

STRUCTURAL CALCULATIONS

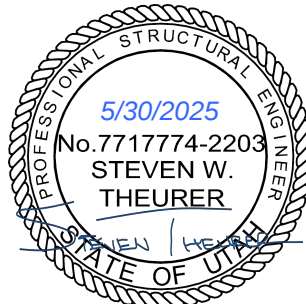
K&B Apartments
Logan, UT

May 30, 2025

Cartwright Project #: 123021

Prepared For:
Kenneth Anhder

Prepared By:



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Analysis / Design Criteria

PROJECT: K&B ApartmentsSUBJECT: Gravity Load SummaryPROJECT NO: 123021ENGINEER: JoshFDATE: May 2025SHEET: 1 of 1**Gravity Load Summary**

Version: October, 2010 / jstuart

File Name: 1.1 Design Criteria.xlsm

Code Ref.: na

Governing Code

2021 IBC

Building Location:Title: K&B ApartmentsAddress: Logan, UT**Dead Loads:**Roof:

Asphalt Shingles	2 psf
Underlayment	1 psf
Sheathing	2 psf
Batt Insulation	4 psf
Joist+Girder	4 psf
Mech/Elec	3 psf
Misc.	2 psf
Roof Dead Load:	18 psf

Live Loads:Roof:

Roof Live Load 20 psf

Floor:

Floor Live Load 40 psf

Snow Load:

Ground Snow Load, pg: 46 psf

Roof Snow Load, pf: 32 psf

Floor:

Floor Finish	2 psf
1 1/2" Gypcrete	13.75 psf
Sheathing	2 psf
Framing	6 psf
Mech/Elec	4 psf
Gypsum	2 psf
Misc.	5.25 psf
Floor Dead Load:	35 psf

Exterior Walls:

Ext. Walls w/ Siding 12 psf

Wall Dead Load: 12 psf

Ext. Walls w/ Brick 45 psf

Wall Dead Load: 45 psf

Floor Finish	2 psf
1 1/2" Gypcrete	13.75 psf
Sheathing	2 psf
Framing	2 psf
6" Topping Slab	75 psf
Double T Estimate	126 psf
Misc	5.25 psf
Floor Dead Load:	226 psf

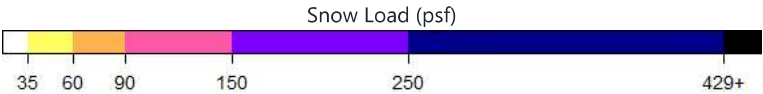
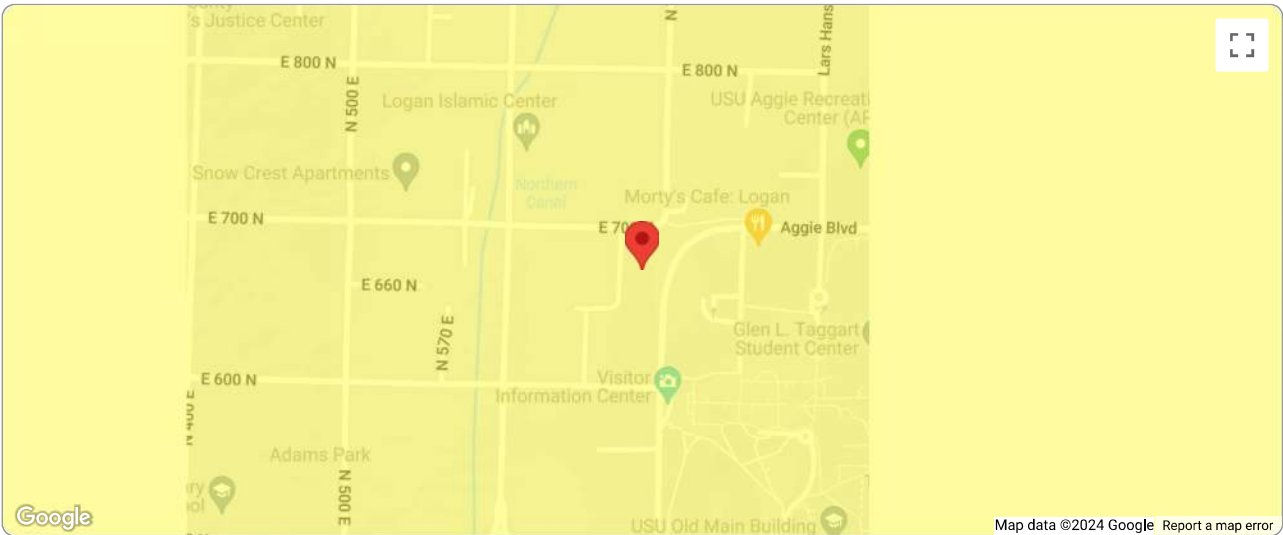
Utah Ground Snow Load Map



Latitude: 41.744
Longitude: -111.817
Elevation: 4,689 ft

Ground Snow Load:
46 psf / 2.22 kPa

**This document is not legally binding. The user is urged to verify ground snow load values with the local authority having jurisdiction.*



These ground snow load values represent 50-year ground snow load estimated value at a 2% probability of exceedance for the location given. The grid used in the map is 3350ft by 3350ft. Elevations for these grid cells were estimated by aggregating data from 100ft by 100ft USGS digital elevation models and may not coincide with the actual site elevation. These predictions are calculated using the process outlined in The Utah Snow Load Study.¹

Final predictions given are bounded at a lower limit for a minimum ground snow load of 21 psf to meet ASCE 7. Estimated values for snow loads at elevations significantly higher than all nearby stations lead to unreasonably high snow load estimates, therefore, the predictions in the map are not allowed to extend beyond the highest 50-year station ground snow load of 429 psf. Elevations over 9,000 ft are also considered less accurate due to the limited number of stations at these elevations. The results shown in this report have included a warning if the results have reached or exceeded the upper limit.

While great efforts have been made to ensure these predictions are as accurate as possible, designers must use expert judgement to ensure that such predictions are appropriate for their particular project. The SEAU and the authors cannot accept responsibility for prediction errors or any consequences resulting therefrom.

¹ Bean, Brennan; Maguire, Marc; and Sun, Yan, "The Utah Snow Load Study" (2018). Civil and Environmental Engineering Faculty Publications. Paper 3589.

PROJECT: K&B Apartments
 SUBJECT: Gravity Load Summary

PROJECT NO: 123021
 ENGINEER: JoshF

DATE: May 2025
 SHEET: 1 of 2

Roof Snow Loads

Version: September 2019 / quinnl
 File Name: 1.3_Loads_Gravity_Snow 7-16.xlsm
 Code Ref: ASCE 7-16

Snow Loads

Ground snow load (p_g): 46 psf
 Risk Category: II
 Terrain Category: B
 Exposure Category: Partially Exposed
 Exposure Factor (C_e): 1.0
 Thermal Factor (C_t): 1.0
 Importance Factor (I_s): 1.0
 Flat Roof Snow Load (p_f): 32 psf
 Snow Density (γ): 19.98 pcf
 Roof Surface: All Other
 Roof Pitch: 4.00 on 12
 Sloped Roof Factor (C_s): 1.00
 Sloped Roof Load (p_s): 32 psf
 Height of Balance Snow Load (h_b): 1.61 ft
 Minimum Snow Load (p_m): N/A psf

$$p_f = 0.7 C_e C_t I_s p_g$$

$$\gamma = 0.13 p_g + 14$$

$$p_s = C_s p_f$$

only for roofs < 15°

$$p_m = I_s p_g \text{ but not more than } I_s * 20 \text{ psf}$$

Figure 7-1/Table 7-1

Table 1.5-1

Sect. 26.7.2

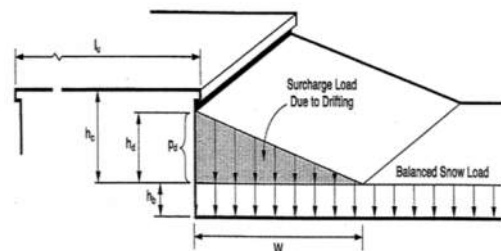
Table 7-2

Table 7-3

Table 1.5-2

Eqn. 7.3-1

Eqn. 7.7-1



Eqn. C7.4

Eqn. 7.4-1

Sect. 7.7.1

Section 7.3.4

Snow Drifts (if applicable)¹

Drift Mark	Δ Roof Height	L_{upper}	L_{lower}	h_c	Drift Req'd	$h_{d,leeward}^2$	$h_{d,windward}^2$	p_d	w
SD-#	ft	ft	ft	ft	Check	ft	ft	psf	ft

Notes:

1. See section 7.7.1
2. From Figure 7-9

Snow Drifts at Framing Increments (psf)

Framing Spacing: 1.33

Drift Mark	0	1.3	2.7	4.0	5.3	6.7	8.0	9.3	10.6
SD-#	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.

Average Drifts for 3 Sections

Drift Mark	Sec. 1 Ave.	Sec. 1 End	Sec. 2 Ave.	Sec. 2 End	Sec. 3 Ave.	Sec. 3 End
SD-#	psf	ft.	psf	ft.	psf	ft.

PROJECT: K&B Apartments
SUBJECT: Gravity Load Summary

PROJECT NO: 123021
ENGINEER: JoshF

DATE: May 2025
SHEET: 2 of 2

Roof Snow Loads

Version: September 2019 / quinnl
File Name: 1.3_Loads_Gravity_Snow 7-16.xlsm
File Name: ASCE 7-16

Snow Loads

Ground snow load (pg): 46 psf
Risk Category: II
Terrain Category: B
Exposure Category: Partially Exposed
Exposure Factor (Ce): 1
Thermal Factor (Ct): 1
Importance Factor (Is): 1
Flat Roof Snow Load (pf): 32.2 psf
Snow Density (g): 19.98 pcf
Sloped Roof Factor (Cs): 1.00
Roof Pitch: 4 on 12
Sloped Roof Load (ps): 32.2 psf
Height of Balance Snow Load (hb): 1.6 ft
Minimum Snow Load (pm): N/A psf

$$p_f = 0.7 C_e C_t I_s p_g$$

$$\gamma = 0.13 p_g + 14$$

$$p_s = C_s p_f$$

only for roofs < 15°
 $p_m = I_s p_g$ but not more than $I_s * 20$ psf

Figure 7-1/Table 7-1

Table 1.5-1

Sect. 26.7.2

Table 7-2

Table 7-2

Table 7-3

Table 1.5-2

Eqn. 7.3-1

Eqn. 7.7-1

Eqn. C7.4

Eqn. 7.4-1

Sect. 7.7.1

Sloped Roof Snow Loads (If Applicable)¹

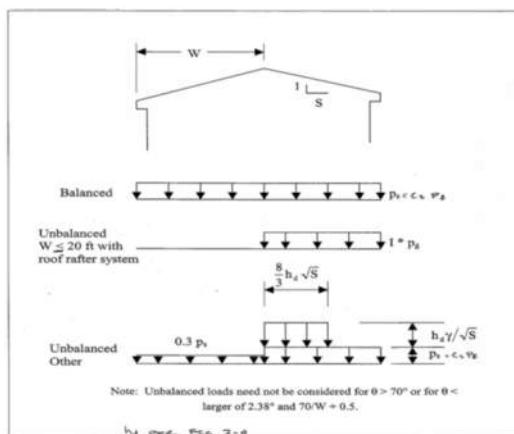
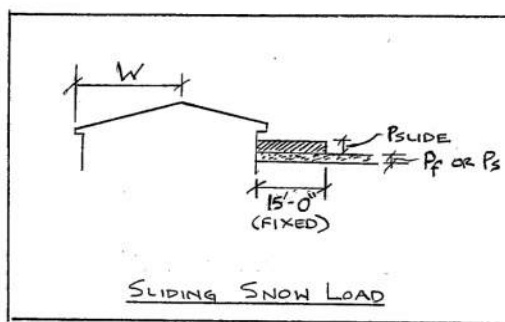


FIGURE 7-4 BALANCED AND UNBALANCED SNOW LOADS FOR HIP AND GABLE ROOFS



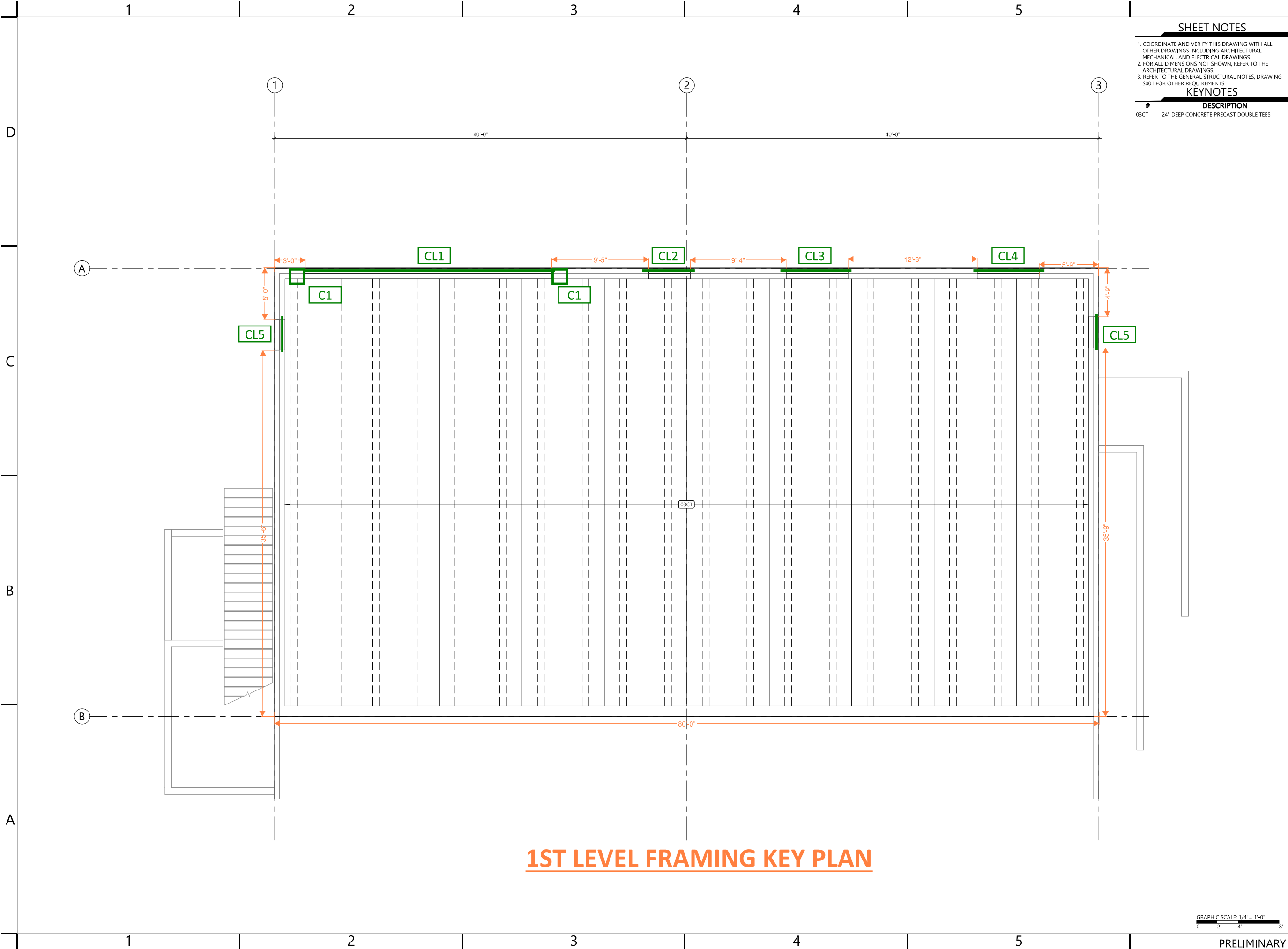
Lower Roof Length: 0 ft				Balanced ¹	Unbalanced ¹	Unbalanced Other ¹			Sliding ²
Roof Mark	W	Slope:	Cs ³ :	P _s :	I*P _g :	0.3*P _s :	8/3h _d S ^{1/2}	h _d V/S ^{1/2}	P _{slide} :
RF-#	ft.	on 12		psf	psf	psf	ft.	psf	psf
1	30.0	4.0	1.0	32.2	46.0	9.7	10.0	24.9	0.0

Notes

1. See Section 7.6
2. See Section 7.9
3. See Figure 7-2



Gravity Analysis / Design



SHEET NOTES

- COORDINATE AND VERIFY THIS DRAWING WITH ALL OTHER DRAWINGS INCLUDING ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS.
- FOR ALL DIMENSIONS NOT SHOWN, REFER TO THE ARCHITECTURAL DRAWINGS.
- REFER TO THE GENERAL STRUCTURAL NOTES, DRAWING 5001 FOR OTHER REQUIREMENTS.

KEYNOTES

#	DESCRIPTION
03CT	24" DEEP CONCRETE PRECAST DOUBLE TEES

K&B APARTMENTS

LOGAN, UT

CARTWRIGHT PROJECT #	124021
DATE:	4/16/2024
DRAWN BY:	FWP
CHECKED BY:	JPF
APPROVED BY:	SWT

DATE	REVISIONS DESCRIPTION
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MAIN LEVEL
PLAN

S102

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

PRELIMINARY

PROJECT: K & B Apartments
SUBJECT: RH1-RH3

PROJECT NO: 123021
ENGINEER: JPF

DATE: May 2025
SHEET: 1 of 7

Wood Beams

Version: June 2020/JoshF
File Name: 2.2 Wood Beams_2024-02-29.xlsm
Code Ref.: NDS 2018

Mark: RH1			D	L	Lr	S	Trib	D+L	D+Lr/S	D+75L+75Lr/S	Max
Span (ft):	3.5	Roof, (psf)	18	0	20	32	6	18	50	42	50
Unbraced Length (ft):	3.5	Floor, (psf)	30	40	0	0	0	70	30	60	70
ΔTL:	L/240	Floor, (psf)	0	0	0	0	0	0	0	0	0
ΔLL:	L/360	Wall, (psf)	45	0	0	0	2	45	45	45	45
C _p ^(A) :	1.15	Total Dist. Load, (plf)	198	0	120	192		198	390	342	390

		DL	L	Lr	S	Location, (ft)	D+L	D+Lr/S	D+75L+75Lr/S	Max
Max Shear, (lb):	682	Point Load 1, (lb)	0	0	0	0	0	0	0	0
Max Moment, (lb-ft):	597	Point Load 2, (lb)	0	0	0	0	0	0	0	0

		DL	L	Lr	S	D+L	D+Lr/S	D+75L+75Lr/S	Max
Right Side Reaction, (lb)		347	0	210	336	347	683	599	683
Left Side Reaction, (lb)		347	0	210	336	347	683	599	683

# of Plies/Width	# of Plies/Width 2			# of Plies/Width 3			# of Plies/Width 5 1/8			Selection # 33		
	2x			LVL			Glu-Lam			Custom Selection		
	(2) 2x6			(3) 1-3/4 x 5.5 LVL			5-1/8 x 9 GLB			(3) 1-3/4 x 11.25 LVL		
	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check
	Fv ^(B,C,D) (psi)											
	62.0	207.0	0.30	35.5	327.8	0.11	22.2	304.8	0.07	17.3	327.8	0.05
Fb ^(E,F,G) (psi)	473.8	1345.5	0.35	270.7	2983.2	0.09	103.6	2749.4	0.04	64.7	2975.2	0.02
ΔTL	0.020	0.175	0.11	0.010	0.175	0.05	0.002	0.175	0.01	0.001	0.175	0.01
ΔLL	0.010	0.117	0.08	0.005	0.117	0.04	0.001	0.117	0.01	0.001	0.117	0.00

PROJECT: **K & B Apartments**
SUBJECT: RB1-RB3

PROJECT NO: 123021
ENGINEER: JPF

DATE: May 2025
SHEET: 2 of 7

Wood Beams

Version: June 2020/JoshF
File Name: 2.2 Wood Beams_2024-02-29.xlsm
Code Ref.: NDS 2018

Mark: RB1			D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Span (ft):	16.0	Roof, (psf)	18	0	20	32	6	18	50	42	50
Unbraced Length (ft):	16.0	Floor, (psf)	30	40	0	0	0	70	30	60	70
ΔTL:	L/240	Floor, (psf)	0	0	0	0	0	0	0	0	0
ΔLL:	L/360	Wall, (psf)	45	0	0	0	0	45	45	45	45
C _p ^(A) :	1.15	Total Dist. Load, (plf)	108	0	120	192		108	300	252	300

		DL	L	Lr	S	Location, (ft)	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Max Shear, (lb):	2395	Point Load 1, (lb)	0	0	0	0	0	0	0	0
Max Moment, (lb-ft):	9600	Point Load 2, (lb)	0	0	0	0	0	0	0	0

		DL	L	Lr	S	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Right Side Reaction, (lb)		864	0	960	1536	864	2400	2016	2400
Left Side Reaction, (lb)		864	0	960	1536	864	2400	2016	2400

# of Plies/Width	3	# of Plies/Width	3	# of Plies/Width	5 1/8	Selection #	33					
Fv ^(B,C,D) (psi) Fb ^(E,F,G) (psi) ΔTL ΔLL	2x			LVL			Glu-Lam			Custom Selection		
	NG			(3) 1-3/4 x 9.25 LVL			5-1/8 x 9 GLB			(3) 1-3/4 x 11.25 LVL		
	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check
				74.0	327.8	0.23	77.9	304.8	0.26	60.8	327.8	0.19
				1538.7	2927.4	0.53	1665.0	2705.5	0.62	1040.3	2907.6	0.36
				0.672	0.800	0.84	0.789	0.800	0.99	0.374	0.800	0.47
			0.430	0.533	0.81	0.505	0.533	0.95	0.239	0.533	0.45	

Selection: **LVL** USE: (3) 1-3/4 x 9.25 LVL

Mark: RB2			D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Span (ft):	13.5	Roof, (psf)	18	0	20	32	26	18	50	42	50
Unbraced Length (ft):	13.5	Floor, (psf)	30	40	0	0	0	70	30	60	70
ΔTL:	L/240	Floor, (psf)	0	0	0	0	0	0	0	0	0
ΔLL:	L/360	Wall, (psf)	45	0	0	0	0	45	45	45	45
C _p ^(A) :	1.15	Total Dist. Load, (plf)	468	0	520	832		468	1300	1092	1300

		DL	L	Lr	S	Location, (ft)	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Max Shear, (lb):	8757	Point Load 1, (lb)	0	0	0	0	0	0	0	0
Max Moment, (lb-ft):	29616	Point Load 2, (lb)	0	0	0	0	0	0	0	0

		DL	L	Lr	S	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Right Side Reaction, (lb)		3159	0	3510	5616	3159	8775	7371	8775
Left Side Reaction, (lb)		3159	0	3510	5616	3159	8775	7371	8775

# of Plies/Width	# of Plies/Width 3			# of Plies/Width 3			# of Plies/Width 5 1/8			Selection # 37		
	2x			LVL			Glu-Lam			Custom Selection		
	NG			(3) 1-3/4 x 14 LVL			5-1/8 x 13.5 GLB			(3) 1-3/4 x 18 LVL		
	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check
	F _v ^(B,C,D) (psi)			178.7	327.8	0.55	189.9	304.8	0.62	139.0	327.8	0.42
	F _b ^(E,F,G) (psi)			2072.2	2873.8	0.72	2282.9	2681.8	0.85	1253.6	2797.9	0.45
ΔTL:			0.426	0.675	0.63	0.514	0.675	0.76	0.200	0.675	0.30	
ΔLL:			0.273	0.450	0.61	0.329	0.450	0.73	0.128	0.450	0.29	

Selection: **Truss Girder** Truss Girder

Mark: RB3			D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr	Max
Span (ft):	8.5	Roof, (psf)	18	0	20	32	13	18	50	42	50
Unbraced Length (ft):	8.5	Floor, (psf)	30	40	0	0	0	70	30	60	70
ΔTL:	L/240	Floor, (psf)	0	0	0	0	0	0	0	0	0
ΔLL:	L/360	Wall, (psf)	45	0	0	0	0	45	45	45	45
C _p ^(A) :	1.15	Total Dist. Load, (plf)	234	0	260	416		234	650	546	650

		DL	L	Lr	S	Location, (ft)	D+L	D+Lr/S	D+.75L+.75Lr	Max
Max Shear, (lb):	2762	Point Load 1, (lb)	0	0	0	0	0	0	0	0
Max Moment, (lb-ft):	5870	Point Load 2, (lb)	0	0	0	0	0	0	0	0

		DL	L	Lr	S	D+L	D+Lr/S	D+.75L+.75Lr	Max
Right Side Reaction, (lb)		995	0	1105	1768	995	2763	2321	2763
Left Side Reaction, (lb)		995	0	1105	1768	995	2763	2321	2763

# of Plies/Width	3			2			5 1/8			Selection #			42		
	2x			LVL			Glu-Lam			Custom Selection					
	(3) 2x10			(2) 1-3/4 x 7.25 LVL			5-1/8 x 9 GLB			3-1/8 x 15 GLB					
	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check			
	F _v ^(B,C,D) (psi):	99.5	207.0	0.48	163.3	327.8	0.50	89.8	304.8	0.29	88.4	304.8	0.29		
F _b ^(E,F,G) (psi):	1097.7	1138.5	0.96	2297.5	2840.7	0.81	1018.2	2734.2	0.37	601.1	2471.9	0.24			
ΔTL:	0.161	0.425	0.38	0.362	0.425	0.85	0.136	0.425	0.32	0.048	0.425	0.11			
ΔLL:	0.103	0.283	0.36	0.231	0.283	0.82	0.087	0.283	0.31	0.031	0.283	0.11			

Selection: **2x** USE: (3) 2x10

PROJECT: K & B Apartments
SUBJECT: FH1-FH3

PROJECT NO: 123021
ENGINEER: JPF

DATE: May 2025
SHEET: 3 of 7

Wood Beams

Version: June 2020/JoshF
File Name: 2.2 Wood Beams_2024-02-29.xlsm
Code Ref.: NDS 2018

Mark: FH1			D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Span (ft):	3.5	Roof, (psf)	18	0	20	32	0	18	50	42	50
Unbraced Length (ft):	3.5	Floor, (psf)	35	40	0	0	2	75	35	65	75
ΔTL:	L/240	Floor, (psf)	0	0	0	0	0	0	0	0	0
ΔLL:	L/360	Wall, (psf)	45	0	0	0	8	45	45	45	45
Cp(A):	1.15	Total Dist. Load, (plf)	430	80	0	0		510	430	490	510

		DL	L	Lr	S	Location, (ft)	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Max Shear, (lb):	892	Point Load 1, (lb)	0	0	0	0	0	0	0	0
Max Moment, (lb-ft):	781	Point Load 2, (lb)	0	0	0	0	0	0	0	0

		DL	L	Lr	S	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Right Side Reaction, (lb)		753	140	0	0	893	753	858	893
Left Side Reaction, (lb)		753	140	0	0	893	753	858	893

# of Plies/Width	2	# of Plies/Width	3	# of Plies/Width	5 1/8	Selection #						33
2x			LVL			Glu-Lam			Custom Selection			
(2) 2x6			(3) 1-3/4 x 5.5 LVL			5-1/8 x 9 GLB			(3) 1-3/4 x 11.25 LVL			
	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check
F _v ^(B,C,D) (psi)	81.1	207.0	0.39	46.4	327.8	0.14	29.0	304.8	0.10	22.7	327.8	0.07
F _b ^(E,F,G) (psi)	619.6	1345.5	0.46	354.0	2983.2	0.12	135.4	2749.4	0.05	84.6	2975.2	0.03
ΔTL	0.026	0.175	0.15	0.012	0.175	0.07	0.003	0.175	0.02	0.001	0.175	0.01
ΔLL	0.004	0.117	0.03	0.002	0.117	0.02	0.000	0.117	0.00	0.000	0.117	0.00

Selection: **2x** **USE: (2) 2x6**

Mark: FH2			D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Span (ft):	3.5	Roof, (psf)	18	0	20	32	0	18	50	42	50
Unbraced Length (ft):	3.5	Floor, (psf)	35	40	0	0	6	75	35	65	75
	ΔTL:	L/240	Floor, (psf)	0	0	0	0	0	0	0	0
	ΔLL:	L/360	Wall, (psf)	45	0	0	0	8	45	45	45
	Cp(A):	1.15	Total Dist. Load, (plf)	570	240	0	0		810	570	750

		DL	L	Lr	S	Location, (ft)	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Max Shear, (lb):	1417	Point Load 1, (lb)	0	0	0	0	0	0	0	0
Max Moment, (lb-ft):	1240	Point Load 2, (lb)	0	0	0	0	0	0	0	0

		DL	L	Lr	S	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Right Side Reaction, (lb)		998	420	0	0	1418	998	1313	1418
Left Side Reaction, (lb)		998	420	0	0	1418	998	1313	1418

# of Plies/Width	2	# of Plies/Width	2	# of Plies/Width	5 1/8	Selection #						37
2x			LVL			Glu-Lam			Custom Selection			
(2) 2x6			(2) 1-3/4 x 5.5 LVL			5-1/8 x 9 GLB			(3) 1-3/4 x 18 LVL			
	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check
F _v ^(B,C,D) (psi)	128.9	207.0	0.62	110.5	327.8	0.34	46.1	304.8	0.15	22.5	327.8	0.07
F _b ^(E,F,G) (psi)	984.0	1345.5	0.73	843.5	2973.9	0.28	215.1	2749.4	0.08	52.5	2964.9	0.02
ΔTL	0.041	0.175	0.23	0.030	0.175	0.17	0.005	0.175	0.03	0.001	0.175	0.00
ΔLL	0.012	0.117	0.10	0.009	0.117	0.08	0.001	0.117	0.01	0.000	0.117	0.00

Selection: **2x** **USE: (2) 2x6**

Mark: FH3			D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr	Max
Span (ft):	3.8	Roof, (psf)	18	0	20	32	0	18	50	42	50
Unbraced Length (ft):	3.8	Floor, (psf)	35	40	0	0	15	75	35	65	75
ΔTL:	L/240	Floor, (psf)	0	0	0	0	0	0	0	0	0
ΔLL:	L/360	Wall, (psf)	45	0	0	0	0	45	45	45	45
Cp(A):	1.15	Total Dist. Load, (plf)	525	600	0	0		1125	525	975	1125

		DL	L	Lr	S	Location, (ft)	D+L	D+Lr/S	D+.75L+.75Lr	Max
Max Shear, (lb):	2105	Point Load 1, (lb)	0	0	0	0	0	0	0	0
Max Moment, (lb-ft):	1978	Point Load 2, (lb)	0	0	0	0	0	0	0	0

		DL	L	Lr	S	D+L	D+Lr/S	D+.75L+.75Lr	Max
Right Side Reaction, (lb)		984	1125	0	0	2109	984	1828	2109
Left Side Reaction, (lb)		984	1125	0	0	2109	984	1828	2109

# of Plies/Width	2	# of Plies/Width	2	# of Plies/Width	5 1/8	Selection #						26
2x			LVL			Glu-Lam			Custom Selection			
(2) 2x8			(2) 1-3/4 x 5.5 LVL			5-1/8 x 9 GLB			(2) 1-3/4 x 14 LVL			
	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check
F _v ^(B,C,D) (psi)	145.2	207.0	0.70	164.0	327.8	0.50	68.5	304.8	0.22	64.4	327.8	0.20
F _b ^(E,F,G) (psi)	902.9	1242.0	0.73	1344.8	2973.9	0.45	343.0	2748.6	0.12	207.6	2940.7	0.07
ΔTL	0.033	0.188	0.18	0.054	0.188	0.29	0.009	0.188	0.05	0.003	0.188	0.02
ΔLL	0.018	0.125	0.14	0.029	0.125	0.23	0.005	0.125	0.04	0.002	0.125	0.01

Selection: **2x** **USE: (2) 2x8**

PROJECT: **K & B Apartments**
SUBJECT: FH4-FH5

PROJECT NO: 123021
ENGINEER: JPF

DATE: May 2025
SHEET: 4 of 7

Wood Beams

Version: June 2020/JoshF
File Name: 2.2 Wood Beams_2024-02-29.xlsm
Code Ref.: NDS 2018

Mark: FH4											
		D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr/S	Max	
Span (ft):	3.5	Roof, (psf)	18	0	20	32	0	18	50	42	50
Unbraced Length (ft):	3.5	Floor, (psf)	35	40	0	0	2	75	35	65	75
	ΔTL:	Balcony Floor, (psf)	35	60	0	0	3.5	95	35	80	95
	ΔLL:	Wall, (psf)	45	0	0	0	8	45	45	45	45
Cp(A):	1.15	Total Dist. Load, (plf)	552.5	290	0	0		843	553	770	843

		DL	L	Lr	S	Location, (ft)	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Max Shear, (lb):	1474	Point Load 1, (lb)	0	0	0	0	0	0	0	0
Max Moment, (lb-ft):	1290	Point Load 2, (lb)	0	0	0	0	0	0	0	0

		DL	L	Lr	S	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Right Side Reaction, (lb)		967	508	0	0	1474	967	1348	1474
Left Side Reaction, (lb)		967	508	0	0	1474	967	1348	1474

# of Piles/Width	2	# of Piles/Width		3	# of Piles/Width		5 1/8	Selection #		33		
F _v ^(B,C,D) (psi) F _b ^(E,F,G) (psi) ΔTL ΔLL	2x			LVL			Glu-Lam			Custom Selection		
	(2) 2x6			(3) 1-3/4 x 5.5 LVL			5-1/8 x 9 GLB			(3) 1-3/4 x 11.25 LVL		
	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check
	134.0	207.0	0.65	76.6	327.8	0.23	47.9	304.8	0.16	37.4	327.8	0.11
	1023.5	1345.5	0.76	584.9	2983.2	0.20	223.8	2749.4	0.08	139.8	2975.2	0.05
	0.043	0.175	0.24	0.021	0.175	0.12	0.005	0.175	0.03	0.002	0.175	0.01
	0.015	0.117	0.13	0.007	0.117	0.06	0.002	0.117	0.01	0.001	0.117	0.01

Selection: **2x** **USE: (2) 2x6**

Mark: FH5			D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Span (ft):	6.5	Roof, (psf)	18	0	20	32	0	18	50	42	50
Unbraced Length (ft):	6.5	Floor, (psf)	35	40	0	0	2	75	35	65	75
	ΔTL:	Floor, (psf)	35	60	0	0	3.5	95	35	80	95
	ΔLL:	Wall, (psf)	45	0	0	0	8	45	45	45	45
C _p ^(A) :	1.15	Total Dist. Load, (plf)	552.5	290	0	0		843	553	770	843

		DL	L	Lr	S	Location, (ft)	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Max Shear, (lb):	2738	Point Load 1, (lb)	0	0	0	0	0	0	0	0
Max Moment, (lb-ft):	4449	Point Load 2, (lb)	0	0	0	0	0	0	0	0

		DL	L	Lr	S	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Right Side Reaction, (lb)		1796	943	0	0	2738	1796	2503	2738
Left Side Reaction, (lb)		1796	943	0	0	2738	1796	2503	2738

# of Plies/Width	3			# of Plies/Width	2			# of Plies/Width	5 1/8			Selection #	37		
	2x				LVL				Glu-Lam				Custom Selection		
	(3) 2x10				(2) 1-3/4 x 7.25 LVL				5-1/8 x 9 GLB				(3) 1-3/4 x 18 LVL		
	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check			
F _v ^(B,C,D) (psi)	98.7	207.0	0.48	161.9	327.8	0.49	89.0	304.8	0.29	43.5	327.8	0.13			
F _b ^(E,F,G) (psi)	832.0	1138.5	0.73	1741.4	2967.6	0.59	771.7	2740.1	0.28	188.3	2964.9	0.06			
ΔTL	0.071	0.325	0.22	0.160	0.325	0.49	0.060	0.325	0.19	0.007	0.325	0.02			
ΔLL	0.025	0.217	0.11	0.055	0.217	0.25	0.021	0.217	0.10	0.002	0.217	0.01			

Selection: **2x** **USE: (3) 2x10**

PROJECT: K & B Apartments
SUBJECT: FB1-FB3

PROJECT NO: 123021
ENGINEER: JPF

DATE: May 2025
SHEET: 5 of 7

Wood Beams

Version: June 2020/JoshF
File Name: 2.2 Wood Beams_2024-02-29.xlsm
Code Ref.: NDS 2018

Mark: FB1			D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Span (ft):	16.0	Roof, (psf)	18	0	20	32	0	18	50	42	50
Unbraced Length (ft):	16.0	Floor, (psf)	35	40	0	0	0	75	35	65	75
ΔTL:	L/240	Balcony Floor, (psf)	35	60	0	0	3.5	95	35	80	95
ΔLL:	L/360	Wall, (psf)	15	0	0	0	3.5	15	15	15	15
C _p ^(A) :	1.15	Total Dist. Load, (plf)	175	210	0	0		385	175	333	385

		DL	L	Lr	S	Location, (ft)	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Max Shear, (lb):	3074	Point Load 1, (lb)	0	0	0	0	0	0	0	0
Max Moment, (lb-ft):	12320	Point Load 2, (lb)	0	0	0	0	0	0	0	0

		DL	L	Lr	S	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Right Side Reaction, (lb)		1400	1680	0	0	3080	1400	2660	3080
Left Side Reaction, (lb)		1400	1680	0	0	3080	1400	2660	3080

# of Plies/Width	3	# of Plies/Width	3	# of Plies/Width	5 1/8	Selection #	33					
Fv ^(B,C,D) (psi) Fb ^(E,F,G) (psi) ΔTL ΔLL	2x			LVL			Glu-Lam			Custom Selection		
	NG			(3) 1-3/4 x 9.5 LVL			5-1/8 x 10.5 GLB			(3) 1-3/4 x 11.25 LVL		
	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check
				92.4	327.8	0.28	85.7	304.8	0.28	78.1	327.8	0.24
				1872.1	2925.1	0.64	1569.9	2692.6	0.58	1335.0	2907.6	0.46
				0.797	0.800	1.00	0.638	0.800	0.80	0.480	0.800	0.60
				0.434	0.533	0.81	0.348	0.533	0.65	0.262	0.533	0.49

Selection: **LVL** USE: (3) 1-3/4 x 9.5 LVL

Mark: FB2 (See Steel Beam Calc)			D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Span (ft):	8.5	Roof, (psf)	18	0	20	32	0	18	50	42	50
Unbraced Length (ft):	8.5	Floor, (psf)	35	40	0	0	0	75	35	65	75
	ΔTL:	L/240	35	60	0	0	2	95	35	80	95
	ΔLL:	L/360	45	0	0	0	0	45	45	45	45
	C _p ^(A) :	1.15	Total Dist. Load, (plf)	70	120	0	0	190	70	160	190

		DL	L	Lr	S	Location, (ft)	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Max Shear, (lb):	807	Point Load 1, (lb)	0	0	0	0	0	0	0	0
Max Moment, (lb-ft):	1716	Point Load 2, (lb)	0	0	0	0	0	0	0	0

		DL	L	Lr	S	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Right Side Reaction, (lb)		298	510	0	0	808	298	680	808
Left Side Reaction, (lb)		298	510	0	0	808	298	680	808

# of Plies/Width	3	# of Plies/Width			2	# of Plies/Width			5 1/8	Selection #			11
	2x			LVL			Glu-Lam			Custom Selection			
	(3) 2x6			(2) 1-3/4 x 5.5 LVL			5-1/8 x 9 GLB			(3) 2x10			
	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	
	F _v ^(B,C,D) (psi):	48.9	207.0	0.24	62.9	327.8	0.19	26.3	304.8	0.09	29.1	207.0	0.14
F _b ^(E,F,G) (psi):	907.6	1345.5	0.67	1166.9	2895.0	0.40	297.6	2734.2	0.11	320.9	1138.5	0.28	
ΔTL:	0.224	0.425	0.53	0.242	0.425	0.57	0.040	0.425	0.09	0.047	0.425	0.11	
ΔLL:	0.141	0.283	0.50	0.153	0.283	0.54	0.025	0.283	0.09	0.030	0.283	0.10	

Selection: **Custom** USE: (3) 2x10

Mark: FB3			D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr	Max
Span (ft):	8.5	Roof, (psf)	18	0	20	32	0	18	50	42	50
Unbraced Length (ft):	8.5	Floor, (psf)	35	40	0	0	12	75	35	65	75
ΔTL:	L/240	Floor, (psf)	0	0	0	0	0	0	0	0	0
ΔLL:	L/360	Wall, (psf)	45	0	0	0	0	45	45	45	45
C _p ^(A) :	1.15	Total Dist. Load, (plf)	420	480	0	0		900	420	780	900

		DL	L	Lr	S	Location, (ft)	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Max Shear, (lb):	3825	Point Load 1, (lb)	0	0	0	0	0	0	0	0
Max Moment, (lb-ft):	8128	Point Load 2, (lb)	0	0	0	0	0	0	0	0

		DL	L	Lr	S	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Right Side Reaction, (lb)		1785	2040	0	0	3825	1785	3315	3825
Left Side Reaction, (lb)		1785	2040	0	0	3825	1785	3315	3825

# of Plies/Width	3			2			5 1/8			Selection #			26		
	2x			LVL			Glu-Lam			Custom Selection					
	(3) 2x12			(2) 1-3/4 x 9.25 LVL			5-1/8 x 9 GLB			(2) 1-3/4 x 14 LVL					
	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check			
	F _v ^(B,C,D) (psi):	113.3	207.0	0.55	177.2	327.8	0.54	124.4	304.8	0.41	117.1	327.8	0.36		
F _b ^(E,F,G) (psi):	1027.6	1035.0	0.99	1954.2	2752.1	0.71	1409.8	2734.2	0.52	853.1	2385.7	0.36			
ΔTL:	0.124	0.425	0.29	0.241	0.425	0.57	0.189	0.425	0.44	0.070	0.425	0.16			
ΔLL:	0.066	0.283	0.23	0.129	0.283	0.45	0.101	0.283	0.36	0.037	0.283	0.13			

Selection: **Custom** USE: (2) 1-3/4 x 14 LVL

PROJECT: K & B Apartments
SUBJECT: FJ2

PROJECT NO: 123021
ENGINEER: JPF

DATE: May 2025
SHEET: 6 of 7

Wood Beams

Version: June 2020/JoshF
File Name: 2.2 Wood Beams_2024-02-29.xlsm
Code Ref.: NDS 2018

Mark: FJ2		D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Span (ft):	7.0	18	0	20	32	0	18	50	42	50
Unbraced Length (ft):	7.0	35	40	0	0	0	75	35	65	75
ΔTL:	L/240	35	60	0	0	2	95	35	80	95
ΔLL:	L/360	45	0	0	0	0	45	45	45	45
C _p ^(A) :	1.15	70	120	0	0		190	70	160	190
Total Dist. Load, (plf)										

		DL	L	Lr	S	Location, (ft)	D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Max Shear, (lb):	665	0	0	0	0	0	0	0	0	0
Max Moment, (lb-ft):	1164	0	0	0	0	0	0	0	0	0

		DL	L	Lr	S		D+L	D+Lr/S	D+.75L+.75Lr/S	Max
Right Side Reaction, (lb)		245	420	0	0		665	245	560	665
Left Side Reaction, (lb)		245	420	0	0		665	245	560	665

