

# CK Engineering LLC.

19229 38th PL NE  
Lake Forest Park, WA 98155

Phone: (206) 417-0670

## STRUCTURAL CALCULATIONS

Lateral & Gravity Design  
22-028



6/10/2022

LIU RESIDENCE  
3705 77th PL SE  
Mercer Island, WA 98040  
June 10, 2022

### Search Information

**Address:** 3705 77th PI SE, Mercer Island, WA 98040, USA

**Coordinates:** 47.57743379999999, -122.2355749

**Elevation:** 121 ft

**Timestamp:** 2022-06-02T22:58:35.609Z

**Hazard Type:** Seismic

**Reference Document:** ASCE7-16

**Risk Category:** I

**Site Class:** D-default



### Basic Parameters

Name	Value	Description
$S_S$	1.412	$MCE_R$ ground motion (period=0.2s)
$S_1$	0.491	$MCE_R$ ground motion (period=1.0s)
$S_{MS}$	1.695	Site-modified spectral acceleration value
$S_{M1}$	* null	Site-modified spectral acceleration value
$S_{DS}$	1.13	Numeric seismic design value at 0.2s SA
$S_{D1}$	* null	Numeric seismic design value at 1.0s SA

\* See Section 11.4.8

### ▼Additional Information

Name	Value	Description
SDC	* null	Seismic design category
$F_a$	1.2	Site amplification factor at 0.2s
$F_v$	* null	Site amplification factor at 1.0s
$CR_S$	0.902	Coefficient of risk (0.2s)
$CR_1$	0.897	Coefficient of risk (1.0s)
PGA	0.604	$MCE_G$ peak ground acceleration
$F_{PGA}$	1.2	Site amplification factor at PGA
$PGA_M$	0.725	Site modified peak ground acceleration

T <sub>L</sub>	6	Long-period transition period (s)
SsRT	1.412	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.565	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	3.49	Factored deterministic acceleration value (0.2s)
S1RT	0.491	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.548	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	1.404	Factored deterministic acceleration value (1.0s)
PGAd	1.194	Factored deterministic acceleration value (PGA)

\* See Section 11.4.8

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

## Disclaimer

Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

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**Search Information**

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**Coordinates:** 47.57743379999999, -122.2355749  
**Elevation:** 121 ft  
**Timestamp:** 2022-06-02T22:57:06.114Z  
**Hazard Type:** Wind



**ASCE 7-16**

MRI 10-Year ..... 67 mph  
 MRI 25-Year ..... 73 mph  
 MRI 50-Year ..... 78 mph  
 MRI 100-Year ..... 83 mph  
 Risk Category I ..... 92 mph  
 Risk Category II ..... 97 mph  
 Risk Category III ..... 104 mph  
 Risk Category IV ..... 108 mph

**ASCE 7-10**

MRI 10-Year ..... 72 mph  
 MRI 25-Year ..... 79 mph  
 MRI 50-Year ..... 85 mph  
 MRI 100-Year ..... 91 mph  
 Risk Category I ..... 100 mph  
 Risk Category II ..... 110 mph  
 Risk Category III-IV ..... 115 mph

**ASCE 7-05**

ASCE 7-05 Wind Speed ..... 85 mph

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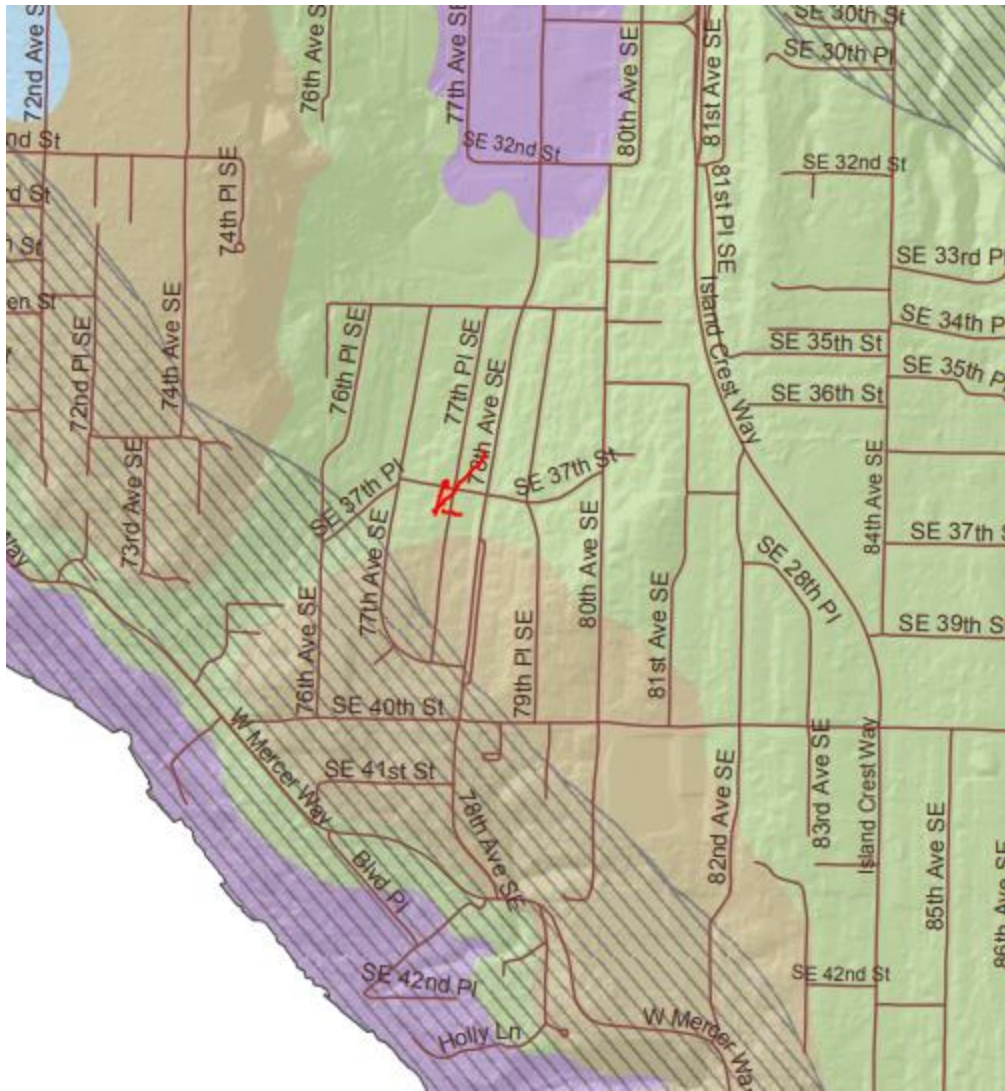
**Disclaimer**

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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## Design Criteria

Scope of Work:	Lateral & Gravity Design		
Site Address:	3705 77th PL SE Mercer Island, WA 98040		
Number of Stories:	3	Engineer:	PK

## Roof Loading

Roofing	Composition	3.0
Sheathing	5/8" Plywood	1.8
Insulation	Roll/Batt	3.0
Ceiling	5/8" GWB	2.8
Framing	Trusses	2.2
Miscellaneous	fixtures, mechanical, electrical, etc.	2.2
TOTAL DEAD LOAD:		15.0 psf
ROOF SNOW LOAD:		25.0 psf

