed building in the northeast corner of the property under NWCC's Job Number 07-7550, dated July 27, 2007. A Supplemental Subsurface Investigation and Geotechnical Recommendations report was completed for the site under this job number and dated March 15, 2021.

Proposed Construction: Based on our discussions with the client and Peter Kelly of KL&A, NWCC understands the renovation of the existing building will consist of a five-story wood framed constructed in the southeast portion of the building. Isolated interior pads will be constructed under the existing concrete slab to support the upper floors.

Additional Geotechnical Design Recommendations: The structural engineer, Peter Kelly of KL&A, has requested a modulus of subgrade reaction for the soils at the existing structure as well as increasing the allowable soil bearing pressure for short term transient loads (wind/seismic).

NWCC recommends a modulus of subgrade reaction of 200 pounds per cubic inch may be used in the design of the foundations. The allowable bearing capacity of 3,000 psf recommended in our previous reports may be increased by 1/3 for transient loads.

(970) 879-7888 • Fax (970) 879-7891
2580 Copper Ridge Drive • Steamboat Springs, CO 80487

If you have any questions regarding this report or if we may be of further service, please do not hesitate to contact us.

Sincerely,
NWCC, INC.,

Timothy S. Travis, P.E.
Senior Project Engineer

Reviewed by Brian D. Len, P.E.
Principal Engineer

COLORADO LICENSED BRIAN D. LEN 25750 2/7/2022 PROFESSIONAL ENGINEER

cc: Peter Kelly-KL&A

NorthWest Colorado Consultants, Inc.
Geotechnical / Environmental Engineering • Materials Testing

March 15, 2021

FV Basecamp, LLC
c/o May Riegler Properties
2201 Wisconsin Ave., Suite 200
Washington DC 20007

Attn: Gaby Riegler

Job Number: 20-11961

Subject: Supplemental Subsurface Investigation and Geotechnical Recommendations, Steamboat Basecamp, Lots 1 and 2, Worldwest Subdivision, Steamboat Springs, Colorado.

Gaby,

As requested, NWCC, Inc. (NWCC) has completed this Supplemental Subsurface Investigation and Geotechnical Recommendations report for the proposed Steamboat Basecamp to be constructed within Lots 1 and 2 of the Worldwest Subdivision in Steamboat Springs, Colorado. A Subsoil Investigation report was prepared for a proposed retail building under NWCC's Job Number 95-2241, dated June 27, 1995 within Lot 3, Block 1 of the Curve Subdivision. A Subsoil and Foundation Investigation report was prepared for a proposed building in the northeast corner of the property under NWCC's Job Number 07-7550, dated July 27, 2007. These reports were used in the preparation of this report as well as information from a Supplemental Subsurface Investigation completed at the site on November 11, 2020.

Proposed Construction: Based on our discussions with the client and Jake Mielke with Steamboat Engineering and Design, NWCC understands the project will consist of the renovation of the existing building and the construction of several multi-family residential and mixed use buildings, as well as several garage buildings in three phases.

The existing building will be remodeled for mixed commercial/residential use in Phase I of the project. A two-story addition will be constructed in the southeast portion of the building. Isolated interior pads will be constructed under the existing concrete slab to support the upper floors. A small addition will also be constructed in the northwest portion of the building. We have assumed that the addition will be constructed with a concrete slab-on-grade floor system placed near the existing ground surface.

Phase 2 of the project will consist of the construction of a multi-family building with 21 units and a commercial area in the northwest corner. Phase 3 of the project will consist of two multi-family units with separate garage structures within Lot 2 of the Worldwest Subdivision. We understand the buildings will consist of one to four story wood framed structures with the lower levels constructed with concrete slab on grade floor systems and/or crawlspaces. NWCC has assumed the lower levels of the buildings will be

(970) 879-7888 • Fax (970) 879-7891
2580 Copper Ridge Drive • Steamboat Springs, CO 80487

constructed at or above the existing ground surface. NWCC has assumed site grading will include minor unretained cuts and fills of less than 6 feet in height.

Subsurface Conditions: To investigate the subsurface conditions at the site, six test holes were advanced in the area of the existing building for the investigation completed in 1995. Three additional test holes were drilled within Lot 2 for the investigation completed in 2007. Four test pits were advanced within Phase 2 and 3 on November 11, 2020 with a Komatsu PC238 trackhoe. A site plan showing the approximate test hole and pit locations is presented in Figure #1.

The subsurface conditions encountered in the test holes and test pits were variable and generally consisted of variable layers of fill materials overlying natural topsoil and organic materials, natural clays and natural sands and gravels to the maximum depth investigated, 15 feet below the existing ground surface (bgs). It should be noted that practical rig refusal was encountered in the test holes on cobbles at depths ranging from 8 to 15 feet bgs. Graphic logs of the exploratory test holes and test pits are presented in Figures #2, #3 and #4. The associated Legend and Notes are presented in Figure #5.

A thin layer of topsoil and organic fill materials was encountered at the ground surface in Test Pits 1 through 4 and was approximately 3 to 6 inches in thickness. Sand and gravel fill materials were encountered below the topsoil fill materials in Test Pits 1 and 2 and were approximately 12 to 30 inches in thickness. The sand and gravel fill materials were silty to clayey, low to non-plastic, medium dense, moist and brown in color. Clay fill materials were encountered at the existing ground surface in Test Holes 3, 4, 5, 7, 8 and 9; below the topsoil fill materials in Test Pits 3 and 4; and below the sand and gravel fill materials in Test Pit 1. The clay fill materials ranged from approximately 1 to 6 feet in thickness. The clay fill materials were sandy with occasional gravels and debris, low to highly plastic, medium stiff to soft, moist and brown in color.

A layer of natural topsoil and organic materials was encountered at the ground surface in Test Holes 1, 2, and 6 and below the fill materials in Test Holes 3, 4, and 5 and Test Pits 2 and 3. The layer of natural topsoil and organic materials was approximately 3 to 18 inches in thickness.

Natural clays were encountered below the natural topsoil materials in Test Holes 1, 3, 4, 5, 6 and Test Pits 2 and 3, and below the clay fill materials in Test Holes 8 and 9, and Test Pits 1 and 4 at depths ranging from 1 ½ to 5 feet bgs. The natural clays extended to depths ranging from 2 ½ to 12 feet bgs. The natural clays were slightly sandy to sandy, moderately to highly plastic, stiff, moist and brown in color. Samples of the natural clays classified as CL to CH soils in accordance with the Unified Soil Classification System (USCS).

Natural sands and gravels were encountered below the natural topsoil and organic materials in Test Hole 2, below the fill materials in Test Hole 7 and below the natural clays in Test Holes 1, 3, 4, 5, 6, 8 and 9, and Test Pits 1, 2, 3 and 4. The natural sands and gravels were encountered at depths ranging from 6 inches to 12 feet bgs in all of the test holes and test pits. The sands and gravels extended to the maximum depth investigated in each test hole and test pit. The natural sands and gravels were silty to slightly clayey, fine to coarse grained with cobbles and small boulders, very low to non-plastic, dense, moist to wet and brown to gray in color. Samples of the natural gravels classified as SM to GM soils in accordance with the USCS.

Swell-consolidation tests conducted on samples of the natural clays from the previous investigations indicate these materials exhibited a moderate to high swell potential when wetted under a constant load.