# of Plies/Width	1	# of Plies/Width			3	# of Plies/Width			5 1/8	Selection #			3
F _v ^(B,C,D) (psi): F _b ^(E,F,G) (psi): ΔTL: ΔLL:	2x			LVL			Glu-Lam			Custom Selection			
	2x8			(3) 1-3/4 x 5.5 LVL			5-1/8 x 9 GLB			2x10			
	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	Actual	Capacity	Unity Check	
	91.7	207.0	0.44	34.5	327.8	0.11	21.6	304.8	0.07	71.9	207.0	0.35	
	1062.7	1345.5	0.79	527.6	2977.2	0.18	201.8	2738.6	0.07	652.9	1345.5	0.49	
	0.135	0.350	0.38	0.074	0.350	0.21	0.018	0.350	0.05	0.065	0.350	0.19	
	0.085	0.233	0.36	0.047	0.233	0.20	0.012	0.233	0.05	0.041	0.233	0.18	

Selection: **Custom** USE: **2x10 @ 16 o.c.**

PROJECT: [K & B Apartments](#)
SUBJECT: [Code References](#)

PROJECT NO: [123021](#)
ENGINEER: [JPF](#)

DATE: [May 2025](#)
SHEET: [7 of 7](#)

Wood Beams - Tabulated Values Notes and Equations

Version: June 2020/JoshF
File Name: 2.2 Wood Beams_2024-02-29.xlsm
Code Ref.: NDS 2018

Equations

A = Value found from Table 2.3.2
B = Sawn lumber shear capacity equation found in Table 4.3.1 ($F_v' = F_v \cdot C_D \cdot C_M \cdot C_t \cdot C_i$)
C = LVL & Glu-Lam shear capacity equation found in Table 4.3.1 ($F_v' = F_v \cdot C_D \cdot C_M \cdot C_t \cdot C_i$)
D = Sawn Lumber, LVL & Glu-Lam actual shear equation found in Table 4.3.1 ($f_v = 3 \cdot V / (2 \cdot b \cdot d)$)
E = Sawn lumber bending capacity equation found in Table 4.3.1 ($F_b' = F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_P \cdot C_u \cdot C_i \cdot C_r$)
F = LVL & Glu-Lam bending capacity equation found in Table 4.3.1 ($F_b' = F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_P \cdot C_u \cdot C_i \cdot C_r$)
G = Sawn Lumber, LVL & Glu-Lam actual bending equation found in Table 4.3.1 ($f_b = 6 \cdot M / (b \cdot d^2)$)

Variables	Definition
V	Shear
M	Moment
b	Beam Width
d	Beam Depth

Variables	Solid Sawn Reference	LVL Reference	Glu Lam Reference
F_v	Table 4A	Table 5A	Table 5A
F_b	Table 4A	Table 5A	Table 5A
C_D	Table 2.3.2	Table 2.3.2	Table 2.3.2
C_M	Table 4A	Table 5A	Table 5A
C_t	Table 2.3.3	Table 2.3.3	Table 2.3.3
C_L	Section 3.3.3	Section 3.3.3	Section 3.3.3
C_P	Table 4A	-	-
C_u	Table 4A	-	Eqn. 5.3-2
C_i	Table 4.3.8	-	-
C_r	Section 4.3.9	Section 8.3.7	-
C_v	-	-	Equation 5.3-1
C_e	-	-	Section 5.3.8
C_l	-	-	Equation 5.3-4
C_{vr}	-	-	Section 5.3.10

Steel Beam

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.06.04

CARTWRIGHT AEC

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DESCRIPTION: Stringer 1 (S1)

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

Load Combination Set : IBC 2021

Material Properties

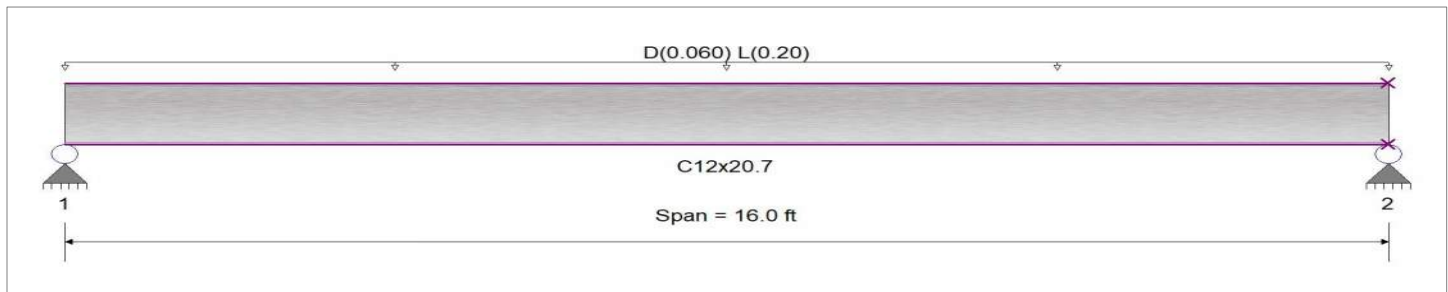
Analysis Method : Allowable Strength Design

Fy : Steel Yield : 36.0 ksi

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

E: Modulus : 29,000.0 ksi

Bending Axis : Major Axis Bending



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading

Uniform Load : D = 0.030, L = 0.10 ksf, Tributary Width = 2.0 ft, (Stringer)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.195 : 1	Maximum Shear Stress Ratio =	0.051 : 1
Section used for this span	C12x20.7	Section used for this span	C12x20.7
Ma : Applied	8.982 k-ft	Va : Applied	2.246 k
Mn / Omega : Allowable	45.988 k-ft	Vn/Omega : Allowable	43.769 k
Load Combination	+D+L	Load Combination	+D+L
Span # where maximum occurs	Span # 1	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Maximum Deflection			
Max Downward Transient Deflection	0.079 in	Ratio =	2,424 >=360
Max Upward Transient Deflection	0 in	Ratio =	0 <360
Max Downward Total Deflection	0.111 in	Ratio =	1727 >=240
Max Upward Total Deflection	0 in	Ratio =	0 <240.0
		Span: 1 : L Only	n/a
		Span: 1 : +D+L	n/a

Vertical Reactions

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.246	2.246
Max Upward from Load Combinations	2.246	2.246
Max Upward from Load Cases	1.600	1.600
D Only	0.646	0.646
+D+L	2.246	2.246
+D+0.750L	1.846	1.846
+0.60D	0.387	0.387
L Only	1.600	1.600

Steel Beam

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.25.04.16

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: FB2

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021

Load Combination Set : ASCE 7-16

Material Properties

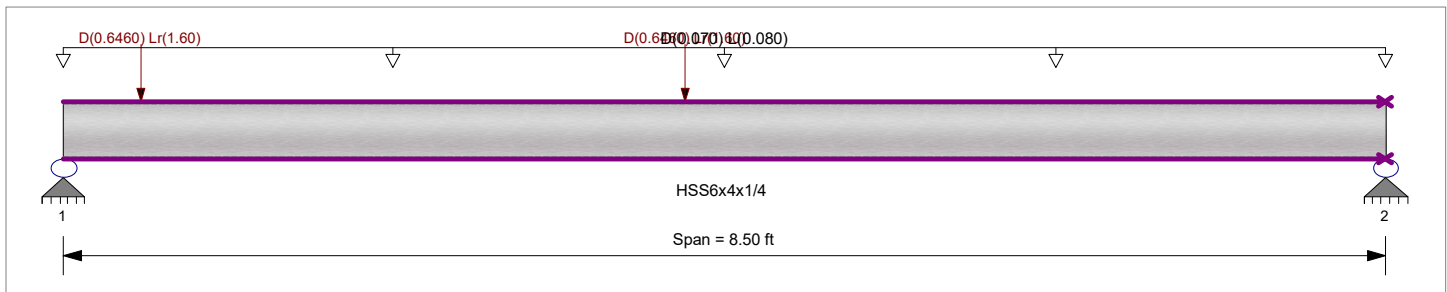
Analysis Method : Allowable Strength Design

Fy : Steel Yield : 50.0 ksi

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

E: Modulus : 29,000.0 ksi

Bending Axis : Major Axis Bending



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading

Uniform Load : D = 0.0350, L = 0.040 ksf, Tributary Width = 2.0 ft, (Floor)

Point Load : D = 0.6460, Lr = 1.60 k @ 0.50 ft, (Stringer (S1))

Point Load : D = 0.6460, Lr = 1.60 k @ 4.0 ft, (Stringer (S1))

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio = 0.287 : 1

Maximum Shear Stress Ratio = 0.083 : 1

Section used for this span

HSS6x4x1/4

Section used for this span

HSS6x4x1/4

Ma : Applied 6.113 k-ft

Va : Applied 3.667 k

Mn / Omega : Allowable 21.282 k-ft

Vn/Omega : Allowable 44.376 k

Load Combination

Load Combination

+D+Lr

+D+Lr

Span # where maximum occurs

Span # 1

Location of maximum on span

0.000 ft

Span # where maximum occurs

Span # 1

Maximum Deflection

Max Downward Transient Deflection 0.069 in Ratio = 1,483 >=360 Span: 1 : Lr Only

Max Upward Transient Deflection 0 in Ratio = 0 <360 n/a

Max Downward Total Deflection 0.113 in Ratio = 901 >=180 Span: 1 : +D+Lr

Max Upward Total Deflection 0 in Ratio = 0 <180 n/a

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+Lr	0.1132	4.129		0.0000	0.000

Vertical Reactions

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	3.667	1.596
Max Upward from Load Combinations	3.667	1.596
Max Upward from Load Cases	2.353	0.847
D Only	1.314	0.706
+D+L	1.654	1.046
+D+Lr	3.667	1.553
+D+0.750Lr+0.750L	3.334	1.596
+D+0.750L	1.569	0.961
+0.60D	0.788	0.424
Lr Only	2.353	0.847
L Only	0.340	0.340

Concrete Slender Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Concrete Wall Design (Line 1 & 2)

Code References

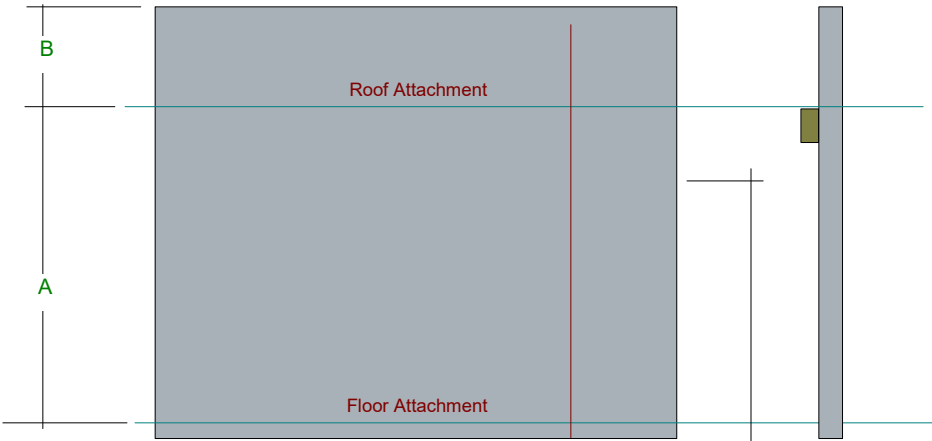
Calculations per ACI 318-19 Sec 11.8, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-22 / IBC 2024 (L<=100psf)

General Information

f'c : Concrete 28 day streng	=	3.0 ksi	Wall Thickness	12 in	Temp Diff across thickness	=	deg F
Fy : Rebar Yield	=	60.0 ksi	Rebar at each face		Min Allow Out-of-Plane Defl Ratio	=	0.0
Ec : Concrete Elastic Modu	=	3,122.0 ksi	Rebar "d" distance	1.250 in			
λ : Lt Wt Conc Fact	=	1.0	Lower Level Rebar . . .		Min allow As/bd	=	0.0020
Fr : Rupture Modulus	=	273.861 psi	Bar Size	# 4			
Max Allow As/bd	=	0.01355	Bar Spacing	18 in			
Max Pu/Ag = f'c *	=	0.060					
Concrete Density	=	144.0 pcf					
Width of Design Strip	=	12.0 in					

One-Story Wall Dimensions

A Clear Height	=	14 ft
B Parapet height	=	ft
Wall Support ConditionTop & Bottom Pinned		



Vertical Loads

Vertical Uniform Loads . . . (Applied per foot of Strip Width)			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load	Eccentricity	6.750 in					k/ft
Concentric Load			2.782		.640	.192	k/ft

Lateral Loads

Wind Loads :		Seismic Loads :
Full area WIND load	29.1 psf	Wall Weight Seismic Load Input Method :ASCE seismic factors entered

SDS Value per ASCE 12.11.1 $S_{DS} * I = .836$
 $F_p = \text{Wall Wt.} * 0.3344 = 48.154 \text{ psf}$

Concrete Slender Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Concrete Wall Design (Line 1 & 2)

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

Governing Load Combination . . .		Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +0.90D+E	Maximum Bending Stress Ratio0.1427			
		Max Mu	1.180 k-ft	Phi * Mn	8.269 k-ft
PASS	Service Deflection Check E Only	Actual Defl. Ratio L/	16368	Allowable Defl. Ratio	150.0
		Max. Deflection	0.01026 in		
PASS	Axial Load Check +1.20D+0.50L+0.150S+E	Max Pu / Ag	34.566 psi	Max. Allow. Defl.	1.120 in
		Location	6.767 ft	0.06 * f'c	180.0 psi
PASS	Reinforcing Limit Check OK per ACI 318 Section 22.2	Actual As/bd	0.001034	Max Allow As/bd	0.01355
Maximum Reactions for Load Combination...					
		Top Horizontal	E Only		0.3371 k
		Base Horizontal	E Only		0.3371 k
		Vertical Reaction	+D+0.750Lr+0.750L		5.902 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load		Mcr k-ft	Mu k-ft	Moment Values			As in^2	As Ratio	0.6 * rho bal	Bar 'd'
	Pu k	0.06*f'c*b*t k			Phi	Phi Mn k-ft					
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00	
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00	
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00	
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00	
+1.20D+1.60Lr+0.50W at 6.53 to 7.00	5.960	25.920	6.57	0.36	0.90	9.24	0.133	0.0010	0.0135	10.75	
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00	
+1.20D+S+0.50W at 6.53 to 7.00	4.821	25.920	6.57	0.36	0.90	8.80	0.133	0.0010	0.0135	10.75	
+1.20D+0.50Lr+0.50L+W at 6.53 to 7.00	5.365	25.920	6.57	0.71	0.90	9.01	0.133	0.0010	0.0135	10.75	
+1.20D+0.50L+0.30S+W at 6.53 to 7.00	5.006	25.920	6.57	0.71	0.90	8.87	0.133	0.0010	0.0135	10.75	
+0.90D+W at 6.53 to 7.00	3.471	25.920	6.57	0.71	0.90	8.29	0.133	0.0010	0.0135	10.75	
+1.20D+0.50L+0.150S+E at 6.53 to 7.00	4.977	25.920	6.57	1.18	0.90	8.86	0.133	0.0010	0.0135	10.75	
+0.90D+E at 6.53 to 7.00	3.471	25.920	6.57	1.18	0.90	8.29	0.133	0.0010	0.0135	10.75	

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values		I gross in^4	Stiffness		Deflections	
		Mcr k-ft	Mactual k-ft		I cracked in^4	I effective in^4	Deflection in	Defl. Ratio
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
+D+0.60W at 6.53 to 7.00	3.857	6.57	0.43	1,728.00	154.47	1296.000	0.004	45,020.3
+D+0.750Lr+0.750L+0.450W at 6.53 to 7.00	4.961	6.57	0.32	1,728.00	163.04	1296.000	0.003	59,980.1
+D+0.750L+0.5250S+0.450W at 6.53 to 7.00	4.438	6.57	0.32	1,728.00	158.97	1296.000	0.003	60,002.3
+0.60D+0.60W at 6.53 to 7.00	2.314	6.57	0.43	1,728.00	142.37	1296.000	0.004	45,068.7
+D+0.70E at 6.53 to 7.00	3.857	6.57	0.83	1,728.00	154.47	1296.000	0.007	23,319.8
+D+0.750L+0.10S+0.5250E at 6.53 to 7.00	4.356	6.57	0.62	1,728.00	158.33	1296.000	0.005	31,082.1
+0.60D+0.70E at 6.53 to 7.00	2.314	6.57	0.83	1,728.00	142.37	1296.000	0.007	23,344.9
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0

Concrete Slender Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Concrete Wall Design (Line 1 & 2)

	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
W Only at 7.00 to 7.47	0.000	6.57	0.71	1,728.00	123.97	1296.000	0.006	27,084.8
E Only at 7.00 to 7.47	0.000	6.57	1.18	1,728.00	123.97	1296.000	0.010	16,367.8

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	4.798 k
+D+L	0.0 k	0.00 k	5.438 k
+D+Lr	0.0 k	0.00 k	5.630 k
+D+0.70S	0.0 k	0.00 k	4.932 k
+D+0.750Lr+0.750L	0.0 k	0.00 k	5.902 k
+D+0.750L+0.5250S	0.0 k	0.00 k	5.379 k
+D+0.60W	0.1 k	0.12 k	4.798 k
+D+0.750Lr+0.750L+0.450W	0.1 k	0.09 k	5.902 k
+D+0.750L+0.5250S+0.450W	0.1 k	0.09 k	5.379 k

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
+0.60D+0.60W	0.1 k	0.12 k	2.879 k
+D+0.70E	0.2 k	0.24 k	4.798 k
+D+0.750L+0.10S+0.5250E	0.2 k	0.18 k	5.297 k
+0.60D+0.70E	0.2 k	0.24 k	2.879 k
Lr Only	0.0 k	0.00 k	0.832 k
L Only	0.0 k	0.00 k	0.640 k
S Only	0.0 k	0.00 k	0.192 k
W Only	0.2 k	0.20 k	0.000 k
E Only	0.3 k	0.34 k	0.000 k

Concrete Slender Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Concrete Wall Design (Line A & B)

Code References

Calculations per ACI 318-19 Sec 11.8, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-22 / IBC 2024 (L<=100psf)

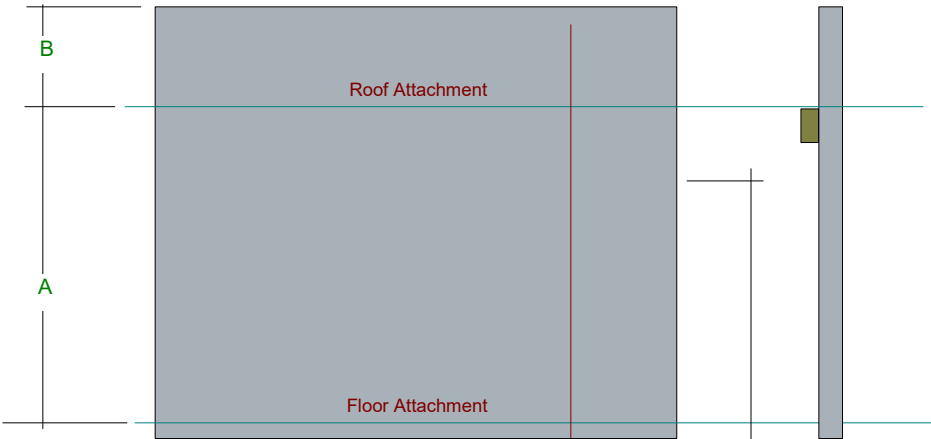
General Information

f'c : Concrete 28 day streng	=	4.0 ksi	Wall Thickness	12.0 in	Temp Diff across thickness	=	deg F
Fy : Rebar Yield	=	60.0 ksi	Rebar at each face		Min Allow Out-of-Plane Defl Ratio	=	0.0
Ec : Concrete Elastic Modu	=	3,122.0 ksi	Rebar "d" distance	1.250 in			
λ : Lt Wt Conc Fact	=	1.0	Lower Level Rebar . . .		Min allow As/bd	=	0.0020
Fr : Rupture Modulus	=	316.228 psi	Bar Size	# 4			
Max Allow As/bd	=	0.01806	Bar Spacing	18.0 in			
Max Pu/Ag = f'c *	=	0.060					
Concrete Density	=	144.0 pcf					
Width of Design Strip	=	12.0 in					

One-Story Wall Dimensions

A Clear Height	=	14.0 ft
B Parapet height	=	ft

Wall Support ConditionTop & Bottom Pinned



Vertical Loads

Vertical Uniform Loads . . . (Applied per foot of Strip Width)

Ledger Load	Eccentricity	3 in
Concentric Load		

DL : Dead

8.202

Lr : Roof Live

Lf : Floor Live

2.610

S : Snow

.736

W : Wind

k/ft

k/ft

Lateral Loads

Wind Loads :

Full area WIND load 29.10 psf

Seismic Loads :

Wall Weight Seismic Load Input Method :ASCE seismic factors entered

SDS Value per ASCE 12.11.1 $S_{DS} * I = 0.8360$

$F_p = \text{Wall Wt.} * 0.3344 = 48.154 \text{ psf}$

Concrete Slender Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Concrete Wall Design (Line A & B)

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

Governing Load Combination . . .		Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +1.20D+1.60L+0.30S	Maximum Bending Stress Ratio0.5111			
		Max Mu	3.560 k-ft	Phi * Mn	6.965 k-ft
PASS	Service Deflection Check +D+0.750L+0.10S+0.5250E	Actual Defl. Ratio L/	8,706	Allowable Defl. Ratio	150.0
		Max. Deflection	0.01930 in		
PASS	Axial Load Check +1.20D+1.60L+0.30S	Max Pu / Ag	198.888 psi	Max. Allow. Defl.	1.120 in
		Location	13.767 ft	0.06 * f'c	240.0 psi
PASS	Reinforcing Limit Check OK per ACI 318 Section 22.2	Actual As/bd	0.001034	Max Allow As/bd	0.01806
Maximum Reactions for Load Combination...					
	Top Horizontal	E Only			0.3371 k
	Base Horizontal	+D+0.70E			0.3823 k
	Vertical Reaction	+D+L			23.640 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load			Moment Values				0.6 *		
	Pu k	0.06*f'c*b*t k	Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	rho bal	Bar 'd'
+1.40D at 13.53 to 14.00	0.000	34.560	7.59	2.87	0.90	6.96	0.133	0.0010	0.0181	10.75
+1.20D+1.60L at 13.53 to 14.00	0.000	34.560	7.59	3.50	0.90	6.96	0.133	0.0010	0.0181	10.75
+1.20D+1.60L+0.30S at 13.53 to 14.0	0.000	34.560	7.59	3.56	0.90	6.96	0.133	0.0010	0.0181	10.75
+1.20D+0.50L at 13.53 to 14.00	0.000	34.560	7.59	2.79	0.90	6.96	0.133	0.0010	0.0181	10.75
+1.20D+0.50W at 13.53 to 14.00	0.000	34.560	7.59	2.46	0.90	6.96	0.133	0.0010	0.0181	10.75
+1.20D+0.50L+S at 13.53 to 14.00	0.000	34.560	7.59	2.97	0.90	6.96	0.133	0.0010	0.0181	10.75
+1.20D+S+0.50W at 13.53 to 14.00	0.000	34.560	7.59	2.64	0.90	6.96	0.133	0.0010	0.0181	10.75
+1.20D+0.50L+W at 13.07 to 13.53	22.456	34.560	7.59	2.79	0.90	15.82	0.133	0.0010	0.0181	10.75
+1.20D+0.50L+0.30S+W at 13.07 to 122.898	34.560	34.560	7.59	2.84	0.90	15.98	0.133	0.0010	0.0181	10.75
+0.90D+W at 11.20 to 11.67	15.126	34.560	7.59	1.95	0.90	13.03	0.133	0.0010	0.0181	10.75
+1.20D+0.50L+0.150S+E at 10.73 to 23.080	34.560	34.560	7.59	3.04	0.90	16.05	0.133	0.0010	0.0181	10.75
+0.90D+E at 9.33 to 9.80	15.368	34.560	7.59	2.30	0.90	13.12	0.133	0.0010	0.0181	10.75

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values		I gross in^4	Stiffness		Deflections	
		Mcr k-ft	Mactual k-ft		I cracked in^4	I effective in^4	Deflection in	Defl. Ratio
D Only at 7.93 to 8.40	17.278	7.59	1.21	1,728.00	254.80	1296.000	0.011	15,096.9
+D+L at 7.93 to 8.40	22.498	7.59	1.60	1,728.00	291.79	1296.000	0.015	11,410.6
+D+0.70S at 7.93 to 8.40	18.308	7.59	1.29	1,728.00	262.16	1296.000	0.012	14,194.4
+D+0.750L at 7.93 to 8.40	21.193	7.59	1.51	1,728.00	282.64	1296.000	0.014	12,154.6
+D+0.750L+0.5250S at 7.93 to 8.40	21.965	7.59	1.56	1,728.00	288.04	1296.000	0.014	11,702.9
+D+0.60W at 7.47 to 7.93	17.345	7.59	1.57	1,728.00	255.27	1296.000	0.015	11,332.8
+D+0.750L+0.450W at 7.47 to 7.93	21.260	7.59	1.74	1,728.00	283.10	1296.000	0.017	10,128.5
+D+0.750L+0.5250S+0.450W at 7.47 to 22.033	34.560	7.59	1.80	1,728.00	288.55	1296.000	0.017	9,812.7
+0.60D+0.60W at 7.47 to 7.93	10.407	7.59	1.11	1,728.00	204.45	1296.000	0.010	16,256.3
+D+0.70E at 7.47 to 7.93	17.345	7.59	1.97	1,728.00	255.27	1296.000	0.018	9,183.8
+D+0.750L+0.10S+0.5250E at 7.47 to 7.93	21.407	7.59	2.05	1,728.00	284.14	1296.000	0.019	8,705.7
+0.60D+0.70E at 7.47 to 7.93	10.407	7.59	1.51	1,728.00	204.45	1296.000	0.014	12,186.1
L Only at 7.93 to 8.40	5.220	7.59	0.38	1,728.00	165.03	1296.000	0.004	47,842.9
S Only at 7.93 to 8.40	1.472	7.59	0.11	1,728.00	135.71	1296.000	0.001	170,101.9
W Only at 7.00 to 7.47	0.000	7.59	0.71	1,728.00	123.97	1296.000	0.006	27,084.8

Concrete Slender Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Concrete Wall Design (Line A & B)

E Only at 7.00 to 7.47 0.000 7.59 1.18 1,728.00 123.97 1296.000 0.010 16,367.8

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.1 k	0.15 k	18.420 k
+D+L	0.2 k	0.19 k	23.640 k
+D+0.70S	0.2 k	0.16 k	19.450 k
+D+0.750L	0.2 k	0.18 k	22.335 k
+D+0.750L+0.5250S	0.2 k	0.19 k	23.108 k
+D+0.60W	0.3 k	0.02 k	18.420 k
+D+0.750L+0.450W	0.3 k	0.09 k	22.335 k
+D+0.750L+0.5250S+0.450W	0.3 k	0.10 k	23.108 k
+0.60D+0.60W	0.2 k	0.03 k	11.052 k
+D+0.70E	0.4 k	0.09 k	18.420 k
+D+0.750L+0.10S+0.5250E	0.4 k	0.01 k	22.482 k

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
+0.60D+0.70E	0.3 k	0.15 k	11.052 k
L Only	0.0 k	0.05 k	5.220 k
S Only	0.0 k	0.01 k	1.472 k
W Only	0.2 k	0.20 k	0.000 k
E Only	0.3 k	0.34 k	0.000 k

Project File: 123021 K&B Apartments.ec6

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: CL1 (For reactions only - precast engineer to design beam)

CODE REFERENCES

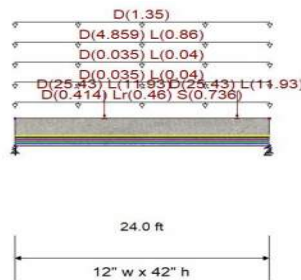
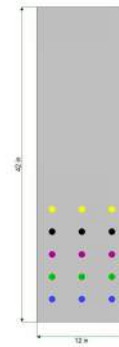
Calculations per ACI 318-19, IBC 2021, ASCE 7-16

Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

General Information

f _c	=	4.50 ksi	Φ Phi Values	Flexure :	0.90
f _r = f _c ^{1/2} · 7.50	=	503.12 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β ₁	=	0.8250
λ _{LtWt} Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		60.0 ksi
f _y - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
		Number of Resisting Legs Per Stirrup	=		2

Seismic Design Category = A



Cross Section & Reinforcing Details

Rectangular Section, Width = 12.0 in, Height = 42.0 in

Span #1 Reinforcing....

3-#7 at 3.0 in from Bottom, from 0.0 to 24.0 ft in this span

3-#7 at 9.0 in from Bottom, from 0.0 to 24.0 ft in this span

3-#7 at 15.0 in from Bottom, from 0.0 to 24.0 ft in this span

3-#7 at 6.0 in from Bottom, from 0.0 to 24.0 ft in this span

3-#7 at 12.0 in from Bottom, from 0.0 to 24.0 ft in this sl

Beam self weight calculated and added to loads

Load for Span Number 1

Uniform Load : $D = 0.0180$, $L_r = 0.020$, $S = 0.0320$ ksf, Tributary Width = 23.0 ft, (Roof)

Uniform Load : $D = 0.0350$, $L = 0.040$ ksf, Tributary Width = 1.0 ft, (3rd Floor)

Uniform Load : $D = 0.0350$, $L = 0.040$ ksf, Tributary Width = 1.0 ft, (2nd Floor)

Uniform Load : $D = 0.2260$, $L = 0.040$ ksf, Tributary Width = 21.50 ft, (1st Floor)

Point Load : D = 25.430, L = 11.930 k @ 8.50 ft, (Precast Beam)

Point Load : D = 25.430, L = 11.930 k @ 21.0 ft. (Precast Beam)

Uniform Load : $D = 0.0450$ ksf, Tributary Width = 30.0 ft, (Wall)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.946 : 1
Section used for this span		Typical Section
Mu : Applied		1,038.42 k-ft
Mn * Phi : Allowable		1,098.27 k-ft
Location of maximum on span		10.885 ft
Span # where maximum occurs		Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.062 in	Ratio =	4611	>=360.0	Lr Only
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360.0	L Only
Max Downward Total Deflection	0.638 in	Ratio =	451	>=240.0	Span: 1 : +D+L
Max Upward Total Deflection	0.000 in	Ratio =	0	<240.0	Span: 1 : +D+L

Concrete Beam

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: CL1 (For reactions only - precast engineer to design beam)

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	126.484	143.608
Max Upward from Load Combinations	126.484	143.608
Max Upward from Load Cases	106.008	117.664
D Only	106.008	117.664
+D+L	126.484	143.608
+D+Lr	111.528	123.184
+D+0.70S	112.191	123.846
+D+0.750Lr+0.750L	125.505	141.262
+D+0.750L+0.5250S	126.002	141.758
+0.60D	63.605	70.598
+D+0.750L+0.10S	122.249	138.005
Lr Only	5.520	5.520
L Only	20.476	25.944
S Only	8.832	8.832

Shear Stirrup Requirements

Between 0.00 to 1.09 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 2 in
 Between 1.14 to 3.76 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 3 in
 Between 3.80 to 5.33 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 4 in
 Between 5.38 to 6.38 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 5 in
 Between 6.43 to 7.13 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 6 in
 Between 7.17 to 7.69 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 7 in
 Between 7.74 to 8.13 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 8 in
 Between 8.17 to 8.48 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 9 in
 Between 8.52 to 9.18 ft, Max spacing per T9.7.6.2.2, use #3 stirrups spaced at 16 in
 Between 9.22 to 12.81 ft, Ties Not Req'd, Stirrups are not required.
 Between 12.85 to 16.87 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 16 in
 Between 16.92 to 17.01 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 15 in
 Between 17.05 to 17.18 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 14 in
 Between 17.22 to 17.36 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 13 in
 Between 17.40 to 17.53 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 12 in
 Between 17.57 to 17.79 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 11 in
 Between 17.84 to 18.05 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 10 in
 Between 18.10 to 18.40 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 9 in
 Between 18.45 to 18.84 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 8 in
 Between 18.89 to 19.41 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 7 in
 Between 19.45 to 20.20 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 6 in
 Between 20.24 to 20.98 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 5 in
 Between 21.03 to 23.96 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 2 in

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	ΦV_c (k)	ΦV_s (k)	ΦV_n (k)	Vu / ΦV_n	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+0.50Lr+1.60L	1	0.00	33.00	162.73	Yes	2.70	41.91	120.82	162.73	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.26	33.00	160.01	Yes	2.77	41.91	118.10	160.01	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.52	33.00	157.29	Yes	2.83	41.91	115.38	157.29	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.79	33.00	154.57	Yes	2.90	41.91	112.66	154.57	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	1.05	33.00	151.85	Yes	2.97	41.91	109.94	151.85	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	1.31	33.00	149.13	Yes	3.05	41.91	107.21	149.13	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	1.57	33.00	146.40	Yes	3.13	41.91	104.49	146.40	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	1.84	33.00	143.68	Yes	3.21	41.91	101.77	143.68	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	2.10	33.00	140.96	Yes	3.30	41.91	99.05	140.96	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	2.36	33.00	138.24	Yes	3.39	41.91	96.33	138.24	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	2.62	33.00	135.52	Yes	3.49	41.91	93.61	135.52	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	2.89	33.00	132.80	Yes	3.59	41.91	90.89	132.80	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	3.15	33.00	130.08	Yes	3.71	41.91	88.17	130.08	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	3.41	33.00	127.36	Yes	3.82	41.91	85.44	127.36	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	3.67	33.00	124.63	Yes	3.95	41.91	82.72	124.63	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	3.93	33.00	121.91	Yes	4.08	41.91	80.00	121.91	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	4.20	33.00	119.19	Yes	4.23	41.91	77.28	119.19	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	4.46	33.00	116.47	Yes	4.38	41.91	74.56	116.47	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	4.72	33.00	113.75	Yes	4.55	41.91	71.84	113.75	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	4.98	33.00	111.03	Yes	4.73	41.91	69.12	111.03	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	5.25	33.00	108.31	Yes	4.92	41.91	66.40	108.31	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	5.51	33.00	105.59	Yes	5.13	41.91	63.67	105.59	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	5.77	33.00	102.87	Yes	5.36	41.91	60.95	102.87	1.000	Eqn (b)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	6.03	33.00	100.14	Yes	5.61	41.91	58.23	100.14	1.000	Eqn (b)	Req'd Vs per 22.5.8.1

Concrete Beam

Project File: 123021 K&B Apartments.ecb

LIC#: KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: CL1 (For reactions only - precast engineer to design beam)

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+0.50Lr+1.60L	1	6.30	33.00	97.42	Yes	5.89	41.91	55.51	97.42	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	6.56	33.00	94.70	Yes	6.19	41.91	52.79	94.70	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	6.82	33.00	91.98	Yes	6.53	41.91	50.07	91.98	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	7.08	33.00	89.26	Yes	6.90	41.91	47.35	89.26	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	7.34	33.00	86.54	Yes	7.32	41.91	44.63	86.54	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	7.61	33.00	83.82	Yes	7.80	41.91	41.91	83.82	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	7.87	33.00	81.10	Yes	8.34	41.91	39.18	81.10	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	8.13	33.00	78.37	Yes	8.96	41.91	36.46	78.37	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	8.39	33.00	75.65	Yes	9.68	41.91	33.74	75.65	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	8.66	33.00	25.55	Yes	16.50	41.91	19.80	61.71	0.414	Eqn (b)	Max spacing per T9.7.6.
+1.40D	1	8.92	33.00	22.91	Yes	16.50	41.91	19.80	61.71	0.371	Eqn (b)	Max spacing per T9.7.6.
+1.40D	1	9.18	33.00	20.27	Yes	16.50	41.91	19.80	61.71	0.328	Eqn (b)	Max spacing per T9.7.6.
+1.40D	1	9.44	33.00	17.62	No	N/A	28.58	0.00	28.58	0.616	Eqn (c)	Ties Not Req'd
+1.40D	1	9.70	33.00	14.98	No	N/A	28.58	0.00	28.58	0.524	Eqn (c)	Ties Not Req'd
+1.40D	1	9.97	33.00	12.33	No	N/A	28.58	0.00	28.58	0.431	Eqn (c)	Ties Not Req'd
+1.40D	1	10.23	33.00	9.69	No	N/A	28.58	0.00	28.58	0.339	Eqn (c)	Ties Not Req'd
+1.20D+S	1	10.49	33.00	7.15	No	N/A	28.58	0.00	28.58	0.250	Eqn (c)	Ties Not Req'd
+1.20D+S	1	10.75	33.00	4.69	No	N/A	28.58	0.00	28.58	0.164	Eqn (c)	Ties Not Req'd
+1.20D+S	1	11.02	33.00	2.23	No	N/A	28.58	0.00	28.58	0.078	Eqn (c)	Ties Not Req'd
+1.20D+1.60L+0.30S	1	11.28	33.00	-3.89	No	N/A	28.58	0.00	28.58	0.136	Eqn (c)	Ties Not Req'd
+1.20D+1.60L+0.30S	1	11.54	33.00	-6.61	No	N/A	28.58	0.00	28.58	0.231	Eqn (c)	Ties Not Req'd
+1.20D+1.60L+0.30S	1	11.80	33.00	-9.33	No	N/A	28.58	0.00	28.58	0.326	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	12.07	33.00	-12.05	No	N/A	28.58	0.00	28.58	0.422	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	12.33	33.00	-14.77	No	N/A	28.58	0.00	28.58	0.517	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	12.59	33.00	-17.49	No	N/A	28.58	0.00	28.58	0.612	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	12.85	33.00	-20.21	Yes	16.50	41.91	19.80	61.71	0.328	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	13.11	33.00	-22.93	Yes	16.50	41.91	19.80	61.71	0.372	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	13.38	33.00	-25.65	Yes	16.50	41.91	19.80	61.71	0.416	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	13.64	33.00	-28.38	Yes	16.50	41.91	19.80	61.71	0.460	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	13.90	33.00	-31.10	Yes	16.50	41.91	19.80	61.71	0.504	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	14.16	33.00	-33.82	Yes	16.50	41.91	19.80	61.71	0.548	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	14.43	33.00	-36.54	Yes	16.50	41.91	19.80	61.71	0.592	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	14.69	33.00	-39.26	Yes	16.50	41.91	19.80	61.71	0.636	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	14.95	33.00	-41.98	Yes	16.50	41.91	19.80	61.71	0.680	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	15.21	33.00	-44.70	Yes	16.50	41.91	19.80	61.71	0.724	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	15.48	33.00	-47.42	Yes	16.50	41.91	19.80	61.71	0.768	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	15.74	33.00	-50.14	Yes	16.50	41.91	19.80	61.71	0.813	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	16.00	33.00	-52.87	Yes	16.50	41.91	19.80	61.71	0.857	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	16.26	33.00	-55.59	Yes	16.50	41.91	19.80	61.71	0.901	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	16.52	33.00	-58.31	Yes	16.50	41.91	19.80	61.71	0.945	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	16.79	33.00	-61.03	Yes	16.50	41.91	19.80	61.71	0.989	Eqn (b)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	17.05	33.00	-63.75	Yes	14.96	41.91	21.84	63.75	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	17.31	33.00	-66.47	Yes	13.30	41.91	24.56	66.47	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	17.57	33.00	-69.19	Yes	11.97	41.91	27.28	69.19	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	17.84	33.00	-71.91	Yes	10.89	41.91	30.00	71.91	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	18.10	33.00	-74.64	Yes	9.98	41.91	32.72	74.64	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	18.36	33.00	-77.36	Yes	9.22	41.91	35.45	77.36	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	18.62	33.00	-80.08	Yes	8.56	41.91	38.17	80.08	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	18.89	33.00	-82.80	Yes	7.99	41.91	40.89	82.80	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	19.15	33.00	-85.52	Yes	7.49	41.91	43.61	85.52	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	19.41	33.00	-88.24	Yes	7.05	41.91	46.33	88.24	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	19.67	33.00	-90.96	Yes	6.66	41.91	49.05	90.96	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	19.93	33.00	-93.68	Yes	6.31	41.91	51.77	93.68	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	20.20	33.00	-96.41	Yes	6.00	41.91	54.49	96.41	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	20.46	33.00	-99.13	Yes	5.71	41.91	57.22	99.13	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	20.72	33.00	-101.85	Yes	5.45	41.91	59.94	101.85	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	20.98	33.00	-104.57	Yes	5.21	41.91	62.66	104.57	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	21.25	33.00	-107.29	Yes	2.84	41.91	114.98	156.89	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	21.51	33.00	-109.99	Yes	2.78	41.91	117.70	159.62	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	21.77	33.00	-112.69	Yes	2.71	41.91	120.43	162.34	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	22.03	33.00	-115.39	Yes	2.65	41.91	123.15	165.06	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	22.30	33.00	-118.09	Yes	2.60	41.91	125.87	167.78	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	22.56	33.00	-120.79	Yes	2.54	41.91	128.59	170.50	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	22.82	33.00	-123.49	Yes	2.49	41.91	131.31	173.22	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	23.08	33.00	-126.19	Yes	2.44	41.91	134.03	175.94	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	23.34	33.00	-128.89	Yes	2.39	41.91	136.75	178.66	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	23.61	33.00	-131.59	Yes	2.34	41.91	139.47	181.38	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	23.87	33.00	-134.29	Yes	2.30	41.91	142.19	184.11	1.000	Eqn (b)	Reqd Vs per 22.5.8.1

Concrete Beam

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: CL1 (For reactions only - precast engineer to design beam)

Maximum Forces & Stresses for Load Combinations

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft)		
			Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	24.000	1,038.42	1,098.26	0.95
+1.40D					
Span # 1	1	24.000	933.82	1,098.26	0.85
+1.20D+0.50Lr+1.60L					
Span # 1	1	24.000	1,038.42	1,098.26	0.95
+1.20D+1.60L+0.30S					
Span # 1	1	24.000	1,037.76	1,098.26	0.94
+1.20D+1.60Lr+0.50L					
Span # 1	1	24.000	922.27	1,098.26	0.84
+1.20D+1.60Lr					
Span # 1	1	24.000	853.19	1,098.26	0.78
+1.20D+0.50L+S					
Span # 1	1	24.000	922.27	1,098.26	0.84
+1.20D+S					
Span # 1	1	24.000	853.19	1,098.26	0.78
+1.20D+0.50Lr+0.50L					
Span # 1	1	24.000	886.03	1,098.26	0.81
+1.20D+0.50L+0.30S					
Span # 1	1	24.000	885.37	1,098.26	0.81
+0.90D					
Span # 1	1	24.000	600.32	1,098.26	0.55
+1.20D+0.50L+0.150S					
Span # 1	1	24.000	877.47	1,098.26	0.80

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
+D+L	1	0.6381	12.000		0.0000	0.000