## Upper Floor Loading

Floor Covering	Carpet/Hardwood/Tile	3.0
Sheathing	3/4" T&G	2.3
Ceiling	1/2" GWB	2.2
Joists	Solid Sawn @ 16" o/c	3.3
Beams		2.8
Miscellaneous	fixtures, mechanical, electrical, etc.	1.4
TOTAL DEAD LOAD:		15.0 psf
FLOOR LIVE LOAD:		40.0 psf

## Main Floor Loading

Floor Covering	Carpet/Hardwood/Tile	3.0
Sheathing	3/4" T&G	2.3
Ceiling	5/8" GWB	2.8
Joists	I-Joists	2.1
Beams		4.2
Miscellaneous	fixtures, mechanical, electrical, etc.	0.6
TOTAL DEAD LOAD:		15.0 psf
FLOOR LIVE LOAD:		40.0 psf

Soil Bearing Capacity:	1500 psf
Frost Depth:	18 in



# LATERAL & GRAVITY DESIGN KEY PLANS

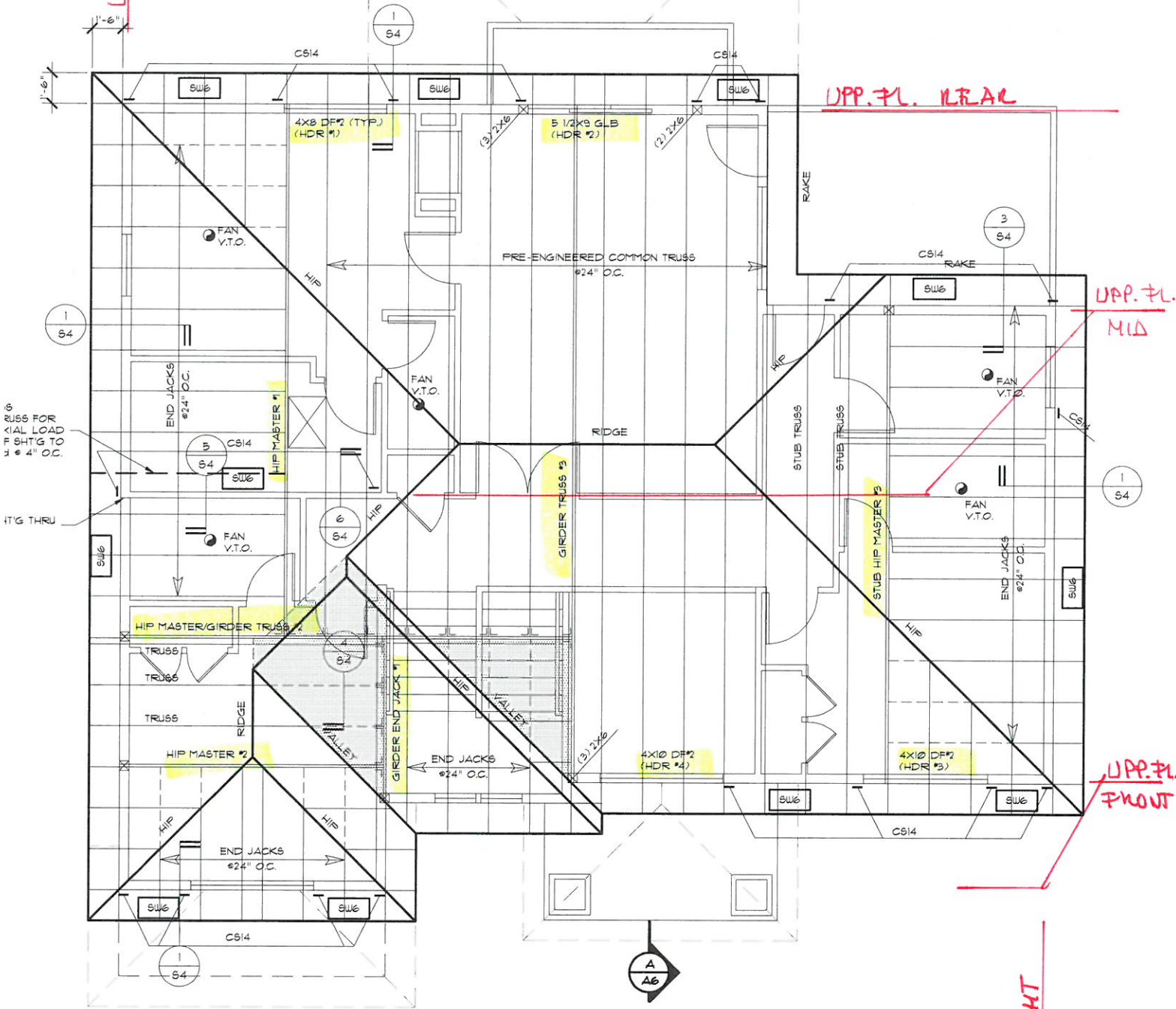
UPP. PL. LEFT

UPP. PL. REAR

UPP. PL. MID

UPP. PL. FRONT

UPP. PL. RIGHT

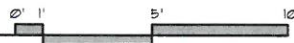


NOTE: COL TO BE (2) 2X6 HF#2 TYP. (UNO.)  
HDR TO BE 4X8 HF#2 TYP. (UNO.)