Groundwater was encountered at depths ranging from 7 to 10 feet bgs in the Test Holes 1 through 6 at the time of drilling. These test holes were drilled on May 25, 1995, which was likely near the seasonal high groundwater table. Groundwater seepage was not encountered in any of the other test holes or pits at the time of drilling/excavation. It should be noted that the groundwater conditions at the site can be expected to fluctuate with changes in precipitation and runoff and flows in the Yampa River, located approximately 1,000 feet to the south.

During construction of the existing building all of the existing fill materials, topsoil and organic materials and natural clays were removed from under the foundations. Structural fill materials consisting of ¾-inch washed rock materials were compacted under the footings. The structural fill materials were compacted to a minimum of 80 percent of the maximum relative density of the materials.

Foundation Recommendations: Based on a review of the Subsoil and Foundation (NWCC, 2007) and Subsoil Investigation (NWCC, 1995) reports, the subsurface conditions encountered in the recent test pits NWCC anticipates that the natural sands and gravels will be encountered from 5 to 12 feet below the existing ground surface. Due to the highly variable depth of the existing fill materials and the swell potential of the natural clays, NWCC believes the most economically feasible building foundation systems will consist of footings placed on properly compacted structural fill materials placed over the natural sands and gravels after all of the existing fill materials and underlying topsoil and organic materials, and natural clays are removed. Due to the moderate to high swell potential of the clays, NWCC recommends these materials be removed from beneath the footings.

NWCC recommends the footings placed on the natural sands and gravels or on properly compacted, structural fill materials placed over the natural sands and gravels be designed using a maximum allowable soil bearing pressure of 3,000 psf. NWCC recommends structural fill materials placed under the footings consist of a non-expansive granular soil approved by this office. Footings placed on the natural sands and gravels or on non-expansive granular fill placed over the natural sands and gravels will not require a minimum dead load.

Structural fill materials should be uniformly placed in 6 to 8 inch loose lifts and compacted to at least 100 percent of the maximum standard Proctor density, within 2 percent of the optimum moisture content as determined by ASTM D-698. Structural fill materials should extend out from the edge of the footings on a 1(horizontal) to 1(vertical) or flatter slope.

NWCC recommends a **Site Class C** designation be used in structural design calculations in accordance with Table 20.3-1 in Chapter 20 of ASCE 7.

Alternate Foundation Recommendations: If the removal of all of the existing fill materials and natural clays is not economically feasible, an alternative deep foundation system for the buildings would be to place the buildings on deep foundation systems consisting of helical screw piles advanced into the natural sands and gravels. High capacity helical piles or pile groups with pile caps will most likely be required for the buildings due to anticipated loadings. The helical screw pile foundations will place the bottom of the foundations in a zone of relatively stable bearing soils and eliminate the risk of foundation movement from swell and/or consolidation of the existing fill materials and natural clays.

Utilizing this type of foundation, each column is supported on a single or group of screw piles and the structures are founded on grade beams or pier caps that are supported by a series of piles. Load applied to the piles is transmitted to the natural sands and gravels through the end bearing pressure at the helices of the screw pile. Foundation movement should be less than ½-inch if the following design and construction conditions are observed.

The helical screw pile foundation system should be designed by a qualified engineer, using industry standards and be installed by a licensed/certified installer. If pile groups are required, we recommend a minimum pile spacing of 3 times the largest helix to achieve the maximum capacity of each individual pile. Lateral loads should be resisted using battered piles or tiebacks or through passive soil pressures against foundation walls or grade beams.

We strongly recommend that at least two test piles be advanced at each building site so that the torque versus depth relationships can be established and the proper shaft and helix size and type can be determined. In addition, load testing of the helical screw piles is strongly recommended to verify the design capacity of the piles. Difficult installation should be anticipated due to the presence of cobbles and boulders in the fill materials.

A representative of this office should observe the test piles/load test and helical screw pile installations.

NWCC also recommends the following:

- Minimum 10-inch diameter helix;
- Minimum installation torque of 4,000 ft-lbs;
- Full-time installation observation by a qualified special inspector;
- Review of the Contractor's quality control plan regarding instrumentation calibration and testing, materials QC, and pile installation procedures.

An alternative deep foundation system would consist of rammed aggregate piers (RAP). The rammed aggregate piers are typically constructed to bridge poor bearing soils, such as the existing fill materials and natural clays encountered at this site, extending down to a suitable bearing layer, the underlying natural sands and gravels. A RAP foundation system should develop an end bearing pressure of at least 4,000 psf for aggregate piers founded in the sand and gravels. A RAP foundation system has the advantage of not only supporting shallow foundation elements, but also supporting floor slab areas and improving the engineering characteristics of the existing fill materials and native soils between the piers, thus decreasing the potential for floor slab movement and eliminating the need for structural slabs or structural floors over crawlspaces.

RAP foundation elements are designed as proprietary foundation systems. If a RAP foundation system is selected, NWCC should be contacted to coordinate with the RAP contractor/design team during foundation design.

Floor Slabs: NWCC has assumed the lower levels of the buildings will most likely be constructed with concrete slab-on-grade floor systems placed near the existing grades. The natural soils, excluding the existing fill materials and topsoil and organic materials, are capable of supporting slab-on-grade construction. However, floor slabs present a very difficult problem where swelling materials are present near floor slab elevation because sufficient dead load cannot be imposed on them to resist the uplift pressure generated when the materials are wetted and expand. Based on the moisture-volume change characteristics of the natural clays encountered at this site, NWCC believes slab-on-grade construction may be used, provided the risk of distress resulting from slab movement is recognized and special design precautions are followed.

The following measures must be taken to reduce damage, which could result from movement should the underslab clays are subjected to moisture changes.

1) Floor slabs must be separated from all bearing walls; columns and their foundation support with a positive slip joint. NWCC recommends the use of ½-inch thick cellotex or impregnated felt.

2) Interior non-bearing partition walls resting on the floor slabs must be provided with a slip joint, preferably at the bottom, so in the event, the floor slab moves this movement is not transmitted to the upper structure. This detail is also important for wallboard and doorframes and is shown in Figure #6. This detail can be omitted if all of the clays are removed from beneath the floor slabs.

3) A minimum 6-inch gravel layer must be provided beneath all floor slabs to act as a capillary break and to help distribute pressures. Prior to placing the gravel, excavation should be shaped so that if water does get under the slab, it will flow to the low point of the excavation. In addition, all existing fill materials and topsoil and organic materials should be removed prior to placement of the underslab gravels or new granular fill materials. If the removal of all of the existing fill materials and topsoil and organics and replacing with granular fill materials is not economically feasible, we recommend the lower levels be constructed on structural floor systems over a crawlspace.

4) Floor slabs must be provided with control joints placed a maximum of 10 to 12 feet on center in each direction, depending on slab configurations, to help control shrinkage cracking. Locations of the joints should be carefully checked to assure that natural, unavoidable cracking will be controlled. Depth of the control joints should be a minimum of ¼ the thickness of the slab.

5) Underslab soils must be kept as close as possible to their in-situ moisture content. Excessive wetting or drying of these soils prior to placement of floor slab could result in differential movement after slabs are constructed.

6) It has been NWCC's experience that the risk of floor slab movement can be reduced by removing at least 2 feet of the expansive soils and replacing them with a well compacted, non-expansive fill. If this is done or if fills are required to bring underslab areas to the desired grade, the fill should consist of non-expansive, granular materials. Fill should be uniformly placed and compacted in 6 to 8-inch lifts to at least 95% of the maximum standard Proctor density at or near the optimum moisture content, as determined by ASTM D-698.