Concrete Beam

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.09.03

CARTWRIGHT AEC

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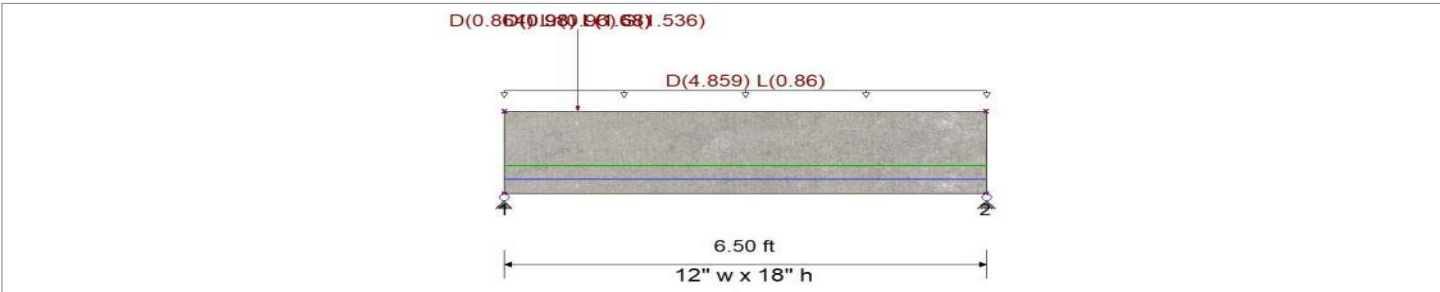
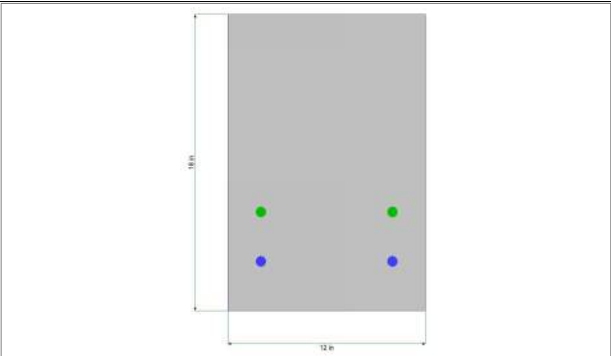
DESCRIPTION: CL2

CODE REFERENCES

Calculations per ACI 318-19, IBC 2021, SDPWS 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

General Information

f'_c	=	4.50 ksi	ϕ Phi Values	Flexure :	0.90
$f_r = f'_c^{1/2} \cdot 7.50$	=	503.12 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.8250
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups	=	60.0 ksi
f_y - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #	=	3
			Number of Resisting Legs Per Stirrup	=	2
Seismic Design Category	=	A			



Cross Section & Reinforcing Details

Rectangular Section, Width = 12.0 in, Height = 18.0 in
Span #1 Reinforcing....
2-#5 at 3.0 in from Bottom, from 0.0 to 6.50 ft in this span 2-#5 at 6.0 in from Bottom, from 0.0 to 6.50 ft in this sp:

Beam self weight calculated and added to loads
Load for Span Number 1
Uniform Load : D = 0.2260, L = 0.040 ksf, Tributary Width = 21.50 ft, (1st Floor)
Point Load : D = 0.980, L = 1.680 k @ 1.0 ft, (FB1)
Point Load : D = 0.980, L = 1.680 k @ 1.0 ft, (FB1)
Point Load : D = 0.980, L = 1.680 k @ 1.0 ft, (FB1)
Point Load : D = 0.980, L = 1.680 k @ 1.0 ft, (FB1)
Point Load : D = 0.8640, Lr = 0.960, S = 1.536 k @ 1.0 ft, (RB1)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.683 : 1
Section used for this span		Typical Section
Mu : Applied		48.382 k-ft
Mn * Phi : Allowable		70.808 k-ft
Location of maximum on span		2.901 ft
Span # where maximum occurs		Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.004 in	Ratio = 22014	>=360.0	Lr Only
Max Upward Transient Deflection	0.000 in	Ratio = 0	<360.0	L Only
Max Downward Total Deflection	0.029 in	Ratio = 2669	>=240.0	Span: 1 : +D+L
Max Upward Total Deflection	0.000 in	Ratio = 0	<240.0	Span: 1 : +D+L

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	29.028	21.063

Concrete Beam

Project File: 123021 K&B Apartments.ecb

LIC# : KW-06016346, Build:20.24.09.03

CARTWRIGHT AEC

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DESCRIPTION: CL2

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from Load Combinations	29.028	21.063
Max Upward from Load Cases	20.547	17.235
D Only	20.547	17.235
+D+L	29.028	21.063
+D+Lr	21.359	17.382
+D+0.70S	21.456	17.400
+D+0.750Lr+0.750L	27.517	20.217
+D+0.750L+0.5250S	27.590	20.230
+0.60D	12.328	10.341
+D+0.750L+0.10S	27.037	20.130
Lr Only	0.812	0.148
L Only	8.481	3.829
S Only	1.300	0.236

Shear Stirrup Requirements

Between 0.00 to 0.00 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 5 in
 Between 0.01 to 1.95 ft, Max spacing per T9.7.6.2.2, use #3 stirrups spaced at 6 in
 Between 1.97 to 3.99 ft, Ties Not Req'd, Stirrups are not required.
 Between 4.00 to 6.49 ft, Max spacing per T9.7.6.2.2, use #3 stirrups spaced at 6 in

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+0.50Lr+1.60L	1	0.00	13.50	38.63	Yes	5.98	16.30	22.33	38.63	1.000	Eqn (a)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.07	13.50	38.10	Yes	6.13	16.30	21.80	38.10	1.000	Eqn (a)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.14	13.50	37.57	Yes	6.28	16.30	21.27	37.57	1.000	Eqn (a)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.21	13.50	37.04	Yes	6.44	16.30	20.74	37.04	1.000	Eqn (a)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.28	13.50	36.51	Yes	6.61	16.30	20.21	36.51	1.000	Eqn (a)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.36	13.50	35.98	Yes	6.75	16.30	19.80	36.10	0.997	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.43	13.50	35.45	Yes	6.75	16.30	19.80	36.10	0.982	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.50	13.50	34.92	Yes	6.75	16.30	19.80	36.10	0.967	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.57	13.50	34.39	Yes	6.75	16.30	19.80	36.10	0.953	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.64	13.50	33.86	Yes	6.75	16.30	19.80	36.10	0.938	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.71	13.50	33.33	Yes	6.75	16.30	19.80	36.10	0.923	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.78	13.50	32.80	Yes	6.75	16.30	19.80	36.10	0.908	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.85	13.50	32.27	Yes	6.75	16.30	19.80	36.10	0.894	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.92	13.50	31.74	Yes	6.75	16.30	19.80	36.10	0.879	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.99	13.50	31.20	Yes	6.75	16.30	19.80	36.10	0.864	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.07	13.50	14.49	Yes	6.75	16.30	19.80	36.10	0.402	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.14	13.50	13.99	Yes	6.75	16.30	19.80	36.10	0.388	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.21	13.50	13.48	Yes	6.75	16.30	19.80	36.10	0.374	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.28	13.50	12.98	Yes	6.75	16.30	19.80	36.10	0.360	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.35	13.50	12.48	Yes	6.75	16.30	19.80	36.10	0.346	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.42	13.50	11.97	Yes	6.75	16.30	19.80	36.10	0.332	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.49	13.50	11.47	Yes	6.75	16.30	19.80	36.10	0.318	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.56	13.50	10.96	Yes	6.75	16.30	19.80	36.10	0.304	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.63	13.50	10.46	Yes	6.75	16.30	19.80	36.10	0.290	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.70	13.50	9.95	Yes	6.75	16.30	19.80	36.10	0.276	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.78	13.50	9.45	Yes	6.75	16.30	19.80	36.10	0.262	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.85	13.50	8.94	Yes	6.75	16.30	19.80	36.10	0.248	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.92	13.50	8.44	Yes	6.75	16.30	19.80	36.10	0.234	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.99	13.50	7.93	No	N/A	11.85	0.00	11.85	0.669	Eqn (c)	Ties Not Req'd
+1.40D	1	2.06	13.50	7.43	No	N/A	11.85	0.00	11.85	0.626	Eqn (c)	Ties Not Req'd
+1.40D	1	2.13	13.50	6.92	No	N/A	11.85	0.00	11.85	0.584	Eqn (c)	Ties Not Req'd
+1.40D	1	2.20	13.50	6.42	No	N/A	11.85	0.00	11.85	0.541	Eqn (c)	Ties Not Req'd
+1.40D	1	2.27	13.50	5.91	No	N/A	11.85	0.00	11.85	0.499	Eqn (c)	Ties Not Req'd
+1.40D	1	2.34	13.50	5.41	No	N/A	11.85	0.00	11.85	0.456	Eqn (c)	Ties Not Req'd
+1.40D	1	2.42	13.50	4.90	No	N/A	11.85	0.00	11.85	0.413	Eqn (c)	Ties Not Req'd
+1.40D	1	2.49	13.50	4.40	No	N/A	11.85	0.00	11.85	0.371	Eqn (c)	Ties Not Req'd
+1.40D	1	2.56	13.50	3.89	No	N/A	11.85	0.00	11.85	0.328	Eqn (c)	Ties Not Req'd
+1.40D	1	2.63	13.50	3.39	No	N/A	11.85	0.00	11.85	0.286	Eqn (c)	Ties Not Req'd
+1.40D	1	2.70	13.50	2.88	No	N/A	11.85	0.00	11.85	0.243	Eqn (c)	Ties Not Req'd
+1.40D	1	2.77	13.50	2.38	No	N/A	11.85	0.00	11.85	0.201	Eqn (c)	Ties Not Req'd
+1.40D	1	2.84	13.50	1.87	No	N/A	11.85	0.00	11.85	0.158	Eqn (c)	Ties Not Req'd
+1.40D	1	2.91	13.50	1.37	No	N/A	11.85	0.00	11.85	0.115	Eqn (c)	Ties Not Req'd
+1.40D	1	2.98	13.50	0.86	No	N/A	11.85	0.00	11.85	0.073	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.05	13.50	-1.15	No	N/A	11.85	0.00	11.85	0.097	Eqn (c)	Ties Not Req'd

Concrete Beam

Project File: 123021 K&B Apartments.ecb

LIC#: KW-06016346, Build:20.24.09.03

CARTWRIGHT AEC

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DESCRIPTION: CL2

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	ΦV_c (k)	ΦV_s (k)	ΦV_n (k)	Vu / ΦV_n	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+0.50Lr+1.60L	1	3.13	13.50	-1.68	No	N/A	11.85	0.00	11.85	0.142	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.20	13.50	-2.21	No	N/A	11.85	0.00	11.85	0.187	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.27	13.50	-2.74	No	N/A	11.85	0.00	11.85	0.231	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.34	13.50	-3.27	No	N/A	11.85	0.00	11.85	0.276	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.41	13.50	-3.80	No	N/A	11.85	0.00	11.85	0.321	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.48	13.50	-4.34	No	N/A	11.85	0.00	11.85	0.366	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.55	13.50	-4.87	No	N/A	11.85	0.00	11.85	0.410	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.62	13.50	-5.40	No	N/A	11.85	0.00	11.85	0.455	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.69	13.50	-5.93	No	N/A	11.85	0.00	11.85	0.500	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.77	13.50	-6.46	No	N/A	11.85	0.00	11.85	0.545	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.84	13.50	-6.99	No	N/A	11.85	0.00	11.85	0.589	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.91	13.50	-7.52	No	N/A	11.85	0.00	11.85	0.634	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.98	13.50	-8.05	No	N/A	11.85	0.00	11.85	0.679	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	4.05	13.50	-8.58	Yes	6.75	16.30	19.80	36.10	0.238	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.12	13.50	-9.11	Yes	6.75	16.30	19.80	36.10	0.252	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.19	13.50	-9.64	Yes	6.75	16.30	19.80	36.10	0.267	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.26	13.50	-10.17	Yes	6.75	16.30	19.80	36.10	0.282	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.33	13.50	-10.70	Yes	6.75	16.30	19.80	36.10	0.296	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.40	13.50	-11.23	Yes	6.75	16.30	19.80	36.10	0.311	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.48	13.50	-11.76	Yes	6.75	16.30	19.80	36.10	0.326	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.55	13.50	-12.29	Yes	6.75	16.30	19.80	36.10	0.341	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.62	13.50	-12.82	Yes	6.75	16.30	19.80	36.10	0.355	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.69	13.50	-13.35	Yes	6.75	16.30	19.80	36.10	0.370	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.76	13.50	-13.88	Yes	6.75	16.30	19.80	36.10	0.385	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.83	13.50	-14.41	Yes	6.75	16.30	19.80	36.10	0.399	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.90	13.50	-14.95	Yes	6.75	16.30	19.80	36.10	0.414	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.97	13.50	-15.48	Yes	6.75	16.30	19.80	36.10	0.429	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.04	13.50	-16.01	Yes	6.75	16.30	19.80	36.10	0.443	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.11	13.50	-16.54	Yes	6.75	16.30	19.80	36.10	0.458	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.19	13.50	-17.07	Yes	6.75	16.30	19.80	36.10	0.473	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.26	13.50	-17.60	Yes	6.75	16.30	19.80	36.10	0.487	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.33	13.50	-18.13	Yes	6.75	16.30	19.80	36.10	0.502	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.40	13.50	-18.66	Yes	6.75	16.30	19.80	36.10	0.517	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.47	13.50	-19.19	Yes	6.75	16.30	19.80	36.10	0.532	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.54	13.50	-19.72	Yes	6.75	16.30	19.80	36.10	0.546	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.61	13.50	-20.25	Yes	6.75	16.30	19.80	36.10	0.561	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.68	13.50	-20.78	Yes	6.75	16.30	19.80	36.10	0.576	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.75	13.50	-21.31	Yes	6.75	16.30	19.80	36.10	0.590	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.83	13.50	-21.84	Yes	6.75	16.30	19.80	36.10	0.605	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.90	13.50	-22.37	Yes	6.75	16.30	19.80	36.10	0.620	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.97	13.50	-22.90	Yes	6.75	16.30	19.80	36.10	0.634	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.04	13.50	-23.43	Yes	6.75	16.30	19.80	36.10	0.649	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.11	13.50	-23.96	Yes	6.75	16.30	19.80	36.10	0.664	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.18	13.50	-24.49	Yes	6.75	16.30	19.80	36.10	0.678	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.25	13.50	-25.02	Yes	6.75	16.30	19.80	36.10	0.693	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.32	13.50	-25.56	Yes	6.75	16.30	19.80	36.10	0.708	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.39	13.50	-26.09	Yes	6.75	16.30	19.80	36.10	0.723	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.46	13.50	-26.62	Yes	6.75	16.30	19.80	36.10	0.737	Eqn (a)	Max spacing per T9.7.6.

Maximum Forces & Stresses for Load Combinations

Load Combination	Span #	Location (ft) along Beam	Bending Stress Results (k-ft)		
Segment			Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	6.500	48.38	70.81	0.68
+1.40D					
Span # 1	1	6.500	40.96	70.81	0.58
+1.20D+0.50Lr+1.60L					
Span # 1	1	6.500	48.38	70.81	0.68
+1.20D+1.60L+0.30S					
Span # 1	1	6.500	48.37	70.81	0.68
+1.20D+1.60Lr+0.50L					
Span # 1	1	6.500	39.97	70.81	0.56
+1.20D+1.60Lr					
Span # 1	1	6.500	35.91	70.81	0.51
+1.20D+0.50L+S					
Span # 1	1	6.500	39.97	70.81	0.56
+1.20D+S					

Concrete Beam

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.09.03

CARTWRIGHT AEC

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DESCRIPTION: CL2

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft)		
			Mu : Max	Phi*Mnx	Stress Ratio
Span # 1	1	6.500	35.91	70.81	0.51
+1.20D+0.50Lr+0.50L					
Span # 1	1	6.500	39.40	70.81	0.56
+1.20D+0.50L+0.30S					
Span # 1	1	6.500	39.39	70.81	0.56
+0.90D					
Span # 1	1	6.500	26.33	70.81	0.37
+1.20D+0.50L+0.150S					
Span # 1	1	6.500	39.27	70.81	0.55

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
+D+L	1	0.0292	3.143		0.0000	0.000

Concrete Beam

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.09.03

CARTWRIGHT AEC

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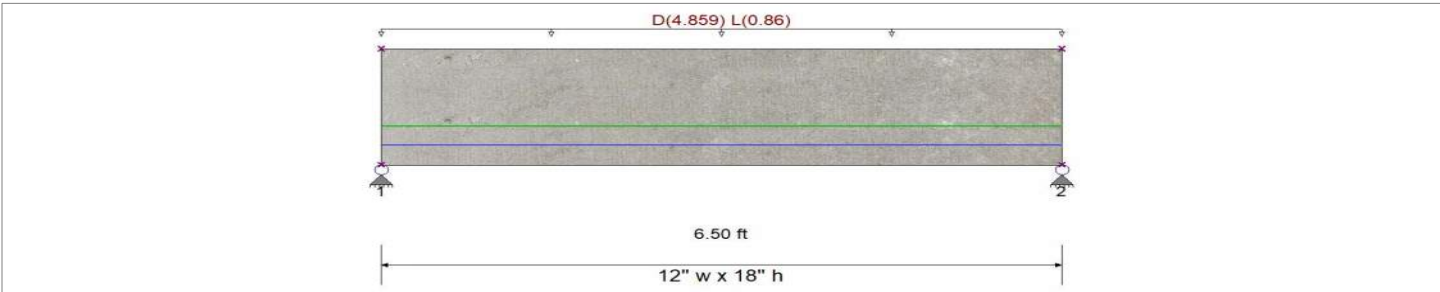
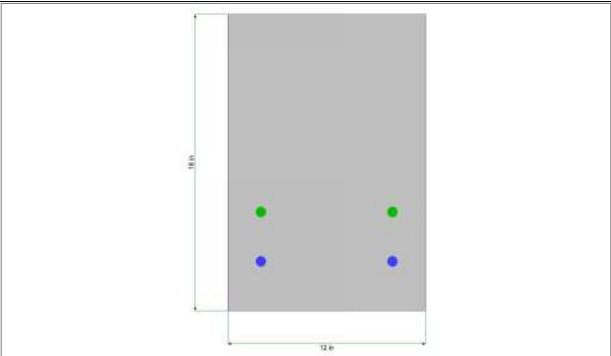
DESCRIPTION: CL3

CODE REFERENCES

Calculations per ACI 318-19, IBC 2021, SDPWS 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

General Information

f'_c	=	4.50 ksi	ϕ Phi Values	Flexure :	0.90
$f_r = f'_c^{1/2} \cdot 7.50$	=	503.12 psi		Shear :	0.750
γ Density	=	145.0 pcf	β_1	=	0.8250
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups	=	60.0 ksi
f_y - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #	=	3
			Number of Resisting Legs Per Stirrup	=	2
Seismic Design Category	=	A			



Cross Section & Reinforcing Details

Rectangular Section, Width = 12.0 in, Height = 18.0 in
Span #1 Reinforcing....
2-#5 at 3.0 in from Bottom, from 0.0 to 6.50 ft in this span 2-#5 at 6.0 in from Bottom, from 0.0 to 6.50 ft in this sp;

Beam self weight calculated and added to loads
Load for Span Number 1
Uniform Load : D = 0.2260, L = 0.040 ksf, Tributary Width = 21.50 ft, (1st Floor)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.557 : 1
Section used for this span		Typical Section
Mu : Applied		39.439 k-ft
Mn * Phi : Allowable		70.808 k-ft
Location of maximum on span		3.256 ft
Span # where maximum occurs		Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.002 in	Ratio = 41129	>=360.0	L Only
Max Upward Transient Deflection	0.000 in	Ratio = 0	<360.0	L Only
Max Downward Total Deflection	0.016 in	Ratio = 4775	>=240.0	Span: 1 : +D+L
Max Upward Total Deflection	0.000 in	Ratio = 0	<240.0	Span: 1 : +D+L

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	19.294	19.294
Max Upward from Load Combinations	19.294	19.294
Max Upward from Load Cases	16.499	16.499
D Only	16.499	16.499
+D+L	19.294	19.294
+D+0.750L	18.595	18.595
+0.60D	9.899	9.899

Concrete Beam

Project File: 123021 K&B Apartments.ecb

LIC# : KW-06016346, Build:20.24.09.03

CARTWRIGHT AEC

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DESCRIPTION: CL3

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
L Only	2.795	2.795

Shear Stirrup Requirements

Between 0.00 to 2.15 ft, Max spacing per T9.7.6.2.2, use #3 stirrups spaced at 6 in
 Between 2.17 to 4.33 ft, Ties Not Req'd, Stirrups are not required.
 Between 4.35 to 6.49 ft, Max spacing per T9.7.6.2.2, use #3 stirrups spaced at 6 in

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+1.60L	1	0.00	13.50	24.27	Yes	6.75	16.30	19.80	36.10	0.672	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.07	13.50	23.74	Yes	6.75	16.30	19.80	36.10	0.658	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.14	13.50	23.21	Yes	6.75	16.30	19.80	36.10	0.643	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.21	13.50	22.68	Yes	6.75	16.30	19.80	36.10	0.628	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.28	13.50	22.15	Yes	6.75	16.30	19.80	36.10	0.614	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.36	13.50	21.62	Yes	6.75	16.30	19.80	36.10	0.599	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.43	13.50	21.09	Yes	6.75	16.30	19.80	36.10	0.584	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.50	13.50	20.56	Yes	6.75	16.30	19.80	36.10	0.569	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.57	13.50	20.03	Yes	6.75	16.30	19.80	36.10	0.555	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.64	13.50	19.50	Yes	6.75	16.30	19.80	36.10	0.540	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.71	13.50	18.97	Yes	6.75	16.30	19.80	36.10	0.525	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.78	13.50	18.43	Yes	6.75	16.30	19.80	36.10	0.511	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.85	13.50	17.90	Yes	6.75	16.30	19.80	36.10	0.496	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.92	13.50	17.37	Yes	6.75	16.30	19.80	36.10	0.481	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	0.99	13.50	16.84	Yes	6.75	16.30	19.80	36.10	0.467	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.07	13.50	16.31	Yes	6.75	16.30	19.80	36.10	0.452	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.14	13.50	15.78	Yes	6.75	16.30	19.80	36.10	0.437	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.21	13.50	15.25	Yes	6.75	16.30	19.80	36.10	0.422	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.28	13.50	14.72	Yes	6.75	16.30	19.80	36.10	0.408	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.35	13.50	14.19	Yes	6.75	16.30	19.80	36.10	0.393	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.42	13.50	13.66	Yes	6.75	16.30	19.80	36.10	0.378	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.49	13.50	13.13	Yes	6.75	16.30	19.80	36.10	0.364	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.56	13.50	12.60	Yes	6.75	16.30	19.80	36.10	0.349	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.63	13.50	12.07	Yes	6.75	16.30	19.80	36.10	0.334	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.70	13.50	11.54	Yes	6.75	16.30	19.80	36.10	0.320	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.78	13.50	11.01	Yes	6.75	16.30	19.80	36.10	0.305	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.85	13.50	10.48	Yes	6.75	16.30	19.80	36.10	0.290	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.92	13.50	9.95	Yes	6.75	16.30	19.80	36.10	0.276	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	1.99	13.50	9.42	Yes	6.75	16.30	19.80	36.10	0.261	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	2.06	13.50	8.89	Yes	6.75	16.30	19.80	36.10	0.246	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	2.13	13.50	8.36	Yes	6.75	16.30	19.80	36.10	0.231	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	2.20	13.50	7.82	No	N/A	11.85	0.00	11.85	0.660	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.27	13.50	7.29	No	N/A	11.85	0.00	11.85	0.615	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.34	13.50	6.76	No	N/A	11.85	0.00	11.85	0.571	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.42	13.50	6.23	No	N/A	11.85	0.00	11.85	0.526	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.49	13.50	5.70	No	N/A	11.85	0.00	11.85	0.481	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.56	13.50	5.17	No	N/A	11.85	0.00	11.85	0.436	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.63	13.50	4.64	No	N/A	11.85	0.00	11.85	0.392	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.70	13.50	4.11	No	N/A	11.85	0.00	11.85	0.347	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.77	13.50	3.58	No	N/A	11.85	0.00	11.85	0.302	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.84	13.50	3.05	No	N/A	11.85	0.00	11.85	0.257	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.91	13.50	2.52	No	N/A	11.85	0.00	11.85	0.213	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.98	13.50	1.99	No	N/A	11.85	0.00	11.85	0.168	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.05	13.50	1.46	No	N/A	11.85	0.00	11.85	0.123	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.13	13.50	0.93	No	N/A	11.85	0.00	11.85	0.078	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.20	13.50	0.40	No	N/A	11.85	0.00	11.85	0.034	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.27	13.50	-0.13	No	N/A	11.85	0.00	11.85	0.011	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.34	13.50	-0.66	No	N/A	11.85	0.00	11.85	0.056	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.41	13.50	-1.19	No	N/A	11.85	0.00	11.85	0.101	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.48	13.50	-1.72	No	N/A	11.85	0.00	11.85	0.145	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.55	13.50	-2.25	No	N/A	11.85	0.00	11.85	0.190	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.62	13.50	-2.79	No	N/A	11.85	0.00	11.85	0.235	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.69	13.50	-3.32	No	N/A	11.85	0.00	11.85	0.280	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.77	13.50	-3.85	No	N/A	11.85	0.00	11.85	0.324	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.84	13.50	-4.38	No	N/A	11.85	0.00	11.85	0.369	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.91	13.50	-4.91	No	N/A	11.85	0.00	11.85	0.414	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.98	13.50	-5.44	No	N/A	11.85	0.00	11.85	0.459	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	4.05	13.50	-5.97	No	N/A	11.85	0.00	11.85	0.503	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	4.12	13.50	-6.50	No	N/A	11.85	0.00	11.85	0.548	Eqn (c)	Ties Not Req'd

Concrete Beam

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.09.03

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2024

DESCRIPTION: CL3

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	ΦV_c (k)	ΦV_s (k)	ΦV_n (k)	Vu / ΦV_n	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+1.60L	1	4.19	13.50	-7.03	No	N/A	11.85	0.00	11.85	0.593	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	4.26	13.50	-7.56	No	N/A	11.85	0.00	11.85	0.638	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	4.33	13.50	-8.09	No	N/A	11.85	0.00	11.85	0.682	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	4.40	13.50	-8.62	Yes	6.75	16.30	19.80	36.10	0.239	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	4.48	13.50	-9.15	Yes	6.75	16.30	19.80	36.10	0.253	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	4.55	13.50	-9.68	Yes	6.75	16.30	19.80	36.10	0.268	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	4.62	13.50	-10.21	Yes	6.75	16.30	19.80	36.10	0.283	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	4.69	13.50	-10.74	Yes	6.75	16.30	19.80	36.10	0.298	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	4.76	13.50	-11.27	Yes	6.75	16.30	19.80	36.10	0.312	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	4.83	13.50	-11.80	Yes	6.75	16.30	19.80	36.10	0.327	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	4.90	13.50	-12.33	Yes	6.75	16.30	19.80	36.10	0.342	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	4.97	13.50	-12.86	Yes	6.75	16.30	19.80	36.10	0.356	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.04	13.50	-13.40	Yes	6.75	16.30	19.80	36.10	0.371	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.11	13.50	-13.93	Yes	6.75	16.30	19.80	36.10	0.386	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.19	13.50	-14.46	Yes	6.75	16.30	19.80	36.10	0.400	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.26	13.50	-14.99	Yes	6.75	16.30	19.80	36.10	0.415	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.33	13.50	-15.52	Yes	6.75	16.30	19.80	36.10	0.430	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.40	13.50	-16.05	Yes	6.75	16.30	19.80	36.10	0.445	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.47	13.50	-16.58	Yes	6.75	16.30	19.80	36.10	0.459	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.54	13.50	-17.11	Yes	6.75	16.30	19.80	36.10	0.474	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.61	13.50	-17.64	Yes	6.75	16.30	19.80	36.10	0.489	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.68	13.50	-18.17	Yes	6.75	16.30	19.80	36.10	0.503	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.75	13.50	-18.70	Yes	6.75	16.30	19.80	36.10	0.518	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.83	13.50	-19.23	Yes	6.75	16.30	19.80	36.10	0.533	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.90	13.50	-19.76	Yes	6.75	16.30	19.80	36.10	0.547	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	5.97	13.50	-20.29	Yes	6.75	16.30	19.80	36.10	0.562	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	6.04	13.50	-20.82	Yes	6.75	16.30	19.80	36.10	0.577	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	6.11	13.50	-21.35	Yes	6.75	16.30	19.80	36.10	0.591	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	6.18	13.50	-21.88	Yes	6.75	16.30	19.80	36.10	0.606	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	6.25	13.50	-22.41	Yes	6.75	16.30	19.80	36.10	0.621	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	6.32	13.50	-22.94	Yes	6.75	16.30	19.80	36.10	0.636	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	6.39	13.50	-23.47	Yes	6.75	16.30	19.80	36.10	0.650	Eqn (a)	Max spacing per T9.7.6.
+1.20D+1.60L	1	6.46	13.50	-24.01	Yes	6.75	16.30	19.80	36.10	0.665	Eqn (a)	Max spacing per T9.7.6.

Maximum Forces & Stresses for Load Combinations

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft)		
			Mu : Max	Phi*Mnx	Stress Ratio
MAXIMUM BENDING Envelope					
Span # 1	1	6.500	39.44	70.81	0.56
+1.40D					
Span # 1	1	6.500	37.53	70.81	0.53
+1.20D+1.60L					
Span # 1	1	6.500	39.44	70.81	0.56
+1.20D+0.50L					
Span # 1	1	6.500	34.44	70.81	0.49
+1.20D					
Span # 1	1	6.500	32.17	70.81	0.45
+0.90D					
Span # 1	1	6.500	24.13	70.81	0.34

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
+D+L	1	0.0163	3.250		0.0000	0.000

Concrete Beam

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

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DESCRIPTION: CL4

CODE REFERENCES

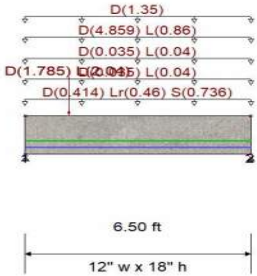
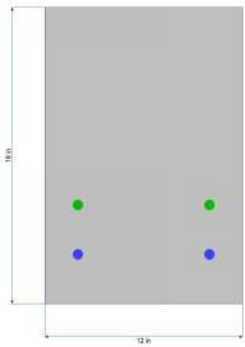
Calculations per ACI 318-19, IBC 2021, ASCE 7-16

Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

General Information

f'_c	=	4.50 ksi	ϕ Phi Values	Flexure :	0.90
$f_r = f'_c^{1/2} \cdot 7.50$	=	503.12 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.8250
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups	=	60.0 ksi
fy - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #	=	3
			Number of Resisting Legs Per Stirrup	=	2

Seismic Design Category = A



Cross Section & Reinforcing Details

Rectangular Section, Width = 12.0 in, Height = 18.0 in

Span #1 Reinforcing....

2-#5 at 3.0 in from Bottom, from 0.0 to 6.50 ft in this span

2-#5 at 6.0 in from Bottom, from 0.0 to 6.50 ft in this span

Beam self weight calculated and added to loads

Load for Span Number 1

Uniform Load : D = 0.0180, Lr = 0.020, S = 0.0320 ksf, Tributary Width = 23.0 ft, (Roof)

Uniform Load : D = 0.0350, L = 0.040 ksf, Tributary Width = 1.0 ft, (3rd Floor)

Uniform Load : D = 0.0350, L = 0.040 ksf, Tributary Width = 1.0 ft, (2nd Floor)

Uniform Load : D = 0.2260, L = 0.040 ksf, Tributary Width = 21.50 ft, (1st Floor)

Point Load : D = 1.785, L = 2.040 k @ 1.250 ft, (FB3 Reaction)

Uniform Load : D = 0.0450 ksf, Tributary Width = 30.0 ft, (Wall)

Point Load : D = 1.785, L = 2.040 k @ 1.250 ft, (FB3 Reaction)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.846 : 1
Section used for this span	Typical Section
Mu : Applied	59.926 k-ft
Mn * Phi : Allowable	70.808 k-ft
Location of maximum on span	3.043 ft
Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.003 in	Ratio = 23668	>=360.0	Lr Only
Max Upward Transient Deflection	0.000 in	Ratio = 0	<360.0	L Only
Max Downward Total Deflection	0.052 in	Ratio = 1492	>=240.0	Span: 1 : +D+0.750L+0.5250S
Max Upward Total Deflection	0.000 in	Ratio = 0	<240.0	Span: 1 : +D+0.750L+0.5250S

Concrete Beam

Project File: 123021 K&B Apartments.ecb

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

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DESCRIPTION: CL4

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	31.693	27.281
Max Upward from Load Combinations	31.693	27.281
Max Upward from Load Cases	25.343	23.146
D Only	25.343	23.146
+D+L	31.693	26.985
+D+Lr	26.838	24.641
+D+0.70S	27.017	24.820
+D+0.750Lr+0.750L	31.227	27.147
+D+0.750L+0.5250S	31.361	27.281
+0.60D	15.206	13.887
+D+0.750L+0.10S	30.345	26.265
Lr Only	1.495	1.495
L Only	6.350	3.840
S Only	2.392	2.392

Shear Stirrup Requirements

Between 0.00 to 0.26 ft, Req'd Vs per 22.5.8.1, use #3 stirrups spaced at 5 in
 Between 0.27 to 2.30 ft, Max spacing per T9.7.6.2.2, use #3 stirrups spaced at 6 in
 Between 2.31 to 3.85 ft, Ties Not Req'd, Stirrups are not required.
 Between 3.86 to 6.49 ft, Max spacing per T9.7.6.2.2, use #3 stirrups spaced at 6 in

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+0.50Lr+1.60L	1	0.00	13.50	41.32	Yes	5.34	16.30	25.02	41.32	1.000	Eqn (a)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.07	13.50	40.61	Yes	5.50	16.30	24.31	40.61	1.000	Eqn (a)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.14	13.50	39.89	Yes	5.66	16.30	23.59	39.89	1.000	Eqn (a)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.21	13.50	39.18	Yes	5.84	16.30	22.88	39.18	1.000	Eqn (a)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.28	13.50	38.47	Yes	6.03	16.30	22.17	38.47	1.000	Eqn (a)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.36	13.50	37.76	Yes	6.23	16.30	21.46	37.76	1.000	Eqn (a)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.43	13.50	37.05	Yes	6.44	16.30	20.74	37.05	1.000	Eqn (a)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.50	13.50	36.33	Yes	6.67	16.30	20.03	36.33	1.000	Eqn (a)	Req'd Vs per 22.5.8.1
+1.20D+0.50Lr+1.60L	1	0.57	13.50	35.62	Yes	6.75	16.30	19.80	36.10	0.987	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.64	13.50	34.91	Yes	6.75	16.30	19.80	36.10	0.967	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.71	13.50	34.20	Yes	6.75	16.30	19.80	36.10	0.947	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.78	13.50	33.48	Yes	6.75	16.30	19.80	36.10	0.928	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.85	13.50	32.77	Yes	6.75	16.30	19.80	36.10	0.908	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.92	13.50	32.06	Yes	6.75	16.30	19.80	36.10	0.888	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	0.99	13.50	31.35	Yes	6.75	16.30	19.80	36.10	0.868	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	1.07	13.50	30.64	Yes	6.75	16.30	19.80	36.10	0.849	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	1.14	13.50	29.92	Yes	6.75	16.30	19.80	36.10	0.829	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	1.21	13.50	29.21	Yes	6.75	16.30	19.80	36.10	0.809	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.28	13.50	18.11	Yes	6.75	16.30	19.80	36.10	0.502	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.35	13.50	17.42	Yes	6.75	16.30	19.80	36.10	0.483	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.42	13.50	16.74	Yes	6.75	16.30	19.80	36.10	0.464	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.49	13.50	16.05	Yes	6.75	16.30	19.80	36.10	0.445	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.56	13.50	15.36	Yes	6.75	16.30	19.80	36.10	0.426	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.63	13.50	14.67	Yes	6.75	16.30	19.80	36.10	0.406	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.70	13.50	13.99	Yes	6.75	16.30	19.80	36.10	0.387	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.78	13.50	13.30	Yes	6.75	16.30	19.80	36.10	0.368	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.85	13.50	12.61	Yes	6.75	16.30	19.80	36.10	0.349	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.92	13.50	11.93	Yes	6.75	16.30	19.80	36.10	0.330	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	1.99	13.50	11.24	Yes	6.75	16.30	19.80	36.10	0.311	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	2.06	13.50	10.55	Yes	6.75	16.30	19.80	36.10	0.292	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	2.13	13.50	9.86	Yes	6.75	16.30	19.80	36.10	0.273	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	2.20	13.50	9.18	Yes	6.75	16.30	19.80	36.10	0.254	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	2.27	13.50	8.49	Yes	6.75	16.30	19.80	36.10	0.235	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	2.34	13.50	7.80	No	N/A	11.85	0.00	11.85	0.658	Eqn (c)	Ties Not Req'd
+1.40D	1	2.42	13.50	7.11	No	N/A	11.85	0.00	11.85	0.600	Eqn (c)	Ties Not Req'd
+1.40D	1	2.49	13.50	6.43	No	N/A	11.85	0.00	11.85	0.542	Eqn (c)	Ties Not Req'd
+1.40D	1	2.56	13.50	5.74	No	N/A	11.85	0.00	11.85	0.484	Eqn (c)	Ties Not Req'd
+1.40D	1	2.63	13.50	5.05	No	N/A	11.85	0.00	11.85	0.426	Eqn (c)	Ties Not Req'd
+1.40D	1	2.70	13.50	4.37	No	N/A	11.85	0.00	11.85	0.368	Eqn (c)	Ties Not Req'd
+1.40D	1	2.77	13.50	3.68	No	N/A	11.85	0.00	11.85	0.310	Eqn (c)	Ties Not Req'd
+1.40D	1	2.84	13.50	2.99	No	N/A	11.85	0.00	11.85	0.252	Eqn (c)	Ties Not Req'd
+1.40D	1	2.91	13.50	2.30	No	N/A	11.85	0.00	11.85	0.194	Eqn (c)	Ties Not Req'd
+1.40D	1	2.98	13.50	1.62	No	N/A	11.85	0.00	11.85	0.136	Eqn (c)	Ties Not Req'd

Concrete Beam

Project File: 123021 K&B Apartments.ecb

LIC#: KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

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DESCRIPTION: CL4

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	ΦV_c (k)	ΦV_s (k)	ΦV_n (k)	Vu / ΦV_n	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+S	1	3.05	13.50	0.94	No	N/A	11.85	0.00	11.85	0.079	Eqn (c)	Ties Not Req'd
+1.20D+1.60L+0.30S	1	3.13	13.50	-0.83	No	N/A	11.85	0.00	11.85	0.070	Eqn (c)	Ties Not Req'd
+1.20D+1.60L+0.30S	1	3.20	13.50	-1.55	No	N/A	11.85	0.00	11.85	0.130	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.27	13.50	-2.26	No	N/A	11.85	0.00	11.85	0.190	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.34	13.50	-2.97	No	N/A	11.85	0.00	11.85	0.250	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.41	13.50	-3.68	No	N/A	11.85	0.00	11.85	0.311	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.48	13.50	-4.39	No	N/A	11.85	0.00	11.85	0.371	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.55	13.50	-5.11	No	N/A	11.85	0.00	11.85	0.431	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.62	13.50	-5.82	No	N/A	11.85	0.00	11.85	0.491	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.69	13.50	-6.53	No	N/A	11.85	0.00	11.85	0.551	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.77	13.50	-7.24	No	N/A	11.85	0.00	11.85	0.611	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.84	13.50	-7.96	No	N/A	11.85	0.00	11.85	0.671	Eqn (c)	Ties Not Req'd
+1.20D+0.50Lr+1.60L	1	3.91	13.50	-8.67	Yes	6.75	16.30	19.80	36.10	0.240	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	3.98	13.50	-9.38	Yes	6.75	16.30	19.80	36.10	0.260	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.05	13.50	-10.09	Yes	6.75	16.30	19.80	36.10	0.280	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.12	13.50	-10.80	Yes	6.75	16.30	19.80	36.10	0.299	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.19	13.50	-11.52	Yes	6.75	16.30	19.80	36.10	0.319	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.26	13.50	-12.23	Yes	6.75	16.30	19.80	36.10	0.339	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.33	13.50	-12.94	Yes	6.75	16.30	19.80	36.10	0.358	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.40	13.50	-13.65	Yes	6.75	16.30	19.80	36.10	0.378	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.48	13.50	-14.37	Yes	6.75	16.30	19.80	36.10	0.398	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.55	13.50	-15.08	Yes	6.75	16.30	19.80	36.10	0.418	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.62	13.50	-15.79	Yes	6.75	16.30	19.80	36.10	0.437	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.69	13.50	-16.50	Yes	6.75	16.30	19.80	36.10	0.457	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.76	13.50	-17.22	Yes	6.75	16.30	19.80	36.10	0.477	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.83	13.50	-17.93	Yes	6.75	16.30	19.80	36.10	0.497	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.90	13.50	-18.64	Yes	6.75	16.30	19.80	36.10	0.516	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	4.97	13.50	-19.35	Yes	6.75	16.30	19.80	36.10	0.536	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.04	13.50	-20.06	Yes	6.75	16.30	19.80	36.10	0.556	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.11	13.50	-20.78	Yes	6.75	16.30	19.80	36.10	0.576	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.19	13.50	-21.49	Yes	6.75	16.30	19.80	36.10	0.595	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.26	13.50	-22.20	Yes	6.75	16.30	19.80	36.10	0.615	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.33	13.50	-22.91	Yes	6.75	16.30	19.80	36.10	0.635	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.40	13.50	-23.63	Yes	6.75	16.30	19.80	36.10	0.654	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.47	13.50	-24.34	Yes	6.75	16.30	19.80	36.10	0.674	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.54	13.50	-25.05	Yes	6.75	16.30	19.80	36.10	0.694	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.61	13.50	-25.76	Yes	6.75	16.30	19.80	36.10	0.714	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.68	13.50	-26.47	Yes	6.75	16.30	19.80	36.10	0.733	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.75	13.50	-27.19	Yes	6.75	16.30	19.80	36.10	0.753	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.83	13.50	-27.90	Yes	6.75	16.30	19.80	36.10	0.773	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.90	13.50	-28.61	Yes	6.75	16.30	19.80	36.10	0.793	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	5.97	13.50	-29.32	Yes	6.75	16.30	19.80	36.10	0.812	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.04	13.50	-30.04	Yes	6.75	16.30	19.80	36.10	0.832	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.11	13.50	-30.75	Yes	6.75	16.30	19.80	36.10	0.852	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.18	13.50	-31.46	Yes	6.75	16.30	19.80	36.10	0.871	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.25	13.50	-32.17	Yes	6.75	16.30	19.80	36.10	0.891	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.32	13.50	-32.89	Yes	6.75	16.30	19.80	36.10	0.911	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.39	13.50	-33.60	Yes	6.75	16.30	19.80	36.10	0.931	Eqn (a)	Max spacing per T9.7.6.
+1.20D+0.50Lr+1.60L	1	6.46	13.50	-34.31	Yes	6.75	16.30	19.80	36.10	0.950	Eqn (a)	Max spacing per T9.7.6.