ROOF FRAMING PLAN

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





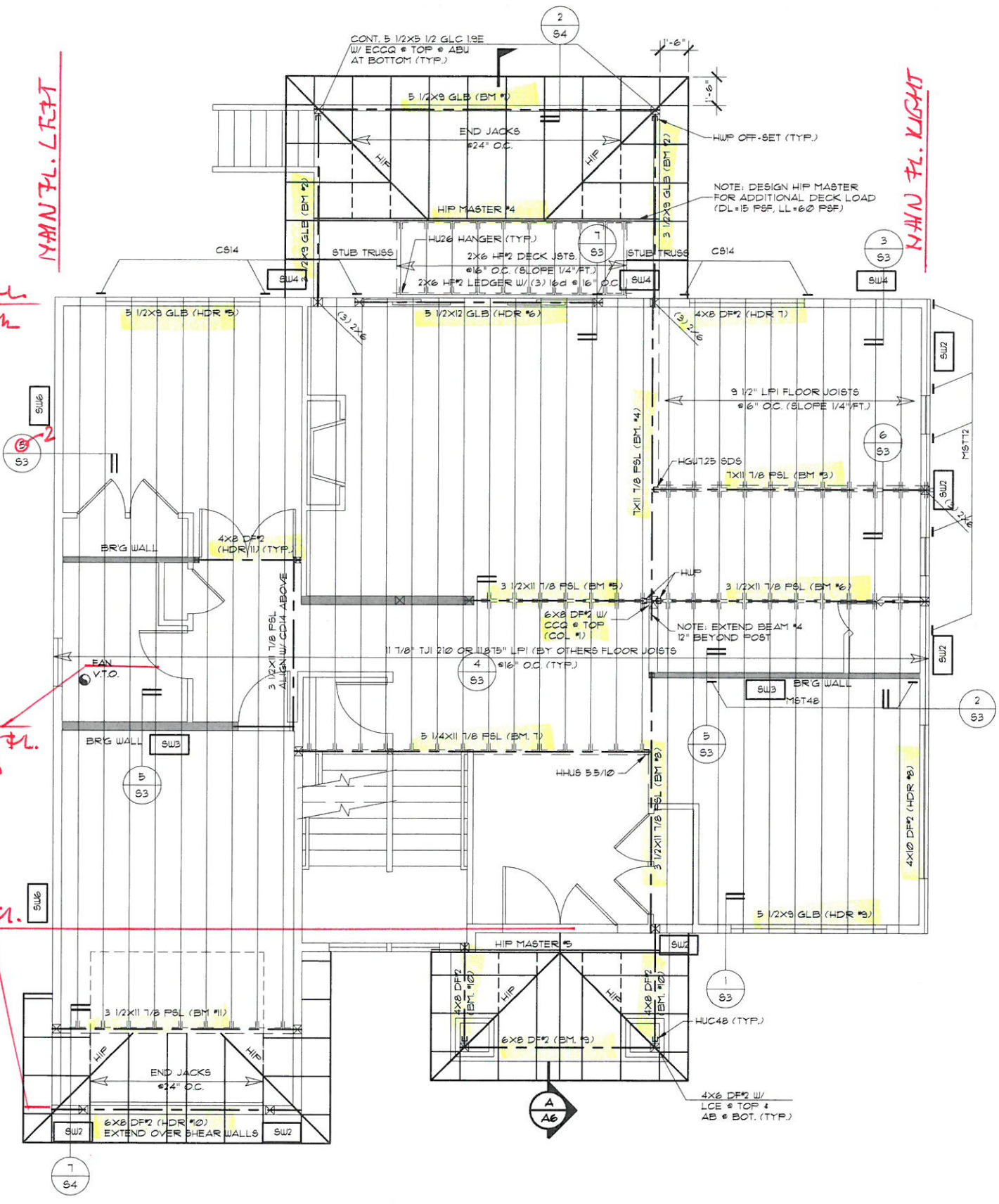
MAIN FL. LEFT

MAIN FL. RIGHT

MAIN FL. REAR

MAIN FL. MID

MAIN FL. FRONT

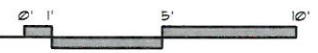


NOTE: COL TO BE (2) 2X6 HF#2 TYP. (UNO.)  
 HDR TO BE 4X8 HF#2 TYP. (UNO.)