Following the above precautions and recommendations will not prevent floor slab movement in the event the clays beneath the floor slabs undergo moisture changes. However, they should reduce the amount of damage if such movement occurs. The only way to eliminate the risk of all floor slab movement is to construct a structural floor over a well-vented crawl space or void form materials or remove all of the expansive clays and replace them with non-expansive granular fill materials.

Foundation Walls and Retaining Structures: Foundation walls and retaining structures, which are laterally supported and can be expected to undergo only a moderate amount of deflection, may be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of 45 pcf for imported, free draining granular backfill and 55 pcf for on-site soils.

Cantilevered retaining structures at the site can be expected to deflect sufficiently to mobilize full active earth pressure condition. Therefore, cantilevered structures may be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of 35 pcf for imported, free draining granular backfill and 45 pcf for on-site soils.

Foundation walls and retaining structures should be designed for appropriate hydrostatic and surcharge pressures such as adjacent buildings, traffic and construction materials. An upward sloping backfill and/or natural slope will also significantly increase earth pressures on foundation walls and retaining structures and the structural engineer should carefully evaluate these additional lateral loads when designing foundation and retaining walls.

Lateral resistance of retaining wall foundations placed on undisturbed natural soils at the site will be a combination of sliding resistance of the footings on the foundation materials and passive pressure against the sides of footings. Sliding friction can be taken as 0.4 times the vertical dead load. Passive pressure against the sides of the footing can be calculated using an equivalent fluid pressure of 250 pcf. Fill placed against the sides of footings to resist lateral loads should be compacted to at least 100% of the maximum standard Proctor density and near the optimum moisture content.

NWCC recommends imported granular soils for backfilling foundation walls and retaining structures because their use results in lower lateral earth pressures. Imported granular materials should be placed to within 2 to 3 feet of the ground surface. Imported granular soils should be free draining and have less than 7 percent passing the No. 200 sieve. Granular soils placed behind foundation and retaining walls should be sloped from the base of the wall at an angle of at least 45 degrees from the vertical. The upper 2 to 3 feet of fill should be a relatively impervious soil or pavement structure to prevent surface water infiltration into the backfill.

Wall backfill should be carefully placed in uniform lifts and compacted to at least 95 percent of the maximum standard Proctor density and near the optimum moisture content. Care should be taken not to overcompact backfill since this could cause excessive lateral pressure on the walls. Some settlement of deep foundation wall backfill materials will occur even if materials are placed correctly.

Underdrain System: Any floor levels constructed below the existing or finished ground surfaces and the foundations should be protected by underdrain systems to help reduce the problems associated with surface and subsurface drainage during high runoff periods. If any level is placed within 2 feet of the seasonal high groundwater table, a permanent/full-time dewatering system may be required in the lower level. NWCC must be consulted to provide or review the design of a dewatering system.

Localized perched water or runoff can infiltrate the lower levels of the structures at the foundation levels. This water can be one of the primary causes of differential foundation and slab movement. Especially, when expansive soils are encountered. Excessive moisture in crawl space areas or lower level can also lead to rotting and mildewing of wooden structural members and the formation of mold and mold spores. Formation of mold and mold spores could have detrimental effects on the air quality in these areas, which in turn can lead to potential adverse health effects.

Drains should be located around the entire perimeter of the lower levels and be placed and at least 12 inches below any floor slab or crawl space levels and at least 6 inches below the bottom of the foundation walls or footings. NWCC recommends the use of perforated PVC pipe for the drainpipe, which meets or exceeds ASTM D-3034/SDR 35 requirements, to minimize the potential for pipe crushing during backfill operations. Holes in the drainpipe should be oriented down between 4 o'clock and 8 o'clock to promote rapid runoff of water. Drainpipe should be surrounded with at least 12 inches of free-draining gravel and should be protected from contamination by a filter covering of Mirafi 140N subsurface drainage fabric or an equivalent product. Drains should have a minimum slope of 1/8 inch per foot and be daylighted at positive outfalls protected from freezing or be led to sumps from which water can be pumped. The use of interior laterals, multiple daylights, or sumps will likely be required for the proposed structure. Caution should be taken when backfilling so as not to damage or disturb the installed underdrain. NWCC recommends the drainage system include a cleanout every 100 feet, be protected against intrusion by animals at outfalls, and be tested prior to backfilling. NWCC also recommends the client retain our firm to observe the underdrain systems during construction to verify that they are being installed in accordance with recommendations provided in this report and observe a flow test prior to backfilling the system.

In addition, NWCC recommends an impervious barrier be constructed to keep water from infiltrating under the footings and/or foundation walls. The barrier should be constructed of an impervious material, which is approved by this office and placed below the perimeter drain and up against the sides of the foundation walls. A typical perimeter/underdrain detail is shown in Figure #7.

Surface Drainage: Proper surface drainage at this site is of paramount importance for minimizing infiltration of surface drainage into wall backfill and bearing soils, which could result in increased wall pressures, differential foundation, and slab movement. The following drainage precautions should be observed during construction and at all times after the structures have been completed:

1) Ground surface surrounding structures should be sloped (minimum of 1.0 inch per foot) to drain away from structures in all directions to a minimum of 10 feet. Ponding must be avoided. If necessary, raising the top of foundation walls to achieve a better surface grade is advisable.

2) Non-structural backfill placed around structures should be compacted to at least 95% of the maximum standard Proctor density at or near the optimum moisture content to minimize future settlement of the fill. Backfill should be placed immediately after the braced foundation walls are able to structurally support the fill. Puddling or sluicing must be avoided.

3) Top 2 to 3 feet of soil placed within 10 feet of foundations should be impervious in nature to minimize infiltration of surface water into wall backfill.

4) Roof downspouts and drains should discharge well beyond the limits of all backfill. Roof overhangs, which project two to three feet beyond foundation walls, should be considered if gutters are not used.

5) Landscaping, which requires excessive watering and lawn sprinkler heads, should be located a minimum of 10 feet from the foundation walls of the structures or any permanent, unretained cuts. Additionally, large piles of man-made or natural snow should be removed prior to melting within 10 feet of the foundation walls of the structures or any permanent, unretained cuts.

6) Plastic membranes should not be used to cover the ground surface adjacent to foundation walls.

Site Grading: Temporary cuts for foundation construction should be constructed to OSHA standards for temporary excavations. Permanent, unretained cuts should be kept as shallow as possible and should not exceed a 3(Horizontal) to 1(Vertical) configuration for the existing fill materials and natural clays.

We recommend permanent, unretained cuts be limited to 10 feet in height or less. The risk of slope instability will be significantly increased if groundwater seepage is encountered in the cuts. NWCC office should be notified immediately to evaluate the site if seepage is encountered or deeper cuts are planned and determine if additional investigations and/or stabilization measures are warranted.

Excavating during periods of low runoff at the site can reduce potential slope instability during excavation. Excavations should not be attempted during the spring or early summer when seasonal runoff and groundwater levels are typically high.

Fills up to 10 feet in height can be constructed at the site and should be constructed to a 2(Horizontal) to 1(Vertical) or flatter configuration. The fill areas should be prepared by stripping any existing fill materials and topsoil and organics, scarification, and compaction to at least 95% of the maximum standard Proctor density and within 2% of optimum moisture content as determined by ASTM D698. The fills should be properly benched/keyed into the natural hillsides after the existing fill materials, natural topsoil, and organic materials, silts, and clays have been removed. The fill materials should consist of the on-site soils (exclusive of topsoil, organics, or silts) and be uniformly placed and compacted in 6 to 8-inch loose lifts to the minimum density value and moisture content range indicated above.