Maximum Forces & Stresses for Load Combinations

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft)		
			Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	6.500	59.93	70.81	0.85
+1.40D					
Span # 1	1	6.500	54.27	70.81	0.77
+1.20D+0.50Lr+1.60L					
Span # 1	1	6.500	59.93	70.81	0.85
+1.20D+1.60L+0.30S					
Span # 1	1	6.500	59.88	70.81	0.85
+1.20D+1.60Lr+0.50L					
Span # 1	1	6.500	54.19	70.81	0.77
+1.20D+1.60Lr					
Span # 1	1	6.500	50.40	70.81	0.71
+1.20D+0.50L+S					
Span # 1	1	6.500	54.19	70.81	0.77

Concrete Beam

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

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DESCRIPTION: CL4

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft)		
			Mu : Max	Phi*Mnx	Stress Ratio
+1.20D+S Span # 1	1	6.500	50.40	70.81	0.71
+1.20D+0.50Lr+0.50L Span # 1	1	6.500	51.53	70.81	0.73
+1.20D+0.50L+0.30S Span # 1	1	6.500	51.48	70.81	0.73
+0.90D Span # 1	1	6.500	34.89	70.81	0.49
+1.20D+0.50L+0.150S Span # 1	1	6.500	50.90	70.81	0.72

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
+D+0.750L+0.5250S	1	0.0523	3.143		0.0000	0.000

Concrete Beam

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

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DESCRIPTION: CL5

CODE REFERENCES

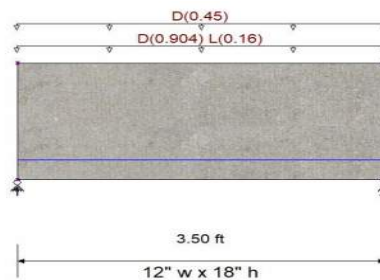
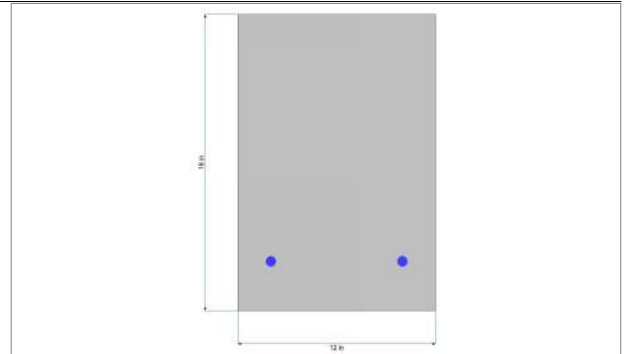
Calculations per ACI 318-19, IBC 2021, ASCE 7-16

Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

General Information

f'_c	=	4.50 ksi	ϕ Phi Values	Flexure :	0.90
$f_r = f'_c^{1/2} \cdot 7.50$	=	503.12 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.8250
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups	=	60.0 ksi
fy - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #	=	3
			Number of Resisting Legs Per Stirrup	=	2

Seismic Design Category = A



Cross Section & Reinforcing Details

Rectangular Section, Width = 12.0 in, Height = 18.0 in

Span #1 Reinforcing....

2-#5 at 3.0 in from Bottom, from 0.0 to 3.50 ft in this span

Beam self weight calculated and added to loads

Load for Span Number 1

Uniform Load : D = 0.2260, L = 0.040 ksf, Tributary Width = 4.0 ft, (1st Floor)

Uniform Load : D = 0.0450 ksf, Tributary Width = 10.0 ft, (Wall)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.083 : 1
Section used for this span		Typical Section
Mu : Applied		3.369 k-ft
Mn * Phi : Allowable		40.719 k-ft
Location of maximum on span		1.747 ft
Span # where maximum occurs		Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.000 in	Ratio =	0 <360.0	L Only
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360.0	L Only
Max Downward Total Deflection	0.000 in	Ratio =	0 <240.0	Span: 1 : +D+L
Max Upward Total Deflection	0.000 in	Ratio =	0 <240.0	Span: 1 : +D+L

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	3.030	3.030
Max Upward from Load Combinations	3.030	3.030
Max Upward from Load Cases	2.750	2.750
D Only	2.750	2.750
+D+L	3.030	3.030
+D+0.750L	2.960	2.960

Concrete Beam

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

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DESCRIPTION: CL5

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+0.60D	1.650	1.650
L Only	0.280	0.280

Shear Stirrup Requirements

Between 0.00 to 0.00 ft, Max spacing per T9.7.6.2.2, use #3 stirrups spaced at 7 in
 Between 0.01 to 3.49 ft, Ties Not Req'd, Stirrups are not required.

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.40D	1	0.00	15.00	3.85	No	7.50	18.11	19.80	37.91	0.102	Eqn (a)	Max spacing per T9.7.6.
+1.40D	1	0.04	15.00	3.77	No	N/A	9.79	0.00	9.79	0.385	Eqn (c)	Ties Not Req'd
+1.40D	1	0.08	15.00	3.68	No	N/A	9.79	0.00	9.79	0.376	Eqn (c)	Ties Not Req'd
+1.40D	1	0.11	15.00	3.60	No	N/A	9.79	0.00	9.79	0.368	Eqn (c)	Ties Not Req'd
+1.40D	1	0.15	15.00	3.51	No	N/A	9.79	0.00	9.79	0.359	Eqn (c)	Ties Not Req'd
+1.40D	1	0.19	15.00	3.43	No	N/A	9.79	0.00	9.79	0.350	Eqn (c)	Ties Not Req'd
+1.40D	1	0.23	15.00	3.35	No	N/A	9.79	0.00	9.79	0.342	Eqn (c)	Ties Not Req'd
+1.40D	1	0.27	15.00	3.26	No	N/A	9.79	0.00	9.79	0.333	Eqn (c)	Ties Not Req'd
+1.40D	1	0.31	15.00	3.18	No	N/A	9.79	0.00	9.79	0.325	Eqn (c)	Ties Not Req'd
+1.40D	1	0.34	15.00	3.09	No	N/A	9.79	0.00	9.79	0.316	Eqn (c)	Ties Not Req'd
+1.40D	1	0.38	15.00	3.01	No	N/A	9.79	0.00	9.79	0.307	Eqn (c)	Ties Not Req'd
+1.40D	1	0.42	15.00	2.92	No	N/A	9.79	0.00	9.79	0.299	Eqn (c)	Ties Not Req'd
+1.40D	1	0.46	15.00	2.84	No	N/A	9.79	0.00	9.79	0.290	Eqn (c)	Ties Not Req'd
+1.40D	1	0.50	15.00	2.76	No	N/A	9.79	0.00	9.79	0.282	Eqn (c)	Ties Not Req'd
+1.40D	1	0.54	15.00	2.67	No	N/A	9.79	0.00	9.79	0.273	Eqn (c)	Ties Not Req'd
+1.40D	1	0.57	15.00	2.59	No	N/A	9.79	0.00	9.79	0.264	Eqn (c)	Ties Not Req'd
+1.40D	1	0.61	15.00	2.50	No	N/A	9.79	0.00	9.79	0.256	Eqn (c)	Ties Not Req'd
+1.40D	1	0.65	15.00	2.42	No	N/A	9.79	0.00	9.79	0.247	Eqn (c)	Ties Not Req'd
+1.40D	1	0.69	15.00	2.34	No	N/A	9.79	0.00	9.79	0.239	Eqn (c)	Ties Not Req'd
+1.40D	1	0.73	15.00	2.25	No	N/A	9.79	0.00	9.79	0.230	Eqn (c)	Ties Not Req'd
+1.40D	1	0.77	15.00	2.17	No	N/A	9.79	0.00	9.79	0.221	Eqn (c)	Ties Not Req'd
+1.40D	1	0.80	15.00	2.08	No	N/A	9.79	0.00	9.79	0.213	Eqn (c)	Ties Not Req'd
+1.40D	1	0.84	15.00	2.00	No	N/A	9.79	0.00	9.79	0.204	Eqn (c)	Ties Not Req'd
+1.40D	1	0.88	15.00	1.91	No	N/A	9.79	0.00	9.79	0.196	Eqn (c)	Ties Not Req'd
+1.40D	1	0.92	15.00	1.83	No	N/A	9.79	0.00	9.79	0.187	Eqn (c)	Ties Not Req'd
+1.40D	1	0.96	15.00	1.75	No	N/A	9.79	0.00	9.79	0.178	Eqn (c)	Ties Not Req'd
+1.40D	1	0.99	15.00	1.66	No	N/A	9.79	0.00	9.79	0.170	Eqn (c)	Ties Not Req'd
+1.40D	1	1.03	15.00	1.58	No	N/A	9.79	0.00	9.79	0.161	Eqn (c)	Ties Not Req'd
+1.40D	1	1.07	15.00	1.49	No	N/A	9.79	0.00	9.79	0.153	Eqn (c)	Ties Not Req'd
+1.40D	1	1.11	15.00	1.41	No	N/A	9.79	0.00	9.79	0.144	Eqn (c)	Ties Not Req'd
+1.40D	1	1.15	15.00	1.33	No	N/A	9.79	0.00	9.79	0.135	Eqn (c)	Ties Not Req'd
+1.40D	1	1.19	15.00	1.24	No	N/A	9.79	0.00	9.79	0.127	Eqn (c)	Ties Not Req'd
+1.40D	1	1.22	15.00	1.16	No	N/A	9.79	0.00	9.79	0.118	Eqn (c)	Ties Not Req'd
+1.40D	1	1.26	15.00	1.07	No	N/A	9.79	0.00	9.79	0.110	Eqn (c)	Ties Not Req'd
+1.40D	1	1.30	15.00	0.99	No	N/A	9.79	0.00	9.79	0.101	Eqn (c)	Ties Not Req'd
+1.40D	1	1.34	15.00	0.90	No	N/A	9.79	0.00	9.79	0.092	Eqn (c)	Ties Not Req'd
+1.40D	1	1.38	15.00	0.82	No	N/A	9.79	0.00	9.79	0.084	Eqn (c)	Ties Not Req'd
+1.40D	1	1.42	15.00	0.74	No	N/A	9.79	0.00	9.79	0.075	Eqn (c)	Ties Not Req'd
+1.40D	1	1.45	15.00	0.65	No	N/A	9.79	0.00	9.79	0.067	Eqn (c)	Ties Not Req'd
+1.40D	1	1.49	15.00	0.57	No	N/A	9.79	0.00	9.79	0.058	Eqn (c)	Ties Not Req'd
+1.40D	1	1.53	15.00	0.48	No	N/A	9.79	0.00	9.79	0.049	Eqn (c)	Ties Not Req'd
+1.40D	1	1.57	15.00	0.40	No	N/A	9.79	0.00	9.79	0.041	Eqn (c)	Ties Not Req'd
+1.40D	1	1.61	15.00	0.32	No	N/A	9.79	0.00	9.79	0.032	Eqn (c)	Ties Not Req'd
+1.40D	1	1.64	15.00	0.23	No	N/A	9.79	0.00	9.79	0.024	Eqn (c)	Ties Not Req'd
+1.40D	1	1.68	15.00	0.15	No	N/A	9.79	0.00	9.79	0.015	Eqn (c)	Ties Not Req'd
+1.40D	1	1.72	15.00	0.06	No	N/A	9.79	0.00	9.79	0.006	Eqn (c)	Ties Not Req'd
+1.40D	1	1.76	15.00	-0.02	No	N/A	9.79	0.00	9.79	0.002	Eqn (c)	Ties Not Req'd
+1.40D	1	1.80	15.00	-0.11	No	N/A	9.79	0.00	9.79	0.011	Eqn (c)	Ties Not Req'd
+1.40D	1	1.84	15.00	-0.19	No	N/A	9.79	0.00	9.79	0.019	Eqn (c)	Ties Not Req'd
+1.40D	1	1.87	15.00	-0.27	No	N/A	9.79	0.00	9.79	0.028	Eqn (c)	Ties Not Req'd
+1.40D	1	1.91	15.00	-0.36	No	N/A	9.79	0.00	9.79	0.037	Eqn (c)	Ties Not Req'd
+1.40D	1	1.95	15.00	-0.44	No	N/A	9.79	0.00	9.79	0.045	Eqn (c)	Ties Not Req'd
+1.40D	1	1.99	15.00	-0.53	No	N/A	9.79	0.00	9.79	0.054	Eqn (c)	Ties Not Req'd
+1.40D	1	2.03	15.00	-0.61	No	N/A	9.79	0.00	9.79	0.062	Eqn (c)	Ties Not Req'd
+1.40D	1	2.07	15.00	-0.69	No	N/A	9.79	0.00	9.79	0.071	Eqn (c)	Ties Not Req'd
+1.40D	1	2.10	15.00	-0.78	No	N/A	9.79	0.00	9.79	0.080	Eqn (c)	Ties Not Req'd
+1.40D	1	2.14	15.00	-0.86	No	N/A	9.79	0.00	9.79	0.088	Eqn (c)	Ties Not Req'd
+1.40D	1	2.18	15.00	-0.95	No	N/A	9.79	0.00	9.79	0.097	Eqn (c)	Ties Not Req'd
+1.40D	1	2.22	15.00	-1.03	No	N/A	9.79	0.00	9.79	0.105	Eqn (c)	Ties Not Req'd

Concrete Beam

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

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DESCRIPTION: CL5

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	ΦV_c (k)	ΦV_s (k)	ΦV_n (k)	Vu / ΦV_n	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.40D	1	2.26	15.00	-1.12	No	N/A	9.79	0.00	9.79	0.114	Eqn (c)	Ties Not Req'd
+1.40D	1	2.30	15.00	-1.20	No	N/A	9.79	0.00	9.79	0.123	Eqn (c)	Ties Not Req'd
+1.40D	1	2.33	15.00	-1.28	No	N/A	9.79	0.00	9.79	0.131	Eqn (c)	Ties Not Req'd
+1.40D	1	2.37	15.00	-1.37	No	N/A	9.79	0.00	9.79	0.140	Eqn (c)	Ties Not Req'd
+1.40D	1	2.41	15.00	-1.45	No	N/A	9.79	0.00	9.79	0.148	Eqn (c)	Ties Not Req'd
+1.40D	1	2.45	15.00	-1.54	No	N/A	9.79	0.00	9.79	0.157	Eqn (c)	Ties Not Req'd
+1.40D	1	2.49	15.00	-1.62	No	N/A	9.79	0.00	9.79	0.166	Eqn (c)	Ties Not Req'd
+1.40D	1	2.52	15.00	-1.70	No	N/A	9.79	0.00	9.79	0.174	Eqn (c)	Ties Not Req'd
+1.40D	1	2.56	15.00	-1.79	No	N/A	9.79	0.00	9.79	0.183	Eqn (c)	Ties Not Req'd
+1.40D	1	2.60	15.00	-1.87	No	N/A	9.79	0.00	9.79	0.191	Eqn (c)	Ties Not Req'd
+1.40D	1	2.64	15.00	-1.96	No	N/A	9.79	0.00	9.79	0.200	Eqn (c)	Ties Not Req'd
+1.40D	1	2.68	15.00	-2.04	No	N/A	9.79	0.00	9.79	0.209	Eqn (c)	Ties Not Req'd
+1.40D	1	2.72	15.00	-2.12	No	N/A	9.79	0.00	9.79	0.217	Eqn (c)	Ties Not Req'd
+1.40D	1	2.75	15.00	-2.21	No	N/A	9.79	0.00	9.79	0.226	Eqn (c)	Ties Not Req'd
+1.40D	1	2.79	15.00	-2.29	No	N/A	9.79	0.00	9.79	0.234	Eqn (c)	Ties Not Req'd
+1.40D	1	2.83	15.00	-2.38	No	N/A	9.79	0.00	9.79	0.243	Eqn (c)	Ties Not Req'd
+1.40D	1	2.87	15.00	-2.46	No	N/A	9.79	0.00	9.79	0.252	Eqn (c)	Ties Not Req'd
+1.40D	1	2.91	15.00	-2.55	No	N/A	9.79	0.00	9.79	0.260	Eqn (c)	Ties Not Req'd
+1.40D	1	2.95	15.00	-2.63	No	N/A	9.79	0.00	9.79	0.269	Eqn (c)	Ties Not Req'd
+1.40D	1	2.98	15.00	-2.71	No	N/A	9.79	0.00	9.79	0.277	Eqn (c)	Ties Not Req'd
+1.40D	1	3.02	15.00	-2.80	No	N/A	9.79	0.00	9.79	0.286	Eqn (c)	Ties Not Req'd
+1.40D	1	3.06	15.00	-2.88	No	N/A	9.79	0.00	9.79	0.295	Eqn (c)	Ties Not Req'd
+1.40D	1	3.10	15.00	-2.97	No	N/A	9.79	0.00	9.79	0.303	Eqn (c)	Ties Not Req'd
+1.40D	1	3.14	15.00	-3.05	No	N/A	9.79	0.00	9.79	0.312	Eqn (c)	Ties Not Req'd
+1.40D	1	3.17	15.00	-3.13	No	N/A	9.79	0.00	9.79	0.320	Eqn (c)	Ties Not Req'd
+1.40D	1	3.21	15.00	-3.22	No	N/A	9.79	0.00	9.79	0.329	Eqn (c)	Ties Not Req'd
+1.40D	1	3.25	15.00	-3.30	No	N/A	9.79	0.00	9.79	0.338	Eqn (c)	Ties Not Req'd
+1.40D	1	3.29	15.00	-3.39	No	N/A	9.79	0.00	9.79	0.346	Eqn (c)	Ties Not Req'd
+1.40D	1	3.33	15.00	-3.47	No	N/A	9.79	0.00	9.79	0.355	Eqn (c)	Ties Not Req'd
+1.40D	1	3.37	15.00	-3.56	No	N/A	9.79	0.00	9.79	0.363	Eqn (c)	Ties Not Req'd
+1.40D	1	3.40	15.00	-3.64	No	N/A	9.79	0.00	9.79	0.372	Eqn (c)	Ties Not Req'd
+1.40D	1	3.44	15.00	-3.72	No	N/A	9.79	0.00	9.79	0.381	Eqn (c)	Ties Not Req'd
+1.40D	1	3.48	15.00	-3.81	No	N/A	9.79	0.00	9.79	0.389	Eqn (c)	Ties Not Req'd

Maximum Forces & Stresses for Load Combinations

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft)		
			Mu : Max	Phi*Mnx	Stress Ratio
MAXIMUM BENDING Envelope					
Span # 1	1	3.500	3.37	40.72	0.08
+1.40D					
Span # 1	1	3.500	3.37	40.72	0.08
+1.20D+1.60L					
Span # 1	1	3.500	3.28	40.72	0.08
+1.20D+0.50L					
Span # 1	1	3.500	3.01	40.72	0.07
+1.20D					
Span # 1	1	3.500	2.89	40.72	0.07
+0.90D					
Span # 1	1	3.500	2.17	40.72	0.05

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
+D+L	1	0.0003	1.750		0.0000	0.000

Concrete Column

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.09.03

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2024

DESCRIPTION: C1

Code References

Calculations per ACI 318-19, IBC 2021, SDPWS 2021

Load Combinations Used : ASCE 7-22 / IBC 2024 (L<=100psf)

General Information

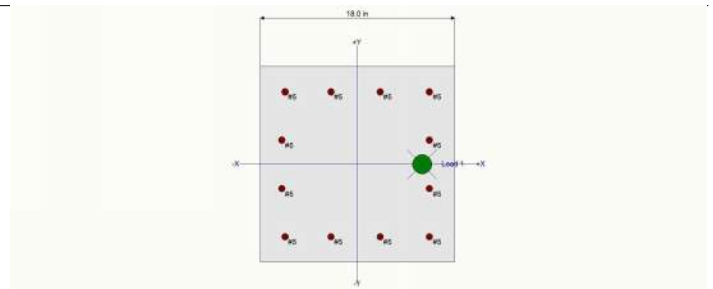
f'_c : Concrete 28 day streng	=	3.0 ksi
E =	=	3,122.0 ksi
Density	=	150.0 pcf
β	=	0.850
f_y - Main Rebar	=	60.0 ksi
E - Main Rebar	=	29,000.0 ksi
Allow. Reinforcing Limits	ASTM A615 Bars Used	
Min. Reinf.	=	1.0 %
Max. Reinf.	=	8.0 %
Seismic Design Category	=	A

Overall Column Height	=	14.0 ft
End Fixity	Top & Bottom Pinned	
Brace condition for deflection (buckling) along column		
X-X (width) axis :		
Unbraced Length for buckling ABOUT X-X Axis = 14.0 ft, K = 1.0		
Y-Y (depth) axis :		
Unbraced Length for buckling ABOUT Y-Y Axis = 14.0 ft, K = 1.0		

Column Cross Section

Column Dimensions : 18.0in Square Column, Column
Edge to Rebar Edge Cover = 2.0in

Column Reinforcing : 4 - #5 bars @ corners,, 2 - #5 bars
top & bottom between corner bars, 2
- #5 bars left & right between corner



Applied Loads

Entered loads are factored per load combinations specified by user.

Column self weight included : 4,725.0 lbs * Dead Load Factor

AXIAL LOADS . . .

CL1 Reaction: Axial Load at 14.0 ft above base, Xecc = 6.0in, D = 117.660, LR = 5.520, L = 25.940, S = 8.830 k

DESIGN SUMMARY

Load Combination	+1.20D+0.50Lr+1.60L		
Location of max.above base	13.906 ft		
Maximum Stress Ratio	0.653 : 1		
Ratio = (Pu^2+Mu^2)^.5 / (PhiPn^2+PhiMn^2)^.5			
Pu =	191.126 k	φ * Pn =	291.819 k
Mu-x =	18.157 k-ft	φ * Mn-x =	20.426 k-ft
Mu-y =	-92.106 k-ft	φ* Mn-y =	142.098 k-ft
Mu Angle =	79.0 deg	φ	= 0.650
Vu at Angle =	93.878 k-ft	φMn at Angle =	143.729 k-ft

P_n & M_n values located at P_u - M_u vector intersection with capacity curve

Column Capacities . .

P_{nmax} : Nominal Max. Compressive Axial Capac	1,039.91 k
P_{nmin} : Nominal Min. Tension Axial Capacity	k
ΦP_n , max : Usable Compressive Axial Capacity	540.76 k
ΦP_n , min : Usable Tension Axial Capacity	k

Maximum SERVICE Load Reactions .

Top along Y-Y	5.129 k	Bottom along Y-Y	5.129 k
Top along X-X	0.0 k	Bottom along X-X	0.0 k

Maximum SERVICE Load Deflections . .

Along Y-Y	0.0 in	at	0.0 ft	above base
for load combination :				
Along X-X	-0.05762 in	at	8.175 ft	above base
for load combination : +D+L				

General Section Information

ρ : % Reinforcing	1.148 %	Rebar % Ok	
Reinforcing Area	3.720 in ²		
Concrete Area	324.0 in ²		

Governing Load Combination Results

Governing Factored Load Combination	Moment		Dist. from base ft	Axial Load k		Bending Analysis k-ft							Utilization	
	X-X	Y-Y		P _u	φ * P _n	δ x	δ x * M _{ux}	δ y	δ y * M _{uy}	Alpha (deg)	δ M _u	φ M _n	Ratio	
+1.40D	M2,min	Actual	13.91	171.34	295.08	1.000	16.28	1.000	-81.81	79.000	83.41	143.38	0.582	

Concrete Column

Project File: 123021 K&B Apartments.ecb

LIC# : KW-06016346, Build:20.24.09.03

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2024

DESCRIPTION: C1

Governing Load Combination Results

Governing Factored Load Combination	Moment		Dist. from base	Axial Load			Bending Analysis k-ft								Utilization	
	X-X	Y-Y		ft	Pu	ϕ * Pn	δ x	δ x * Mux	δ y	δ y * Muy	Alpha (deg)	δ Mu	ϕ Mn	Ratio		
+1.20D+0.50Lr+1.60L	M2,min	Actual	13.91		191.13	291.82	1.000	18.16	1.000	-92.11	79.000	93.88	143.73	0.653		
+1.20D+1.60L+0.30S	M2,min	Actual	13.91		191.02	291.82	1.000	18.15	1.000	-92.05	79.000	93.82	143.73	0.653		
+1.20D+1.60Lr+0.50L	M2,min	Actual	13.91		168.66	291.82	1.000	16.02	1.000	-80.95	79.000	82.52	143.73	0.574		
+1.20D+1.60Lr	M2,min	Actual	13.91		155.69	295.08	1.000	14.79	1.000	-74.51	79.000	75.96	143.38	0.530		
+1.20D+0.50L+S	M2,min	Actual	13.91		168.66	291.82	1.000	16.02	1.000	-80.95	79.000	82.52	143.73	0.574		
+1.20D+S	M2,min	Actual	13.91		155.69	295.08	1.000	14.79	1.000	-74.51	79.000	75.96	143.38	0.530		
+1.20D+0.50Lr+0.50L	M2,min	Actual	13.91		162.59	295.08	1.000	15.45	1.000	-77.93	79.000	79.45	143.38	0.554		
+1.20D+0.50L+0.30S	M2,min	Actual	13.91		162.48	295.08	1.000	15.44	1.000	-77.88	79.000	79.39	143.38	0.554		
+0.90D	M2,min	Actual	13.91		110.15	295.08	1.000	10.46	1.000	-52.59	79.000	53.62	143.38	0.374		
+1.20D+0.50L+0.150S	M2,min	Actual	13.91		161.16	295.08	1.000	15.31	1.000	-77.22	79.000	78.72	143.38	0.549		

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	Mx - End Moments k-ft		My - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top	@ Base	@ Top
D Only	4.202	4.202				122.385				
+D+L	5.129	5.129				148.325				
+D+Lr	4.399	4.399				127.905				
+D+0.70S	4.423	4.423				128.566				
+D+0.750Lr+0.750L	5.045	5.045				145.980				
+D+0.750L+0.5250S	5.063	5.063				146.476				
+0.60D	2.521	2.521				73.431				
+D+0.750L+0.10S	4.929	4.929				142.723				
Lr Only	0.197	0.197				5.520				
L Only	0.926	0.926				25.940				
S Only	0.315	0.315				8.830				

Maximum Moment Reactions

Note: Only non-zero reactions are listed.

Load Combination	Moment About X-X Axis			Moment About Y-Y Axis	
	@ Base	@ Top		@ Base	@ Top
D Only			k-ft		k-ft
+D+L			k-ft		k-ft
+D+Lr			k-ft		k-ft
+D+0.70S			k-ft		k-ft
+D+0.750Lr+0.750L			k-ft		k-ft
+D+0.750L+0.5250S			k-ft		k-ft
+0.60D			k-ft		k-ft
+D+0.750L+0.10S			k-ft		k-ft
Lr Only			k-ft		k-ft
L Only			k-ft		k-ft
S Only			k-ft		k-ft

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance	Max. Y-Y Deflection		Distance
D Only	0.0472	in	8.174 ft	0.000	in	0.000 ft
+D+L	0.0576	in	8.174 ft	0.000	in	0.000 ft
+D+Lr	0.0494	in	8.174 ft	0.000	in	0.000 ft
+D+0.70S	0.0497	in	8.174 ft	0.000	in	0.000 ft
+D+0.750Lr+0.750L	0.0567	in	8.174 ft	0.000	in	0.000 ft
+D+0.750L+0.5250S	0.0569	in	8.174 ft	0.000	in	0.000 ft
+0.60D	0.0283	in	8.174 ft	0.000	in	0.000 ft
+D+0.750L+0.10S	0.0554	in	8.174 ft	0.000	in	0.000 ft
Lr Only	0.0022	in	8.174 ft	0.000	in	0.000 ft
L Only	0.0104	in	8.174 ft	0.000	in	0.000 ft
S Only	0.0035	in	8.174 ft	0.000	in	0.000 ft

Concrete Column

Project File: 123021 K&B Apartments.ec6

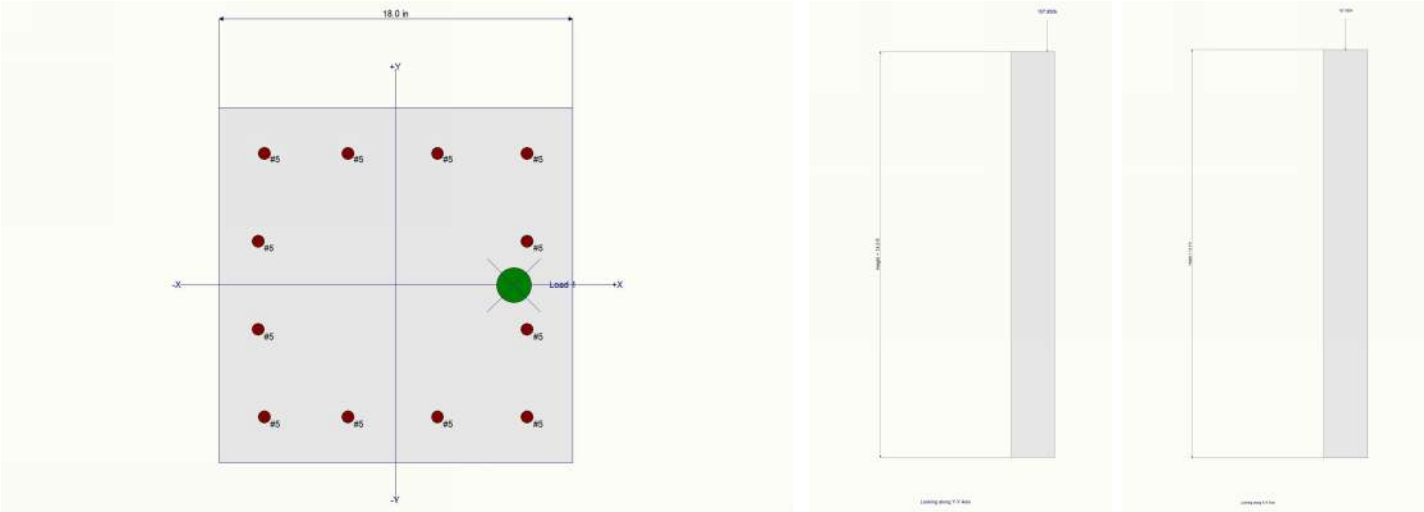
LIC# : KW-06016346, Build:20.24.09.03

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2024

DESCRIPTION: C1

Sketches





PROJECT: K&B Apartments

SUBJECT: Wood Posts

PROJECT NO: 123021

ENGINEER: JoshF

DATE: May 2025

SHEET: 1 of 1

Wood Post Design

Version: July 2020/JPF

File Name: 2.3 Wood Posts - Cartwright.xls

Code Ref: NDS 2015

Snow Load Y/N: Y
 C_p: 1.15

Post	Unbraced Length, le (ft)								Allowable Beam Bearing (kip)
	8	9	10	12	14	16	18	20	
2x4 #2	3.0	2.5	2.0	1.4	1.1	----	----	----	3.3
2x4 stud	2.5	2.1	1.7	1.2	0.9	----	----	----	3.3
2x6 #2	9.3	8.1	6.9	5.1	3.9	3.1	2.4	2.0	5.2
2x6 stud	6.4	5.9	5.3	4.2	3.3	2.6	2.1	1.7	5.2
4x4 #2	7.0	5.7	4.7	3.3	2.5	----	----	----	7.7
4x6 #2	21.7	18.8	16.2	12.0	9.1	7.1	5.7	4.7	12.0
4x8 #2	37.6	35.1	32.3	26.4	21.2	17.0	13.9	11.4	16.4
6x6 #1	30.6	27.6	24.6	19.0	14.8	11.7	9.4	7.7	18.9
6x6 #2	22.6	21.2	19.6	16.1	13.0	10.5	8.5	7.1	18.9
6x8 #2	33.9	33.0	32.0	29.3	26.1	22.6	19.4	16.5	25.8
8x8 #1	66.3	63.6	60.3	52.5	44.2	36.6	30.4	25.4	35.2
8x8 #2	46.2	45.0	43.6	40.0	35.6	30.9	26.4	22.5	35.2

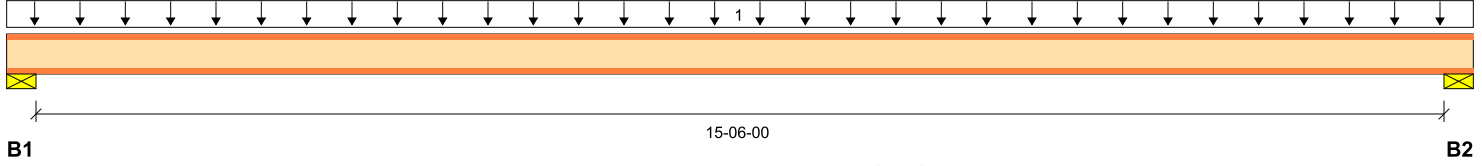
Column #	Qty	Type	Height (ft)	Actual Load (kip)	Allowable Load (kip)	Check
C1	(1)	2x6 stud	9.0	4.8	5.9	OK
C2	(2)	2x6 stud	9.0	10.1	11.7	OK
C3	(1)	2x6 stud	9.0	5.1	5.9	OK
C4	(3)	2x6 stud	9.0	15.4	17.6	OK
C5	(2)	2x6 stud	9.0	7.7	11.7	OK

FJ1 (Joist)

BC CALC® Member Report
Build 8931
Job name:
Address:
City, State, Zip:
Customer:
Code reports: ESR-1336

Dry | 1 span | No cant. | 16" OCS | Repetitive | Glued & nailed
File name:
Description:
Specifier:
Designer: Josh Fallon
Company:

May 28, 2025 17:19:46



Reaction Summary (Down / Uplift) (lbs)

Bearing	Live	Dead	Snow	Wind	Roof Live
B1, 3-1/2"	429 / 0	375 / 0			
B2, 3-1/2"	429 / 0	375 / 0			

Load Summary

Tag	Description	Load Type	Ref.	Start	End	Loc.	100%	90%	115%	160%	Roof Live 125%	OCS
1	Standard Load	Unf. Area (lb/ft²)	L	00-00-00	16-01-00	Top	40	35				16"

Controls Summary

	Value	% Allowable	Duration	Case	Location
Pos. Moment	3052 ft-lbs	81.7%	100%	1	08-00-08
End Reaction	804 lbs	54.5%	100%	1	00-00-00
End Shear	775 lbs	42.5%	100%	1	00-03-08
Total Load Deflection	L/611 (0.307")	39.3%	n/a	1	08-00-08
Live Load Deflection	L/1145 (0.164")	41.9%	n/a	2	08-00-08
Max Defl.	0.307"	30.7%	n/a	1	08-00-08
Span / Depth	13.4				

Bearing Supports

	Dim. (LxW)	Value	% Allow Support	% Allow Member	Material
B1	Wall/Plate 3-1/2" x 2"	804 lbs	n/a	54.5%	Unspecified
B2	Wall/Plate 3-1/2" x 2"	804 lbs	n/a	54.5%	Unspecified

BC FloorValue® Summary

BC FloorValue®:  Subfloor: 3/4" OSB, Glue + Nail
Minimum Enhanced Premium Subfloor Rating: Premium
Controlling Location: 08-00-08

Notes

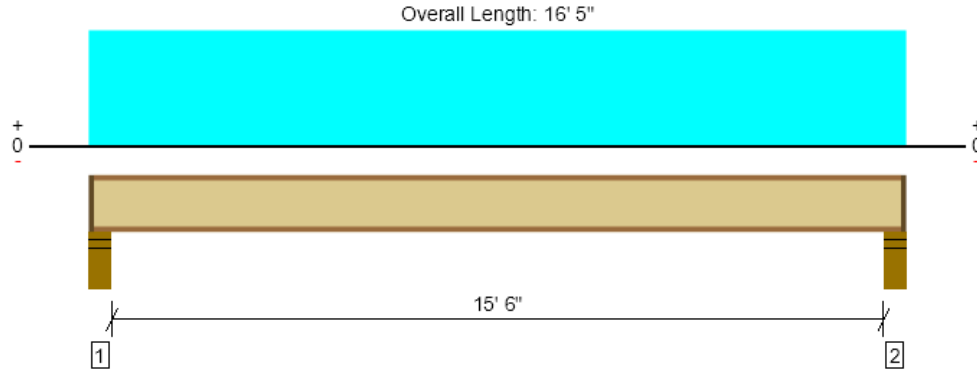
Design meets Code minimum (L/240) Total load deflection criteria.
Design meets User specified (L/480) Live load deflection criteria.
Design meets arbitrary (1") Maximum Total load deflection criteria.
Composite EI value based on 3/4" thick OSB sheathing glued and nailed to member.
Design based on Dry Service Condition.
BC CALC® analysis is based on IBC 2009.
Calculations assume member is fully braced.

Disclosure

Use of the Boise Cascade Software is subject to the terms of the End User License Agreement (EULA).
Completeness and accuracy of input must be reviewed and verified by a qualified engineer or other appropriate expert to assure its adequacy, prior to anyone relying on such output as evidence of suitability for a particular application. The output here is based on building code-accepted design properties and analysis methods.
Installation of Boise Cascade engineered wood products must be in accordance with current Installation Guide and applicable building codes. To obtain Installation Guide or ask questions, please call (800)232-0788 before installation.

Level, FJ1

1 piece(s) 14" TJI® 110 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	810 @ 4 1/2"	1375 (3.50")	Passed (59%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	775 @ 5 1/2"	1860	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3068 @ 8' 2 1/2"	3740	Passed (82%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.173 @ 8' 2 1/2"	0.392	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.325 @ 8' 2 1/2"	0.783	Passed (L/579)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	51	Any	Passed	--	--

Member Length : 16' 2 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - DF	5.50"	4.25"	1.75"	383	438	821	1 1/4" Rim Board
2 - Stud wall - DF	5.50"	4.25"	1.75"	383	438	821	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 5" o/c	
Bottom Edge (Lu)	16' 3" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 16' 5"	16"	35.0	40.0	Default Load

Weyerhaeuser Notes

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

ForteWEB Software Operator	Job Notes
Josh Fallon Cartwright AEC (435) 753-2850 joshf@cartwright-aec.com	



6/12/2024 5:01:42 PM UTC
ForteWEB v3.8, Engine: V8.4.1.22, Data: V8.1.6.2
File Name: K&B Apartments

TABLE 2a

UNIFORM LOADS (psf) ON APA RATED OSB SHEATHING.**MULTI-SPAN, NORMAL DURATION OF LOAD, DRY CONDITIONS, PANELS 24 INCHES OR WIDER**

Span Rating ^b	Load Governed By ^c	Strength Axis ^a													
		Perpendicular to Supports Span Center-to-Center of Supports (inches)										Parallel to Supports Span Center-to-Center of Supports (inches)			
		12	16	19.2	24	30	32	36	40	48	60	12	16	24	
W24 ^d	L/360°	226	85	47	23								48	18	
	L/240°	339	128	70	34								72	27	
	L/180°	452	170	93	45								96	36	12
	Bending	250	141	98	63								81	45	16
	Shear	248	179	147	116								248	179	111
24/0	L/360°	261	98	54	26	13	10						48	18	
	L/240°	392	147	81	39	19	16						72	27	
	L/180°	522	196	107	52	26	21						96	36	
	Bending	250	141	98	63	40	35						81	45	
	Shear	248	179	147	116	91	85						248	179	
24/16	L/360°	339	128	70	34	17	14	12					70	26	
	L/240°	509	191	105	51	25	20	18					104	39	
	L/180°	679	255	140	68	33	27	24					139	52	
	Bending	321	180	125	80	51	45	29					96	54	
	Shear	286	207	169	133	105	98	83					286	207	
32/16	L/360°	500	188	103	50	24	20	18	13				109	41	14
	L/240°	750	282	154	75	37	30	26	19				163	61	21
	L/180°	1,001	376	206	100	49	40	35	25				218	82	28
	Bending	371	209	145	93	59	52	33	27				138	77	28
	Shear	314	228	186	147	116	108	92	82				314	228	141
40/20	L/360°	926	348	191	92	45	37	32	23	15			244	92	31
	L/240°	1,389	523	286	139	68	55	49	35	23			365	137	46
	L/180°	1,852	697	381	185	91	74	65	47	30			487	183	62
	Bending	625	352	244	156	100	88	56	45	31			225	127	45
	Shear	390	283	232	182	144	134	114	102	88			390	283	175
48/24	L/360°	1,523	573	313	152	74	61	53	38	25	12		398	150	51
	L/240°	2,284	859	470	228	112	91	80	57	37	18		597	225	76
	L/180°	3,045	1,146	627	304	149	121	107	77	50	24		796	300	101
	Bending	833	469	326	208	133	117	74	60	42	27		338	190	68
	Shear	476	345	282	222	175	164	139	125	108	85		476	345	213

a. The strength axis is the long panel dimension unless otherwise identified.

b. Nominal thickness may vary within span rating. For range of thicknesses, see Table 5 of APA's *Panel Design Specification*, Form D510.c. Some capacities may be increased by application of formulas in *Panel Design Specification*, Form D510.

d. W24 is not recommended for roof and floor applications.

e. The wall sheathing deflection is not a code requirement.

ROOF

Maximum applied roof load = 32psf (snow) + 18psf (roof) =
50psf < 75psf allowable, therefore OK.

FLOOR

Maximum applied floor load = 40psf(live load) + 35psf (floor) =
75psf < 222psf allowable, therefore OK.

8.1 General

Section and weight properties are provided in Section 8.2. Nominal panel thicknesses tabulated in Table 8.1 were used to calculate section properties. The tabulated section properties were calculated assuming homogeneous rectangular cross sections of one-foot width.

Relationships between nominal thickness and span rating are provided in Table 8.2. The predominant nominal thickness available for each span rating is designated

by the letter “P”. The predominant nominal thickness is also the appropriate thickness for establishing section properties for design.

Reference strength and stiffness may be calculated using applicable section properties from Table 8.1 and design capacities given in Table 5.1, Table 5.2, or Table 5.3. An example derivation is provided in Section 3.2.

8.2 Section and Weight Properties

Table 8.1 Panel Section and Weight Properties ^(a)

Nominal Thickness (in.)	Approximate Weight ^(b) (psf)	Thickness t (in.)	Area A (in. ² /ft)	Moment of Inertia I (in. ⁴ /ft)	Section Modulus S (in. ³ /ft)	Statical Moment Q (in. ³ /ft)	Shear Constant Ib/Q (in. ² /ft)
3/8	1.1	0.375	4.500	0.053	0.281	0.211	3.00
7/16	1.3	0.437	5.250	0.084	0.383	0.287	3.50
15/32	1.4	0.469	5.625	0.103	0.440	0.330	3.75
1/2	1.5	0.500	6.000	0.125	0.500	0.375	4.00
19/32	1.8	0.594	7.125	0.209	0.705	0.529	4.75
5/8	1.9	0.625	7.500	0.244	0.781	0.586	5.00
23/32	2.2	0.719	8.625	0.371	1.033	0.775	5.75
3/4	2.3	0.750	9.000	0.422	1.125	0.844	6.00
7/8	2.6	0.875	10.500	0.670	1.531	1.148	7.00
1	3.0	1.000	12.000	1.000	2.000	1.500	8.00
1-1/8	3.3	1.125	13.500	1.424	2.531	1.898	9.00

^(a) Properties based on rectangular cross section of 1-foot width.

^(b) Approximate plywood weight for calculating actual dead loads. For OSB and COM-PLY panels, increase tabulated weights by 10%.

Table 8.2 Relationship Between Span Rating and Nominal Thickness

Span Rating	Nominal Thickness (in.)										
	3/8	7/16	15/32	1/2	19/32	5/8	23/32	3/4	7/8	1	1-1/8
SHEATHING											
24/0	P	A	A	A							
24/16		P	A	A							
32/16			P	A	A	A					
40/20					P	A	A	A			
48/24							P	A	A		
SINGLE FLOOR											
16 oc					P	A					
20 oc					P	A					
24 oc							P	A			
32 oc									P	A	
48 oc											P

P = Predominant nominal thickness for each span rating.

A = Alternative nominal thickness that may be available for each span rating. Check with suppliers regarding availability.