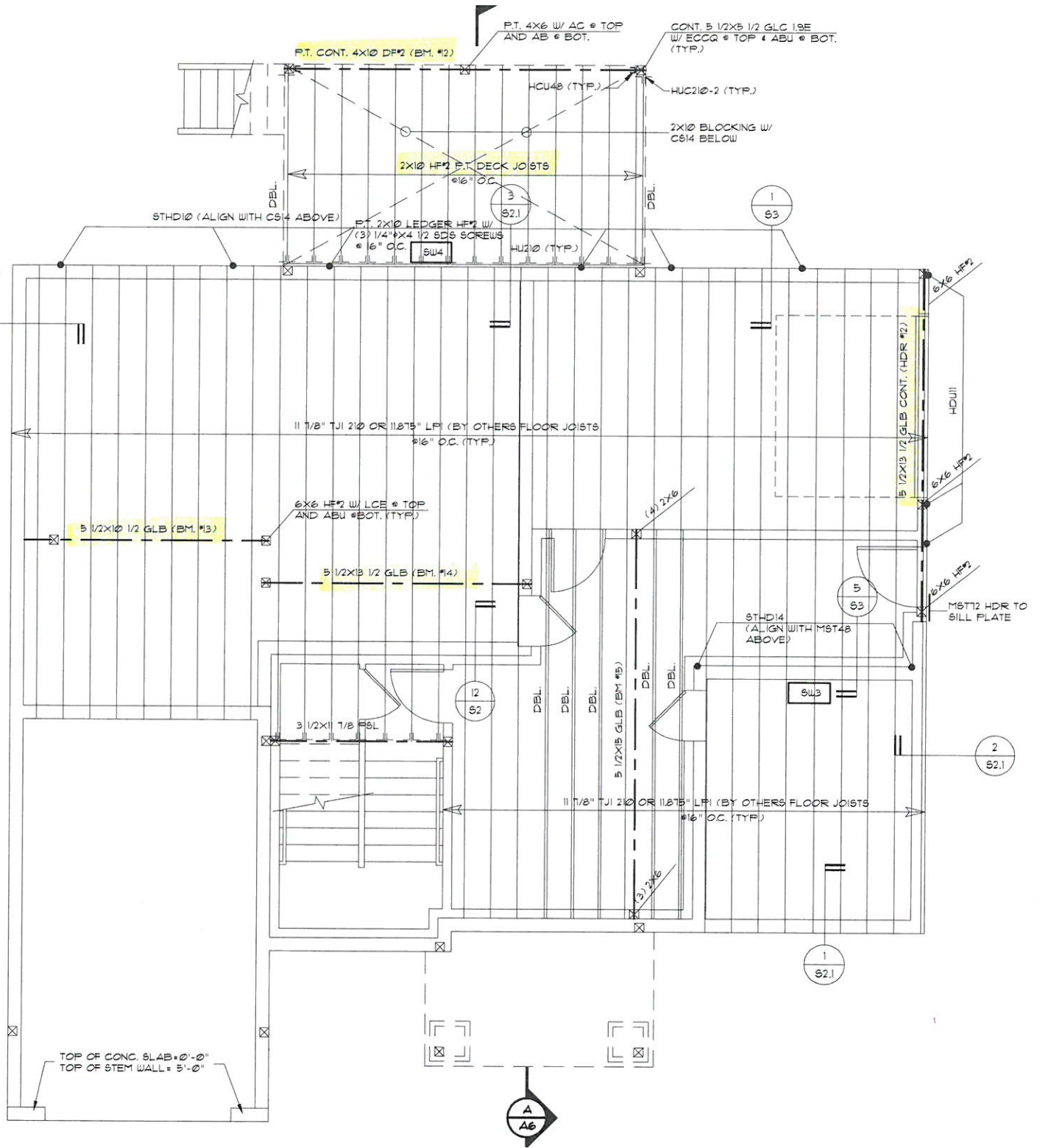


UPPER FLOOR & LOWER ROOF FRAMING PLAN

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



**LOW FL.  
VLRAM**



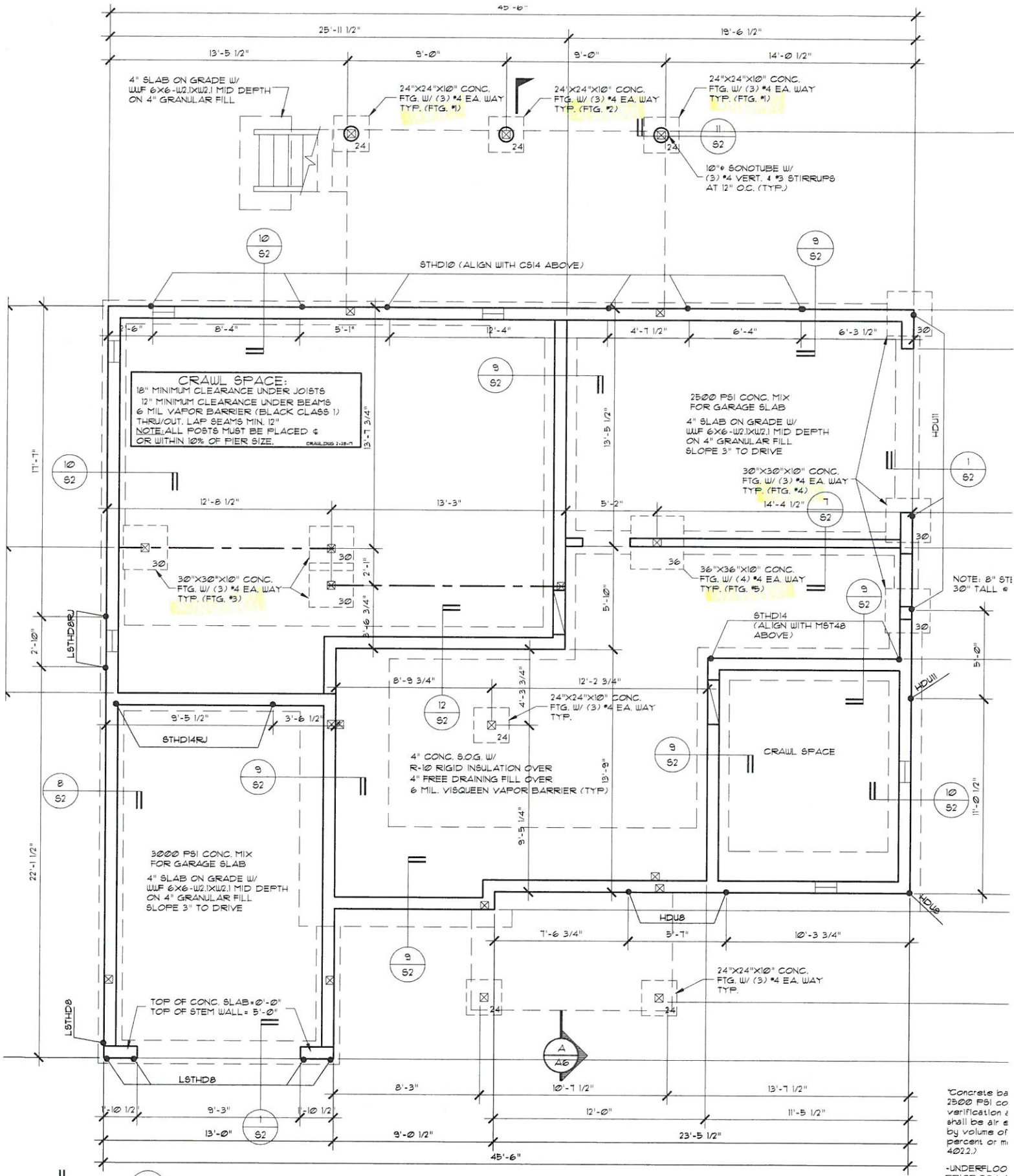
NOTE: COL TO BE (2) 2X6 HF#2 TYP. (UNO.)  
 HDR TO BE 4X8 HF#2 TYP. (UNO.)



**MAIN FLOOR FRAMING PLAN**

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





Concrete to be 2500 PSI concrete verification shall be air-cured by volume of percent or m4022.)

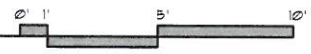
-UNDERFLOOR PRIOR TO LA  
-CONTRACTOR OF ALL POINTS DOWN THROUGH INTO THE FOU

GROUNDING: ELECTRODES (AX6) THAT STRUCTURE IS TO FORM THE NONE OF THE OR MORE OF IN 25052(A).

# FOUNDATION PLAN

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

NOTE:  
• 16"X8" DEEP CONC. CONG. FTG. W/ (2) #4 BARS MID DEPTH (TYP.)





Type of construction: **NEW**  
 Applicable Building Codes: **SBC 2018, ASCE 7/SEI 7-16**

Location: **3705 77th PL SE  
 Mercer Island, WA 98040**

Work performed :

## Lateral & Gravity Design

### WIND DESIGN:

$$P_s = \lambda_w P_{s30} K_{zt}$$

Exposure : **B**  
 Wind Speed = **85 MPH**

Wind Exposure Category as set forth in Section 26.7 of ASCE 7-16  
 Basic Wind Speed (LRFD) as used in Figure 28.5 of ASCE 7-16 and converted to (ASD)

$P_{s30} =$

Simplified design wind pressure for Exposure B, at  $h = 30$  feet and for  $I = 1.0$ , from Figure 28.5-1

$I_w =$  **1**

Importance factor as defined in Table 1.5-2 of ASCE 7-16

$\lambda =$  **1.00**

Adjustment factor for building height and exposure from Figure 28.5-1 of ASCE 7-16

$K_{zt} =$  **1.30**

Adjustment factor for increased wind speed due to a hill or escarpment from Section 26.8 of ASCE 7-16

Roof slope :

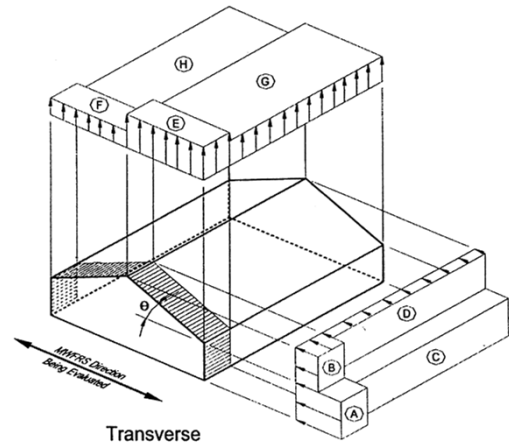
Front/Rear  $\tan^{-1} \left( \frac{\text{rise}}{\text{run}} \right) = \tan^{-1} \left( \frac{4}{12} \right) = 18.4 \text{ degrees}$   
 Left/Right  $\tan^{-1} \left( \frac{4}{12} \right) = 18.4 \text{ degrees}$   
 Mean Elevation **25 ft**

Number of floors: **3**

Average uplift (F/R) = **-10.9 psf** Based on wind zones 'G' and 'H'  
 Average uplift (R/L) = **-10.9 psf** Based on wind zones 'G' and 'H'

	End zone of wall		End zone of roof	
	Front/Rear	Left/Right	Front/Rear	Left/Right
$P_{s30} =$	A = 15.4 psf	15.4 psf	B = -4.4 psf	-4.4 psf
$P_s =$	20.1 psf	20.1 psf	-5.7 psf	-5.7 psf

	Interior zone of wall		Interior zone of roof	
	Front/Rear	Left/Right	Front/Rear	Left/Right
$P_{s30} =$	C = 10.3 psf	10.3 psf	D = -2.4 psf	-2.4 psf
$P_s =$	13.4 psf	13.4 psf	-3.2 psf	-3.2 psf