Proper surface drainage features should be provided around all permanent cuts and fills and steep natural slopes to direct surface runoff away from these areas. Cuts, fills, and other stripped areas should be protected against erosion by revegetation or other methods. Areas of concentrated drainage should be avoided and may require the use of riprap for erosion control. NWCC recommends that a maximum of 4 inches of topsoil be placed over the new cut and fill slopes. It should be noted that the newly placed topsoil materials may slough/slide off the slopes during the spring runoff seasons until the root zone in the vegetated cover establishes.

A qualified engineer experienced in this area should prepare site grading and drainage plans. The contractor must provide a construction sequencing plan for excavation, wall construction, and bracing and backfilling for the steeper and more sensitive portions of the site prior to starting the excavations or construction.

Pavement Section Recommendations: Pavement section alternatives presented below are based on anticipated soil conditions, assumed traffic loadings indicated below, pavement design procedures presented in the AASHTO Guide for Design of Pavement Structures, and our experience with similar sites and conditions in this part of Steamboat Springs. AASHTO pavement design procedures have been adopted and are used by the Colorado Department of Transportation (CDOT). NWCC has assumed the proposed pavement areas will be subjected to automobiles with occasional delivery trucks and with regular trash truck service.

Based on the results of the field and laboratory investigations and our understanding of the proposed construction, it appears the materials to be encountered at proposed pavement subgrade elevations will most likely consist of existing fill materials or natural clays. We have assumed the fill materials will generally classify as CL soils in accordance with the USCS, which is the worst-case scenario. NWCC recommends the pavement areas subjected to both truck and automobile traffic, such as at the entrances and roadways through the facility be constructed with a minimum of 4 inches of hot mix asphalt (HMA) overlying a minimum of 4 inches of CDOT class 6 aggregate base course (ABC) and a minimum of 8 inches of subbase aggregates (Pit Run). The pavement areas subjected to automobiles only, such as the parking stalls, can be paved with a minimum of 3 inches of HMS, 4 inches of CDOT class 6 aggregate base course (ABC), and a minimum of 6 inches of subbase aggregates (subbase).

NWCC recommends the areas subjected to heavy truck turning movements, such as the pads in front of the trash dumpsters or loading docks be paved with a rigid pavement section consisting of at least 8 inches of Portland cement concrete (PCC).

NWCC recommends the asphalt pavement material (HMA) consist of an approved "Superpave" mix designed by a qualified, registered engineer. The mix design should be designed using the SX gradation and mixed with PG 58-28 oil or other performance graded asphaltic materials. The mix should be produced and placed by a qualified contractor and should be compacted to between 92 and 96 percent of the maximum theoretical (Rice) density or at least 92 percent of the maximum Rice density. Quality control activities should be conducted on paving materials at the time of placement.

Base course materials (ABC) should consist of a well-graded aggregate base course material that meets CDOT Class 6 ABC grading and durability requirements and the subbase should consist of well-graded aggregate materials that meet CDOT Class 2 ABC grading and durability requirements.

ABC and subbase materials should be uniformly placed and compacted in 4 to 6-inch loose lifts to at least 95 % of the maximum modified Proctor density and within +/- 2 % of the optimum moisture content as determined by ASTM D1557.

Concrete pavement materials shall be based on a mix design established by a qualified engineer. Concrete should have a minimum 28-day compressive strength of 4,500 psi, be air-entrained with approximately 6 percent air, and have a maximum water/cement ratio of 0.42. Concrete should have a maximum slump of 4 inches and should contain control joints no greater than 10 to 12 feet on center, depending on slab configurations. The depth of the control joints should be at least ¼ of the slab thickness.

Prior to placement of subbase materials, NWCC recommends that all of the existing fill materials be removed, any debris removed and the materials moisture conditioned and compacted. Prior to placement of the subgrade fill materials the natural clays should be scarified and recompacted to a depth of 8 inches. The scarified natural clays and subgrade materials should be compacted in 6 to 8 inch lifts to at least 95 % of the maximum standard Proctor density and within +/- 2 % of the optimum moisture content as determined by ASTM D698. The finished subgrade surface, after recompaction, should also be sloped at least 1 percent to avoid ponding and to reduce the potential for wetting and expansion of the subgrade soils. The finished subgrade surface should be proof rolled with a loaded tandem dump truck or loaded water truck and any areas deflecting or rutting should be removed and or stabilized prior to placing the subbase aggregates.

The collection and diversion of surface and subsurface drainage away from the paved areas is extremely important to the satisfactory performance of the pavement. The design of the surface and subsurface drainage features should be carefully considered to remove all water from paved areas and to prevent ponding of water on and adjacent to paved areas.

Limitations: The recommendations provided in this report are based on the subsurface conditions encountered at this site and our understanding of the proposed construction. We believe that this information gives a high degree of reliability for anticipating the behavior of the proposed structures; however, our recommendations are professional opinions and cannot control nature, nor can they assure the soils profiles beneath those or adjacent to those observed. No warranties expressed or implied are given on the content of this report.

Expansive soils were encountered at this site. These soils are not prone to volume changes at their natural moisture content but can consolidate or swell with changes in moisture and loading. The behavior of expansive soils is not fully understood. The swell and/or consolidation potential of any particular site can change erratically both in lateral and vertical extent. Moisture changes also occur erratically, resulting in conditions, which cannot always be predicted. The recommendations presented in this report are based on the current state of the art for foundations and floor slabs on swelling/consolidating soils. The owner should be aware that there is a risk in construction on these types of materials. Performance of the structures will depend on following the recommendations and in proper maintenance after construction is complete. As water is the main cause for volume change in the soils, it is necessary that the changes in moisture content be kept to a minimum; therefore, positive surface drainage should be maintained away from the structures. Any distress noted in the structures should be brought to the attention of this office.

This report is based on the investigation at the described site and on the specific anticipated construction as stated herein. If either of these conditions is changed, the results would also most likely change. Therefore, NWCC strongly recommends that our firm be contacted prior to finalizing the construction plans so that we can verify that our recommendations are being properly incorporated into the construction plans. Man-made or natural changes in the conditions of a property can also occur over a period of time. In addition, changes in requirements due to state of the art knowledge and/or legislation do from time to time occur. As a result, the findings of this report may become invalid due to these changes. Therefore, this report is subject to review and not considered valid after a period of 3 years or if conditions as stated above are altered.

It is the responsibility of the owner or his representative to ensure information in this report is incorporated into the plans and/or specifications and construction of the project. It is advisable that a contractor familiar with construction details typically used to dealing with the local subsoils and climatic conditions be retained to build the structures.

If you have any questions regarding this report or if we may be of further service, please do not hesitate to contact us.