Lateral Analysis / Design

ATC Hazards by Location

Search Information

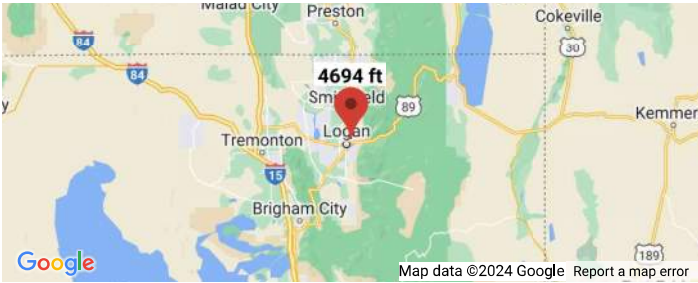
Address: Hillside Cir, Logan, UT 84321, USA

Coordinates: 41.7439793, -111.8173565

Elevation: 4694 ft

Timestamp: 2024-05-16T19:35:19.473Z

Hazard Type: Wind



ASCE 7-16

MRI 10-Year 74 mph

MRI 25-Year 80 mph

MRI 50-Year 85 mph

MRI 100-Year 89 mph

Risk Category I 98 mph

Risk Category II 103 mph

Risk Category III 110 mph

Risk Category IV 114 mph

ASCE 7-10

MRI 10-Year 76 mph

MRI 25-Year 84 mph

MRI 50-Year 90 mph

MRI 100-Year 96 mph

Risk Category I 105 mph

Risk Category II 115 mph

Risk Category III-IV 120 mph

ASCE 7-05

ASCE 7-05 Wind Speed 90 mph

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.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)

Disclaimer

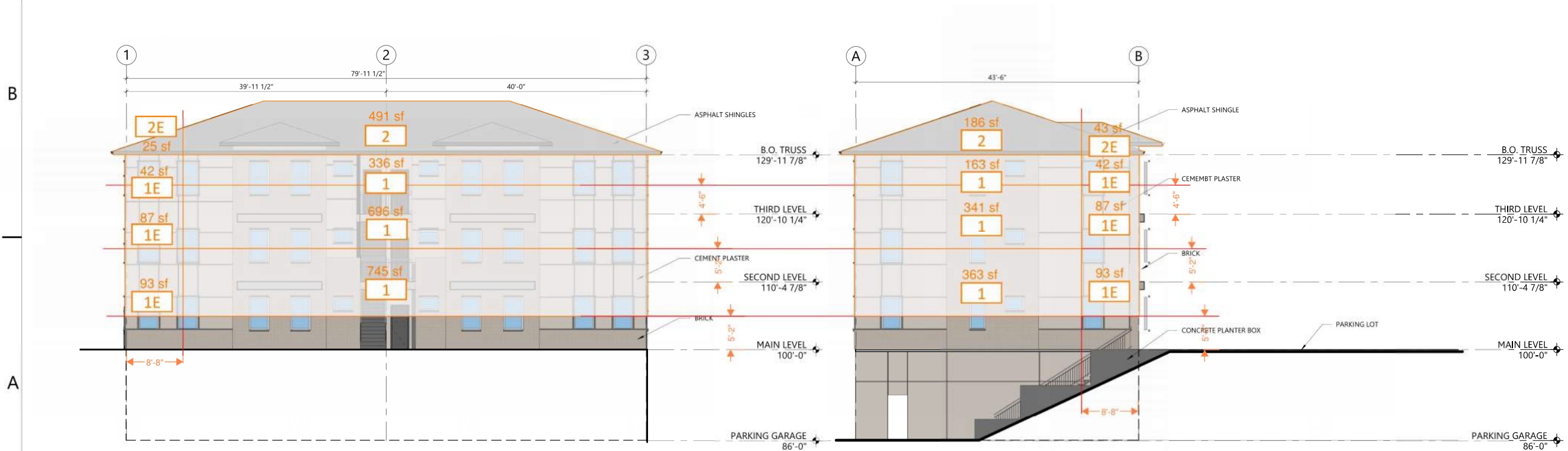
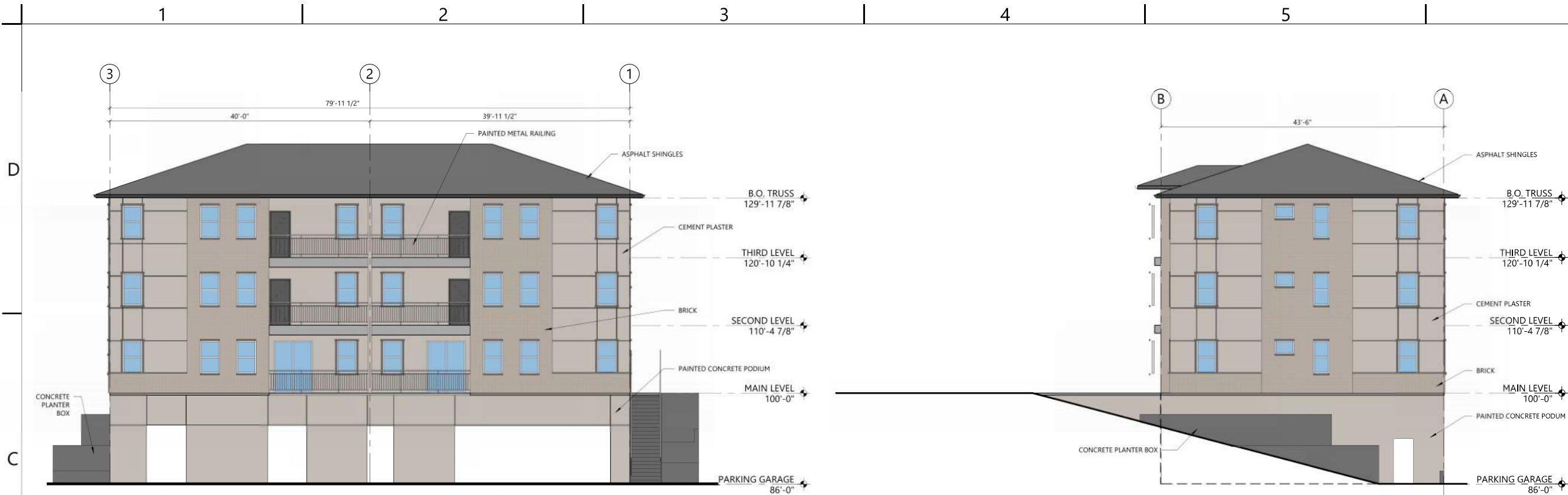
Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

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CARTWRIGHT PROJECT #	123021
DATE:	03/12/2024
DRAWN BY:	RA
CHECKED BY:	JMC
APPROVED BY:	JMC

DATE	REVISIONS DESCRIPTION
------	-----------------------



PROJECT: **K&B Apartments**

PROJECT NO: **123021**

DATE: **May 2025**

SUBJECT: **N-S Wind Loads**

ENGINEER: **JoshF**

SHEET: **1 of 3**

Wind Loading

Version: June 4, 2020/JoshF

File Name: 3.2 Loads_Lateral_Wind ASCE 7-16 Multi Story.xlsm

Code Ref.: [ASCE 7-16]

Envelope Procedure (Chapter 28)

Input Variables:

V: **103** mph
Exposure: **C**
Enclosure: **Enclosed**
Elevation: **4694** ft
L Long.: **80** ft
W Trans.: **43.5** ft
H eave: **30.0** ft
H ridge: **38.0** ft
H par.: **0.0** ft
h: **34.0** ft
Roof Slope: **4** /12
K_z: **0.84**
K_{z1}: **1.0**
K_d: **0.85**
K_e: **1.01**
GC_{pi}: **0.18** (+/-)
q_h: **19.6** psf
a: **4.4** ft
2a: **8.7** ft

[Figure 26.5-1 A,B,C]

[Section 26.7.3]

[Section 26.10]

[Fig. 28.4-1 Load Case A]

(18.43 deg.)

[Tbl. 26.9-1, Note 2]

[Eqn. 26.8-1]

[Table 26.6-1]

[Table 28.3-1]

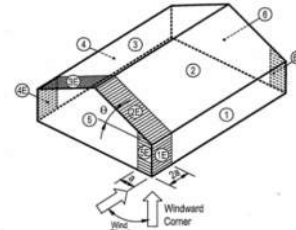
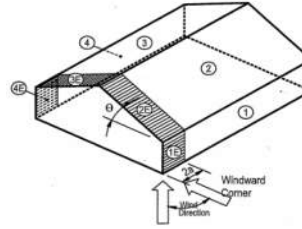
[Figure 26.11-1]

[Eqn. 28.3-1]

Edge Strip

End Zone

[Fig. 28.4-1 Load Case B]



Main Wind-Force Resisting System

Surface Pressures (Normal to Surface)

Surface	GC _{pi} ^A	Case A	Case B
		w/ +Gcpi ¹	w/ -Gcpi ¹
		(psf)	(psf)
1	0.52	6.6	-12.4
2	-0.69	-17.1	-10.0
3	-0.47	-12.7	-5.7
4	-0.42	-11.7	-4.6
5	-	-	0.40
6	-	-	-0.29
1E	0.78	11.8	-13.0
2E	-1.07	-24.6	-17.5
3E	-0.67	-16.8	-9.7
4E	-0.62	-15.7	-8.6
5E	-	-	0.61
6E	-	-	-0.43

of Floors

3

Roof

Net Horizontal MWFRS Pressures and Forces

Surface	Case A	Surface	Case B
	Net Press. ²		Net Press. ²
	(psf)		(psf)
1 & 4	18.3	5 & 6	13.6
2 & 3	-4.4	5E & 6E	20.4
1E & 4E	27.5	-	-
2E & 3E	-7.8	-	-
Parapet	0.0	Parapet	0.0
Min. Press.	16 & 8	Min. Press.	16 & 8
Floor 3 Shear	10,176	Floor 3 Shear	0
0.6*W	6,106	0.6*W	0

2nd Floor

Net Horizontal MWFRS Pressures and Forces

Surface	Case A	Surface	Case B
	Net Press. ²		Net Press. ²
	(psf)		(psf)
1 & 4	18.3	5 & 6	13.6
2 & 3	-4.4	5E & 6E	20.4
1E & 4E	27.5	-	-
2E & 3E	-7.8	-	-
Parapet	0.0	Parapet	0.0
Min. Press.	16 & 8	Min. Press.	16 & 8
Floor 2 Shear	25,305	Floor 2 Shear	0
0.6*W	15,183	0.6*W	0

1st Floor

Net Horizontal MWFRS Pressures and Forces

Surface	Case A			Surface	Case B		
	Net Press. ² (psf)	Proj. Area ^B (ft ²)	F Horiz. ³ (lbs)		Net Press. ² (psf)	Proj. Area ^B (ft ²)	F Horiz. ³ (lbs)
1 & 4	18.3	745	13,636	5 & 6	13.6		0
2 & 3	-4.4	0	0	5E & 6E	20.4		0
1E & 4E	27.5	93	2,554	-	-	-	-
2E & 3E	-7.8	0	0	-	-	-	-
Parapet	0.0	0	0	Parapet	0.0	0	0
Min. Press.	16 & 8	-	13,408	Min. Press.	16 & 8	-	0
Base Shear			41,496	Base Shear			0
0.6*W			24,897	0.6*W			0

DATE: May 2025
SHEET: 2 of 3



PROJECT: K&B Apartments

PROJECT NO: 123021

DATE: May 2025

SUBJECT: N-S Wind Loads

ENGINEER: JoshF

SHEET: 3 of 3

Wind Loading - Tabulated Values Notes and Equations

Version: June 4, 2020/JoshF

File Name: 3.2 Loads_Lateral_Wind ASCE 7-16 Multi Story.xlsm

Code Ref.: [ASCE 7-16]

Notes

A = Value found from Figure 28.4-1 in tabulated values for given roof angle

B = Use vertical projection of the area on WINDWARD FACE of the building

C = The Effective Wind Area found in Figs. 30.4-1 through 30.4-7, 30.5-1, 30.6-1 and 30.8-1 through 30.8-3 is the span length multiplied by an effective width that need not be less than one-third the span length. (ASCE 7-10 26.2)

Equations1 = $p=q*(GC_{pf}-GC_{pi})$ (Eq. 30.4-1; For parapets - Eq. 30.9-1; For overhangs - 30.10-1)2 = Sum of $qh*(GC_{pf}-GC_{pi})$ for Case A surfaces 1 and 4

3 = Horizontal force is found by multiplying the net pressure by the projected area.

PROJECT: **K&B Apartments**

PROJECT NO: **123021**

DATE: **May 2025**

SUBJECT: **E-W Wind Loads**

ENGINEER: **JoshF**

SHEET: **1 of 3**

Wind Loading

Version: June 4, 2020/JoshF

File Name: 3.2 Loads_Lateral_Wind ASCE 7-16 Multi Story.xlsm

Code Ref.: [ASCE 7-16]

Envelope Procedure (Chapter 28)

Input Variables:

V: **103** mph
 Exposure: **C**
 Enclosure: **Enclosed**
 Elevation: **4694** ft
 L Long.: **80** ft
 W Trans.: **43.5** ft
 H eave: **30.0** ft
 H ridge: **38.0** ft
 H par.: **0.0** ft
 h: **34.0** ft
 Roof Slope: **4** /12
 K_{e1} : **0.84**
 K_{z1} : **1.0**
 K_{d1} : **0.85**
 K_{h1} : **1.01**
 GC_{pi1} : **0.18** (+/-)
 q_{h1} : **19.6** psf
 a: **4.4** ft
 2a: **8.7** ft

[Figure 26.5-1 A,B,C]

[Section 26.7.3]

[Section 26.10]

[Fig. 28.4-1 Load Case A]

(18.43 deg.)

[Tbl. 26.9-1, Note 2]

[Eqn. 26.8-1]

[Table 26.6-1]

[Table 28.3-1]

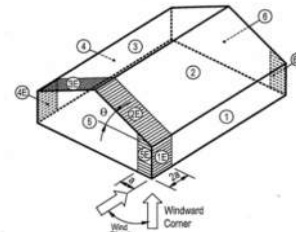
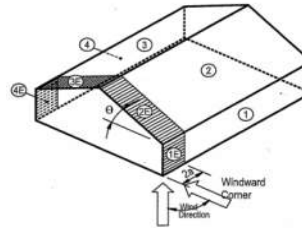
[Figure 26.11-1]

[Eqn. 28.3-1]

Edge Strip

End Zone

[Fig. 28.4-1 Load Case B]



Main Wind-Force Resisting System

Surface Pressures (Normal to Surface)

Surface	GC_{pi}^A	Case A $w/ +GC_{pi}^1$ (psf)	$w/ -GC_{pi}^1$ (psf)	GC_{pi}^A	Case B $w/ +GC_{pi}^1$ (psf)	$w/ -GC_{pi}^1$ (psf)
1	0.52	6.6	13.7	-0.45	-12.4	-5.3
2	-0.69	-17.1	-10.0	-0.69	-17.1	-10.0
3	-0.47	-12.7	-5.7	-0.37	-10.8	-3.7
4	-0.42	-11.7	-4.6	-0.45	-12.4	-5.3
5	-	-	-	0.40	4.3	11.4
6	-	-	-	-0.29	-9.2	-2.2
1E	0.78	11.8	18.9	-0.48	-13.0	-5.9
2E	-1.07	-24.6	-17.5	-1.07	-24.6	-17.5
3E	-0.67	-16.8	-9.7	-0.53	-13.9	-6.9
4E	-0.62	-15.7	-8.6	-0.48	-13.0	-5.9
5E	-	-	-	0.61	8.4	15.5
6E	-	-	-	-0.43	-12.0	-4.9

of Floors

3

Roof

Net Horizontal MWFRS Pressures and Forces

Surface	Case A Net Press. ² (psf)	Proj. Area ^B (ft ²)	F Horiz. ³ (lbs)	Surface	Case B Net Press. ² (psf)	Proj. Area ^B (ft ²)	F Horiz. ³ (lbs)
[Fig. 28.4-1]				[Fig. 28.4-1]			
1 & 4	18.3	163	2,984	5 & 6	13.6		0
2 & 3	-4.4	186	-809	5E & 6E	20.4		0
1E & 4E	27.5	42	1,154	-	-	-	-
2E & 3E	-7.8	43	-335	-	-	-	-
Parapet	0.0	0	0	Parapet	0.0	0	0
Min. Press.	16 & 8	-	5,112	Min. Press.	16 & 8	-	0
Floor 3 Shear			5,112	Floor 3 Shear			0
0.6*W			3,067	0.6*W			0

2nd Floor

Net Horizontal MWFRS Pressures and Forces

Surface	Case A Net Press. ² (psf)	Proj. Area ^B (ft ²)	F Horiz. ³ (lbs)	Surface	Case B Net Press. ² (psf)	Proj. Area ^B (ft ²)	F Horiz. ³ (lbs)
[Fig. 28.4-1]				[Fig. 28.4-1]			
1 & 4	18.3	341	6,242	5 & 6	13.6		0
2 & 3	-4.4	0	0	5E & 6E	20.4		0
1E & 4E	27.5	87	2,390	-	-	-	-
2E & 3E	-7.8	0	0	-	-	-	-
Parapet	0.0	0	0	Parapet	0.0	0	0
Min. Press.	16 & 8	-	6,848	Min. Press.	16 & 8	-	0
Floor 2 Shear			13,743	Floor 2 Shear			0
0.6*W			8,246	0.6*W			0

1st Floor

Net Horizontal MWFRS Pressures and Forces

Surface	Case A			Surface	Case B		
	Net Press. ²	Proj. Area ^B	F Horiz. ³		Net Press. ²	Proj. Area ^B	F Horiz. ³
<i>/Fig. 28.4-1/</i>	(psf)	(ft ²)	(lbs)	<i>/Fig. 28.4-1/</i>	(psf)	(ft ²)	(lbs)
1 & 4	18.3	363	6,644	5 & 6	13.6		0
2 & 3	-4.4	0	0	5E & 6E	20.4		0
1E & 4E	27.5	93	2,554	-	-	-	-
2E & 3E	-7.8	0	0	-	-	-	-
Parapet	0.0	0	0	Parapet	0.0	0	0
Min. Press.	16 & 8	-	7,296	Min. Press.	16 & 8	-	0
Base Shear			22,942	Base Shear			0
0.6*W			13,765	0.6*W			0

DATE: May 2025
SHEET: 2 of 3



PROJECT: K&B Apartments

PROJECT NO: 123021

DATE: May 2025

SUBJECT: E-W Wind Loads

ENGINEER: JoshF

SHEET: 3 of 3

Wind Loading - Tabulated Values Notes and Equations

Version: June 4, 2020/JoshF

File Name: 3.2 Loads_Lateral_Wind ASCE 7-16 Multi Story.xlsm

Code Ref.: [ASCE 7-16]

Notes

A = Value found from Figure 28.4-1 in tabulated values for given roof angle

B = Use vertical projection of the area on WINDWARD FACE of the building

C = The Effective Wind Area found in Figs. 30.4-1 through 30.4-7, 30.5-1, 30.6-1 and 30.8-1 through 30.8-3 is the span length multiplied by an effective width that need not be less than one-third the span length. (ASCE 7-10 26.2)

Equations1 = $p=q*(GC_{pf}-GC_{pi})$ (Eq. 30.4-1; For parapets - Eq. 30.9-1; For overhangs - 30.10-1)2 = Sum of $qh*(GC_{pf}-GC_{pi})$ for Case A surfaces 1 and 4

3 = Horizontal force is found by multiplying the net pressure by the projected area.

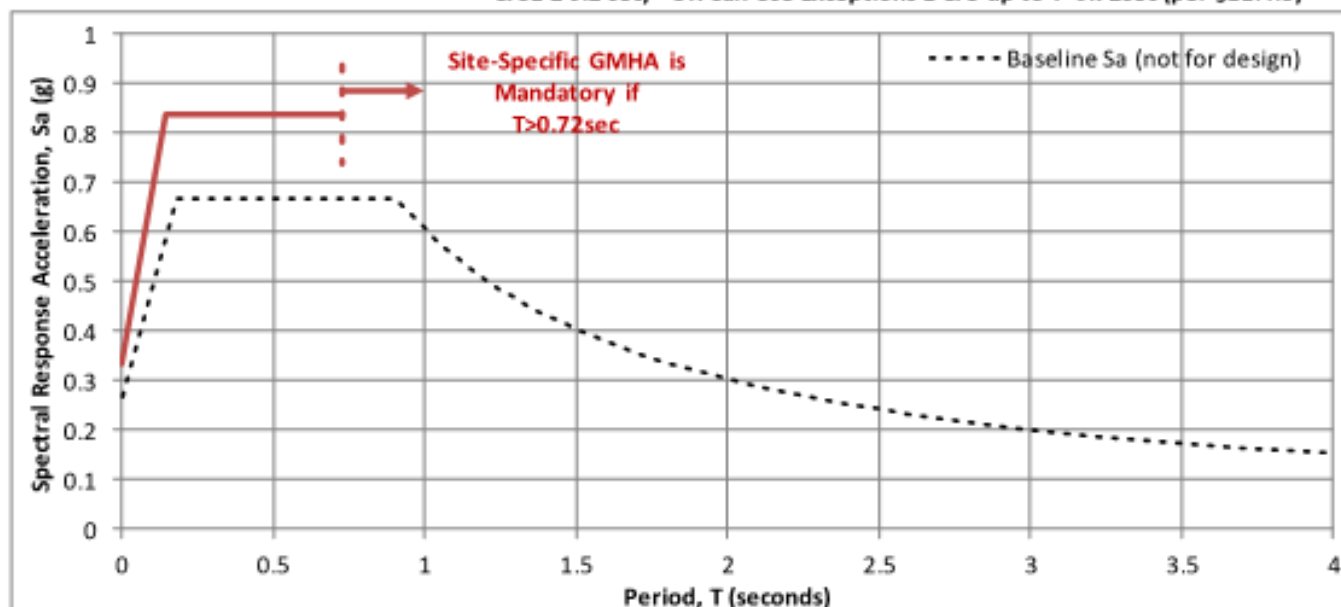
SPECTRAL ACCELERATION PERIOD, T	SITE CLASS B/C BOUNDARY [mapped values] (g)	SITE COEFFICIENT	SITE CLASS E [adjusted for site class effects] (g)	MULTIPLIER	DESIGN VALUES (g)
Peak Ground Acceleration	PGA = 0.451	$F_{pga} = 1.298$	PGA _M = 0.585	1.000	PGA _M = 0.585
0.2 Seconds (Long Period Acceleration)	$S_s = \mathbf{1.045}$	$F_a = \text{N/A}$	$S_{MS} = \text{N/A}$	0.667	$S_{DS} = \text{N/A}$
	(Exception 1:)	$F_a = (1.200)$	$S_{MS} = (1.254)$	0.667	$S_{DS} = (0.836)$
1.0 Second (Long Period Acceleration)	$S_1 = \mathbf{0.349}$	$F_v = \text{N/A}$	$S_{M1} = \text{N/A}$	0.667	$S_{D1} = \text{N/A}$
	(Exception 3:)	$F_v = (2.604)$	$S_{M1} = (0.909)$	0.667	$S_{D1} = (0.606)$

NOTES: 1. TL (seconds): **6**

* Site Class E

2. Site Class: **E**

4. ASCE 7-16 Requires Site-Specific Ground Motion Hazard Analysis (Since $S_s \geq 1.0$ & $S_1 \geq 0.2$ sec) - OR Can Use Exceptions 1 & 3 up to $T=0.72$ sec (per §11.4.8)



As shown in the response spectrum above, if the period of the proposed building is greater than 0.72 seconds, a site-specific ground motion hazard analysis (GMHA) is required. If this situation applies, please contact CMT for a proposal to perform the GMHA. Otherwise, the higher exception values may be used for design.

4.3.4 Liquefaction

The site is located within an area designated by the Utah Geologic Survey⁴ as having "Low" liquefaction potential. This is defined as having between a 5% and 10% probability that within a 100-year period an earthquake strong enough to cause liquefaction will occur.

Liquefaction is defined as the condition when saturated, loose, sandy soils lose their support capabilities because of excessive pore water pressure which develops during a seismic event. Clayey soils, even if saturated, will generally not liquefy during a major seismic event.

⁴Utah Geological Survey, "Liquefaction-Potential Map for a Part of Utah County, Utah," Utah Geological Survey Public Information Series 28, August 1994. https://ugspub.nr.utah.gov/publications/public_information/pi-28.pdf

PROJECT: K&B ApartmentsSUBJECT: Wood Shear WallPROJECT NO: 123021ENGINEER: JPFDATE: May 2025**Equivalent Lateral Force**

Version: June 2019 / quinnl

File Name: 3.4_CE_Loads_Lat_Seismic ASCE 7-16_SEISMIC ZONE E.xlsm

Code Ref.: ASCE 7-16

Base Shear CoefficientRisk Category: **II**

Table 1.5-1

Site Classification: **C**

Table 20.3-1

(Note: Site Class E, but C used per
AISC 7-16, section 11.4.8, exception 1)Seismic Force-Resisting System: **A. Bearing Wall Systems**

Table 12.2-1

15. Light-frame (wood) walls sheathed with wood structural panels rated for shear resistance

R:	6.5		Table 12.2-1
S_s :	1.045		
S_1 :	0.349		
S_{DS} :	0.836		Eq. 11.4-1 & 11.4-3
S_{D1} :	0.606		Eq. 11.4-2 & 11.4-4
Seismic Design Category:	D		Tables 11.6-1 & 11.6-2
Importance factor (I_e):	1.00		Table 1.5-2
Height (h_n):	44	ft.	
Structure Type:	Other		Table 12.8-2
No. Stories:	4		
Ave. Story Height:	11		
T_a :	0.34	seconds	$T_a = C_t * h_n^x$ or $T_a = 0.1 * N$ Eq. 12.8-7 & 12.8-8
T_L :	6	seconds	Fig. 22-14
$(C_s)_{calc}$:	0.129		$C_s = S_{DS} / (R/I_e)$ Eq. 12.8-2
$(C_s)_{max}$:	0.273	For $T \leq T_L$	$C_s = S_{D1} / T * (R/I_e)$ Eq. 12.8-3
		For $T > T_L$	$C_s = S_{D1} * T_L / (T^2 * (R/I_e))$ Eq. 12.8-4
$(C_s)_{min1}$:	0.037		$C_s = 0.044 S_{DS} I_e \geq 0.01$ Eq. 12.8-5
$(C_s)_{min2}$:	N/A	For $S_1 \geq 0.6$	$C_s = 0.5 * S_1 / (R/I_e)$ Eq. 12.8-6
$C_s = 0.129$	* Wt	Base Shear Coefficient	

Seismic Design Factors $\rho =$ **1.0**

Redundancy Factor - Sect. 12.3.4

Are there horizontal irregularities
of type 1a, 1b, 2, 3 or 4?**No**

Table 12.3-1

Or vertical irregularities of type 4?

No

Table 12.3-2



PROJECT: K&B Apartments
 SUBJECT: SpecialReinforcedConcSW

PROJECT NO: 123021
 ENGINEER: JPF

DATE: May 2025

Equivalent Lateral Force

Version: June 2019 / quinnl
 File Name: 3.4_CE_Loads_Lat_Seismic ASCE 7-16_SEISMIC ZONE E.xlsm
 Code Ref.: ASCE 7-16

Base Shear Coefficient

Risk Category: **II** Table 1.5-1
 Site Classification: **C** Table 20.3-1

(Note: Site Class E, but C used per
 AISC 7-16, section 11.4.8, exception 1)

Seismic Force-Resisting System: **A. Bearing Wall Systems**

Table 12.2-1

1. Special reinforced concrete shear walls

R:	5		Table 12.2-1	
S_s :	1.045			
S_1 :	0.349			
S_{DS} :	0.836		Eq. 11.4-1 & 11.4-3	
S_{D1} :	0.606		Eq. 11.4-2 & 11.4-4	
Seismic Design Category:	D		Tables 11.6-1 & 11.6-2	
Importance factor (I_e):	1.00		Table 1.5-2	
Height (h_n):	44	ft.		
Structure Type:	Other			Table 12.8-2
No. Stories:	4			
Ave. Story Height:	11			
T_a :	0.34	seconds	$T_a = C_t * h_n^x$ or $T_a = 0.1 * N$	Eq. 12.8-7 & 12.8-8
T_L :	6	seconds		Fig. 22-14
$(C_s)_{calc}$:	0.167		$C_s = S_{DS} / (R/I_e)$	Eq. 12.8-2
$(C_s)_{max}$:	0.355	For $T \leq T_L$	$C_s = S_{D1} / T * (R/I_e)$	Eq. 12.8-3
		For $T > T_L$	$C_s = S_{D1} * T_L / (T^2 * (R/I_e))$	Eq. 12.8-4
$(C_s)_{min1}$:	0.037		$C_s = 0.044 S_{DS} I_e \geq 0.01$	Eq. 12.8-5
$(C_s)_{min2}$:	N/A	For $S_1 \geq 0.6$	$C_s = 0.5 * S_1 / (R/I_e)$	Eq. 12.8-6
$C_s = 0.167$	* Wt		Base Shear Coefficient	

Seismic Design Factors

$\rho =$ **1.0** Redundancy Factor - Sect. 12.3.4
 Are there horizontal irregularities
 of type 1a, 1b, 2, 3 or 4? **No** Table 12.3-1
 Or vertical irregularities of type 4? **No** Table 12.3-2

PROJECT: K&B Apartments
 SUBJECT: Wood Shear Walls

 PROJECT NO: 123021
 ENGINEER: JoshF

 DATE: May 2025
 SHEET: 1 of 2
Seismic Weights

 Version: June 2020/JPF
 File Name: 3.5 Multi-Story Seismic Weight.xls
 Code Ref.: ASCE 7-16

Design Loads:

 Roof Dead Load 18 psf
 Roof Snow Load 32 psf
 Percent Snow for Seismic 20%
 Seismic Roof Snow Load 6.4 psf
 Floor Dead Load 35 psf

Wall Dead Load

 Type
 A Typ Siding Wall 12 psf
 B Typ Brick Wall 45 psf
 C Average 28.5 psf
 D

Seismic Info:

 # of Stories 3
 Cs 0.129
 Period, Ta 0.2 sec
 K 1

Level	Area Mark	Roof Area (ft^2)	Floor Area (ft^2)	Wall Length (ft)	Wall Trib (ft)	Parapet Height (ft)	Wall Type	Weight (kip)	Shear/Area (kip)	Shear/Level (kip)
Roof	RD1	4007		160	5		C	120.6	24.4	24.4
3	3D1		3269	160	10		C	160.0	46.0	46.0
2	2D1		3269	160	10		C	160.0	56.8	56.8

Total Weight: 440.6 kip

Cs: 0.129

Total Base Shear: 56.8 kip

Shear Per Level:

	Elevation (ft)	Weight (kip)	Wx*hx^k	%Shear	Shear/Level (kip)	Shear @ Level (kip)
Roof	30.00	120.6	3617.1	43%	24.4	24.4
3	20.00	160.0	3200.3	38%	21.6	46.0
2	10.00	160.0	1600.2	19%	10.8	56.8
Total:					56.8	

PROJECT: K&B Apartments
SUBJECT: SpecialReinforcedConcSW

PROJECT NO: 123021
ENGINEER: JoshF

DATE: May 2025
SHEET: 1 of 2

Seismic Weights

Version: June 2020/JPF
File Name: 3.5 Multi-Story Seismic Weight.xls
Code Ref.: ASCE 7-16

Design Loads:

Roof Dead Load 35 psf
Roof Snow Load 32 psf
Percent Snow for Seismic 20%
Seismic Roof Snow Load 6.4 psf
Floor Dead Load 226 psf

Wall Dead Load

Type
A 12" Conc Wall 150 psf
B Typ Siding Wall 12 psf
C Typ Brick Wall 45 psf
D Average 28.5 psf

Seismic Info:

of Stories 1
Cs 0.167
Period, Ta 0.2 sec
K 1

Level	Area Mark	Roof Area (ft^2)	Floor Area (ft^2)	Wall Length (ft)	Wall Trib (ft)	Parapet Height (ft)	Wall Type	Weight (kip)	Shear/Area (kip)	Shear/Level (kip)
Roof	CD1		3269	160	7		A	906.8	151.4	155.2
	Wall Above			160	5		D	22.8	3.8	

Total Weight: 929.6 kip

Cs: 0.167

Total Base Shear: 155.2 kip

Shear Per Level:

	Elevation (ft)	Weight (kip)	Wx*hx^k	%Shear	Shear/Level (kip)	Shear @ Level (kip)
Roof	10.00	929.6	9295.9	100%	155.2	155.2
Total:					155.2	



PROJECT: K&B Apartments
 SUBJECT: Base Shear Comparison

PROJECT NO: 123021
 ENGINEER: JoshF

DATE: May 2025
 SHEET: 1 of 1

Base Shear Comparison

Version: June 2020/JoshF

File Name: 3.6 Base Shear Comparison - Multi Level-Josh.xlsm

Code Ref.: n/a

of Floors: 3

		Total Base Shear		2nd Floor Shear		Roof Shear			
		N-S	E-W	N-S	E-W	N-S	E-W		
	LFRD Seismic, kip:	56.8	56.8	46.0	46.0	24.4	24.4		
	LRFD Wind, kip:	41.5	22.9	25.3	13.7	10.2	5.1		
	ASD Seismic (0.7E), kip:	39.8	39.8	32.2	32.2	17.1	17.1		
	ASD Wind (0.6W), kip:	24.9	13.8	15.2	8.2	6.1	3.1		
ASD Controlling Condition:		Seismic	Seismic	Seismic	Seismic	Seismic	Seismic		
ASD Controlling Load, kip:		39.8	39.8	32.2	32.2	17.1	17.1		

SHEAR WALLS:**Capacity & Applicability**

$$SWA_{cap} := \frac{(730 \text{ plf})}{2.8} = 261 \text{ plf} \quad 7/16" \text{ sheathing, 6" fastener spacing} \quad (2021 \text{ SDPWS Table 4.3A})$$

$$SWB_{cap} := \frac{(1065 \text{ plf})}{2.8} = 380 \text{ plf} \quad 7/16" \text{ sheathing, 4" fastener spacing}$$

$$SWC_{cap} := \frac{(1370 \text{ plf})}{2.8} = 489 \text{ plf} \quad 7/16" \text{ sheathing, 3" fastener spacing}$$

$$SWD_{cap} := \frac{(1790 \text{ plf})}{2.8} = 639 \text{ plf} \quad 7/16" \text{ sheathing, 2" fastener spacing}$$

$$SWCC_{cap} := 2 \cdot \frac{(1370 \text{ plf})}{2.8} = 979 \text{ plf} \quad 2 \text{ sides- } 7/16" \text{ sheathing, 3" fastener spacing}$$

$$SWDD_{cap} := 2 \cdot \frac{(1790 \text{ plf})}{2.8} = 1279 \text{ plf} \quad 2 \text{ sides- } 7/16" \text{ sheathing, 2" fastener spacing}$$

3rd Floor Shear Wall Forces:**N-S:**

$$Vr_{ns} := 17.1 \text{ kip} \quad (\text{Seismic})$$

EFFECTIVE LENGTH**(WITH ASPECT RATIO ADJUSTMENT PER SPDWS 4.3.4)****FORCE****SW**

$$L_1 := 3.916 \text{ ft} \cdot 0.96 + 9 \text{ ft} + 11 \text{ ft} + 4 \text{ ft} \cdot 0.96 = 27.6 \text{ ft} \quad V := \frac{1}{4} \cdot \frac{Vr_{ns}}{L_1} = 155 \frac{\text{lb}}{\text{ft}} \quad \text{SWA}$$

$$L_2 := 20.5 \text{ ft} + 20.5 \text{ ft} + 22 \text{ ft} = 63 \text{ ft} \quad V := \frac{1}{2} \cdot \frac{Vr_{ns}}{L_2} = 136 \frac{\text{lb}}{\text{ft}} \quad \text{SWA}$$

$$L_3 := 3.916 \text{ ft} \cdot 0.96 + 9 \text{ ft} + 11 \text{ ft} + 4 \text{ ft} \cdot 0.96 = 27.6 \text{ ft} \quad V := \frac{1}{4} \cdot \frac{Vr_{ns}}{L_3} = 155 \frac{\text{lb}}{\text{ft}} \quad \text{SWA}$$

E-W:

$$Vr_{ew} := 17.1 \text{ kip} \quad (\text{Seismic})$$

EFFECTIVE LENGTH**(WITH ASPECT RATIO ADJUSTMENT PER SPDWS 4.3.4)****FORCE****SW**

$$L_A := 2 \cdot (9.916 \text{ ft}) = 19.83 \text{ ft} \quad V := \frac{1}{2} \cdot \frac{Vr_{ew}}{L_A} = 431 \frac{\text{lb}}{\text{ft}} \quad \text{SWC}$$

$$L_B := 2 \cdot (3 \text{ ft} \cdot 0.875 + 6.416 \text{ ft} + 3.416 \text{ ft} \cdot 0.92) = 24.37 \text{ ft} \quad V := \frac{1}{2} \cdot \frac{Vr_{ew}}{L_B} = 351 \frac{\text{lb}}{\text{ft}} \quad \text{SWB}$$

2nd Floor Shear Wall Forces:

N-S:

$$V3_{ns} := 32.2 \text{ kip}$$

(Seismic)

EFFECTIVE LENGTH

(WITH ASPECT RATIO ADJUSTMENT PER SPDWS 4.3.4)

FORCE

SW

$$L_1 := 3.916 \text{ ft} \cdot 0.96 + 9 \text{ ft} + 11 \text{ ft} + 4 \text{ ft} \cdot 0.96 = 27.6 \text{ ft}$$

$$V := \frac{1}{4} \cdot \frac{V3_{ns}}{L_1} = 292 \frac{\text{lb}}{\text{ft}}$$

SWB

$$L_2 := 20.5 \text{ ft} + 20.5 \text{ ft} + 22 \text{ ft} = 63 \text{ ft}$$

$$V := \frac{1}{2} \cdot \frac{V3_{ns}}{L_2} = 256 \frac{\text{lb}}{\text{ft}}$$

SWA

$$L_3 := 3.916 \text{ ft} \cdot 0.96 + 9 \text{ ft} + 11 \text{ ft} + 4 \text{ ft} \cdot 0.96 = 27.6 \text{ ft}$$

$$V := \frac{1}{4} \cdot \frac{V3_{ns}}{L_3} = 292 \frac{\text{lb}}{\text{ft}}$$

SWB

E-W:

$$V3_{ew} := 32.2 \text{ kip}$$

(Seismic)

EFFECTIVE LENGTH

(WITH ASPECT RATIO ADJUSTMENT PER SPDWS 4.3.4)

FORCE

SW

$$L_A := 2 \cdot (9.916 \text{ ft}) = 19.83 \text{ ft}$$

$$V := \frac{1}{2} \cdot \frac{V3_{ew}}{L_A} = 812 \frac{\text{lb}}{\text{ft}}$$

SWCC

$$L_B := 2 \cdot (3 \text{ ft} \cdot 0.875 + 6.416 \text{ ft} + 3.416 \text{ ft} \cdot 0.92) = 24.37 \text{ ft}$$

$$V := \frac{1}{2} \cdot \frac{V3_{ew}}{L_B} = 661 \frac{\text{lb}}{\text{ft}}$$

SWCC

1st Floor Shear Wall Forces:

N-S:

$$V2_{ns} := 39.8 \text{ kip}$$

(Seismic)

EFFECTIVE LENGTH

(WITH ASPECT RATIO ADJUSTMENT PER SPDWS 4.3.4)

FORCE

SW

$$L_1 := 3.916 \text{ ft} \cdot 0.96 + 9 \text{ ft} + 11 \text{ ft} + 4 \text{ ft} \cdot 0.96 = 27.6 \text{ ft}$$

$$V := \frac{1}{4} \cdot \frac{V2_{ns}}{L_1} = 361 \frac{\text{lb}}{\text{ft}}$$

SWB

$$L_2 := 20.5 \text{ ft} + 20.5 \text{ ft} + 22 \text{ ft} = 63 \text{ ft}$$

$$V := \frac{1}{2} \cdot \frac{V2_{ns}}{L_2} = 316 \frac{\text{lb}}{\text{ft}}$$

SWB

$$L_3 := 3.916 \text{ ft} \cdot 0.96 + 9 \text{ ft} + 11 \text{ ft} + 4 \text{ ft} \cdot 0.96 = 27.6 \text{ ft}$$

$$V := \frac{1}{4} \cdot \frac{V2_{ns}}{L_3} = 361 \frac{\text{lb}}{\text{ft}}$$

SWB

E-W:

$$V2_{ew} := 39.8 \text{ kip}$$

(Seismic)

EFFECTIVE LENGTH

(WITH ASPECT RATIO ADJUSTMENT PER SPDWS 4.3.4)

FORCE

SW

$$L_A := 2 \cdot (9.916 \text{ ft}) = 19.83 \text{ ft}$$

$$V := \frac{1}{2} \cdot \frac{V2_{ew}}{L_A} = 1003 \frac{\text{lb}}{\text{ft}}$$

SWDD

$$L_B := 2 \cdot (3 \text{ ft} \cdot 0.875 + 6.416 \text{ ft} + 3.416 \text{ ft} \cdot 0.92) = 24.37 \text{ ft}$$

$$V := \frac{1}{2} \cdot \frac{V2_{ew}}{L_B} = 817 \frac{\text{lb}}{\text{ft}}$$

SWCC

Two Stage Lateral Design - Lower Level Special Reinforced Concrete Shear Walls:

Lower Level R Value: $R_{lower} := 5$

Upper Levels R Value: $R_{upper} := 6.5$

Modification Factor: $F_{mod} := \frac{R_{upper}}{R_{lower}} = 1.3$

Modified Shear Value From Above: $V_{mod} := F_{mod} \cdot V_{2ns} = 51.7 \text{ kip}$

Shear Value From Lower Level: $V_{low} := 130.13 \text{ kip} \cdot 0.7 = 91.1 \text{ kip}$

At Rest Pressure: $p_{atrest} := 57 \text{ pcf}$

Soil Pressure at Diaphragm: $V_{soil} := \frac{1}{3} \cdot p_{atrest} \cdot 14 \text{ ft} \cdot 14 \text{ ft} \cdot 80 \text{ ft} = 297.9 \text{ kip}$

N-S Total Shear: $V_{ns} := V_{mod} + V_{low} + V_{soil} = 440.8 \text{ kip}$

E-W Total Shear: $V_{ew} := V_{mod} + V_{low} = 142.8 \text{ kip}$

$L_1 := 33.5 \text{ ft} + 5 \text{ ft} = 38.5 \text{ ft} \quad V := \frac{1}{2} \cdot \frac{V_{ns}}{L_1} = 5724 \frac{\text{lbf}}{\text{ft}}$

 See Enercalc Calculation
For SW Calc

$L_3 := 33.75 \text{ ft} + 4.75 \text{ ft} = 38.5 \text{ ft} \quad V := \frac{1}{2} \cdot \frac{V_{ns}}{L_3} = 5724 \frac{\text{lbf}}{\text{ft}}$

 See Enercalc Calculation
For SW Calc

$L_A := 3 \text{ ft} + 9.416 \text{ ft} + 9.33 \text{ ft} + 12.5 \text{ ft} + 5.75 \text{ ft} = 40 \text{ ft}$

$V := \frac{1}{2} \cdot \frac{V_{ew}}{L_A} = 1786 \frac{\text{lbf}}{\text{ft}}$

 See Enercalc Calculation
For SW Calc

$L_B := 80 \text{ ft}$

$V := \frac{1}{2} \cdot \frac{V_{ew}}{L_B} = 893 \frac{\text{lbf}}{\text{ft}}$

 See Enercalc Calculation
For SW Calc

N-S 1st Floor LRFD Diaphragm Shear: $V_{ns_1st} := \frac{V_{low}}{0.7} + 1.6 V_{soil} = 606.8 \text{ kip}$

E-W 1st Floor LRFD Diaphragm Shear: $V_{ew_1st} := \frac{V_{low}}{0.7} = 130.1 \text{ kip}$

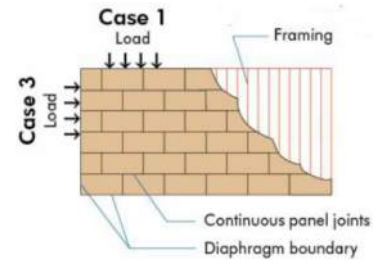
1. SWA: Minimum of blocked 7/16" sheathing (min. 24/0 span rating) w/ 8d nails spaced at 6" at panel edges and 12" in field shall be used. Minimum fastener penetration into framing member or blocking of 1-3/8" shall be provided. (a) Wall studs shall be spaced at a maximum of 16 in. OC, or (b) panels shall be applied with long dimension across studs, or (c) 15/32" sheathing shall be used.
2. SWB: Minimum of blocked 7/16" sheathing (min. 24/0 span rating) w/ 8d nails spaced at 4" at panel edges and 12" in field shall be used. Minimum fastener penetration into framing member or blocking of 1-3/8" shall be provided. (a) Wall studs shall be spaced at a maximum of 16 in. OC, or (b) panels shall be applied with long dimension across studs, or (c) 15/32" sheathing shall be used.
3. SWC: Minimum of blocked 7/16" sheathing (min. 24/0 span rating) w/ 8d nails spaced at 3" at panel edges and 12" in field shall be used. Minimum fastener penetration into framing member or blocking of 1-3/8" shall be provided. (a) Wall studs shall be spaced at a maximum of 16 in. OC, or (b) panels shall be applied with long dimension across studs, or (c) 15/32" sheathing shall be used.
4. SWD: Minimum of blocked 7/16" sheathing (min. 24/0 span rating) w/ 8d nails spaced at 2" at panel edges and 12" in field shall be used. Minimum fastener penetration into framing member or blocking of 1-3/8" shall be provided. (a) Wall studs shall be spaced at a maximum of 16 in. OC, or (b) panels shall be applied with long dimension across studs, or (c) 15/32" sheathing shall be used.
5. SWCC: Minimum of blocked 7/16" sheathing (min. 24/0 span rating) both sides of wall w/ 8d nails spaced at 3" at panel edges and 12" in field shall be used. Minimum fastener penetration into framing member or blocking of 1-3/8" shall be provided. (a) Wall studs shall be spaced at a maximum of 16 in. OC, or (b) panels shall be applied with long dimension across studs, or (c) 15/32" sheathing shall be used.
6. SWDD: Minimum of blocked 7/16" sheathing (min. 24/0 span rating) both sides of wall w/ 8d nails spaced at 2" at panel edges and 12" in field shall be used. Minimum fastener penetration into framing member or blocking of 1-3/8" shall be provided. (a) Wall studs shall be spaced at a maximum of 16 in. OC, or (b) panels shall be applied with long dimension across studs, or (c) 15/32" sheathing shall be used.