### WIND LOAD CALCULATIONS FRONT → REAR

#### ΣV 3RD FLOOR =

WIND ZONE	B	D			A	C						
AVE. HEIGHT	6	6			4.25	4.25						
AVE. WIDTH	8	24			8	38						
$P_s$	0.00	0.00	0.00	0.00	20.06	13.37	0.00	0.00	0.00	0.00	0.00	0.00
SUBTOTAL	0	0	0	0	682	2160	0	0	0	0	0	0
<b>TOTAL</b>	3,875 lbs		Minimum net pressure controls. The calc. pressure is less than the min. net pressure, equal to 16psf(A-C), and 8psf(B-D) applied over the entire area. (ASCE 7-16 28.5.3)									

#### ΣV 2ND FLOOR =

WIND ZONE	A	C										
AVE. HEIGHT	9.75	9.75										
AVE. WIDTH	8	38										
$P_s$	20.06	13.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUBTOTAL	1565	4955	0	0	0	0	0	0	0	0	0	0
<b>TOTAL</b>	6,519 lbs											

#### ΣV (1ST FLOOR) =

WIND ZONE	A	C										
AVE. HEIGHT	7.5	7.5										
AVE. WIDTH	8	30										
$P_s$	20.06	13.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUBTOTAL	1204	3009	0	0	0	0	0	0	0	0	0	0
<b>TOTAL</b>	4,213 lbs											

## WIND LOAD CALCULATIONS

LEFT → RIGHT

**ΣV 3RD FLOOR =**

WIND ZONE	B	D			A	C						
AVE. HEIGHT	6	6			4.25	4.25						
AVE. WIDTH	7	21			7	31						
Ps	0.00	0.00	0.00	0.00	20.06	13.37	0.00	0.00	0.00	0.00	0.00	0.00
SUBTOTAL	0	0	0	0	597	1762	0	0	0	0	0	0

**TOTAL** 3,295 lbs

Minimum net pressure controls. The calc. pressure is less than the min. net pressure, equal to 16psf(A-C), and 8psf(B-D) applied over the entire area. (ASCE 7-16 28.5.3)

**ΣV 2ND FLOOR =**

WIND ZONE	A	C										
AVE. HEIGHT	9.75	9.75										
AVE. WIDTH	7	31										
Ps	20.06	13.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUBTOTAL	1369	4042	0	0	0	0	0	0	0	0	0	0

**TOTAL** 5,411 lbs**ΣV (1ST FLOOR) =**

WIND ZONE	A	C										
AVE. HEIGHT	9.5	9.5										
AVE. WIDTH	5	11										
Ps	20.06	13.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUBTOTAL	953	1397	0	0	0	0	0	0	0	0	0	0

**TOTAL** 2,350 lbs**ρ CALCS:****3RD FLOOR CALCULATIONS:**

Plate Height:	8.50 ft
Total length of Shearwall in Shortest Line:	8.00 ft
Length of Shortest Segment within Shear Line:	4.00 ft
Length of Longest Segment in Shear Line:	4.00 ft

Tributary Area:	1.0
Total Area:	2.0

$\rho = 1.00$

ASCE 7-16 12.3.4.2 a

**2ND FLOOR CALCULATIONS:**

Plate Height:	9.00 ft
Total length of Shearwall in Shortest Line:	16.00 ft
Length of Shortest Shearwall within Shear Line:	8.00 ft
Length of Longest Wall in Shear Line:	8.00 ft

Tributary Area:	1.0
Total Area:	2.0

$\rho = 1.00$

ASCE 7-16 12.3.4.2 b

**MAIN FLOOR CALCULATIONS:**

Plate Height:	9.00 ft
Total length of Shearwall in Shortest Line:	10.00 ft
Length of Shortest Shearwall within Shear Line:	4.50 ft
Length of Longest Wall in Shear Line:	5.50 ft

Tributary Area:	1.0
Total Area:	2.0

$\rho = 1.00$

ASCE 7-16 12.3.4.2 b

All loads in pounds per square foot

**SEISMIC DESIGN:**

$E = E_h + E_v$

$E = \rho Q_E + .2S_{DS}D$

$Q_E = V = C_s W$

WALL DEAD LOAD =	10 psf
FLAT ROOF SNOW LOAD =	25 psf
RED. S.L. (20%*S.L.) =	0

ROOF DEAD LOAD =	15.0 psf
UPPER FLOOR D.L. =	15.0 psf
LOWER FLOOR D.L. =	15.0 psf
FLOOR LIVE LOAD =	40.0 psf

$\rho =$	1.00
Site Class =	D
$I_E =$	1
R =	6.5
$h_n =$	29

Geotech Report **No** 20% Seismic Load Increase  
 Importance factor as defined in Table 11.5-1

Total height of structure

$V = 0.7S_{DS}I_E W / R$

$S_{DS} = 2/3 S_{MS}$

Ss = 141.2%

$S_{MS} = 169.4\%$

$V = 0.122 W$

$V_{max} = S_{D1}I_E W / T_g R$

$S_{MS} = (F_a)(S_s)$

Fa = 1.20

$S_{DS} = 113.0\%$

$E = 0.122 W$

$T_g = 0.02h_n^{0.75}$

$S_{D1} = 2/3 S_{M1}$

S1 = 49.1%

$S_{M1} = 73.7\%$

$T_g = 0.25 s$

$S_{M1} = (F_v)(S_1)$

Fv = 1.50

$S_{D1} = 49.1\%$

$C_s = 0.122$

**3RD FLOOR DIAPHRAGM LOADING:**

W (ROOF) =

LENGTH	WIDTH	LOAD	TOTAL
49	26	15.0	19110
35	10	15.0	5250
16	5	15.0	1200
25	1	15.0	375
		15.0	0

Area = 1729 Sub-Total= 25935

W (FLOOR) =

LENGTH	WIDTH	LOAD	TOTAL
		15.0	0
		15.0	0
		15.0	0
		15.0	0
		15.0	0

Area = 0 Sub-Total= 0

W (WALL) =

LENGTH	TRIB. HT.	LOAD	TOTAL
100	4.5	10.0	4500
120	4.5	10.0	5400
		10.0	0
		10.0	0
		10.0	0

Area = 990 Sub-Total= 9900

TOTAL = 35835 lb

**2ND FLOOR DIAPHRAGM LOADING:**

W (ROOF) =

LENGTH	WIDTH	LOAD	TOTAL
		15.0	0
		15.0	0
		15.0	0
		15.0	0
		15.0	0

Area = 0 Sub-Total= 0

W (FLOOR) =

LENGTH	WIDTH	LOAD	TOTAL
1305	1	15.0	19575
		15.0	0
		15.0	0
		15.0	0
		15.0	0

Area = 1305 Sub-Total= 19575

W (WALL) =

LENGTH	TRIB. HT.	LOAD	TOTAL
100	8.5	10.0	8500
120	8.5	10.0	10200
		10.0	0
		10.0	0
		10.0	0

Area = 1870 Sub-Total= 18700

TOTAL = 38275 lb

**1ST FLOOR DIAPHRAGM LOADING:**

W (ROOF) =

LENGTH	WIDTH	LOAD	TOTAL
		15.0	0
		15.0	0
		15.0	0
		15.0	0
		15.0	0

Area = 0 Sub-Total= 0

W (FLOOR) =

LENGTH	WIDTH	LOAD	TOTAL
1332	1	15.0	19980
		15.0	0
		15.0	0
		15.0	0
		15.0	0

Area = 1332 Sub-Total= 19980

W (WALL) =

LENGTH	TRIB. HT.	LOAD	TOTAL
100	4	10.0	4000
		10.0	0
		10.0	0
		10.0	0
		10.0	0

Area = 400 Sub-Total= 4000

TOTAL = 23980 lb

V (3RD FLOOR) = .122 x 35835 lb = 4359 lbs

V (2ND FLOOR) = .122 x 38275 lb = 4656 lbs

V (1ST FLOOR) = .122 x 23980 lb = 2917 lbs

**REDISTRIBUTE:**

$\Sigma V \times \rho$	height	$\Sigma V \times \text{height}$
4359 lb	21.5	93725
4656 lb	12	55873
2917 lb	2	5834