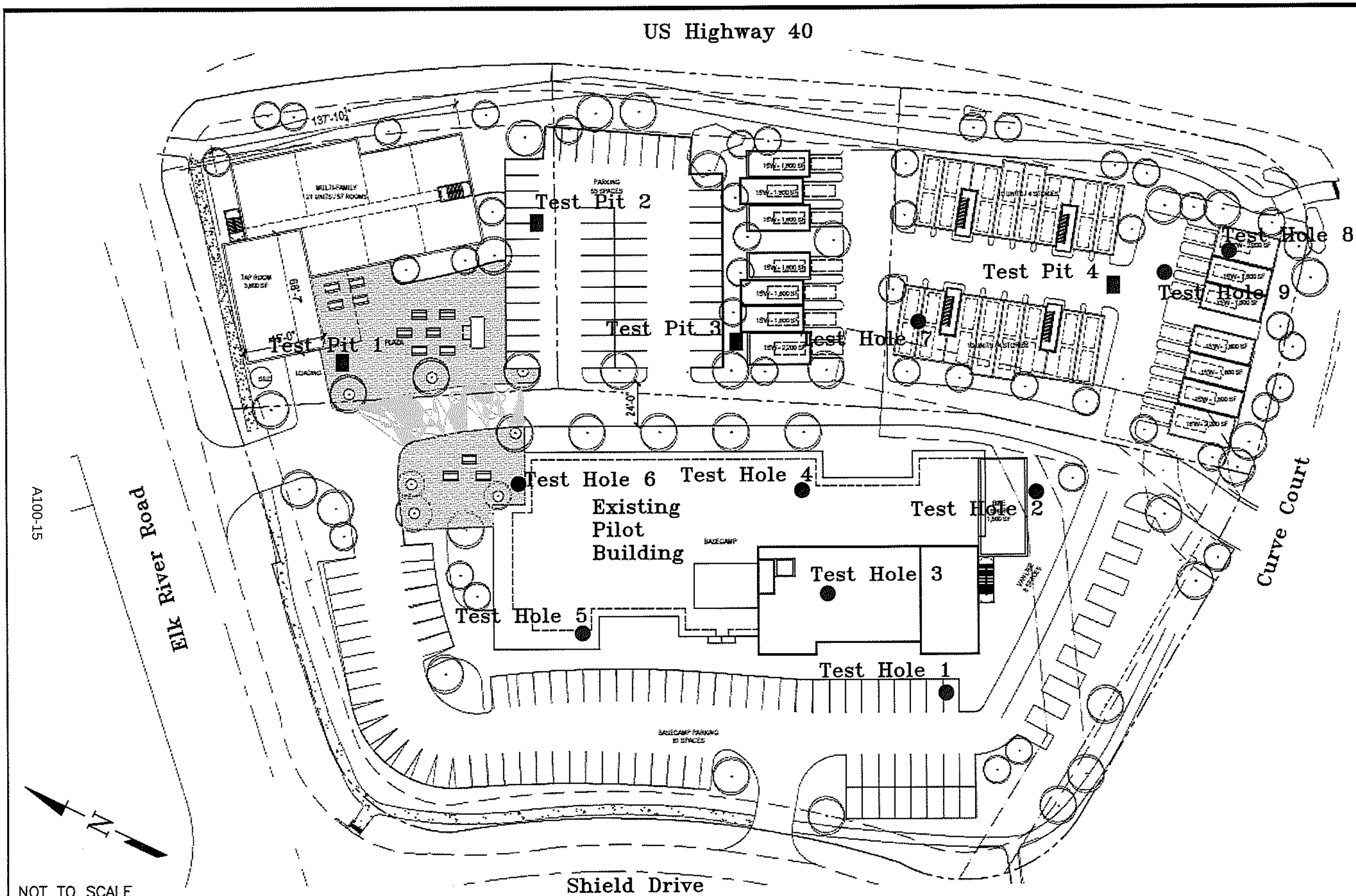
Sincerely,
NWCC, INC.,

Timothy S. Travis, P.E.
Senior Project Engineer

COLORADO LICENSED
BRIAN D. LEH
25750
PROFESSIONAL ENGINEER

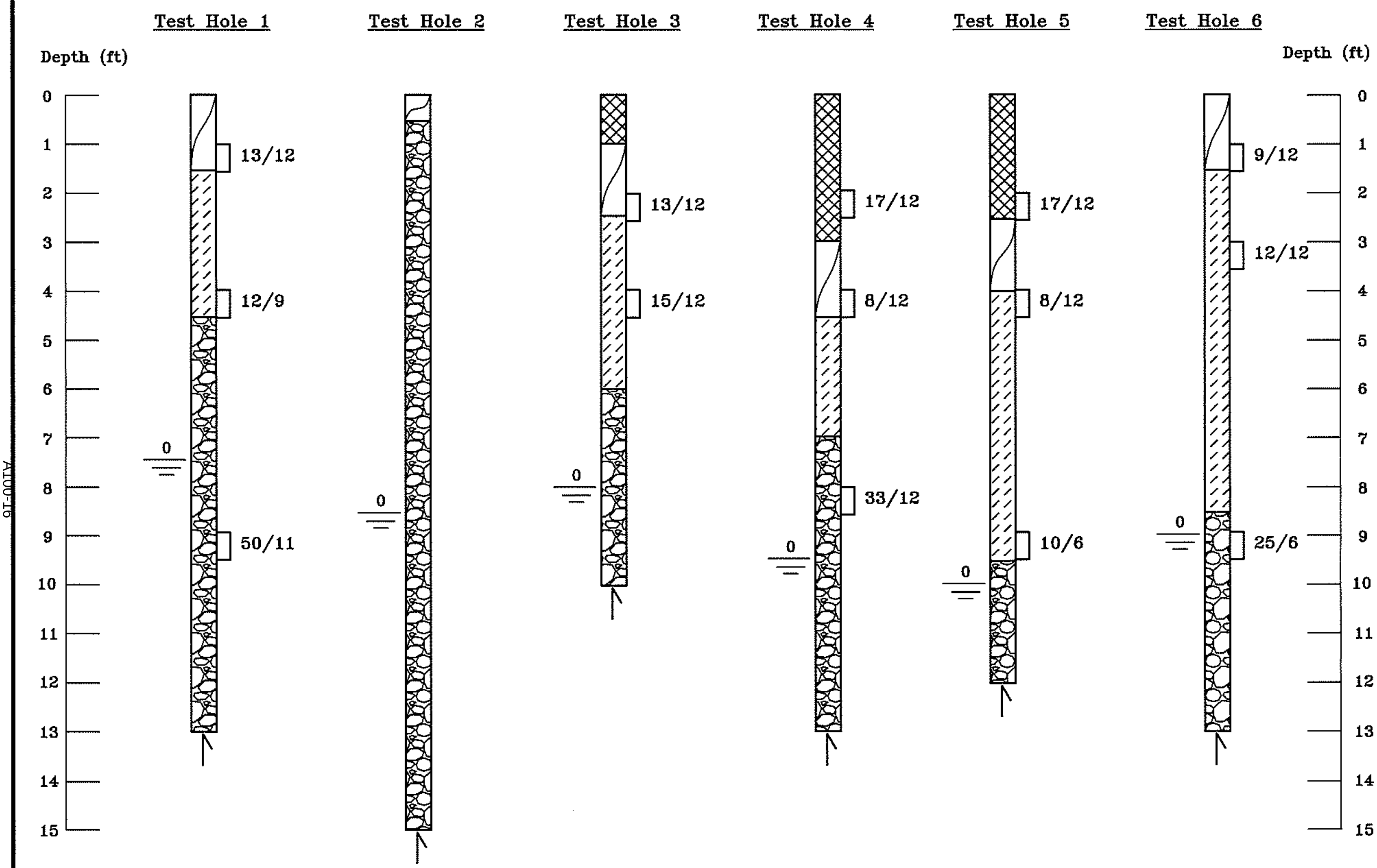
Reviewed by Brian D. Leh, P.E.
Principal Engineer
3/16/21