DIAPHRAGM & CHORD CAPACITY AND FORCES:

Roof Diaphragm Capacities (2021 SDPWS Table 4.2C):

$$v_{roof_case1} := \frac{(760 \text{ plf})}{2.8} = 271 \text{ plf} \quad 15/32" \text{ sheathing - Case 1}$$

$$v_{roof_case3} := \frac{(505 \text{ plf})}{2.8} = 180 \text{ plf} \quad 15/32" \text{ sheathing - Case 3}$$



Deflection

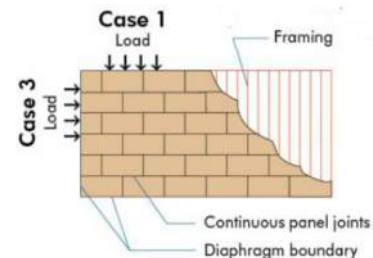
Span rating minimum of 32/16 shall be used for a max snow loading of 39.2 psf, which is predominantly available in 15/32" thickness.

Therefore, roof diaphragm to consist of a minimum of unblocked 15/32" sheathing (min. 32/16 span rating) w/ 8d nails spaced at 6" at diaphragm boundaries and supported panel edges and 12" in field shall be used. Minimum fastener penetration into framing member or blocking of 1-3/8" shall be provided. Continuous panel joints recommended to run perpendicular to framing.

Floor Diaphragm Capacities (2021 SDPWS Table 4.2C):

$$v_{floor_case1} := \frac{(800 \text{ plf})}{2.8} = 286 \text{ plf} \quad 23/32" \text{ sheathing - Case 1}$$

$$v_{floor_case3} := \frac{(600 \text{ plf})}{2.8} = 214 \text{ plf} \quad 23/32" \text{ sheathing - Case 3}$$



Deflection

Span rating minimum of 48/24 shall be used for a live loading of 80 psf, which is predominantly available in 23/32" thickness.

Therefore, a minimum of unblocked 23/32" sheathing (min. 48/24 span rating) w/ 10d nails spaced at 6" at diaphragm boundaries and supported panel edges and 12" in field shall be used. Minimum fastener penetration into framing member or blocking of 1-1/2" shall be provided. Continuous panel joints recommended to run perpendicular to framing.

Chord Capacity:

(2) 2x6 Top Plate

$$A := 1.5 \text{ in} \cdot 5.5 \text{ in} = 8.25 \text{ in}^2 \quad F_t := 575 \text{ psi} \quad C_D := 1.6 \quad F_t' := F_t \cdot C_D \cdot A = 7590 \text{ lbf}$$

$$6'-0" \text{ Splice - 16d nails @ 4" o.c.} \quad Z := 141 \text{ lbf} \quad \#_{nails} := 17 \quad Z' := \#_{nails} \cdot Z \cdot C_D = 3835 \text{ lbf}$$

Roof Diaphragm (RD1):**Diaphragm Dimensions:**

$$D_1 := 40 \text{ ft} \quad D_2 := 43.5 \text{ ft}$$

$$\text{N-S: } V_{ns} := \frac{V_{r_{ns}}}{2} = 8.6 \text{ kip} \quad (\text{Seismic})$$

$$v_{\text{roof_cap_ns}} := v_{\text{roof_case1}} = 271.43 \text{ plf}$$

LENGTH**DEPTH****LOAD****SHEAR**

$$L := D_1 = 40 \text{ ft} \quad D := D_2 = 43.5 \text{ ft} \quad w := \frac{V_{ns}}{L} = 214 \frac{\text{lbf}}{\text{ft}} \quad v_{ns} := \frac{w \cdot L}{2 \cdot D} = 98 \frac{\text{lbf}}{\text{ft}}$$

$$\text{RoofDiaphragm}_{chk} := \text{if}(v_{\text{roof_cap_ns}} \geq v_{ns}, \text{"Diaphragm OK"}, \text{"Diaphragm NG"})$$

$$\text{RoofDiaphragm}_{chk} = \text{"Diaphragm OK"}$$

$$\text{E-W: } V_{ew} := \frac{V_{r_{ew}}}{2} = 8.55 \text{ kip} \quad (\text{Seismic})$$

$$v_{\text{roof_cap_ew}} := v_{\text{roof_case3}} = 180.36 \text{ plf}$$

LENGTH**DEPTH****LOAD****SHEAR**

$$L := D_2 = 43.5 \text{ ft} \quad D := D_1 = 40 \text{ ft} \quad w := \frac{V_{ew}}{L} = 197 \frac{\text{lbf}}{\text{ft}} \quad v_{ew} := \frac{w \cdot L}{2 \cdot D} = 107 \frac{\text{lbf}}{\text{ft}}$$

$$\text{RoofDiaphragm}_{chk} := \text{if}(1.02 \cdot v_{\text{roof_cap_ew}} \geq v_{ew}, \text{"Diaphragm OK"}, \text{"Diaphragm NG"})$$

$$\text{RoofDiaphragm}_{chk} = \text{"Diaphragm OK"}$$

Chord Capacity:

(2) 2x6 Top Plate

$$A := 1.5 \text{ in} \cdot 5.5 \text{ in} = 8.25 \text{ in}^2 \quad F_t := 575 \text{ psi} \quad C_D := 1.6 \quad F_t' := F_t \cdot C_D \cdot A = 7590 \text{ lbf}$$

$$6'-0" \text{ Splice} - 16\text{d nails @ } 4" \text{ o.c.} \quad Z := 141 \text{ lbf} \quad \#_{\text{nails}} := 17 \quad Z' := \#_{\text{nails}} \cdot Z \cdot C_D = 3835 \text{ lbf}$$

$$\text{N-S: } V_{ns} = 8.6 \text{ kip} \quad (\text{Seismic})$$

LENGTH**DEPTH****LOAD****MOMENT****CHORD FORCE**

$$L := D_1 = 40 \text{ ft} \quad D := D_2 = 43.5 \text{ ft} \quad w := \frac{V_{ns}}{L} = 214 \frac{\text{lbf}}{\text{ft}} \quad M := \frac{w \cdot L^2}{8} = 42750 \text{ ft} \cdot \text{lbf} \quad T := \frac{M}{D} = 983 \text{ lbf}$$

$$\text{Chord}_{chk} := \text{if}(Z' \geq T, \text{"Chord OK"}, \text{"Chord NG"})$$

$$\text{Chord}_{chk} = \text{"Chord OK"}$$

$$\text{E-W: } V_{ew} = 8.55 \text{ kip} \quad (\text{Seismic})$$

LENGTH**DEPTH****LOAD****MOMENT****CHORD FORCE**

$$L := D_2 = 43.5 \text{ ft} \quad D := D_1 = 40 \text{ ft} \quad w := \frac{V_{ew}}{L} = 197 \frac{\text{lbf}}{\text{ft}} \quad M := \frac{w \cdot L^2}{8} = 46491 \text{ ft} \cdot \text{lbf} \quad T := \frac{M}{D} = 1162 \text{ lbf}$$

$$\text{Chord}_{chk} := \text{if}(Z' \geq T, \text{"Chord OK"}, \text{"Chord NG"})$$

$$\text{Chord}_{chk} = \text{"Chord OK"}$$

Floor Diaphragm (3D1):

Diaphragm Dimensions:

$$D_1 := 80 \text{ ft} \quad D_2 := 43.5 \text{ ft}$$

N-S: $V_{ns} := V3_{ns} - Vr_{ns} = 15 \text{ kip}$ (Seismic)

$$v_{\text{floor_cap_ns}} := v_{\text{floor_case1}} = 285.71 \text{ plf}$$

LENGTH	DEPTH	LOAD	SHEAR
$L := D_1 = 80 \text{ ft}$	$D := D_2 = 43.5 \text{ ft}$	$w := \frac{V_{ns}}{L} = 189 \frac{\text{lbf}}{\text{ft}}$	$v_{ns} := \frac{w \cdot L}{2 \cdot D} = 174 \frac{\text{lbf}}{\text{ft}}$

$$\text{FloorDiaphragm}_{chk} := \text{if}(v_{\text{floor_cap_ns}} \geq v_{ns}, \text{"Diaphragm OK"}, \text{"Diaphragm NG"})$$

$$\text{FloorDiaphragm}_{chk} = \text{"Diaphragm OK"}$$

E-W: $V_{ew} := V3_{ew} - Vr_{ew} = 15.1 \text{ kip}$ (Seismic)

$$v_{\text{floor_cap_ew}} := v_{\text{floor_case3}} = 214.29 \text{ plf}$$

LENGTH	DEPTH	LOAD	SHEAR
$L := D_2 = 43.5 \text{ ft}$	$D := D_1 = 80 \text{ ft}$	$w := \frac{V_{ew}}{L} = 347 \frac{\text{lbf}}{\text{ft}}$	$v_{ew} := \frac{w \cdot L}{2 \cdot D} = 94 \frac{\text{lbf}}{\text{ft}}$

$$\text{FloorDiaphragm}_{chk} := \text{if}(v_{\text{floor_cap_ew}} \geq v_{ew}, \text{"Diaphragm OK"}, \text{"Diaphragm NG"})$$

$$\text{FloorDiaphragm}_{chk} = \text{"Diaphragm OK"}$$

Chord Capacity:

(2) 2x6 Top Plate

$$A := 1.5 \text{ in} \cdot 5.5 \text{ in} = 8.25 \text{ in}^2 \quad F_t := 575 \text{ psi} \quad C_D := 1.6 \quad F_t' := F_t \cdot C_D \cdot A = 7590 \text{ lbf}$$

$$6'-0" \text{ Splice} - 16d \text{ nails @ } 4" \text{ o.c.} \quad Z := 141 \text{ lbf} \quad \#_{\text{nails}} := 17 \quad Z' := \#_{\text{nails}} \cdot Z \cdot C_D = 3835 \text{ lbf}$$

N-S: $V_{ns} = 15.1 \text{ kip}$ (Seismic)

LENGTH	DEPTH	LOAD	MOMENT	CHORD FORCE
$L := D_1 = 80 \text{ ft}$	$D := D_2 = 43.5 \text{ ft}$	$w := \frac{V_{ns}}{L} = 189 \frac{\text{lbf}}{\text{ft}}$	$M := \frac{w \cdot L^2}{8} = (2 \cdot 10^5) \text{ ft} \cdot \text{lbf}$	$T := \frac{M}{D} = 3471 \text{ lbf}$

$$\text{Chord}_{chk} := \text{if}(Z' \geq T, \text{"Chord OK"}, \text{"Chord NG"})$$

$$\text{Chord}_{chk} = \text{"Chord OK"}$$

E-W: $V_{ew} = 15.1 \text{ kip}$ (Seismic)

LENGTH	DEPTH	LOAD	MOMENT	CHORD FORCE
$L := D_2 = 43.5 \text{ ft}$	$D := D_1 = 80 \text{ ft}$	$w := \frac{V_{ew}}{L} = 347 \frac{\text{lbf}}{\text{ft}}$	$M := \frac{w \cdot L^2}{8} = 82106 \text{ ft} \cdot \text{lbf}$	$T := \frac{M}{D} = 1026 \text{ lbf}$

$$\text{Chord}_{chk} := \text{if}(Z' \geq T, \text{"Chord OK"}, \text{"Chord NG"})$$

$$\text{Chord}_{chk} = \text{"Chord OK"}$$

Floor Diaphragm (2D1):**Diaphragm Dimensions:**

$$D_1 := 80 \text{ ft}$$

$$D_2 := 43.5 \text{ ft}$$

$$\text{N-S: } V_{ns} := V2_{ns} - V3_{ns} = 8 \text{ kip} \quad (\text{Seismic})$$

$$v_{\text{floor_cap_ns}} := v_{\text{floor_case1}} = 285.71 \text{ plf}$$

LENGTH**DEPTH****LOAD****SHEAR**

$$L := D_1 = 80 \text{ ft} \quad D := D_2 = 43.5 \text{ ft} \quad w := \frac{V_{ns}}{L} = 95 \frac{\text{lb}}{\text{ft}} \quad v_{ns} := \frac{w \cdot L}{2 \cdot D} = 87 \frac{\text{lb}}{\text{ft}}$$

$$\text{FloorDiaphragm}_{chk} := \text{if}(v_{\text{floor_cap_ns}} \geq v_{ns}, \text{"Diaphragm OK"}, \text{"Diaphragm NG"})$$

$$\text{FloorDiaphragm}_{chk} = \text{"Diaphragm OK"}$$

$$\text{E-W: } V_{ew} := V2_{ew} - V3_{ew} = 7.6 \text{ kip} \quad (\text{Seismic})$$

$$v_{\text{floor_cap_ew}} := v_{\text{floor_case3}} = 214.29 \text{ plf}$$

LENGTH**DEPTH****LOAD****SHEAR**

$$L := D_2 = 43.5 \text{ ft} \quad D := D_1 = 80 \text{ ft} \quad w := \frac{V_{ew}}{L} = 175 \frac{\text{lb}}{\text{ft}} \quad v_{ew} := \frac{w \cdot L}{2 \cdot D} = 48 \frac{\text{lb}}{\text{ft}}$$

$$\text{FloorDiaphragm}_{chk} := \text{if}(v_{\text{floor_cap_ew}} \geq v_{ew}, \text{"Diaphragm OK"}, \text{"Diaphragm NG"})$$

$$\text{FloorDiaphragm}_{chk} = \text{"Diaphragm OK"}$$

Chord Capacity:

(2) 2x6 Top Plate

$$A := 1.5 \text{ in} \cdot 5.5 \text{ in} = 8.25 \text{ in}^2$$

$$F_t := 575 \text{ psi}$$

$$C_D := 1.6$$

$$F'_t := F_t \cdot C_D \cdot A = 7590 \text{ lb}$$

6'-0" Splice - 16d nails @ 4" o.c.

$$Z := 141 \text{ lb}$$

$$\#_{\text{nails}} := 17$$

$$Z' := \#_{\text{nails}} \cdot Z \cdot C_D = 3835 \text{ lb}$$

$$\text{N-S: } V_{ns} = 7.6 \text{ kip} \quad (\text{Seismic})$$

LENGTH**DEPTH****LOAD****MOMENT****CHORD FORCE**

$$L := D_1 = 80 \text{ ft} \quad D := D_2 = 43.5 \text{ ft} \quad w := \frac{V_{ns}}{L} = 95 \frac{\text{lb}}{\text{ft}} \quad M := \frac{w \cdot L^2}{8} = 76000 \text{ ft} \cdot \text{lb} \quad T := \frac{M}{D} = 1747 \text{ lb}$$

$$\text{Chord}_{chk} := \text{if}(Z' \geq T, \text{"Chord OK"}, \text{"Chord NG"})$$

$$\text{Chord}_{chk} = \text{"Chord OK"}$$

$$\text{E-W: } V_{ew} = 7.6 \text{ kip} \quad (\text{Seismic})$$

LENGTH**DEPTH****LOAD****MOMENT****CHORD FORCE**

$$L := D_2 = 43.5 \text{ ft} \quad D := D_1 = 80 \text{ ft} \quad w := \frac{V_{ew}}{L} = 175 \frac{\text{lb}}{\text{ft}} \quad M := \frac{w \cdot L^2}{8} = 41325 \text{ ft} \cdot \text{lb} \quad T := \frac{M}{D} = 517 \text{ lb}$$

$$\text{Chord}_{chk} := \text{if}(Z' \geq T, \text{"Chord OK"}, \text{"Chord NG"})$$

$$\text{Chord}_{chk} = \text{"Chord OK"}$$

Floor Diaphragm (1D1):

Diaphragm Dimensions:

$$D_1 := 80 \text{ ft} \quad D_2 := 43.5 \text{ ft}$$

N-S: $V_{ns} := V_{ns_1st} = 606.8 \text{ kip}$ (Seismic+Soil)

Diaphragm Capacity:

$$\phi := 0.75 \quad t := 6 \text{ in} \quad f'_c := 3000 \text{ psi} \quad f_y := 60 \text{ ksi}$$

$$A_{cv_ns} := t \cdot D_2 = 21.75 \text{ ft}^2 \quad A_{cv_ew} := t \cdot D_1 = 40 \text{ ft}^2 \quad \rho_t := \frac{0.31 \text{ in}^2}{12 \text{ in} \cdot t} = 0.004$$

$$\phi V_{n_ns} := \phi \cdot A_{cv_ns} \cdot (2 \cdot \sqrt{f'_c} \cdot \text{psi} + f_y \cdot \rho_t) = 864.15 \text{ kip} \quad \phi V_{n_ew} := \phi \cdot A_{cv_ew} \cdot 2 \cdot \sqrt{f'_c} \cdot \text{psi} = 473.23 \text{ kip}$$

$$v_{\text{floor_cap_ns}} := \frac{\phi V_{n_ns}}{D_2} = 19865 \frac{\text{lbf}}{\text{ft}}$$

LENGTH	DEPTH	LOAD	SHEAR
$L := D_1 = 80 \text{ ft}$	$D := D_2 = 43.5 \text{ ft}$	$w := \frac{V_{ns}}{L} = 7585 \frac{\text{lbf}}{\text{ft}}$	$v_{ns} := \frac{w \cdot L}{2 \cdot D} = 6975 \frac{\text{lbf}}{\text{ft}}$

$$\text{FloorDiaphragm}_{chk} := \text{if}(v_{\text{floor_cap_ns}} \geq v_{ns}, \text{"Diaphragm OK"}, \text{"Diaphragm NG"})$$

$$\text{FloorDiaphragm}_{chk} = \text{"Diaphragm OK"}$$

E-W: $V_{ew} := V_{ew_1st} = 130.13 \text{ kip}$ (Seismic)

Diaphragm Capacity:

$$\phi := 0.75 \quad t := 6 \text{ in} \quad f'_c := 3000 \text{ psi}$$

$$A_{cv_ns} := t \cdot D_2 = 21.75 \text{ ft}^2 \quad A_{cv_ew} := t \cdot D_1 = 40 \text{ ft}^2$$

$$\phi V_{n_ns} := \phi \cdot A_{cv_ns} \cdot 2 \cdot \sqrt{f'_c} \cdot \text{psi} = 257.32 \text{ kip} \quad \phi V_{n_ew} := \phi \cdot A_{cv_ew} \cdot 2 \cdot \sqrt{f'_c} \cdot \text{psi} = 473.23 \text{ kip}$$

$$v_{\text{floor_cap_ew}} := \frac{\phi V_{n_ew}}{D_1} = 5915 \frac{\text{lbf}}{\text{ft}}$$

LENGTH	DEPTH	LOAD	SHEAR
$L := D_2 = 43.5 \text{ ft}$	$D := D_1 = 80 \text{ ft}$	$w := \frac{V_{ew}}{L} = 2991 \frac{\text{lbf}}{\text{ft}}$	$v_{ew} := \frac{w \cdot L}{2 \cdot D} = 813 \frac{\text{lbf}}{\text{ft}}$

$$\text{FloorDiaphragm}_{chk} := \text{if}(v_{\text{floor_cap_ew}} \geq v_{ew}, \text{"Diaphragm OK"}, \text{"Diaphragm NG"})$$

$$\text{FloorDiaphragm}_{chk} = \text{"Diaphragm OK"}$$

Shear Transfer To Wall:

$$\phi := 0.75 \quad \mu := 0.6 \quad f_y := 60 \text{ ksi}$$

$$A_{vf} := \frac{0.31 \text{ in}^2}{12 \text{ in}} = 0.31 \frac{\text{in}^2}{\text{ft}}$$

$$\phi V_n := \phi \cdot \mu \cdot A_{vf} \cdot f_y = 8370 \frac{\text{lbf}}{\text{ft}} \quad v_{ns} = 6975 \frac{\text{lbf}}{\text{ft}} \quad v_{ew} = 813 \frac{\text{lbf}}{\text{ft}}$$

$$\text{FloorDiaphragm}_{chk} := \text{if}(\phi V_n \geq v_{ns}, \text{"Shear Transfer OK"}, \text{"Shear Transfer NG"})$$

$$\text{FloorDiaphragm}_{chk} = \text{"Shear Transfer OK"}$$

Provide min #5 dowels @ 12" o.c.

Chord Capacity:

$$\phi := 0.90 \quad f_y := 60 \text{ ksi}$$

$$A_{s_{ns}} := 10 \cdot 0.31 \text{ in}^2 = 3.1 \text{ in}^2$$

$$\phi T_{n_{ns}} := \phi \cdot A_{s_{ns}} \cdot f_y = 167.4 \text{ kip}$$

(10) #5 Bars within
first 10' of diaphragm

$$A_{s_{ew}} := 2 \cdot 0.31 \text{ in}^2 = 0.62 \text{ in}^2$$

$$\phi T_{n_{ew}} := \phi \cdot A_{s_{ew}} \cdot f_y = 33.48 \text{ kip}$$

(2) #5 Bars

N-S: $V_{ns} = 606.8 \text{ kip}$

(Seismic+Soil)

LENGTH

DEPTH

LOAD

MOMENT

CHORD FORCE

$$L := D_1 = 80 \text{ ft} \quad D := D_2 = 43.5 \text{ ft} \quad w := \frac{V_{ns}}{L} = 7585 \frac{\text{lb}}{\text{ft}} \quad M := \frac{w \cdot L^2}{8} = 6068 \text{ ft} \cdot \text{kip} \quad T := \frac{M}{D - 5 \text{ ft}} = 158 \text{ kip}$$

$$\text{Chord}_{chk} := \text{if}(\phi T_{n_{ns}} \geq T, \text{"Chord OK"}, \text{"Chord NG"})$$

$$\text{Chord}_{chk} = \text{"Chord OK"}$$

E-W: $V_{ew} = 130.13 \text{ kip}$

(Seismic)

LENGTH

DEPTH

LOAD

MOMENT

CHORD FORCE

$$L := D_2 = 43.5 \text{ ft} \quad D := D_1 = 80 \text{ ft} \quad w := \frac{V_{ew}}{L} = 2991 \frac{\text{lb}}{\text{ft}} \quad M := \frac{w \cdot L^2}{8} = 708 \text{ ft} \cdot \text{kip} \quad T := \frac{M}{D} = 8845 \text{ lb}$$

$$\text{Chord}_{chk} := \text{if}(\phi T_{n_{ew}} \geq T, \text{"Chord OK"}, \text{"Chord NG"})$$

$$\text{Chord}_{chk} = \text{"Chord OK"}$$

DRAG CHORD FORCE FROM DRAG CALCULATION (LINE A)

$$T := 25519 \text{ lb}$$

$$\text{Chord}_{chk} := \text{if}(\phi T_{n_{ew}} \geq T, \text{"Chord OK"}, \text{"Chord NG"})$$

$$\text{Chord}_{chk} = \text{"Chord OK"}$$

CARTWRIGHT

PROJECT: K&B ApartmentsPROJECT NO: 123021DATE: May 2025SUBJECT: Drag Forces (1)ENGINEER: JoshFSHEET: 1 of 2
☒ Cartwright Approved Spreadsheet

Drag Force along Grid-Line

Version: Dec. 16, 2021 / jdabel

File Name: 3.7.1 CE_Loads_Lat_DragForces-3 & 2 Per Page Opt

R: 5 (ASCE 17, Table 12.2-1)

Code Ref.: n/a

Overstrength Factor: 2.5 (ASCE 17, Table 12.2-1)Building Bearing Wall Type: ConcreteBuilding Irregularities: No (ASCE 17, Table 12.3-2)

Input:

Factor: 1

Grid ID: Grid A (1st Floor)					Total Shear at Line: 102,021 lbs
Total Shear Wall Length: 40.0 ft					Diaphragm Shear: 1,275 plf
Total Diaphragm Length: 80.0 ft					Shear Wall Shear: -2,551 plf
Sect. No.	Sect. Type	Sect. ft.	Location (ft)	Drag Force lbs.	
0	-	-	0	0	
1	Shear Wall	3.0	3	-3,826	
2	Drag	24.0	27	26,781	
3	Shear Wall	9.4	36	14,772	
4	Drag	4.0	40	19,874	
5	Shear Wall	9.3	50	7,971	
6	Drag	6.0	56	15,623	
7	Shear Wall	12.5	68	-319	
8	Drag	6.0	74	7,333	
9	Shear Wall	5.8	80	0	
Grid ID: Grid A (2nd Floor)					Total Shear at Line: 19,891 lbs
Total Shear Wall Length: 19.8 ft					Diaphragm Shear: 248 plf
Total Diaphragm Length: 80.2 ft					Shear Wall Shear: -1,003 plf
Sect. No.	Sect. Type	Sect. ft.	Location (ft)	Drag Force lbs.	
0	-	-	0	0	
1	Drag	5.1	5	1,261	
2	Shear Wall	9.9	15	-6,224	
3	Drag	9.5	24	-3,867	
4	Drag	15.6	40	0	
5	Drag	15.6	56	3,867	
6	Drag	9.5	65	6,224	
7	Shear Wall	9.9	75	-1,261	
8	Drag	5.1	80	0	
Grid ID: Grid A (3rd Floor)					Total Shear at Line: 16,104 lbs
Total Shear Wall Length: 19.8 ft					Diaphragm Shear: 201 plf
Total Diaphragm Length: 80.2 ft					Shear Wall Shear: -812 plf
Sect. No.	Sect. Type	Sect. ft.	Location (ft)	Drag Force lbs.	
0	-	-	0	0	
1	Drag	5.1	5	1,021	
2	Shear Wall	9.9	15	-5,039	
3	Drag	9.5	24	-3,130	
4	Drag	15.6	40	0	
5	Drag	15.6	56	3,130	
6	Drag	9.5	65	5,039	
7	Shear Wall	9.9	75	-1,021	
8	Drag	5.1	80	0	

SHEET: 2 of 2

Building Irregularities: **Yes** (ASCE 17, Table 12.3-2)

Factor: 1

Number of People	Number of Cars
0	0
10	500
20	-2500
40	0
60	2500
70	-500
80	0

A blank coordinate system with a vertical y-axis from 0 to 1 and a horizontal x-axis with labels 0, 0, 0, 1, 1, 1. A single black dot is plotted at the origin (0,0).

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Line 1 (33'6" - Line 3 Sim.)

Code References

Calculations per ACI 318-19, IBC 2021, ASCE 7-16
 Load Combinations Used : IBC 2021

General Information

Wall Material	CONCRETE	Material Properties			
Sds	0.30	f _c	4.0 ksi	E _c	3,120.0 ksi
		f _y	60.0 ksi	E _v	1,248.0 ksi
		Density	150.0 pcf	Phi - Shear	0.650

Wall Data

Bottom

Analysis Height	0.00 ft
Wall Offset (datum)	ft
Wall Length	33.50 ft
Wall Thickness	12.0 in
Structural Depth	25.125 ft



DESIGN SUMMARY

Bottom Level

Vu : Story Shear	188.873 +1.20D+0.50L+
Mu : Story Moment	2,644.22 +1.20D+0.50L+
Nu : Axial	233.776 +1.20D+1.60L+
Uplift @ Left End	7.114 +0.90D+E
Uplift @ Right End	7.114 +0.90D+E

Phi * 8 * sqrt(f _c)*h*Lw	586.50 k
Phi * Vc	594.94 k
Phi * Vs Req'd	0.0 k
Horizontal As Req'd	0.2880 in^2
Vertical As Req'd	0.360 in^2
Bending As Req'd	6.512 in^2

Force Summary

Load Combination	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Wall Level	Vu (k)	Mu (k)	Pu (k)		Left	Right
+1.40D							
	Wall Level : 1			228.966			
+1.20D+1.60L							
	Wall Level : 1			230.560			
+1.20D+1.60L+0.50S							
	Wall Level : 1			233.776			
+1.20D+0.50L							
	Wall Level : 1			206.976			
+1.20D							

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Line 1 (33'6" - Line 3 Sim.)

Force Summary

Load Combination Wall Level	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Vu (k)	Mu (k)	Pu (k)			Left	Right
Wall Level : 1 +1.20D+0.50L+1.60S			196.256				
Wall Level : 1 +1.20D+1.60S			217.268				
Wall Level : 1 +1.20D+0.50L+0.50S			206.548				
Wall Level : 1 +1.20D+0.50L+0.70S+E			210.192				
Wall Level : 1 +0.90D	188.873	2,644.222	211.479	12.503	1.340		
Wall Level : 1 +0.90D+E			147.192				
Wall Level : 1	188.873	2,644.222	147.192	17.964	0.932	7.114	7.114

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

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DESCRIPTION: Line 1 (5'-0" - Line 3 Sim.)

Code References

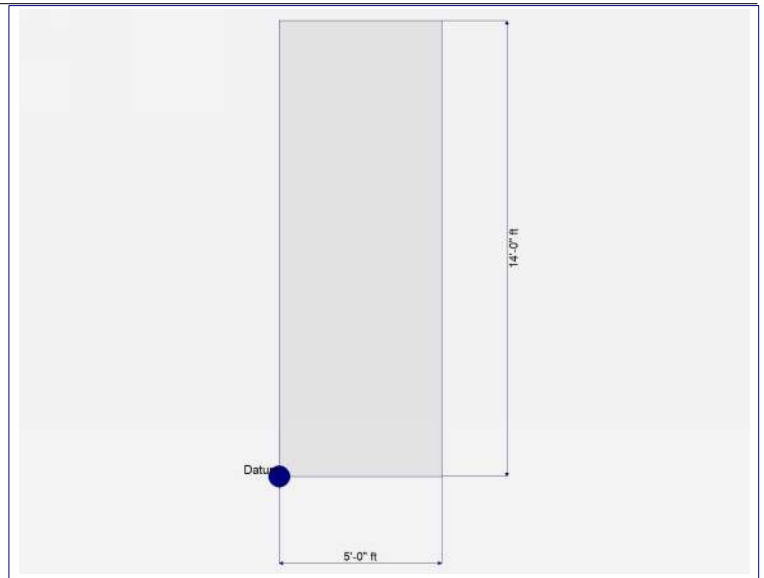
Calculations per ACI 318-19, IBC 2021, ASCE 7-16
 Load Combinations Used : IBC 2021

General Information

Wall Material	CONCRETE	Material Properties			
Sds	0.30	f _c	4.0 ksi	E _c	3,120.0 ksi
		f _y	60.0 ksi	E _v	1,248.0 ksi
		Density	150.0 pcf	Phi - Shear	0.650

Wall Data

	Bottom
Analysis Height	0.00 ft
Wall Offset (datum)	ft
Wall Length	5.0 ft
Wall Thickness	12.0 in
Structural Depth	3.750 ft



DESIGN SUMMARY

	Bottom Level
Vu : Story Shear	28.190 +1.20D+0.50L+
Mu : Story Moment	394.660 +1.20D+0.50L+
Nu : Axial	34.892 +1.20D+1.60L+
Uplift @ Left End	90.597 +0.90D+E
Uplift @ Right End	90.597 +0.90D+E
Phi * 8 * sqrt(f _c)*h*Lw	236.791 k
Phi * V _c	59.198 k
Phi * V _s Req'd	0.0 k
Horizontal As Req'd	0.2880 in^2
Vertical As Req'd	0.360 in^2
Bending As Req'd	2.015 in^2

Force Summary

Load Combination	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Wall Level	Vu (k)	Mu (k)	Pu (k)		Left	Right
+1.40D							
	Wall Level : 1			34.174			
+1.20D+1.60L							
	Wall Level : 1			34.412			
+1.20D+1.60L+0.50S							
	Wall Level : 1			34.892			
+1.20D+0.50L							
	Wall Level : 1			30.892			
+1.20D							

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Line 1 (5'-0" - Line 3 Sim.)

Force Summary

Load Combination Wall Level	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Vu (k)	Mu (k)	Pu (k)			Left	Right
Wall Level : 1			29.292				
+1.20D+0.50L+1.60S							
Wall Level : 1			32.428				
+1.20D+1.60S							
Wall Level : 1			30.828				
+1.20D+0.50L+0.50S							
Wall Level : 1			31.372				
+1.20D+0.50L+0.70S+E							
Wall Level : 1	28.190	394.660	31.564	12.503	0.200	84.200	84.200
+0.90D							
Wall Level : 1			21.969				
+0.90D+E							
Wall Level : 1	28.190	394.660	21.969	17.964	0.139	90.597	90.597

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

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DESCRIPTION: Line A (3'-0")

Code References

Calculations per ACI 318-19, IBC 2021, ASCE 7-16

Load Combinations Used : IBC 2021

General Information

Wall Material CONCRETE
Sds 0.30

Material Properties

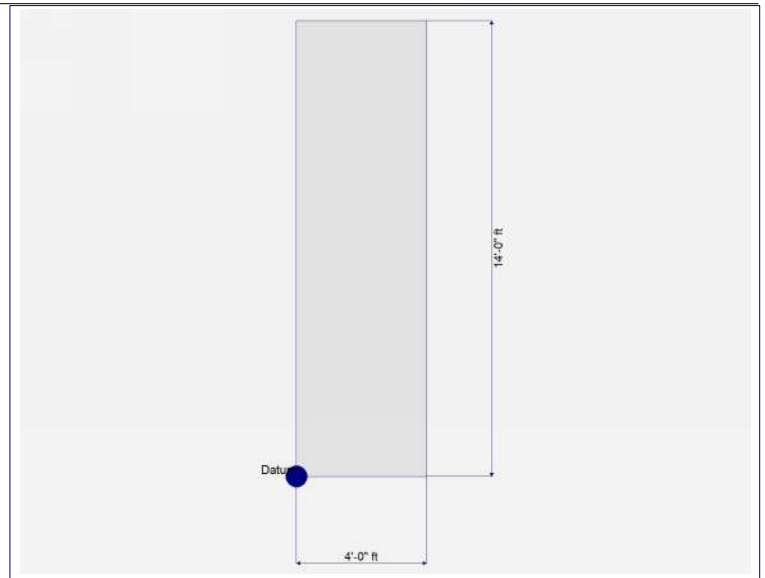
f_c 3.0 ksi
 f_y 60.0 ksi
Density 150.0 pcf

E_c 3,120.0 ksi
 E_v 1,248.0 ksi
Phi - Shear 0.650

Wall Data

Bottom

Analysis Height 0.00 ft
Wall Offset (datum) ft
Wall Length 4.0 ft
Wall Thickness 12.0 in
Structural Depth 2.250 ft



DESIGN SUMMARY

Bottom Level

V_u : Story Shear 5.109 +1.20D+0.50L+
 M_u : Story Moment 60.453 +0.90D+E
 N_u : Axial 53.239 +1.20D+1.60L+
Uplift @ Left End 10.306 +0.90D+E
Uplift @ Right End 10.306 +0.90D+E

$\Phi * 8 * \sqrt{f_c} * h * L_w$ 164.054 k

$\Phi * V_c$ 41.013 k

$\Phi * V_s$ Req'd 0.0 k

Horizontal As Req'd 0.2880 in²

Vertical As Req'd 0.360 in²

Bending As Req'd 0.6759 in²

Force Summary

Load Combination	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Wall Level	V_u (k)	M_u (k)	P_u (k)		Left	Right
+1.40D							
	Wall Level : 1		17.224	46.208	0.373		
+1.20D+1.60L							
	Wall Level : 1		21.028	52.135	0.403		
+1.20D+1.60L+0.50S							
	Wall Level : 1		21.580	53.239	0.405		
+1.20D+0.50L							
	Wall Level : 1		16.721	43.522	0.384		
+1.20D							

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Line A (3'-0")

Force Summary

Load Combination Wall Level	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Vu (k)	Mu (k)	Pu (k)			Left	Right
Wall Level : 1		14.764	39.607	0.373			
+1.20D+0.50L+1.60S							
Wall Level : 1		18.488	47.055	0.393			
+1.20D+1.60S							
Wall Level : 1		16.530	43.140	0.383			
+1.20D+0.50L+0.50S							
Wall Level : 1		17.273	44.626	0.387			
+1.20D+0.50L+0.70S+E							
Wall Level : 1	5.109	54.032	45.068	1.199	1.505		
+0.90D							
Wall Level : 1		11.073	29.705	0.373			
+0.90D+E							
Wall Level : 1	5.109	60.453	29.705	2.035	0.985	10.306	10.306

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Line A (9'-5")

Code References

Calculations per ACI 318-19, IBC 2021, ASCE 7-16

Load Combinations Used : IBC 2021

General Information

Wall Material CONCRETE
Sds 0.30

Material Properties

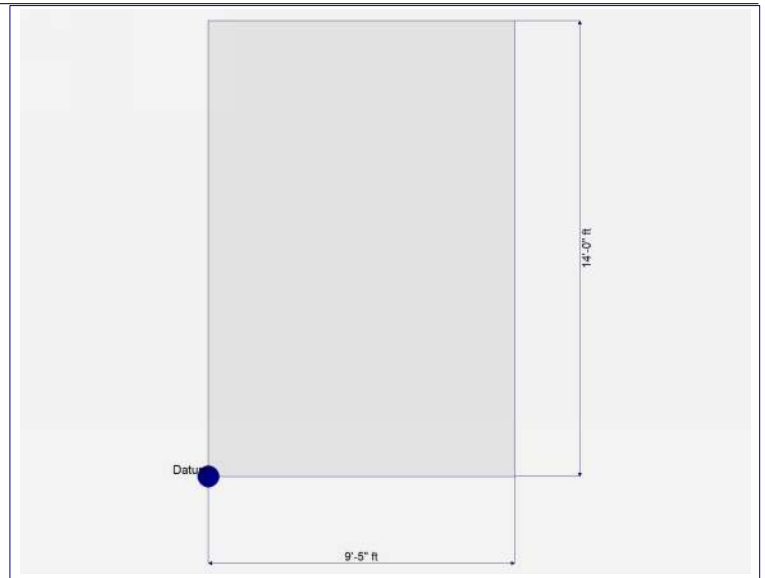
f_c 4.0 ksi
 f_y 60.0 ksi
Density 150.0 pcf

E_c 3,120.0 ksi
 E_v 1,248.0 ksi
Phi - Shear 0.650

Wall Data

Bottom

Analysis Height 0.00 ft
Wall Offset (datum) ft
Wall Length 9.416 ft
Wall Thickness 12.0 in
Structural Depth 6.330 ft



DESIGN SUMMARY

Bottom Level

V_u : Story Shear 16.035 +1.20D+0.50L+
 M_u : Story Moment 224.490 +1.20D+0.50L+
 N_u : Axial 159.191 +1.20D+1.60L+
Uplift @ Left End 0.0
Uplift @ Right End 0.0

$\Phi * 8 * \sqrt{f_c} * h * L_w$ 445.925 k

$\Phi * V_c$ 167.222 k

$\Phi * V_s$ Req'd 0.0 k

Horizontal As Req'd 0.2880 in²

Vertical As Req'd 0.360 in²

Bending As Req'd 1.641 in²

Force Summary

Load Combination	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Wall Level	V_u (k)	M_u (k)	P_u (k)		Left	Right
+1.40D							
Wall Level : 1				135.805			
+1.20D+1.60L							
Wall Level : 1				155.726			
+1.20D+1.60L+0.50S							
Wall Level : 1				159.191			
+1.20D+0.50L							
Wall Level : 1				128.692			
+1.20D							

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Line A (9'-5")

Force Summary

Load Combination Wall Level	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Vu (k)	Mu (k)	Pu (k)			Left	Right
Wall Level : 1 +1.20D+0.50L+1.60S			116.404				
Wall Level : 1 +1.20D+1.60S			139.781				
Wall Level : 1 +1.20D+0.50L+0.50S			127.493				
Wall Level : 1 +1.20D+0.50L+0.70S+E			132.157				
Wall Level : 1 +0.90D	16.035	224.490	133.543	1.681	2.801		
Wall Level : 1 +0.90D+E			87.303				
Wall Level : 1	16.035	224.490	87.303	2.571	1.831		

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Line A (12'-6")

Code References

Calculations per ACI 318-19, IBC 2021, ASCE 7-16

Load Combinations Used : IBC 2021

General Information

Wall Material CONCRETE
Sds 0.30

Material Properties

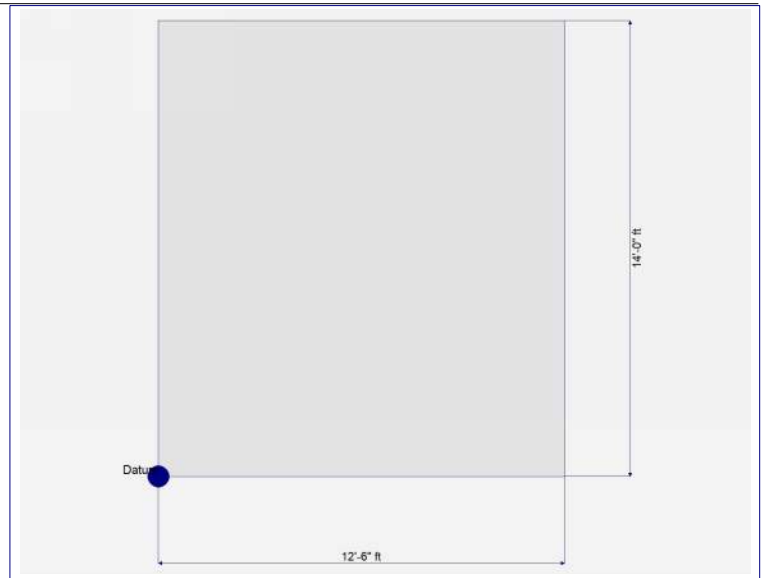
f_c 4.0 ksi
 f_y 60.0 ksi
Density 150.0 pcf