TOTAL = 11933 lb

TOTAL = 155433

$E (3RD) = \frac{\Sigma V \times \text{height} \times \Sigma V \text{ TOTAL}}{\Sigma V \times \text{height TOTAL}} = 7195 \text{ lbs}$

$E (2ND) = \frac{\Sigma V \times \text{height} \times \Sigma V \text{ TOTAL}}{\Sigma V \times \text{height TOTAL}} = 4289 \text{ lbs}$

$E (1ST) = \frac{\Sigma V \times \text{height} \times \Sigma V \text{ TOTAL}}{\Sigma V \times \text{height TOTAL}} = 448 \text{ lbs}$

SUMMARY:

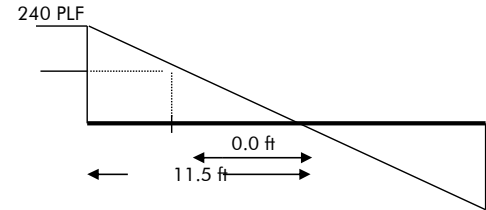
	WIND (front-rear)	WIND (left-right)	SEISMIC
$\Sigma V$ (3RD) =	3875 lbs	3295 lbs	8634 lbs
$\Sigma V$ (2ND) =	6519 lbs	5411 lbs	5147 lbs
$\Sigma V$ (MAIN) =	4213 lbs	2350 lbs	537 lbs
TOTAL =	14607 lbs	11056 lbs	14319 lbs

DIAPHRAGM SHEAR:

Total diaphragm length = 45.0 ft      Sub-diaphragm length = 45.0 ft  
 Diaphragm width = 23.0 ft       $\Sigma V$  (3RD) = 8,634 lbs

$$v = \frac{\Sigma V(\text{roof})}{(2)(\text{width})} = \frac{8634 \text{ lb}}{46 \text{ ft}} = 188 \text{ PLF}$$

IBC Table 2306.3.1       $\longrightarrow$       240 PLF



USE 15/32 CDX ROOF SHEATHING OR 3/4 T&G CDX SUBFLOORING w/8d AT 6 in o/c(PANEL EDGE), END 8d AT 12in o/c(PANEL FIELD)

CHORD:

Sub-diaphragm length = 45.0 ft      Total-diaphragm length = 45.0 ft  
 Sub-diaphragm width = 23.0 ft

$$T = \frac{M}{B} = \frac{\Sigma V \times (\text{diaphragm length})}{8 \times (\text{diaphragm width})} = \frac{8634 \times 45 \text{ ft}}{8 \times 23 \text{ ft}} = 2112 \text{ lbs}$$

Top Plate Size: 2x6      Species/Grade: HF #2

Area = 8.25 in<sup>2</sup>       $F_t = 525 \text{ psi}$   
 Load duration ( $C_D$ ) = 1.33       $T_{\text{allowable}} = \text{Area} \times C_D \times F_t = 5,761 \text{ lbs}$

Since T allowable is greater than T applied, OK.

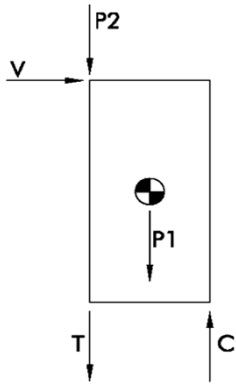
SHEAR CAPACITY OF 10d COMMON NAIL = 102 lbs       $102 \times C_d \times p = 136 \text{ lbs}$       2018 NDS

# OF NAILS PER 4 FT SPLICE =  $\frac{2112 \text{ lbs}}{136 \text{ lbs}} = 16$

USE 2x6 HF #2 TOP PLATE W/ (2) 10d NAILS @ 6 in O/C.



### Lateral Calculation Key



V = Shear, plf  
 H = Height of shearwall  
 L = Length of shearwall  
 P1 = Weight of shearwall and connected framing  
 P2 = Weight of adjacent wall

$T = V \times H - 0.5P1 - P2$  = Tension reaction to be resisted by holdown  
 $C = V \times H + 0.5P1$  = Compression reaction

### ASD Basic Load Combinations

For calculation of tension and compression forces in compliance with ASCE 7-16 2.4.1

#### Tension Equations (Uplift)

7.  $0.6D + W$

8.  $(0.6 - 0.14S_{Ds})D + E$   $\longrightarrow$   $0.44 D + E$

\*8.  $(0.6 - 0.14S_{Ds})D + 2.5 E$   $\longrightarrow$   $0.44 D + 2.5 E$

#### Compression Equations

5.  $D + W$

5.  $(1 + 0.14S_{Ds})D + E$   $\longrightarrow$   $1.16 D + E$

6.  $D + 0.75W + 0.75L + 0.75S$

6.  $(1.0 + 0.105S_{Ds})D + 0.75E + 0.75L + 0.75S$   $\longrightarrow$   $1.12 D + 0.75 E + 0.75 L + 0.75 S$

\*5.  $(1 + 0.14S_{Ds})D + 2.5E$   $\longrightarrow$   $1.16 D + 2.5 E$

\*6.  $(1.0 + 0.105S_{Ds})D + 1.875E + 0.75L + 0.75S$   $\longrightarrow$   $1.12 D + 1.875 E + 0.75 L + 0.75 S$

\* Equations include overstrength factor.

Note: The 0.7 factor for Earthquake loading has already been incorporated into the calculation of the lateral design force  $E_h$ , but not  $E_v$ . Therefore this factor has been omitted from equations 5, 6 and 8 where appropriate.