cc: Jake Mielke, SEAD

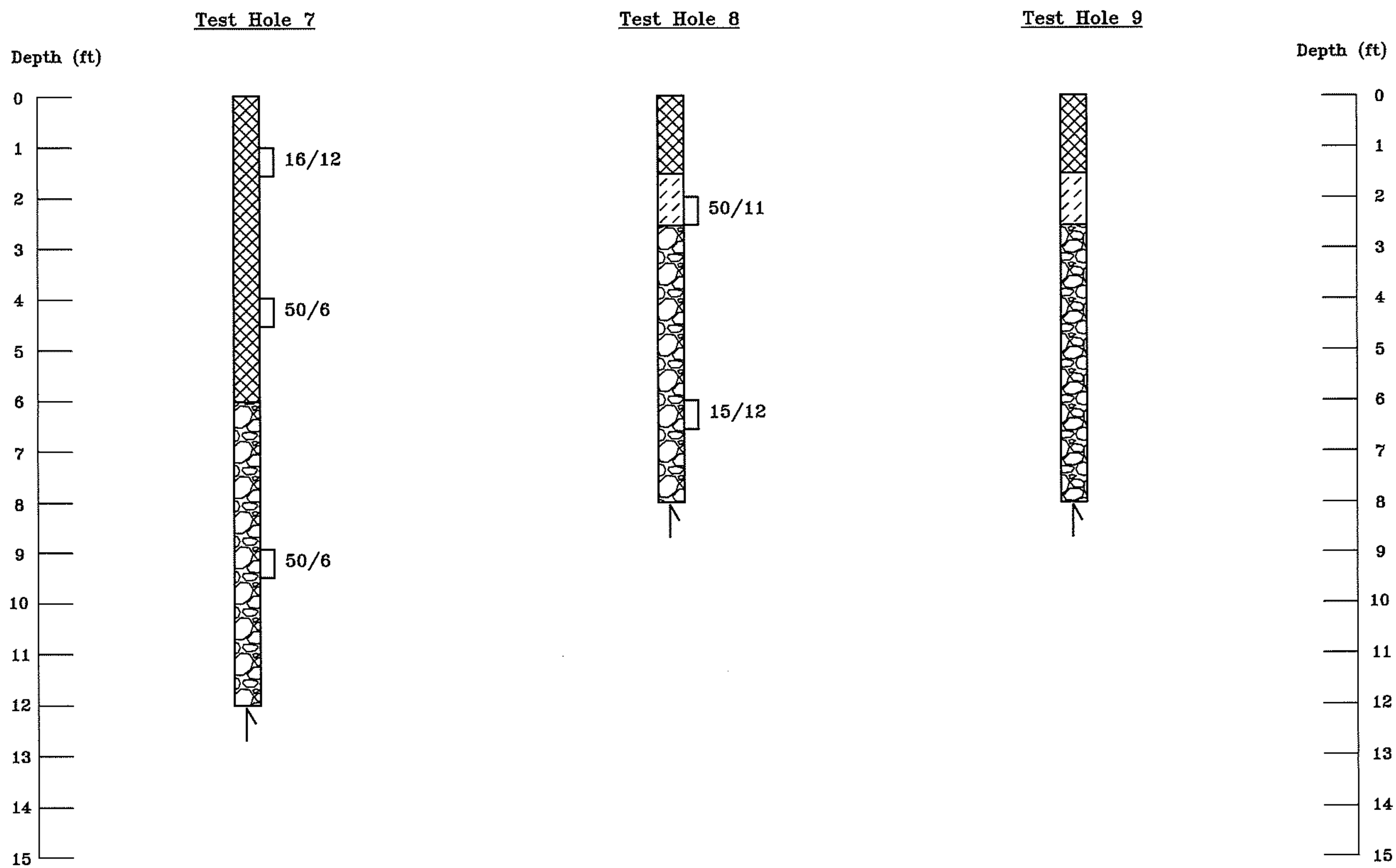


Title: SITE PLAN–LOCATION OF TEST HOLES AND PITS	**Date:** 2/2/2021
Job Name: Steamboat Basecamp	**Job No.** 20–11961
LOCATION: Worldwest Subdivision, Steamboat Springs, Colorado	**Figure** #1

North West Colorado Consultants, Inc.
Geotechnical / Environmental Engineering · Materials Testing
(970)879-7888 · Fax (970)879-7891
2580 Copper Ridge Drive
Steamboat Springs, Colorado 80487