E_c 3,120.0 ksi
 E_v 1,248.0 ksi
Phi - Shear 0.650

Wall Data

Bottom

Analysis Height 0.00 ft
Wall Offset (datum) ft
Wall Length 12.50 ft
Wall Thickness 12.0 in
Structural Depth 9.0 ft



DESIGN SUMMARY

Bottom Level

V_u : Story Shear 21.290 +1.20D+0.50L+

M_u : Story Moment 298.060 +1.20D+0.50L+

N_u : Axial 211.330 +1.20D+1.60L+

Uplift @ Left End 0.0

Uplift @ Right End 0.0

$\Phi * 8 * \sqrt{f_c} * h * L_w$ 591.98 k

$\Phi * V_c$ 221.992 k

$\Phi * V_s$ Req'd 0.0 k

Horizontal As Req'd 0.2880 in²

Vertical As Req'd 0.360 in²

Bending As Req'd 2.333 in²

Force Summary

Load Combination	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Wall Level	V_u (k)	M_u (k)	P_u (k)		Left	Right
+1.40D							
	Wall Level : 1			180.285			
+1.20D+1.60L							
	Wall Level : 1			206.730			
+1.20D+1.60L+0.50S							
	Wall Level : 1			211.330			
+1.20D+0.50L							
	Wall Level : 1			170.843			
+1.20D							

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Line A (12'-6")

Force Summary

Load Combination Wall Level	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Vu (k)	Mu (k)	Pu (k)			Left	Right
Wall Level : 1			154.530				
+1.20D+0.50L+1.60S							
Wall Level : 1			185.563				
+1.20D+1.60S							
Wall Level : 1			169.250				
+1.20D+0.50L+0.50S							
Wall Level : 1			175.443				
+1.20D+0.50L+0.70S+E							
Wall Level : 1	21.290	298.060	177.283	1.681	3.717		
+0.90D							
Wall Level : 1			115.898				
+0.90D+E							
Wall Level : 1	21.290	298.060	115.898	2.572	2.430		

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Line A (5'-9")

Code References

Calculations per ACI 318-19, IBC 2021, ASCE 7-16

Load Combinations Used : IBC 2021

General Information

Wall Material CONCRETE
 Sds 0.30

Material Properties

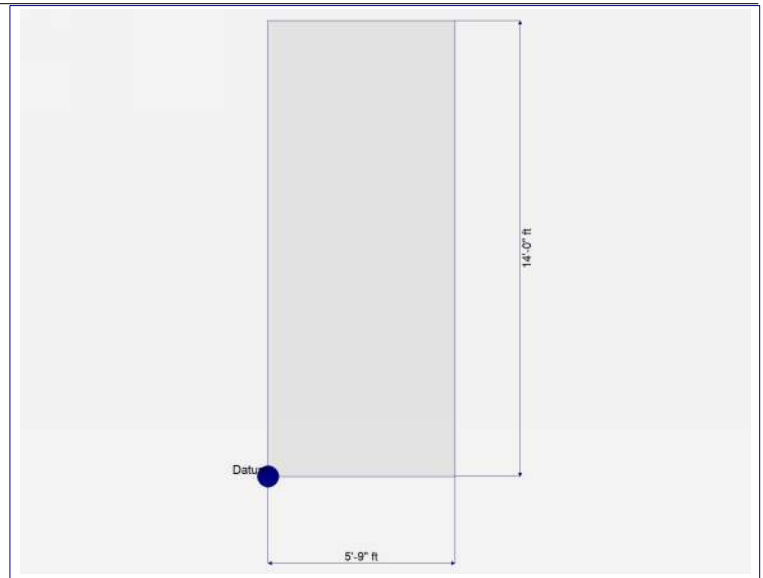
f_c 4.0 ksi
 f_y 60.0 ksi
 Density 150.0 pcf

E_c 3,120.0 ksi
 E_v 1,248.0 ksi
 Phi - Shear 0.650

Wall Data

Bottom

Analysis Height 0.00 ft
 Wall Offset (datum) ft
 Wall Length 5.750 ft
 Wall Thickness 12.0 in
 Structural Depth 4.313 ft



DESIGN SUMMARY

Bottom Level

V_u : Story Shear 9.790 +1.20D+0.50L+
 M_u : Story Moment 137.060 +1.20D+0.50L+
 N_u : Axial 97.212 +1.20D+1.60L+
 Uplift @ Left End 0.0
 Uplift @ Right End 0.0

$\Phi * 8 * \sqrt{f_c} * h * L_w$ 272.310 k

$\Phi * V_c$ 68.078 k

$\Phi * V_s$ Req'd 0.0 k

Horizontal As Req'd 0.2880 in²

Vertical As Req'd 0.360 in²

Bending As Req'd 1.118 in²

Force Summary

Load Combination	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Wall Level	V_u (k)	M_u (k)	P_u (k)		Left	Right
+1.40D							
	Wall Level : 1			82.931			
+1.20D+1.60L							
	Wall Level : 1			95.096			
+1.20D+1.60L+0.50S							
	Wall Level : 1			97.212			
+1.20D+0.50L							
	Wall Level : 1			78.588			
+1.20D							

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Line A (5'-9")

Force Summary

Load Combination Wall Level	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Vu (k)	Mu (k)	Pu (k)			Left	Right
Wall Level : 1 +1.20D+0.50L+1.60S			71.084				
Wall Level : 1 +1.20D+1.60S			85.359				
Wall Level : 1 +1.20D+0.50L+0.50S			77.855				
Wall Level : 1 +1.20D+0.50L+0.70S+E			80.704				
Wall Level : 1 +0.90D	9.790	137.060	81.550	1.681	1.711		
Wall Level : 1 +0.90D+E			53.313				
Wall Level : 1	9.790	137.060	53.313	2.571	1.118		

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Line B (80'-0")

Code References

Calculations per ACI 318-19, IBC 2021, ASCE 7-16

Load Combinations Used : IBC 2021

General Information

Wall Material CONCRETE
Sds 0.30

Material Properties

f_c 3.0 ksi
 f_y 60.0 ksi
Density 150.0 pcf

E_c 3,120.0 ksi
 E_v 1,248.0 ksi
Phi - Shear 0.650

Wall Data

Bottom

Analysis Height 0.00 ft
Wall Offset (datum) ft
Wall Length 80.0 ft
Wall Thickness 12.0 in
Structural Depth 60.0 ft



DESIGN SUMMARY

Bottom Level

V_u : Story Shear 68.080 +1.20D+0.50L+

M_u : Story Moment 953.12 +1.20D+0.50L+

N_u : Axial 1,352.51 +1.20D+1.60L+

Uplift @ Left End 0.0

Uplift @ Right End 0.0

$\Phi * 8 * \sqrt{f_c} * h * L_v$ 1,281.08 k

$\Phi * V_c$ 1,230.40 k

$\Phi * V_s$ Req'd 0.0 k

Horizontal As Req'd 0.2880 in²

Vertical As Req'd 0.360 in²

Bending As Req'd 15.552 in²

Force Summary

Load Combination	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Wall Level	V_u (k)	M_u (k)	P_u (k)		Left	Right
+1.40D							
	Wall Level : 1			1,153.824			
+1.20D+1.60L							
	Wall Level : 1			1,323.072			
+1.20D+1.60L+0.50S							
	Wall Level : 1			1,352.512			
+1.20D+0.50L							
	Wall Level : 1			1,093.392			
+1.20D							

Concrete Shear Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Line B (80'-0")

Force Summary

Load Combination Wall Level	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Vu (k)	Mu (k)	Pu (k)			Left	Right
Wall Level : 1			988.992				
+1.20D+0.50L+1.60S							
Wall Level : 1			1,187.600				
+1.20D+1.60S							
Wall Level : 1			1,083.200				
+1.20D+0.50L+0.50S							
Wall Level : 1			1,122.832				
+1.20D+0.50L+0.70S+E							
Wall Level : 1	68.080	953.120	1,134.608	0.840	47.617		
+0.90D							
Wall Level : 1			741.744				
+0.90D+E							
Wall Level : 1	68.080	953.120	741.744	1.285	31.129		



PROJECT: K&B Apartments
SUBJECT: Holdowns N-S

PROJECT NO: 123021
ENGINEER: JoshF

DATE: May 2025

Holdown Forces - N-S

Version: October 2019 / quinnl

File Name: 3.8_Holdown Forces.xlsm

Code Ref.: na

Diaphragm	Force (kips)
RD1	17.10
3D1	32.20
2D1	39.80

Line	Length (ft)	Diaphragm	% of Force From Dia.	Diaphragm	% of Force From Dia.	Total Force (kips)	
1_3rd	27.916	RD1	25.0%		0.0%	4.28	
2_3rd	63	RD1	50.0%		0.0%	8.55	
3_3rd	27.916	RD1	25.0%		0.0%	4.28	
1_2nd	27.916	3D1	25.0%		0.0%	8.05	
2_2nd	63	3D1	50.0%		0.0%	16.10	
3_2nd	27.916	3D1	25.0%		0.0%	8.05	
1_1st	27.916	2D1	25.0%		0.0%	9.95	
2_1st	63	2D1	50.0%		0.0%	19.90	
3_1st	27.916	2D1	25.0%		0.0%	9.95	

* Capacities from
Simpson Wood
Construction
Connectors Manual

Line	Length (ft)	Height (ft)	Weight (psf)	Superimposed (plf)	SW Uplift Abv. (kips)	Req. HD Force (kips)	Holdown	Capacity (kips)
1_3rd	3.92	9.00	12	108		1.12	CS16	1.705
1_3rd	9.00	9.00	12	108		0.80	CS16	1.705
1_3rd	11.00	9.00	12	108		0.67	CS16	1.705
1_3rd	4.00	9.00	12	108		1.12	CS16	1.705
2_3rd	20.50	9.00	12	36		0.34	N/A	
2_3rd	20.50	9.00	12	36		0.34	N/A	
2_3rd	22.00	9.00	12	36		0.27	N/A	
3_3rd	3.92	9.00	12	108		1.12	CS16	1.705
3_3rd	9.00	9.00	12	108		0.80	CS16	1.705
3_3rd	11.00	9.00	12	108		0.67	CS16	1.705
3_3rd	4.00	9.00	12	108		1.12	CS16	1.705
1_2nd	3.92	9.00	12	80	1.12	3.50	CMSTC16	4.690
1_2nd	9.00	9.00	12	80	0.80	2.88	CMSTC16	4.690
1_2nd	11.00	9.00	12	80	0.67	2.64	CMSTC16	4.690
1_2nd	4.00	9.00	12	80	1.12	3.49	CMSTC16	4.690
2_2nd	20.50	9.00	12	192	0.34	0.79	CS16	1.705
2_2nd	20.50	9.00	12	192	0.34	0.79	CS16	1.705
2_2nd	22.00	9.00	12	256	0.27	0.17	CS16	1.705
3_2nd	3.92	9.00	12	80	1.12	3.50	CMSTC16	4.690
3_2nd	9.00	9.00	12	80	0.80	2.88	CMSTC16	4.690
3_2nd	11.00	9.00	12	80	0.67	2.64	CMSTC16	4.690
3_2nd	4.00	9.00	12	80	1.12	3.49	CMSTC16	4.690
1_1st	3.92	9.00	12	80	3.50	6.49	HDU8	6.765
1_1st	9.00	9.00	12	80	2.88	5.58	HDU8	6.765
1_1st	11.00	9.00	12	80	2.64	5.23	HDU8	6.765
1_1st	4.00	9.00	12	80	3.49	6.47	HDU8	6.765
2_1st	20.50	9.00	12	192	0.79	1.79	DTT2Z	1.825
2_1st	20.50	9.00	12	192	0.79	1.79	DTT2Z	1.825
2_1st	22.00	9.00	12	256	0.17	0.61	DTT2Z	1.825
3_1st	3.92	9.00	12	80	3.50	6.49	HDU8	6.765
3_1st	9.00	9.00	12	80	2.88	5.58	HDU8	6.765
3_1st	11.00	9.00	12	80	2.64	5.23	HDU8	6.765
3_1st	4.00	9.00	12	80	3.49	6.47	HDU8	6.765

Holdown Equation

$$F_{HD1} = \frac{P_{total} \cdot \frac{L}{L_{total}} \cdot h - 0.6 \cdot \gamma \cdot h \cdot \frac{L^2}{2} - 0.6 \cdot w \cdot \frac{L^2}{2} + F_{HD2} \cdot L}{L} = \frac{P_{total}}{L_{total}} \cdot h - 0.6 \cdot \gamma \cdot h \cdot \frac{L}{2} - 0.6 \cdot w \cdot \frac{L}{2} + F_{HD2}$$



PROJECT: K&B Apartments
SUBJECT: Holdowns E-W

PROJECT NO: 123021
ENGINEER: JoshF

DATE: May 2025

Holdown Forces - N-S

Version: October 2019 / quinnl

File Name: 3.8_Holdown Forces.xlsm

Code Ref.: na

Diaphragm	Force (kips)
RD1	17.10
3D1	32.20
2D1	39.80

Line	Length (ft)	Diaphragm	% of Force From Dia.	Diaphragm	% of Force From Dia.	Total Force (kips)	
A_3rd	19.832	RD1	50.0%		0.0%	8.55	
B_3rd	25.664	RD1	50.0%		0.0%	8.55	
A_2nd	19.832	3D1	50.0%		0.0%	16.10	
B_2nd	25.664	3D1	50.0%		0.0%	16.10	
A_1st	19.832	2D1	50.0%		0.0%	19.90	
B_1st	25.664	2D1	50.0%		0.0%	19.90	
	0						
	0						
	0						

* Capacities from
Simpson Wood
Construction
Connectors Manual

Line	Length (ft)	Height (ft)	Weight (psf)	Superimposed (plf)	SW Uplift Abv. (kips)	Req. HD Force (kips)	Holdown	Capacity (kips)
A_3rd	9.92	9.00	12	419		2.31	CMSTC16	4.690
A_3rd	9.92	9.00	12	419		2.31	CMSTC16	4.690
B_3rd	3.00	9.00	12	419		2.52	CMSTC16	4.690
B_3rd	6.42	9.00	12	419		1.98	CMSTC16	4.690
B_3rd	3.42	9.00	12	36		2.85	CMSTC16	4.690
B_3rd	3.42	9.00	12	36		2.85	CMSTC16	4.690
B_3rd	6.42	9.00	12	419		1.98	CMSTC16	4.690
B_3rd	3.00	9.00	12	419		2.52	CMSTC16	4.690
A_2nd	9.92	9.00	12	32	2.31	9.20	HDU14 w/ 6x6	10.770
A_2nd	9.92	9.00	12	32	2.31	9.20	HDU14 w/ 6x6	10.770
B_2nd	3.00	9.00	12	32	2.52	8.04	HDU14 w/ 6x6	10.770
B_2nd	6.42	9.00	12	32	1.98	7.36	HDU14 w/ 6x6	10.770
B_2nd	3.42	9.00	12	32	2.85	8.35	HDU14 w/ 6x6	10.770
B_2nd	3.42	9.00	12	32	2.85	8.35	HDU14 w/ 6x6	10.770
B_2nd	6.42	9.00	12	32	1.98	7.36	HDU14 w/ 6x6	10.770
B_2nd	3.00	9.00	12	32	2.52	8.04	HDU14 w/ 6x6	10.770
A_1st	9.92	9.00	12	32	9.20	17.82	HD19 w/ #1 6x6	19.070
A_1st	9.92	9.00	12	32	9.20	17.82	HD19 w/ #1 6x6	19.070
B_1st	3.00	9.00	12	32	8.04	14.90	HD19 w/ #1 6x6	19.070
B_1st	6.42	9.00	12	32	7.36	14.07	HD19 w/ #1 6x6	19.070
B_1st	3.42	9.00	12	32	8.35	15.19	HD19 w/ #1 6x6	19.070
B_1st	3.42	9.00	12	32	8.35	15.19	HD19 w/ #1 6x6	19.070
B_1st	6.42	9.00	12	32	7.36	14.07	HD19 w/ #1 6x6	19.070
B_1st	3.00	9.00	12	32	8.04	14.90	HD19 w/ #1 6x6	19.070

Holdown Equation

$$F_{HD1} = \frac{P_{total} \cdot \frac{L}{L_{total}} \cdot h - 0.6 \cdot \gamma \cdot h \cdot \frac{L^2}{2} - 0.6 \cdot w \cdot \frac{L^2}{2} + F_{HD2} \cdot L}{L} = \frac{P_{total}}{L_{total}} \cdot h - 0.6 \cdot \gamma \cdot h \cdot \frac{L}{2} - 0.6 \cdot w \cdot \frac{L}{2} + F_{HD2}$$



CARTWRIGHT

PROJECT: K&B Apartments
SUBJECT: 1stFloor - Floor Bearing

PROJECT NO: 123021
ENGINEER: JoshF

DATE: May 2025
SHEET: 1 of 4

Wood Stud Wall Design

Version: July 2020/JPF

File Name: 3.9 Wood Wall Studs - Cartwright.xls

Code Ref: NDS 2015

Description: **1stFloor - Floor Bearing**

Lumber Grade: DF-L Stud Grade

Stud Height (ft): 9.0

Lumber Size: 2x6

Stud Spacing (in): 16.0

Deflection L/: 240.0

C & C Interior Zone (psf): 24.2

C & C End Zone (psf): 29.1

S_{DS}: 0.836

Weight of Wall (psf): 45.0

Earthquake Pressure (psf): 15.0

Loads Above	D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr/S	D+.6Wint	D+.6Wext	D+.7Eh
Roof, (psf)	18	0	20	32	6	108	300	252	108	108	108
Floor, (psf)	35	40	0	0	6	450	210	390	210	210	210
Floor, (psf)	35	40	0	0	6	450	210	390	210	210	210
Wall, (psf)	45	0	0	0	20	900	900	900	900	900	900
Wall Line Load, (plf)	1428	480	120	192		1908	1620	1932	1428	1428	1428

Load Case	D+L			D+Lr/S			D+.75L+.75Lr/S			D+.6Wint			D+.6Wext			D+.7Eh		
C _D :	1			1.15			1.15			1.6			1.6			1.6		
CF _{bend} :	1			1			1			1			1			1		
F* _b :	700			805			805			1120			1120			1120		
F _{bE} :	1260			1260			1260			1260			1260			1260		
CL:	1.00			1.00			1.00			1.00			1.00			1.00		
C _r :	1.15			1.15			1.15			1.15			1.15			1.15		
F* _b (psi):	805			925.8			925.8			1288			1288			1288		
w (plf):	0			0			0			19.36			23.28			14		
M (lb-in):	0			0			0			2352			2829			1706		
F _b (psi):	0			0			0			311.0			374.0			225.6		
Unity Check:	0.00	<1	OK	0.00	<1	OK	0.00	<1	OK	0.24	<1	OK	0.29	<1	OK	0.18	<1	OK
C _{fcomp} :	1.00			1.00			1.00			1.00			1.00			1.00		
F* _c :	850			977.5			977.5			1360			1360			1360		
F _{cE} :	1087			1087			1087			1087			1087			1087		
c:	0.8			0.8			0.8			0.8			0.8			0.8		
C _P :	0.77			0.73			0.73			0.61			0.61			0.61		
F* _c (psi):	653			710			710			829			829			829		
P (lb):	2544			2160			2576			1904			1904			1904		
F _c (psi):	308.4			261.8			312.2			230.8			230.8			230.8		
Unity Check:	0.47	<1	OK	0.37	<1	OK	0.44	<1	OK	0.28	<1	OK	0.28	<1	OK	0.28	<1	OK
CSR:	0.22	<1	OK	0.14	<1	OK	0.19	<1	OK	0.38	<1	OK	0.45	<1	OK	0.30	<1	OK
D _{allow} (in):	0.45			0.45			0.45			0.45			0.45			0.45		
D (in.):	0			0			0			0.098			0.118			0.071		
Unity Check:	0	<1	OK	0	<1	OK	0	<1	OK	0.218	<1	OK	0.262	<1	OK	0.158	<1	OK

Single Trimmer Capacity (lb): 5390

Trib Width Interior Zone - Moment (ft): 5.521

Trib Width End Zone - Deflection (ft): 5.083

Trimmer Spacing (ft): 2.8

Trib Width Interior Zone - Deflection (ft): 6.113

Trib Width Earthquake - Moment (ft): 7.611

Single King Stud Capacity (lb-ft): 811.7

Trib Width End Zone - Moment (ft): 4.592

Trib Width Earthquake - Deflection (ft): 8.426

Opening Width (ft)	# of Trimmers	# of King Studs Interior Zones	# of King Studs Edge Zones
2	1	1	1
3	1	1	1
4	1	1	1
5	1	1	1
6	2	1	1
7	2	1	1
8	2	1	2
9	2	1	2
10	2	2	2
11	2	2	2
12	3	2	2
13	3	2	2
14	3	2	2
15	3	2	2
16	3	2	2
17	4	2	2
18	4	2	3

CARTWRIGHT

PROJECT: K&B Apartments
SUBJECT: 1stFloor - Roof Bearing

PROJECT NO: 123021
ENGINEER: JoshF

DATE: May 2025
SHEET: 1 of 4

Wood Stud Wall Design

Version: July 2020/JPF

File Name: 3.9 Wood Wall Studs - Cartwright.xls

Code Ref: NDS 2015

Description: **1stFloor - Roof Bearing**

Lumber Grade: DF-L Stud Grade

Stud Height (ft): 9.0

Lumber Size: 2x6

Stud Spacing (in): 16.0

Deflection L/: 240.0

C & C Interior Zone (psf): 24.2

C & C End Zone (psf): 29.1

S_{DS}: 0.836

Weight of Wall (psf): 45.0

Earthquake Pressure (psf): 15.0

Loads Above	D	L	Lr	S	Trib	D+L	D+Lr/S	D+0.75L+0.75Lr/S	D+0.6Wint	D+0.6Wext	D+0.7Eh
Roof, (psf)	18	0	20	32	23.5	423	1175	987	423	423	423
Floor, (psf)	35	40	0	0	2	150	70	130	70	70	70
Floor, (psf)	35	40	0	0	2	150	70	130	70	70	70
Wall, (psf)	45	0	0	0	20	900	900	900	900	900	900
Wall Line Load, (plf)	1463	160	470	752		1623	2215	2147	1463	1463	1463

Load Case	D+L			D+Lr/S			D+0.75L+0.75Lr/S			D+0.6Wint			D+0.6Wext			D+0.7Eh		
C _D :	1			1.15			1.15			1.6			1.6			1.6		
CF _{bend} :	1			1			1			1			1			1		
F* _b :	700			805			805			1120			1120			1120		
F _{bE} :	1260			1260			1260			1260			1260			1260		
CL:	1.00			1.00			1.00			1.00			1.00			1.00		
C _r :	1.15			1.15			1.15			1.15			1.15			1.15		
F* _b (psi):	805			925.8			925.8			1288			1288			1288		
w (plf):	0			0			0			19.36			23.28			14		
M (lb-in):	0			0			0			2352			2829			1706		
F _b (psi):	0			0			0			311.0			374.0			225.6		
Unity Check:	0.00	<1	OK	0.00	<1	OK	0.00	<1	OK	0.24	<1	OK	0.29	<1	OK	0.18	<1	OK
C _{fcomp} :	1.00			1.00			1.00			1.00			1.00			1.00		
F* _c :	850			977.5			977.5			1360			1360			1360		
F _{cE} :	1087			1087			1087			1087			1087			1087		
c:	0.8			0.8			0.8			0.8			0.8			0.8		
C _P :	0.77			0.73			0.73			0.61			0.61			0.61		
F* _c (psi):	653			710			710			829			829			829		
P (lb):	2164			2953			2863			1951			1951			1951		
F _c (psi):	262.3			358.0			347.0			236.4			236.4			236.4		
Unity Check:	0.40	<1	OK	0.50	<1	OK	0.49	<1	OK	0.29	<1	OK	0.29	<1	OK	0.29	<1	OK
CSR:	0.16	<1	OK	0.25	<1	OK	0.24	<1	OK	0.39	<1	OK	0.45	<1	OK	0.31	<1	OK
D _{allow} (in):	0.45			0.45			0.45			0.45			0.45			0.45		
D (in.):	0			0			0			0.098			0.118			0.071		
Unity Check:	0	<1	OK	0	<1	OK	0	<1	OK	0.218	<1	OK	0.262	<1	OK	0.158	<1	OK

Single Trimmer Capacity (lb): 5390

Trib Width Interior Zone - Moment (ft): 5.521

Trib Width End Zone - Deflection (ft): 5.083

Trimmer Spacing (ft): 2.4

Trib Width Interior Zone - Deflection (ft): 6.113

Trib Width Earthquake - Moment (ft): 7.611

Single King Stud Capacity (lb-ft): 811.7

Trib Width End Zone - Moment (ft): 4.592

Trib Width Earthquake - Deflection (ft): 8.426

Opening Width (ft)	# of Trimmers	# of King Studs Interior Zones	# of King Studs Edge Zones
2	1	1	1
3	1	1	1
4	1	1	1
5	2	1	1
6	2	1	1
7	2	1	1
8	2	1	2
9	2	1	2
10	3	2	2
11	3	2	2
12	3	2	2
13	3	2	2
14	3	2	2
15	4	2	2
16	4	2	2
17	4	2	2
18	4	2	3

CARTWRIGHT

PROJECT: K&B Apartments
SUBJECT: 1stFloor - Roof Bearing@Balcony

PROJECT NO: 123021
ENGINEER: JoshF

DATE: May 2025
SHEET: 1 of 4

Wood Stud Wall Design

Version: July 2020/JPF

File Name: 3.9 Wood Wall Studs - Cartwright.xls

Code Ref: NDS 2015

Description: **1stFloor - Roof Bearing@Balcony** Lumber Grade: DF-L Stud Grade

Stud Height (ft): 9.0

Stud Spacing (in): 16.0

Deflection L/: 240.0

C & C Interior Zone (psf): 24.2

C & C End Zone (psf): 29.1

S_{DS}: 0.836

Weight of Wall (psf): 45.0

Earthquake Pressure (psf): 15.0

Lumber Size: 2x6

Loads Above	D	L	Lr	S	Trib	D+L	D+Lr/S	D+.75L+.75Lr/S	D+.6Wint	D+.6Wext	D+.7Eh
Roof, (psf)	18	0	20	32	23.5	423	1175	987	423	423	423
Floor, (psf)	35	60	0	0	6	570	210	480	210	210	210
Floor, (psf)	35	60	0	0	6	570	210	480	210	210	210
Wall, (psf)	45	0	0	0	20	900	900	900	900	900	900
Wall Line Load, (plf)	1743	720	470	752		2463	2495	2847	1743	1743	1743

Load Case	D+L			D+Lr/S			D+.75L+.75Lr/S			D+.6Wint			D+.6Wext			D+.7Eh		
C _b :	1			1.15			1.15			1.6			1.6			1.6		
CF _{bend} :	1			1			1			1			1			1		
F* _b :	700			805			805			1120			1120			1120		
F _{bE} :	1260			1260			1260			1260			1260			1260		
CL:	1.00			1.00			1.00			1.00			1.00			1.00		
C _r :	1.15			1.15			1.15			1.15			1.15			1.15		
F* _b (psi):	805			925.8			925.8			1288			1288			1288		
w (plf):	0			0			0			19.36			23.28			14		
M (lb-in):	0			0			0			2352			2829			1706		
F _b (psi):	0			0			0			311.0			374.0			225.6		
Unity Check:	0.00	<1	OK	0.00	<1	OK	0.00	<1	OK	0.24	<1	OK	0.29	<1	OK	0.18	<1	OK
C _{fcomp} :	1.00			1.00			1.00			1.00			1.00			1.00		
F* _c :	850			977.5			977.5			1360			1360			1360		
F _{cE} :	1087			1087			1087			1087			1087			1087		
c:	0.8			0.8			0.8			0.8			0.8			0.8		
CP:	0.77			0.73			0.73			0.61			0.61			0.61		
F* _c (psi):	653			710			710			829			829			829		
P (lb):	3284			3327			3796			2324			2324			2324		
F _c (psi):	398.1			403.2			460.1			281.7			281.7			281.7		
Unity Check:	0.61	<1	OK	0.57	<1	OK	0.65	<1	OK	0.34	<1	OK	0.34	<1	OK	0.34	<1	OK
CSR:	0.37	<1	OK	0.32	<1	OK	0.42	<1	OK	0.44	<1	OK	0.51	<1	OK	0.35	<1	OK
D _{allow} (in):	0.45			0.45			0.45			0.45			0.45			0.45		
D (in.):	0			0			0			0.098			0.118			0.071		
Unity Check:	0	<1	OK	0	<1	OK	0	<1	OK	0.218	<1	OK	0.262	<1	OK	0.158	<1	OK

Single Trimmer Capacity (lb): 5390

Trimmer Spacing (ft): 1.9

Single King Stud Capacity (lb-ft): 811.7

Trib Width Interior Zone - Moment (ft): 5.521

Trib Width Interior Zone - Deflection (ft): 6.113

Trib Width End Zone - Moment (ft): 4.592

Trib Width End Zone - Deflection (ft): 5.083

Trib Width Earthquake - Moment (ft): 7.611

Trib Width Earthquake - Deflection (ft): 8.426

Opening Width (ft)	# of Trimmers	# of King Studs Interior Zones	# of King Studs Edge Zones
2	1	1	1
3	1	1	1
4	2	1	1
5	2	1	1
6	2	1	1
7	2	1	1
8	3	1	2
9	3	1	2
10	3	2	2
11	3	2	2
12	4	2	2
13	4	2	2
14	4	2	2
15	4	2	2
16	5	2	2
17	5	2	2
18	5	2	3

CARTWRIGHT

PROJECT: K&B Apartments
SUBJECT: 1stFloor - Interior Bearing

PROJECT NO: 123021
ENGINEER: JoshF

DATE: May 2025
SHEET: 1 of 4

Wood Stud Wall Design

Version: July 2020/JPF

File Name: 3.9 Wood Wall Studs - Cartwright.xls

Code Ref: NDS 2015

Description: **1stFloor - Interior Bearing**

Lumber Grade: DF-L Stud Grade

Stud Height (ft): 9.0

Lumber Size: 2x6

Stud Spacing (in): 16.0

Deflection L/: 240.0

C & C Interior Zone (psf): 5.0

C & C End Zone (psf): 5.0

S_{DS}: 0.836

Weight of Wall (psf): 12.0

Earthquake Pressure (psf): 4.0

Loads Above	D	L	Lr	S	Trib	D+L	D+Lr/S	D+0.75L+0.75Lr/S	D+0.6Wint	D+0.6Wext	D+0.7Eh
Roof, (psf)	18	0	20	32	2	36	100	84	36	36	36
Floor, (psf)	35	40	0	0	16	1200	560	1040	560	560	560
Floor, (psf)	16	40	0	0	16	896	256	736	256	256	256
Wall, (psf)	12	0	0	0	20	240	240	240	240	240	240
Wall Line Load, (plf)	1092	1280	40	64		2372	1156	2100	1092	1092	1092

Load Case	D+L			D+Lr/S			D+0.75L+0.75Lr/S			D+0.6Wint			D+0.6Wext			D+0.7Eh		
C _b :	1			1.15			1.15			1.6			1.6			1.6		
CF _{bend} :	1			1			1			1			1			1		
F* _b :	700			805			805			1120			1120			1120		
F _{bE} :	1260			1260			1260			1260			1260			1260		
CL:	1.00			1.00			1.00			1.00			1.00			1.00		
C _r :	1.15			1.15			1.15			1.15			1.15			1.15		
F* _b (psi):	805			925.8			925.8			1288			1288			1288		
w (plf):	0			0			0			4			4			4		
M (lb-in):	0			0			0			486			486			455.1		
F _b (psi):	0			0			0			64.3			64.3			60.2		
Unity Check:	0.00	<1	OK	0.00	<1	OK	0.00	<1	OK	0.05	<1	OK	0.05	<1	OK	0.05	<1	OK
C _{fcomp} :	1.00			1.00			1.00			1.00			1.00			1.00		
F* _c :	850			977.5			977.5			1360			1360			1360		
F _{cE} :	1087			1087			1087			1087			1087			1087		
c:	0.8			0.8			0.8			0.8			0.8			0.8		
C _P :	0.77			0.73			0.73			0.61			0.61			0.61		
F* _c (psi):	653			710			710			829			829			829		
P (lb):	3163			1541			2800			1456			1456			1456		
F _c (psi):	383.4			186.8			339.4			176.5			176.5			176.5		
Unity Check:	0.59	<1	OK	0.26	<1	OK	0.48	<1	OK	0.21	<1	OK	0.21	<1	OK	0.21	<1	OK
CSR:	0.34	<1	OK	0.07	<1	OK	0.23	<1	OK	0.10	<1	OK	0.10	<1	OK	0.10	<1	OK
D _{allow} (in):	0.45			0.45			0.45			0.45			0.45			0.45		
D (in.):	0			0			0			0.02			0.02			0.019		
Unity Check:	0	<1	OK	0	<1	OK	0	<1	OK	0.045	<1	OK	0.045	<1	OK	0.042	<1	OK

Single Trimmer Capacity (lb): 5390

Trib Width Interior Zone - Moment (ft): 26.72

Trib Width End Zone - Deflection (ft): 29.58

Trimmer Spacing (ft): 2.3

Trib Width Interior Zone - Deflection (ft): 29.58

Trib Width Earthquake - Moment (ft): 28.54

Single King Stud Capacity (lb-ft): 811.7

Trib Width End Zone - Moment (ft): 26.72

Trib Width Earthquake - Deflection (ft): 31.6

Opening Width (ft)	# of Trimmers	# of King Studs Interior Zones	# of King Studs Edge Zones
2	1	1	1
3	1	1	1
4	1	1	1
5	2	1	1
6	2	1	1
7	2	1	1
8	2	1	1
9	2	1	1
10	3	1	1
11	3	1	1
12	3	1	1
13	3	1	1
14	4	1	1
15	4	1	1
16	4	1	1
17	4	1	1
18	4	1	1



Foundation Analysis / Design

Footings (Gravity):

Allowable Soil Bearing Capacity: $q := 4000 \text{ psf}$ (Per Geotechnical Report)

Line A&B Footing

Total Roof Load: $q_r := 18 \text{ psf} + 32 \text{ psf} = 50 \text{ psf}$

(All loads are dead + snow/live loads notated as TL (total load) pulled from the load development spreadsheet)

Roof Tributary Width: $b_r := 23 \text{ ft}$

Roof Uniform Load: $w_r := q_r \cdot b_r = 1150 \text{ plf}$

Total Floor Load: $q_f := 35 \text{ psf} + 40 \text{ psf} = 75 \text{ psf}$

Floor Tributary Width: $b_f := \frac{43.5 \text{ ft}}{2} \cdot 2 = 43.5 \text{ ft}$

Floor Uniform Load: $w_f := q_f \cdot b_f = 3262.5 \text{ plf}$

Total Wall Load: $q_w := 45 \text{ psf}$

Wall Height: $b_w := 30 \text{ ft}$

Wall Uniform Load: $w_w := q_w \cdot b_w = 1350 \text{ plf}$

Total Concrete Floor Load: $q_{cf} := 226 \text{ psf} + 40 \text{ psf} = 266 \text{ psf}$

Concrete Floor Tributary Width: $b_{cf} := \frac{43.5 \text{ ft}}{2} = 21.75 \text{ ft}$

Concrete Floor Uniform Load: $w_{cf} := q_{cf} \cdot b_{cf} = 5785.5 \text{ plf}$

Total Concrete Wall Load: $q_{cw} := 150 \text{ psf}$

Concrete Wall Height: $b_{cw} := 14 \text{ ft}$

Concrete Wall Uniform Load: $w_{cw} := q_{cw} \cdot b_{cw} = 2100 \text{ plf}$

Total Uniform Load: $w_t := w_r + w_f + w_w + w_{cf} + w_{cw} = 13648 \text{ plf}$

Required Footing Width:

$$W_{ftg} := \frac{w_t}{q} = 3.4 \text{ ft}$$

Use a 3'-6" wide, 1.0 ft deep continuous footing

Line 1&3 Footing*Total Roof Load:*

$$q_r := 18 \text{ psf} + 32 \text{ psf} = 50 \text{ psf}$$

(All loads are dead + snow/live loads notated as TL (total load) pulled from the load development spreadsheet)

Roof Tributary Width:

$$b_r := 6 \text{ ft}$$

Roof Uniform Load:

$$w_r := q_r \cdot b_r = 300 \text{ plf}$$

Total Floor Load:

$$q_f := 35 \text{ psf} + 40 \text{ psf} = 75 \text{ psf}$$

Floor Tributary Width:

$$b_f := 6 \text{ ft} \cdot 2 = 12 \text{ ft}$$

Floor Uniform Load:

$$w_f := q_f \cdot b_f = 900 \text{ plf}$$

Total Wall Load:

$$q_w := 45 \text{ psf}$$

Wall Height:

$$b_w := 30 \text{ ft}$$

Wall Uniform Load:

$$w_w := q_w \cdot b_w = 1350 \text{ plf}$$

Total Concrete Floor Load:

$$q_{cf} := 226 \text{ psf} + 40 \text{ psf} = 266 \text{ psf}$$

Concrete Floor Tributary Width:

$$b_{cf} := 4 \text{ ft}$$

Concrete Floor Uniform Load:

$$w_{cf} := q_{cf} \cdot b_{cf} = 1064 \text{ plf}$$

Total Concrete Wall Load:

$$q_{cw} := 150 \text{ psf}$$

Concrete Wall Height:

$$b_{cw} := 14 \text{ ft}$$

Concrete Wall Uniform Load:

$$w_{cw} := q_{cw} \cdot b_{cw} = 2100 \text{ plf}$$

Total Uniform Load:

$$w_t := w_r + w_f + w_w + w_{cf} + w_{cw} = 5714 \text{ plf}$$

Required Footing Width:

$$W_{ftg} := \frac{w_t}{q} = 1.43 \text{ ft}$$

Use a 2'-0" wide, 1.0 ft deep continuous footing

Maximum Point Load on Continuous Footing

Width of Concrete: $W_c := 2 \text{ ft}$

Frost Depth: $d := 30 \text{ in}$

Length of Concrete: $L_c := 2 \cdot d = 5 \text{ ft}$

Max Point Load: $P_{max} := q \cdot W_c \cdot L_c = 40 \text{ kip}$

(NOTE: No spot footing required for loads $< P_{max} = 40 \text{ kip}$)

Spot Footings Below Headers/Beams:

Point Load Under CL1: $P := 143.6 \text{ kip}$

Required Footing Size: $W_f := \sqrt{\frac{P}{q}} = 5.99 \text{ ft}$

Use 6'-0"x6'-0"x1'-0" spot footing

Restrained Retaining Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

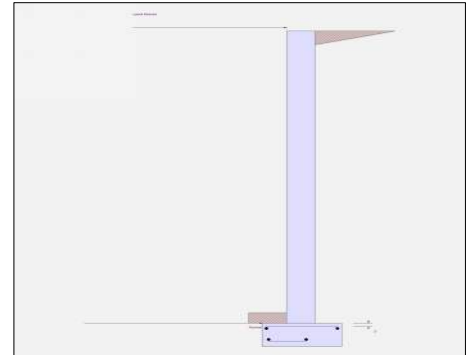
CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Typ Garage Wall

Code Reference:

Calculations per IBC 2021 1807.3, ASCE 7-16



Criteria

Retained Height	=	14.0 ft
Wall height above soil	=	ft
Total Wall Height	=	14.0 ft
Top Support Height	=	14.0 ft
Slope Behind Wall	=	0
Height of Soil over Toe	=	6 in

Soil Data

Allow Soil Bearing	=	4,000.0 psf
Equivalent Fluid Pressure Method		
At-Rest Heel Pressure	=	57.0 psf/ft
	=	0.0 psf/ft
Passive Pressure	=	450.0 psf/ft
Soil Density	=	110 pcf
Footings Soil Frictior	=	0.4 psf
Soil height to ignore for passive pressure	=	12 in

Surcharge Loads

Surcharge Over Heel	=	psf
>>>Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	psf
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	lbs
Axial Live Load	=	lbs
Axial Load Eccentricity	=	in

Earth Pressure Seismic Load

Uniform Lateral Load Applied to Stem

Lateral Load	=	#/ft
...Height to Top	=	ft
...Height to Bottom	=	ft
Load Type	=	Wind (W) (Strength Level)
Wind on Exposed Stem	=	0.00 psf (Strength Level)
Wind acts left-to-right toward retention side.		