UPPER FL. REAR (MASTER SUITE)

SHEARWALL

WIND

SEISMIC

**Floor Info**  
**Upper** Floor Level, e.g. Upper, Main, Lower  
**Lt-Rt** Load Direction, e.g. Left-Right, Front-Rear  
 (For Left Wall, Use Front-Rear Load Direction)  
**CDX** Sheathing type  
 Values in accordance with AF&PA SDPWS-2015  
**Roof** Resisting Dead Load  
 (e.g. Roof, Upper Floor, Main Floor)  
**21.00 ft** Total Length of Shearwalls

V(from upper)= 3295 lb 8634 lb  
 V(from main)= 0 lb 0 lb  
 V(from lower)= 0 lb 0 lb  
 Σ (Wind) = 3,295 lb Σ (Smc) = 8,634 lb  
 v = 41 PLF v = 108 PLF

Tributary Width (Upper Floor)  
**10.0** tributary width  
**38.0** total width  
 Tributary Width (Main Floor)  
**1.0** tributary width  
**2.0** total width  
 Tributary Width (Lower Floor)  
**1.0** tributary width  
**2.0** total width

Tributary Area (Upper Floor)  
**10.0** tributary area  
**38.0** total area  
 Tributary Area (Main Floor)  
**1.0** tributary area  
**2.0** total area  
 Tributary Area (Lower Floor)  
**1.0** tributary area  
**2.0** total area

Height of Shearwall = **8.5 ft**  
 Length of Shearwall = **3.5 ft**

Weight of Shearwall = **10.0 lbs**  
 Tributary width for dead load = **1.0 ft**  
 Length of adjoining wall = **1.0 ft**

Aspect Ratio OK

Use alternate R factor for seismic? **No**

SDPWS, Table 4.3A → (2w/h) x 0.93 x 242 = 185 PLF

USE **SW6**

Seismic controls shearwall design

C<sub>TOTAL</sub> = (floor above) + (this floor) = **644 lbs** = 644 lbs Seismic controls  
 T<sub>TOTAL</sub> = (floor above) + (this floor) = **798 lbs** = 798 lbs Load case 8 controls - Seismic

Seismic controls holdown design

Where overstrength factor is applicable, use this value for E in equations 5, 6, and 8: **E = 920 lbs**

USE SIMPSON DESIGNED HOLDOWN: **CS14**  
 OR AT FOUNDATION / INTERIOR WALLS USE: **LSTHD8/RJ**

UPPER FL. FRONT (BDRM 2 & 3)

SHEARWALL

WIND

SEISMIC

**Floor Info**  
**Upper** Floor Level, e.g. Upper, Main, Lower  
**Lt-Rt** Load Direction, e.g. Left-Right, Front-Rear  
 (For Left Wall, Use Front-Rear Load Direction)  
**CDX** Sheathing type  
 Values in accordance with AF&PA SDPWS-2015  
**Roof** Resisting Dead Load  
 (e.g. Roof, Upper Floor, Main Floor)  
**15.00 ft** Total Length of Shearwalls

V(from upper)= 3295 lb 8634 lb  
 V(from main)= 0 lb 0 lb  
 V(from lower)= 0 lb 0 lb  
 Σ (Wind) = 3,295 lb Σ (Smc) = 8,634 lb  
 v = 64 PLF v = 167 PLF

Tributary Width (Upper Floor)  
**11.0** tributary width  
**38.0** total width  
 Tributary Width (Main Floor)  
**1.0** tributary width  
**2.0** total width  
 Tributary Width (Lower Floor)  
**1.0** tributary width  
**2.0** total width

Tributary Area (Upper Floor)  
**11.0** tributary area  
**38.0** total area  
 Tributary Area (Main Floor)  
**1.0** tributary area  
**2.0** total area  
 Tributary Area (Lower Floor)  
**1.0** tributary area  
**2.0** total area

Height of Shearwall = **8.5 ft**  
 Length of Shearwall = **3.5 ft**

Weight of Shearwall = **10.0 lbs**  
 Tributary width for dead load = **1.0 ft**  
 Length of adjoining wall = **1.0 ft**

Aspect Ratio OK

Use alternate R factor for seismic? **No**

SDPWS, Table 4.3A → (2w/h) x 0.93 x 242 = 185 PLF

USE **SW6**

Seismic controls shearwall design

C<sub>TOTAL</sub> = (floor above) + (this floor) = **991 lbs** = 991 lbs Seismic controls  
 T<sub>TOTAL</sub> = (floor above) + (this floor) = **1295 lbs** = 1295 lbs Load case 8 controls - Seismic

Seismic controls holdown design

Where overstrength factor is applicable, use this value for E in equations 5, 6, and 8: **E = 1416 lbs**

USE SIMPSON DESIGNED HOLDOWN: **CS14**  
 OR AT FOUNDATION / INTERIOR WALLS USE: **LSTHD8/RJ**

UPPER FL. LEFT (BDRM 2, MASTER SUITE)

SHEARWALL

WIND

SEISMIC

**Floor Info**  
**Upper** Floor Level, e.g. Upper, Main, Lower  
**Fi-Rr** Load Direction, e.g. Left-Right, Front-Rear  
 (For Left Wall, Use Front-Rear Load Direction)  
**CDX** Sheathing type  
 Values in accordance with AF&PA SDPWS-2015  
**Roof** Resisting Dead Load  
 (e.g. Roof, Upper Floor, Main Floor)  
**29.00 ft** Total Length of Shearwalls

V(from upper)= 3875 lb 8634 lb  
 V(from main)= 0 lb 0 lb  
 V(from lower)= 0 lb 0 lb  
 Σ (Wind) = 3,875 lb Σ (Smc) = 8,634 lb  
 v = 67 PLF v = 149 PLF

Tributary Width (Upper Floor)  
**1.0** tributary width  
**2.0** total width  
 Tributary Width (Main Floor)  
**1.0** tributary width  
**2.0** total width  
 Tributary Width (Lower Floor)  
**1.0** tributary width  
**2.0** total width

Tributary Area (Upper Floor)  
**1.0** tributary area  
**2.0** total area  
 Tributary Area (Main Floor)  
**1.0** tributary area  
**2.0** total area  
 Tributary Area (Lower Floor)  
**1.0** tributary area  
**2.0** total area

Height of Shearwall = **8.5 ft**  
 Length of Shearwall = **29.0 ft**

Weight of Shearwall = **10.0 lbs**  
 Tributary width for dead load = **2.0 ft**  
 Length of adjoining wall = **1.0 ft**

Aspect Ratio OK

Use alternate R factor for seismic? **No**

SDPWS, Table 4.3A → 0.93 x 242 = 225 PLF

USE **SW6**

Seismic controls shearwall design

C<sub>TOTAL</sub> = (floor above) + (this floor) = **886 lbs** = 886 lbs Seismic controls  
 T<sub>TOTAL</sub> = (floor above) + (this floor) = **478 lbs** = 478 lbs Load case 8 controls - Seismic

Seismic controls holdown design

Where overstrength factor is applicable, use this value for E in equations 5, 6, and 8: **E = 1265 lbs**

NO HOLDOWNS REQUIRED **OK**

UPPER FL. RIGHT (BED 3)

SHEARWALL

WIND

SEISMIC

Floor Info

Upper	Floor Level, e.g. Upper, Main, Lower
Fr-Rr	Load Direction, e.g. Left-Right, Front-Rear (For Left Wall, Use Front-Rear Load Direction)
CDX	Sheathing type Values in accordance with AF&PA SDPWS-2015
Roof	Resisting Dead Load (e.g. Roof, Upper Floor, Main Floor)
18.00 ft	Total Length of Shearwalls