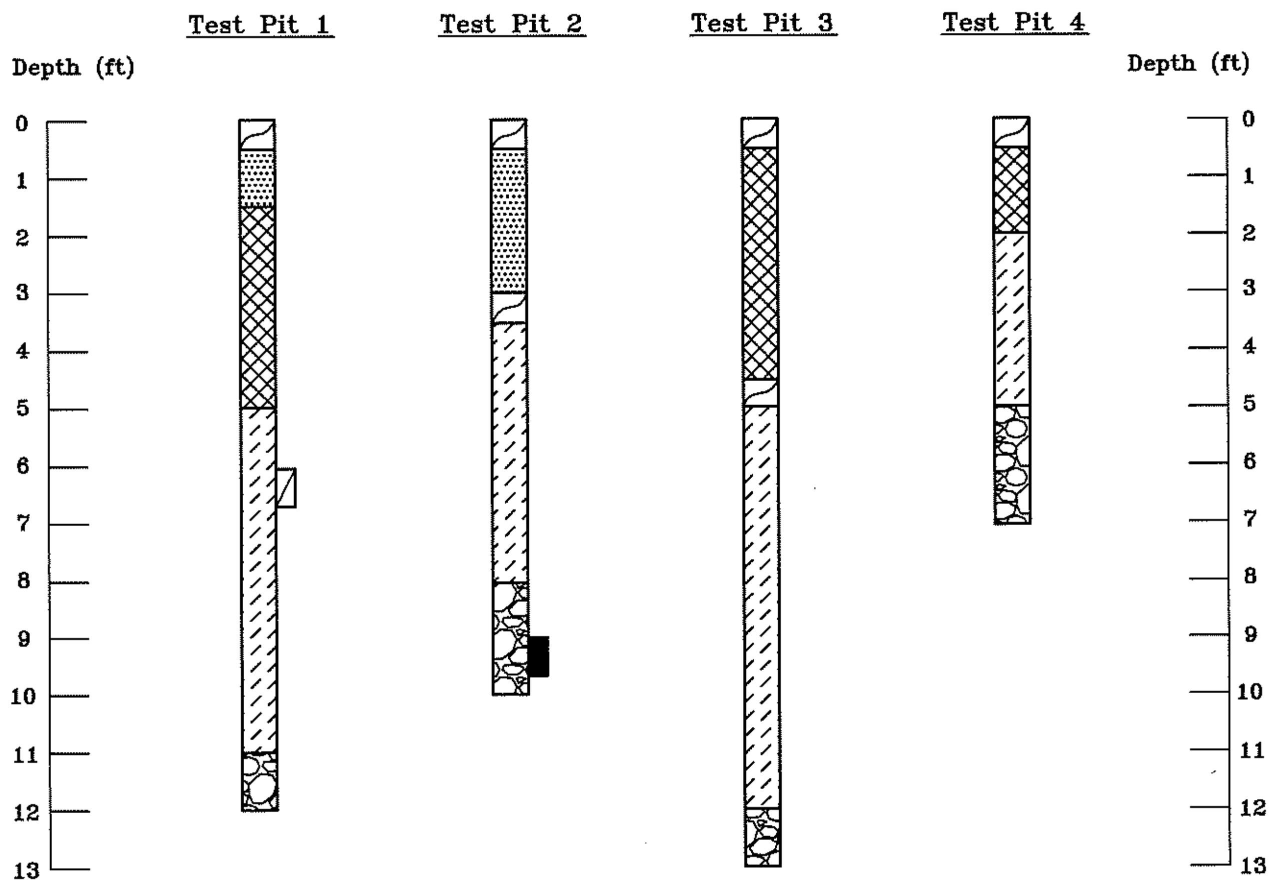


Title: LOGS OF EXPLORATORY TEST HOLES		Date: 3/5/2021	NWCC North West Colorado Consultants Inc.
Job Name: Steamboat Basecamp		Job No. 20-11961	Geotechnical / Environmental Engineering · Materials Testing
LOCATION: Worldwest Subdivision, Steamboat Springs, Colorado		Figure #2	(970)879-7888 · Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487



Title: LOGS OF EXPLORATORY TEST HOLES		Date: 3/5/2021	
Job Name: Steamboat Basecamp		Job No. 20-11961	
LOCATION: Worldwest Subdivision, Steamboat Springs, Colorado		Figure #3	

NWCC North West Colorado Consultants, Inc.
Geotechnical / Environmental Engineering · Materials Testing
(970)879-7888 · Fax (970)879-7891
2580 Copper Ridge Drive
Steamboat Springs, Colorado 80487



Title:	LOGS OF EXPLORATORY TEST PITS	Date:	3/5/2021
Job Name:	Steamboat Basecamp	Job No.	20-11961
LOCATION:	Worldwest Subdivision, Steamboat Springs, Colorado	Figure	#4

North West Colorado Consultants Inc.
Geotechnical / Environmental Engineering · Materials Testing
(970)879-7888 · Fax (970)879-7891
2580 Copper Ridge Drive
Steamboat Springs, Colorado 80487

LEGEND:

Topsoil and organics.

SAND AND GRAVEL FILL: Silty to clayey, low to non–plastic, medium dense, moist and brown in color.

CLAY FILL: Sandy with occasional gravels and debris, low to highly plastic, medium stiff to soft, moist and brown in color.

CLAY: Slightly sandy to sandy, moderately to highly plastic, stiff, moist and brown in color.

SANDS AND GRAVELS: Silty to slightly clayey, fine to coarse grained with cobbles and small boulders, very low to non–plastic, dense, moist to wet and brown to gray in color.

Drive Sample, 2–inch I.D. California Liner Sampler.

Hand Drive Sample–California Liner.

Small Disturbed Sample.

Indicates depth of practical rig refusal on cobbles.

13/12 Drive Sample Blow Count, indicates 13 blows of a 140–pound hammer falling 30 inches were required to drive the sampler 12 inches.

Indicates depth at which groundwater was encountered at the time of drilling.

NOTES:

1) Test Holes 1 through 6 were drilled on May 25, 1995 and Test Holes 7 through 9 were drilled on May 10, 2007 with a truck–mounted drill rig using 4–inch diameter continuous flight power augers. Test Pits 1 through 4 were excavated on November 11, 2020 with a Cat trackhoe.

2) Locations of the test holes and test pits were determined in the field by pacing from the existing structure.

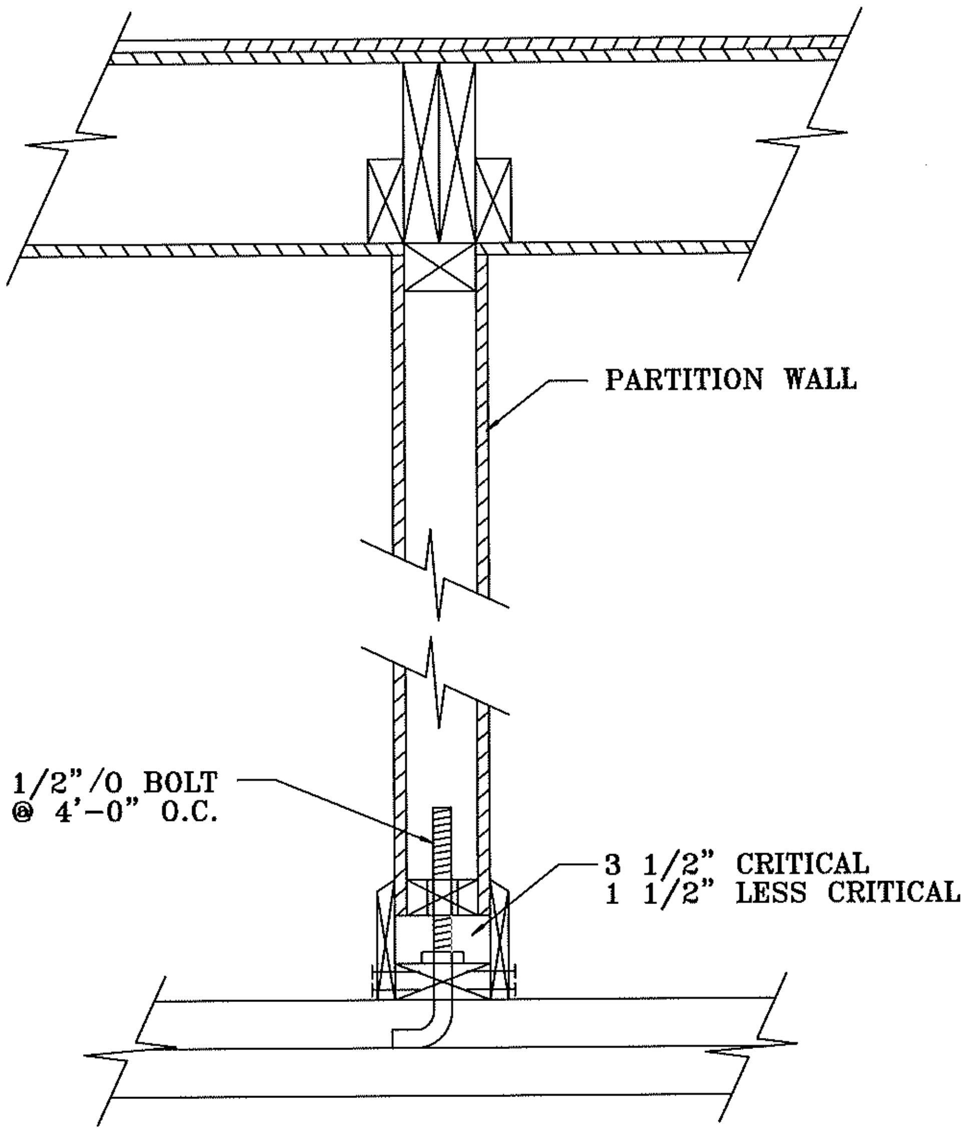
3) Elevations of the test holes were not measured and logs are drawn to the depths investigated.

4) The lines between materials shown on the logs represent the approximate boundaries between material types and transitions may be gradual.

5) The water level readings shown on the logs were made at the time and under the conditions indicated. Fluctuations in the water levels will probably occur with time.