K_h Soil Density Multiplier	=	0.2 g	Added seismic per unit area	=	0.0 psf
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Adjacent Footing Load

Adjacent Footing Load	=	lbs
Footing Width	=	ft
Eccentricity	=	in
Wall to Ftg CL Dist	=	ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	ft
Poisson's Ratio	=	0.3

Design Summary

Total Bearing Load	=	4,195.63 lbs
...resultant ecc.	=	0.0 in
Soil Pressure @ Toe	=	1,398.54 psf OK
Soil Pressure @ Heel	=	1,398.54 psf OK
Allowable	=	psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	0.0 psf
ACI Factored @ Heel	=	0.0 psf
Footing Shear @ Toe	=	0.0 psi OK
Footing Shear @ Heel	=	0.0 psi OK
Allowable	=	82.158 psi
Reaction at Top	=	1,116.10 lbs
Reaction at Bottom	=	5,391.86 lbs

Sliding Calcs

Lateral Sliding Force	=	5,391.86 lbs
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Concrete Stem Construction

Thickness	=	12.00 in	F_y	=	60000 psi
Wall Weight	=	150.0 psf	f'_c	=	4,000.0 psi
Stem is FIXED to top of footing					

	@ Top Support	Mmax Between Top & Base	@ Base of Wall
	Stem OK	Stem OK	Stem OK
Design Height Above Ftg	= 14.0 ft	7.815 ft	0.00 ft
Rebar Size	= # 5	# 5	# 5
Rebar Spacing	= 6.00 in	6.00 in	6.00 in
Rebar Placed at	= Edge	Edge	Edge
Rebar Depth 'd'	= 9.688 in	10.188 in	9.688 in
Design Data			
$f_b/FB + f_a/Fa$	=	0.275	0.648
μ_uActual	=	0.0 ft-#	7,461.02 ft-#
$M_n * \Phi$Allowable	=	25,752.4 ft-#	27,147.4 ft-#
Shear Force @ this height	=	1,787.50 lbs	7,150.10 lbs
Shear.....Actual	=	15.376 psi	61.506 psi
Shear.....Allowable	=	66.30 psi	66.30 psi

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Restrained Retaining Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Typ Garage Wall

Footing Strengths & Dimensions

Toe Width	=	1 ft
Heel Width	=	2
Total Footing Width	=	3.0
Footing Thickness	=	13.350 in

f'_c = 3,000 psi F_y = 60000 psi
 Footing Concrete Density = 150 pcf
 Min. As % = 0.0018
 Cover @ Top = 2 in @ Btm.= 3 in

Footing Design Results

	<u>Toe</u>	<u>Heel</u>	
Factored Pressure	= 0.0	0.0	psf
μ_u : Upward	= 0.0		ft-#
μ_u : Downward	= 0.0		ft-#
μ_u : Design	= 0	0	ft-#
Actual 1-Way Shear	= 0.0	0.0	psi
Allow 1-Way Shear	= 45.036	43.633	psi

Other Acceptable Sizes & Spacings:

Toe: # 5 @ 12.00 in -or- #4@ 8.32 in, #5@ 12.90 in, #6@ 18.31 in, #7@ 24.96 in
 Heel: # 5 @ 12.00 in -or- #4@ 8.32 in, #5@ 12.90 in, #6@ 18.31 in, #7@ 24.96 in

Min footing T&S reinf Area 0.87 in²
 Min footing T&S reinf Area per foot 0.29 in² /ft
 If one layer of horizontal bars: If two layers of horizontal bars:
 #4@ 8.32 in #4@ 16.65 in
 #5@ 12.90 in #5@ 25.80 in
 #6@ 18.31 in #6@ 36.62 in

Summary of Forces on Footing : Slab RESISTS sliding, stem is FIXED at footing

Forces acting on footing for soil pressure

>>> Sliding Forces are restrained by the adjacent slab

Load & Moment Summary For Footing : For Soil Pressure Calcs

Moment @ Top of Footing Applied from Stem	=	-10,427.4 ft-#
Surcharge Over Heel	= 0.0 lbs 0.0 ft	0.0 ft-#
Adjacent Footing Load	= 0.0 lbs 0.0 ft	0.0 ft-#
Axial Dead Load on Stem	= 0.0 lbs 0.0 ft	0.0 ft-#
Soil Over Toe	= 55.0 lbs 0.50 ft	27.50 ft-#
Surcharge Over Toe	= 0.0 lbs 0.0 ft	0.0 ft-#
Stem Weight	= 2,100.0 lbs 1.50 ft	3,150.0 ft-#
Soil Over Heel	= 1,540.0 lbs 2.50 ft	3,850.0 ft-#
Footing Weight	= 500.63 lbs 1.50 ft	750.94 ft-#
Total Vertical Force	= 4,195.63 lbs	Base Moment = -2,648.97 ft-#

Stem is specified to be fixed to footing, and top restraint is assumed to react out any tendency for moment at the footing/soil interface, so uniform soil pressure is assumed.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Restrained Retaining Wall

Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Typ Garage Wall

Rebar Lap & Embedment Lengths Information

Project File: 123021 K&B Apartments.ec6

(c) ENERCALC INC 1983-2023

The diagram illustrates a structural cross-section of a retaining wall. Key features include:

- Lateral Restraint:** Indicated at the top left.
- Concrete Slabs:** Three horizontal sections are labeled "12" Concrete w/ #5 @ 6".
- Vertical Dimensions:** The main vertical section is 14'-0" high. Other vertical dimensions shown are 14'-0" and 14'-0" on the right side, and 1'-1" near the base.
- Base Details:** A 6" Restraint is shown at the base. Horizontal dimensions at the base include 1'-0", 2'-0", and a total width of 3'-0".
- Reinforcement:** Reinforcement bars are specified as #5@12." @ Toe and #5@12." @ Heel.
- Other Dimensions:** Additional horizontal dimensions include 2" and 3", and a vertical dimension of 1'-1" near the base.

Restrained Retaining Wall

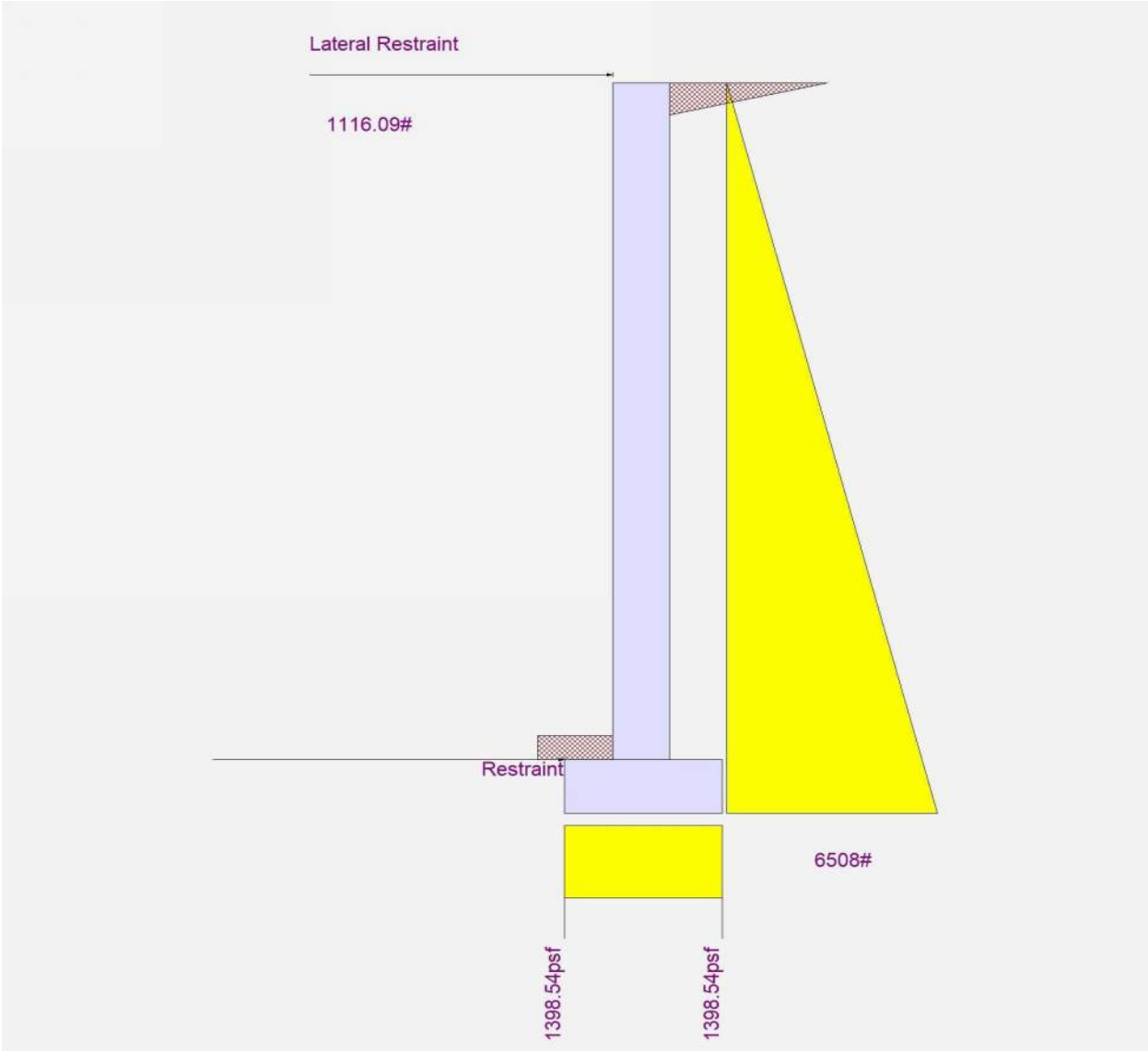
Project File: 123021 K&B Apartments.ec6

LIC# : KW-06016346, Build:20.24.08.01

CARTWRIGHT AEC

(c) ENERCALC INC 1983-2023

DESCRIPTION: Typ Garage Wall



Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.25.04.16

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 3' Retaining

Code Reference:

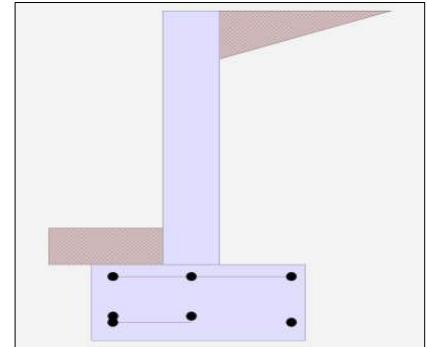
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	3.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	37.0 psf/ft
	=	
Passive Pressure	=	450.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem	=	0.0 psf (Strength Level)

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type	=	Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.25.04.16

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 3' Retaining

Design Summary

Wall Stability Ratios

Overtuning	=	2.91	OK
Sliding	=	2.05	OK
Global Stability	=	2.78	

Total Bearing Load	=	1,338	lbs
...resultant ecc.	=	3.67	in

Eccentricity within middle third

Soil Pressure @ Toe	=	815	psf	OK
Soil Pressure @ Heel	=	125	psf	OK
Allowable	=	1,500	psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	1,140 psf	
ACI Factored @ Heel	=	175 psf	
Footing Shear @ Toe	=	0.6 psi	OK
Footing Shear @ Heel	=	2.3 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	382.9 lbs	
less 100% Passive Force	-	315.0 lbs	
less 100% Friction Force	= -	469.7 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS
 NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Design Height Above Ftg

ft =	0.00
Wall Material Above "Ht"	= Concrete
Design Method	= SD
Thickness	= 8.00
Rebar Size	= # 5
Rebar Spacing	= 18.00
Rebar Placed at	= Center

Design Data

fb/FB + fa/Fa	=	0.119
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Total Force @ Section

Service Level	lbs =
Strength Level	lbs = 362.6

Moment....Actual

Service Level	ft-# =
Strength Level	ft-# = 423.0

Moment.....Allowable	=	3,531.0
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Shear.....Actual

Service Level	psi =
Strength Level	psi = 7.6

Shear.....Allowable	psi = 53.5
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Anet (Masonry)	in2 =
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Wall Weight	psf = 100.0
-------------	-------------

Rebar Depth 'd'	in = 4.00
-----------------	-----------

Masonry Data

f'm	psi =
Fs	psi =
Solid Grouting	=
Modular Ratio 'n'	=
Equiv. Solid Thick.	=
Masonry Block Type	=
Masonry Design Method	= ASD

Concrete Data

f'c	psi = 3,000.0
Fy	psi = 60,000.0

Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.25.04.16

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 3' Retaining

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.0255 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.1728 in2/ft	#4@ 13.89 in #4@ 27.78 in
Provided Area :	0.2067 in2/ft	#5@ 21.53 in #5@ 43.06 in
Maximum Area :	0.6503 in2/ft	#6@ 30.56 in #6@ 61.11 in

Footing Data

Toe Width	=	0.83 ft
Heel Width	=	1.67
Total Footing Width	=	2.50
Footing Thickness	=	12.59 in

f'c = 3,000 psi Fy = 60,000 psi
 Footing Concrete Density = 150.00 pcf
 Min. As % = 0.0018
 Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

	Toe	Heel	
Factored Pressure	= 1,140	175	psf
Mu' : Upward	= 359	152	ft-#
Mu' : Downward	= 88	325	ft-#
Mu: Design	= 270	174	ft-#
φ Mn	= 8,441	12,258	ft-#
Actual 1-Way Shear	= 0.59	2.34	psi
Allow 1-Way Shear	= 40.39	42.78	psi
Toe Reinforcing	= # 5 @ 18.00 in		
Heel Reinforcing	= # 5 @ 13.67 in		
Key Reinforcing	= None Spec'd		
Footing Torsion, Tu	=	0.00	ft-lbs
Footing Allow. Torsion, φ Tn	=	0.00	ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 8.82 in, #5@ 13.67 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 8.82 in, #5@ 13.67 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 0.68 in2
 Min footing T&S reinf Area per foot 0.27 in2 /ft

If one layer of horizontal bars:

#4@ 8.83 in
 #5@ 13.68 in
 #6@ 19.42 in

If two layers of horizontal bars:

#4@ 17.65 in
 #5@ 27.36 in
 #6@ 38.83 in

Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.25.04.16

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 3' Retaining

Summary of Overturning & Resisting Forces & Moments

.....OVERTURNING.....				RESISTING.....			
Item	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	382.9	1.52	580.6	Soil Over HL (ab. water tbl)	385.0	2.00	770.0
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.00	770.0
Hydrostatic Force				Water Table			
Buoyant Force	=			Sloped Soil Over Heel	=		
Surcharge over Heel	=			Surcharge Over Heel	=		
Surcharge Over Toe	=			Adjacent Footing Load	=		
Adjacent Footing Load	=			Axial Dead Load on Stem	=		
Added Lateral Load	=			* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=			Soil Over Toe	=	45.8	19.1
	=			Surcharge Over Toe	=		
				Stem Weight(s)	=	350.0	408.3
				Earth @ Stem Transitions	=		
				Footing Weight	=	393.4	491.8
				Key Weight	=	2.25	
				Vert. Component	=		
Total	=	382.9	O.T.M. = 580.6	Total	=	1,174.3 lbs	R.M. = 1,689.2
Resisting/Overturning Ratio		=	2.91	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure	=	1,337.6	lbs				

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci

Horizontal Defl @ Top of Wall (approximate only) 0.032 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.25.04.16

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 3' Retaining

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) = 21.36 in

Development length for #5 bar specified in this stem design segment = 16.43 in

Hooked embedment length into footing for #5 bar specified in this stem design segment = 7.87 in

As Provided = 0.2067 in²/ft

As Required = 0.1728 in²/ft

Cantilevered Retaining Wall

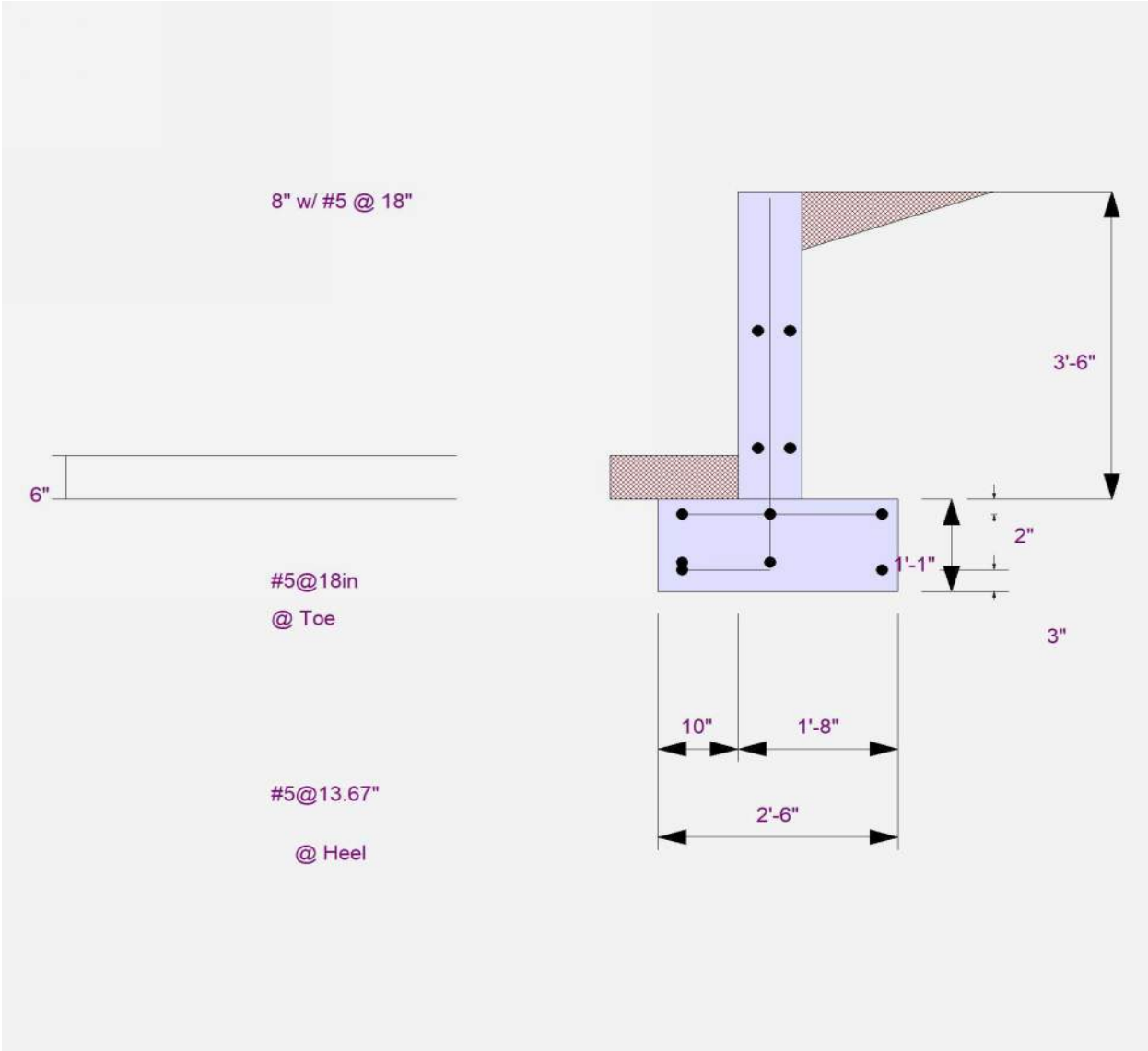
Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.25.04.16

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 3' Retaining



Cantilevered Retaining Wall

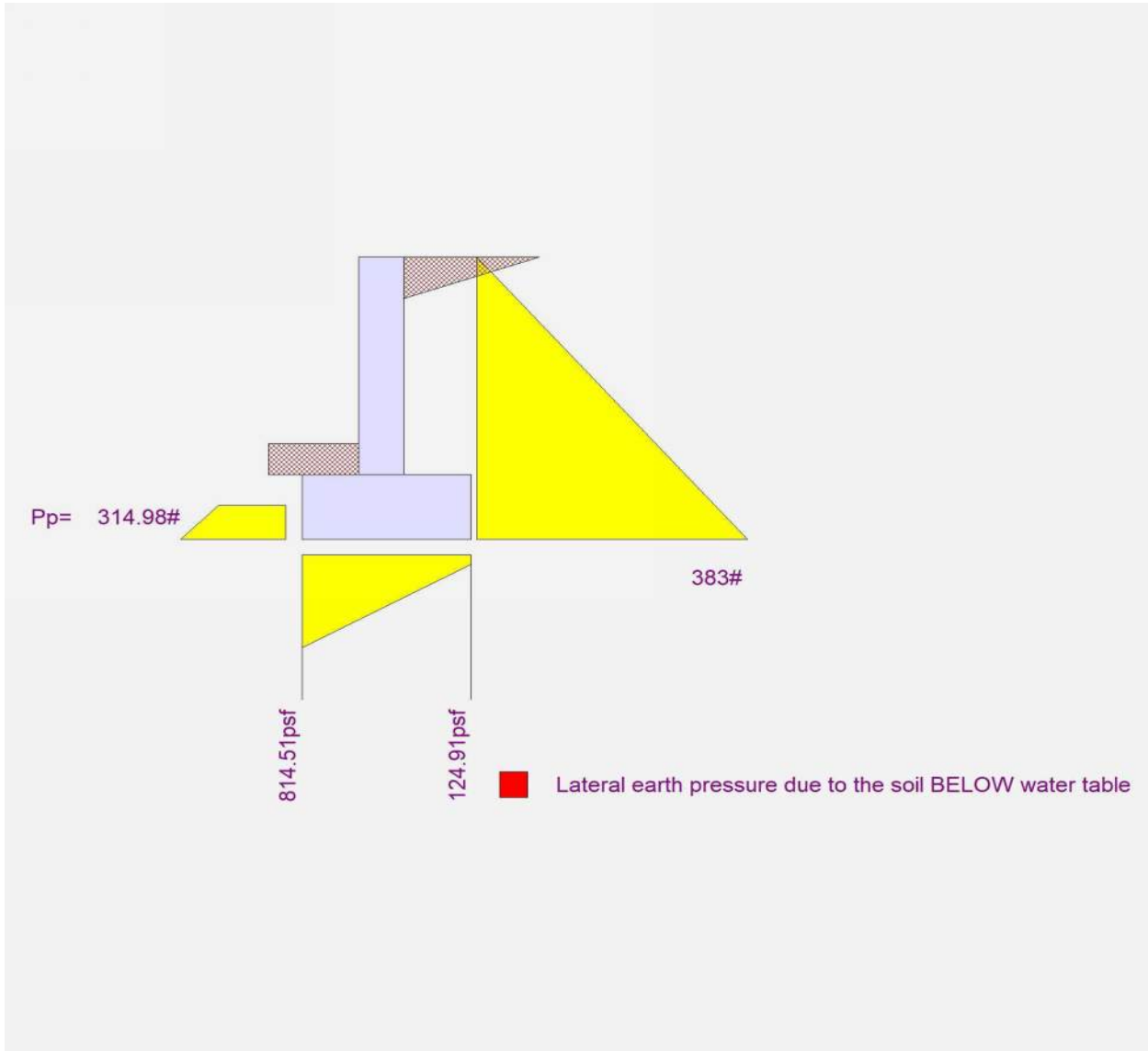
Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.25.04.16

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 3' Retaining



Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.24.12.17

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 6' Retaining

Code Reference:

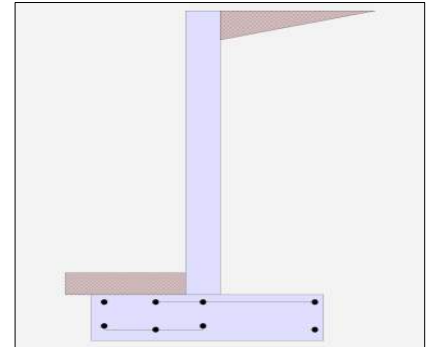
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	6.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	37.0 psf/ft
	=	
Passive Pressure	=	450.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem	=	0.0 psf (Strength Level)

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type	=	Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.24.12.17

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 6' Retaining

Design Summary

Wall Stability Ratios

Overturing	=	3.05	OK
Sliding	=	1.57	OK
Global Stability	=	1.77	

Total Bearing Load	=	3,339 lbs
...resultant ecc.	=	4.38 in

Eccentricity within middle third

Soil Pressure @ Toe	=	954 psf	OK
Soil Pressure @ Heel	=	330 psf	OK
Allowable	=	1,500 psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	1,336 psf	
ACI Factored @ Heel	=	462 psf	
Footing Shear @ Toe	=	9.4 psi	OK
Footing Shear @ Heel	=	6.5 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	1,054.3 lbs	
less 100% Passive Force	-	315.0 lbs	
less 100% Friction Force	= -	1,335.5 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS
 NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Design Height Above Ftg

ft =	0.00
Wall Material Above "Ht"	= Concrete
Design Method	= SD
Thickness	= 8.00
Rebar Size	= # 5
Rebar Spacing	= 12.00
Rebar Placed at	= Center

Design Data

fb/FB + fa/Fa	=	0.525
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Total Force @ Section

Service Level	lbs =
Strength Level	lbs = 1,250.6

Moment....Actual

Service Level	ft-# =
Strength Level	ft-# = 2,709.6

Moment.....Allowable	=	5,154.8
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Shear.....Actual

Service Level	psi =
Strength Level	psi = 26.1

Shear.....Allowable	psi = 61.2
---------------------	------------

Anet (Masonry)	in2 =
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Wall Weight	psf = 100.0
-------------	-------------

Rebar Depth 'd'	in = 4.00
-----------------	-----------

Masonry Data

f'm	psi =
Fs	psi =
Solid Grouting	=
Modular Ratio 'n'	=
Equiv. Solid Thick.	=
Masonry Block Type	=
Masonry Design Method	= ASD

Concrete Data

f'c	psi = 3,000.0
Fy	psi = 60,000.0

Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.24.12.17

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 6' Retaining

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1636 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.1728 in2/ft	#4@ 13.89 in #4@ 27.78 in
Provided Area :	0.31 in2/ft	#5@ 21.53 in #5@ 43.06 in
Maximum Area :	0.6503 in2/ft	#6@ 30.56 in #6@ 61.11 in

Footing Data

Toe Width	=	1.83 ft
Heel Width	=	2.67
Total Footing Width	=	4.50
Footing Thickness	=	12.59 in

f'c = 3,000 psi Fy = 60,000 psi
 Footing Concrete Density = 150.00 pcf
 Min. As % = 0.0018
 Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

	Toe	Heel	
Factored Pressure	= 1,336	462	psf
Mu' : Upward	= 2,046	1,182	ft-#
Mu' : Downward	= 428	2,094	ft-#
Mu: Design	= 1,617	912	ft-#
φ Mn	= 12,518	12,258	ft-#
Actual 1-Way Shear	= 9.42	6.46	psi
Allow 1-Way Shear	= 46.23	42.78	psi
Toe Reinforcing	= # 5 @ 12.00 in		
Heel Reinforcing	= # 5 @ 13.67 in		
Key Reinforcing	= None Spec'd		
Footing Torsion, Tu	=	0.00	ft-lbs
Footing Allow. Torsion, φ Tn	=	0.00	ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 8.82 in, #5@ 13.67 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 8.82 in, #5@ 13.67 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 1.22 in2
 Min footing T&S reinf Area per foot 0.27 in2 /ft

If one layer of horizontal bars:

#4@ 8.83 in
 #5@ 13.68 in
 #6@ 19.42 in

If two layers of horizontal bars:

#4@ 17.65 in
 #5@ 27.36 in
 #6@ 38.83 in

Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.24.12.17

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 6' Retaining

Summary of Overturning & Resisting Forces & Moments

Item	OVERTURNING.....				RESISTING.....		
	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	1,054.3	2.52	2,653.1	Soil Over HL (ab. water tbl)	1,430.0	3.50	5,005.0
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.50	5,005.0
Hydrostatic Force				Water Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	100.8	0.92	92.4
				Surcharge Over Toe =			
				Stem Weight(s) =	650.0	2.17	1,408.3
				Earth @ Stem Transitions =			
				Footing Weight =	708.2	2.25	1,593.4
				Key Weight =		2.25	
				Vert. Component =			
Total	= 1,054.3	O.T.M. =	2,653.1	Total =	2,889.0 lbs	R.M. =	8,099.2
Resisting/Overturning Ratio		= 3.05		* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =		3,338.8 lbs					

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci
 Horizontal Defl @ Top of Wall (approximate only) 0.038 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.24.12.17

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 6' Retaining

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) = 21.36 in

Development length for #5 bar specified in this stem design segment = 16.43 in

Hooked embedment length into footing for #5 bar specified in this stem design segment = 7.87 in

As Provided = 0.3100 in²/ft

As Required = 0.1636 in²/ft

Cantilevered Retaining Wall

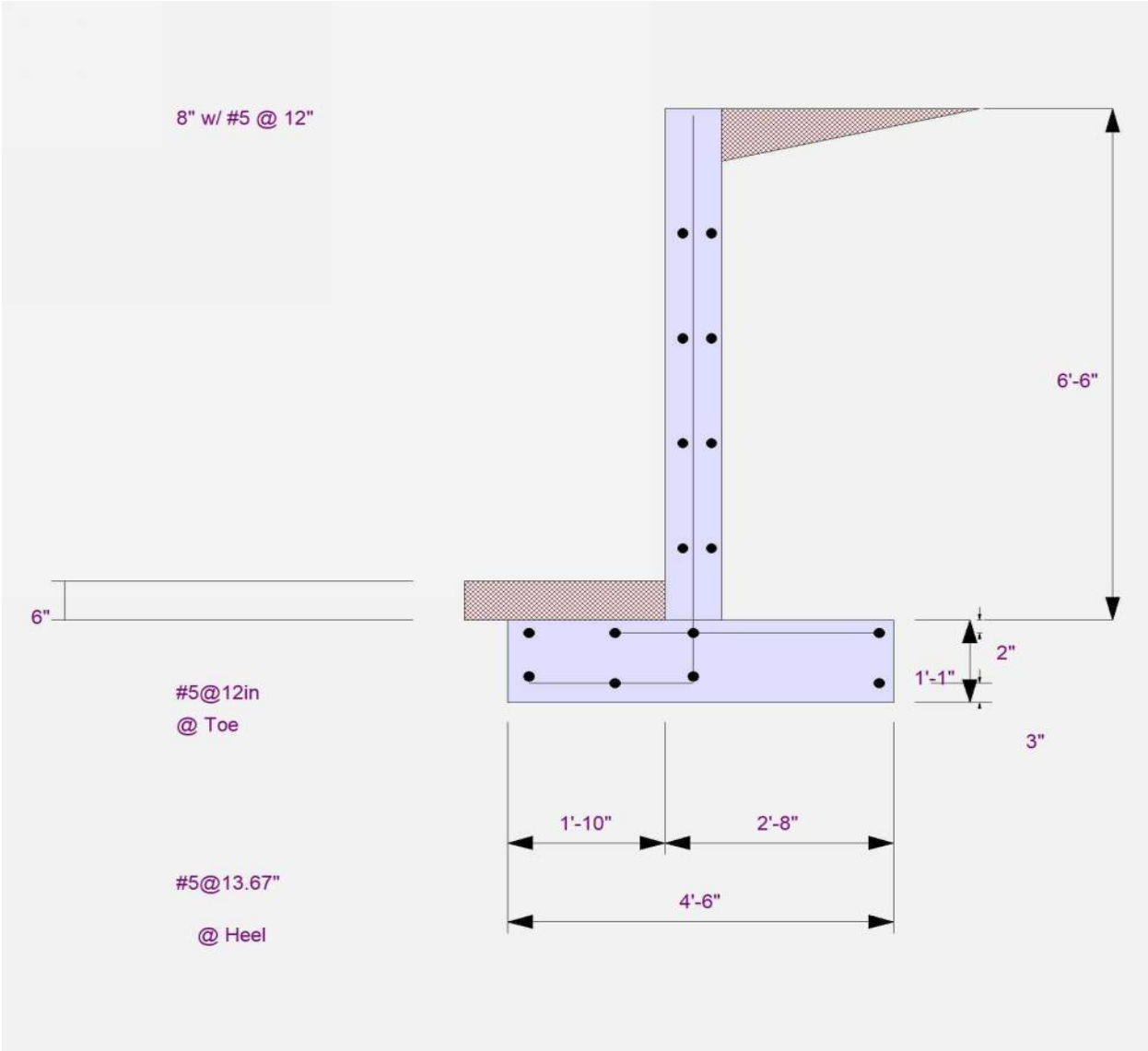
Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.24.12.17

CARTWRIGHT AEC

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DESCRIPTION: 6' Retaining



Cantilevered Retaining Wall

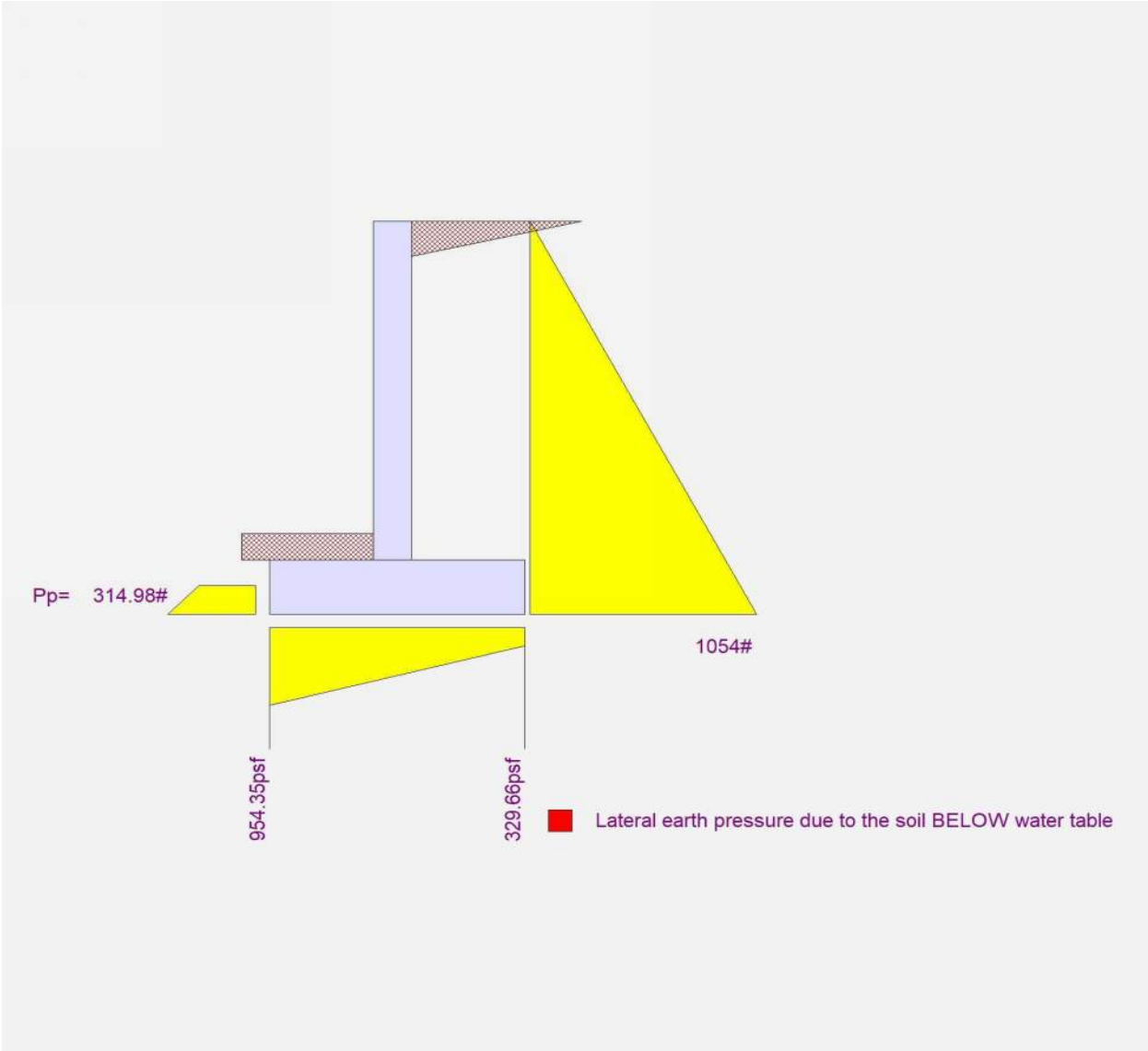
Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.24.12.17

CARTWRIGHT AEC

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DESCRIPTION: 6' Retaining



Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.24.12.17

CARTWRIGHT AEC

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DESCRIPTION: 12' Retaining

Code Reference:

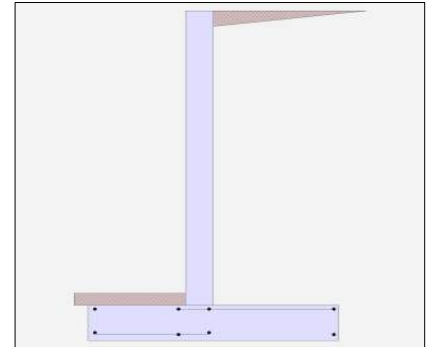
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	12.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	37.0 psf/ft
	=	
Passive Pressure	=	450.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	6.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem	=	0.0 psf (Strength Level)

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type	=	Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.24.12.17

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 12' Retaining

Design Summary

Wall Stability Ratios

Overturing	=	3.47	OK
Sliding	=	1.54	OK
Global Stability	=	1.77	

Total Bearing Load	=	11,827 lbs
...resultant ecc.	=	5.21 in

Eccentricity within middle third

Soil Pressure @ Toe	=	1,473 psf	OK
Soil Pressure @ Heel	=	811 psf	OK
Allowable	=	1,500 psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	2,062 psf	
ACI Factored @ Heel	=	1,136 psf	
Footing Shear @ Toe	=	20.9 psi	OK
Footing Shear @ Heel	=	13.4 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	3,626.0 lbs	
less 100% Passive Force	-	843.8 lbs	
less 100% Friction Force	= -	4,730.7 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS
 NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Design Height Above Ftg

ft =	0.00
Wall Material Above "Ht"	= Concrete
Design Method	= SD
Thickness	= 12.00
Rebar Size	= # 5
Rebar Spacing	= 8.00
Rebar Placed at	= Edge

Design Data

fb/FB + fa/Fa	=	0.946
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Total Force @ Section

Service Level	lbs =
Strength Level	lbs = 4,625.0

Moment....Actual

Service Level	ft-# =
Strength Level	ft-# = 19,270.8

Moment.....Allowable

=	20,360.5
---	----------

Shear.....Actual

Service Level	psi =
Strength Level	psi = 37.8

Shear.....Allowable

psi =	51.1
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Anet (Masonry)

in2 =	
-------	--

Wall Weight

psf =	150.0
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Rebar Depth 'd'

in =	10.19
------	-------

Masonry Data

f'm	psi =
Fs	psi =
Solid Grouting	=
Modular Ratio 'n'	=
Equiv. Solid Thick.	=
Masonry Block Type	=
Masonry Design Method	= ASD

Concrete Data

f'c	psi = 3,000.0
Fy	psi = 60,000.0

Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.24.12.17

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 12' Retaining

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.4339 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.4339 in2/ft	#4@ 9.26 in #4@ 18.52 in
Provided Area :	0.465 in2/ft	#5@ 14.35 in #5@ 28.70 in
Maximum Area :	1.6561 in2/ft	#6@ 20.37 in #6@ 40.74 in

Footing Data

Toe Width	=	3.50 ft
Heel Width	=	5.50
Total Footing Width	=	9.00
Footing Thickness	=	18.00 in

f'c = 3,000 psi Fy = 60,000 psi
 Footing Concrete Density = 150.00 pcf
 Min. As % = 0.0018
 Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

	Toe	Heel	
Factored Pressure	= 2,062	1,136	psf
Mu' : Upward	= 11,896	13,065	ft-#
Mu' : Downward	= 2,058	19,440	ft-#
Mu: Design	= 9,838	6,375	ft-#
φ Mn	= 25,049	26,800	ft-#
Actual 1-Way Shear	= 20.89	13.37	psi
Allow 1-Way Shear	= 42.79	41.86	psi
Toe Reinforcing	= # 5 @ 9.56 in		
Heel Reinforcing	= # 5 @ 9.56 in		
Key Reinforcing	= None Spec'd		
Footing Torsion, Tu	=	0.00	ft-lbs
Footing Allow. Torsion, φ Tn	=	0.00	ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 3.50 in2
 Min footing T&S reinf Area per foot 0.39 in2 /ft

If one layer of horizontal bars:

#4@ 6.17 in
 #5@ 9.57 in
 #6@ 13.58 in

If two layers of horizontal bars:

#4@ 12.35 in
 #5@ 19.14 in
 #6@ 27.16 in

Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.24.12.17

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 12' Retaining

Summary of Overturning & Resisting Forces & Moments

Item	OVERTURNING.....				RESISTING.....		
	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	3,626.0	4.67	16,921.3	Soil Over HL (ab. water tbl)	6,187.5	6.75	41,765.6
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		6.75	41,765.6
Hydrostatic Force				Water Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	192.5	1.75	336.9
				Surcharge Over Toe =			
				Stem Weight(s) =	1,875.0	4.00	7,500.0
				Earth @ Stem Transitions =			
				Footing Weight =	2,025.0	4.50	9,112.5
				Key Weight =		4.25	
				Vert. Component =			
Total	= 3,626.0	O.T.M. =	16,921.3	Total =	10,280.0 lbs	R.M. =	58,715.0
Resisting/Overturning Ratio		= 3.47		* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =		11,826.8	lbs				

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci
 Horizontal Defl @ Top of Wall (approximate only) 0.057 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.24.12.17

CARTWRIGHT AEC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 12' Retaining

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) = 21.36 in

Development length for #5 bar specified in this stem design segment = 16.43 in

Hooked embedment length into footing for #5 bar specified in this stem design segment = 7.87 in

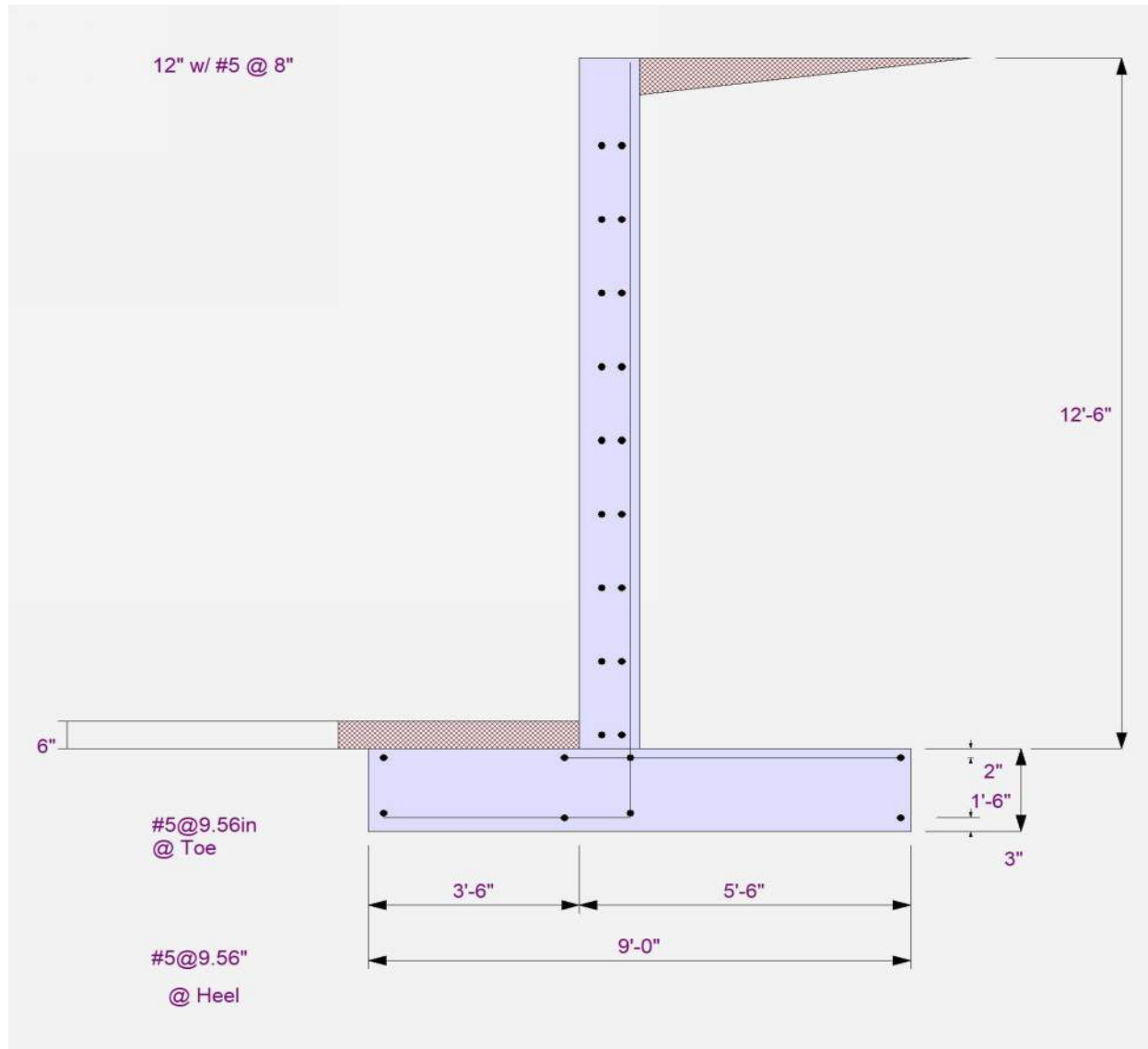
As Provided = 0.4650 in²/ft

As Required = 0.4339 in²/ft

Project File: K&B Apartments Retaining walls.ec6

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: 12' Retaining



Cantilevered Retaining Wall

Project File: K&B Apartments Retaining walls.ec6

LIC# : KW-06016346, Build:20.24.12.17

CARTWRIGHT AEC

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DESCRIPTION: 12' Retaining