Title: LEGEND AND NOTES	Date: 3/5/2021
Job Name: Steamboat Basecamp	Job No. 20–11961
Location: Worldwest Subdivision, Steamboat Springs, Colorado	Figure #5

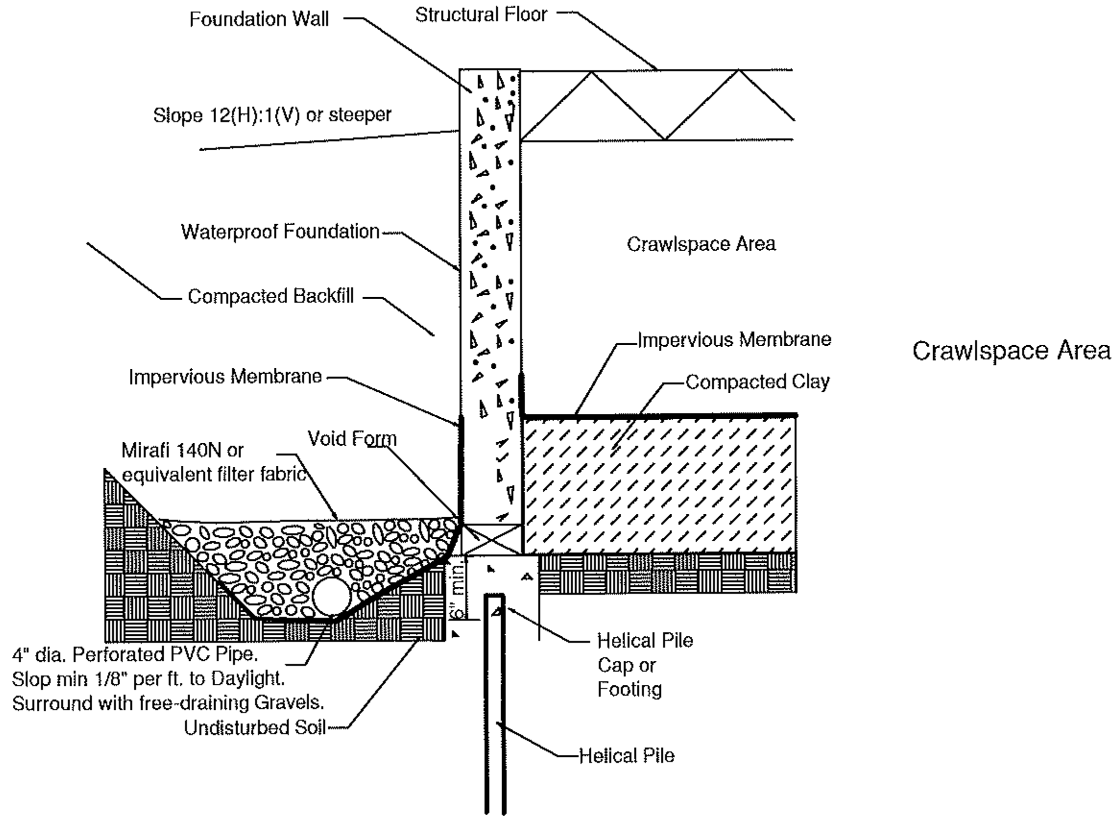
North West Colorado Consultants, Inc.
Geotechnical / Environmental Engineering · Materials Testing
(970)879-7888 · Fax (970)879-7891
2580 Copper Ridge Drive
Steamboat Springs, Colorado 80487

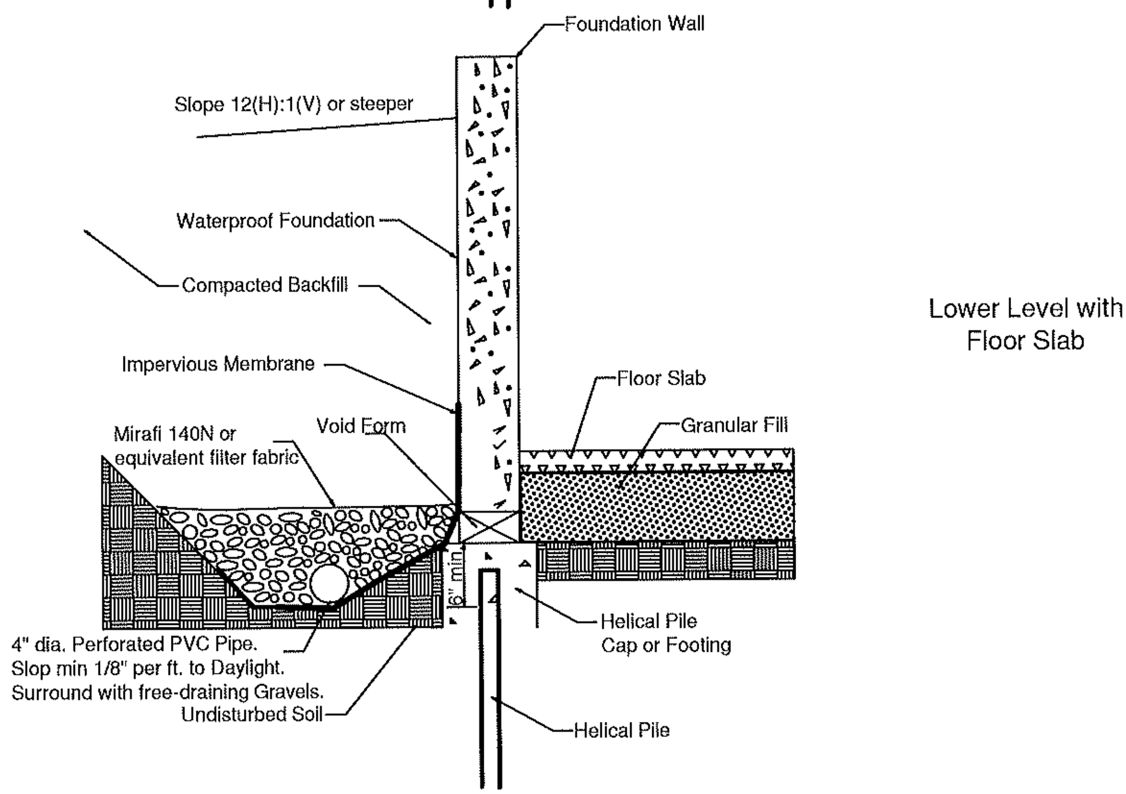


Title: HUNG PARTITION WALL DETAIL	Date: 3/5/2021
Job Name: Steamboat Basecamp	Job No. 20-11961
Location: Worldwest Subdivision, Steamboat Springs, Colorado	Figure #6

North West Colorado Consultants, Inc.
Geotechnical / Environmental Engineering · Materials Testing
(970)879-7888 · Fax (970)879-7891
2580 Copper Ridge Drive
Steamboat Springs, Colorado 80487

A100-20





Title: PERIMETER/UNDERDRAIN DETAIL

Date: 3/5/2021

Job Name: Steamboat Basecamp

Job No. 20-11961

Location: Worldwest Subdivision, Steamboat Springs, Colorado

Figure #7

A100.21

NWCC
North West Colorado Consultants, Inc.
Geotechnical / Environmental Engineering · Materials Testing
(970)879-7888 · Fax (970)879-7891
2580 Copper Ridge Drive
Steamboat Springs, Colorado 80487