V(from upper)=	3875 lb	8634 lb
V(from main)=	0 lb	0 lb
V(from lower)=	0 lb	0 lb
Σ (Wind) =	3,875 lb	Σ (Smc) = 8,634 lb
v =	108 PLF	v = 240 PLF

Tributary Width (Upper Floor)	
1.0	tributary width
2.0	total width
Tributary Width (Main Floor)	
1.0	tributary width
2.0	total width
Tributary Width (Lower Floor)	
1.0	tributary width
2.0	total width
Height of Shearwall =	8.5 ft
Length of Shearwall =	18.0 ft
Aspect Ratio OK	
Use alternate R factor for seismic?	No

Tributary Area (Upper Floor)	
1.0	tributary area
2.0	total area
Tributary Area (Main Floor)	
1.0	tributary area
2.0	total area
Tributary Area (Lower Floor)	
1.0	tributary area
2.0	total area
Weight of Shearwall =	10.0 lbs
Tributary width for dead load =	2.0 ft
Length of adjoining wall =	1.0 ft

SDPWS, Table 4.3A → 0.93 x 353 = 328 PLF

USE SW4

Seismic controls shearwall design

C <sub>TOTAL</sub> =	(floor above) + (this floor) =		+ 1427 lbs	= 1427 lbs	Seismic controls
T <sub>TOTAL</sub> =	(floor above) + (this floor) =		+ 1531 lbs	= 1531 lbs	Load case 8 controls - Seismic

Seismic controls holdown design

Where overstrength factor is applicable, use this value for E in equations 5, 6, and 8: E = 2039 lbs

USE SIMPSON DESIGNED HOLDOWN: CS14  
OR AT FOUNDATION / INTERIOR WALLS USE: LSTHD8/RJ

MAIN FL. REAR (GUEST/DEN,KITCHEN)

SHEARWALL

WIND

SEISMIC

Floor Info

Main	Floor Level, e.g. Upper, Main, Lower
Lt-Rt	Load Direction, e.g. Left-Right, Front-Rear (For Left Wall, Use Front-Rear Load Direction)
CDX	Sheathing type Values in accordance with AF&PA SDPWS-2015
U/FL	Resisting Dead Load (e.g. Roof, Upper Floor, Main Floor)
16.00 ft	Total Length of Shearwalls

V(from upper)=	3295 lb	8634 lb
V(from main)=	5411 lb	5147 lb
V(from lower)=	0 lb	0 lb
Σ (Wind) =	8,706 lb	Σ (Smc) = 13,782 lb
v =	143 PLF	v = 226 PLF

Tributary Width (Upper Floor)	
10.0	tributary width
38.0	total width
Tributary Width (Main Floor)	
11.0	tributary width
42.0	total width
Tributary Width (Lower Floor)	
1.0	tributary width
2.0	total width
Height of Shearwall =	9.0 ft
Length of Shearwall =	5.0 ft
Aspect Ratio OK	
Use alternate R factor for seismic?	No

Tributary Area (Upper Floor)	
10.0	tributary area
38.0	total area
Tributary Area (Main Floor)	
11.0	tributary area
42.0	total area
Tributary Area (Lower Floor)	
1.0	tributary area
2.0	total area
Weight of Shearwall =	10.0 lbs
Tributary width for dead load =	4.0 ft
Length of adjoining wall =	3.0 ft

SDPWS, Table 4.3A → 0.93 x 353 = 328 PLF

USE SW4

Seismic controls shearwall design

C <sub>TOTAL</sub> =	(floor above) + (this floor) =	644	+ 1425 lbs	= 2069 lbs	Seismic controls
T <sub>TOTAL</sub> =	(floor above) + (this floor) =	794	+ 1672 lbs	= 2466 lbs	Load case 8 controls - Seismic

Seismic controls holdown design

Where overstrength factor is applicable, use this value for E in equations 5, 6, and 8: E = 2036 lbs

USE SIMPSON DESIGNED HOLDOWN: CS14  
OR AT FOUNDATION / INTERIOR WALLS USE: STHD10/RJ

MAIN FLOOR MID (GARAGE, DINING)

SHEARWALL

WIND

SEISMIC

Floor Info

Main	Floor Level, e.g. Upper, Main, Lower
Lt-Rt	Load Direction, e.g. Left-Right, Front-Rear (For Left Wall, Use Front-Rear Load Direction)
CDX	Sheathing type Values in accordance with AF&PA SDPWS-2015
U/FL	Resisting Dead Load (e.g. Roof, Upper Floor, Main Floor)
20.00 ft	Total Length of Shearwalls

V(from upper)=	3295 lb	8634 lb
V(from main)=	5411 lb	5147 lb
V(from lower)=	0 lb	0 lb
Σ (Wind) =	8,706 lb	Σ (Smc) = 13,782 lb
v =	218 PLF	v = 345 PLF

Tributary Width (Upper Floor)	
1.0	tributary width
2.0	total width
Tributary Width (Main Floor)	
1.0	tributary width
2.0	total width
Tributary Width (Lower Floor)	
1.0	tributary width
2.0	total width
Height of Shearwall =	9.0 ft
Length of Shearwall =	9.0 ft
Aspect Ratio OK	
Use alternate R factor for seismic?	No

Tributary Area (Upper Floor)	
1.0	tributary area
2.0	total area
Tributary Area (Main Floor)	
1.0	tributary area
2.0	total area
Tributary Area (Lower Floor)	
1.0	tributary area
2.0	total area
Weight of Shearwall =	10.0 lbs
Tributary width for dead load =	1.0 ft
Length of adjoining wall =	1.0 ft

SDPWS, Table 4.3A → 0.93 x 456 = 424 PLF

USE SW3

Seismic controls shearwall design

C <sub>TOTAL</sub> =	(floor above) + (this floor) =		+ 2171 lbs	= 2171 lbs	Seismic controls
T <sub>TOTAL</sub> =	(floor above) + (this floor) =		+ 2846 lbs	= 2846 lbs	Load case 8 controls - Seismic

Seismic controls holdown design

Where overstrength factor is applicable, use this value for E in equations 5, 6, and 8: E = 3101 lbs

USE SIMPSON DESIGNED HOLDOWN: MST48  
OR AT FOUNDATION / INTERIOR WALLS USE: STHD14/RJ

MAIN FL. FRONT (GARAGE)

SHEARWALL

WIND

SEISMIC

**Floor Info**  
**Main** Floor Level, e.g. Upper, Main, Lower  
**Lt-Rt** Load Direction, e.g. Left-Right, Front-Rear  
 (For Left Wall, Use Front-Rear Load Direction)  
**CDX** Sheathing type  
 Values in accordance with AF&PA SDPWS-2015  
**U/FL** Resisting Dead Load  
 (e.g. Roof, Upper Floor, Main Floor)  
**9.00 ft** Total Length of Shearwalls  
 $V(\text{from upper}) = 3295 \text{ lb}$        $8634 \text{ lb}$   
 $V(\text{from main}) = 5411 \text{ lb}$        $5147 \text{ lb}$   
 $V(\text{from lower}) = 0 \text{ lb}$        $0 \text{ lb}$   
 $\Sigma (\text{Wind}) = 8,706 \text{ lb}$        $\Sigma (\text{Smc}) = 13,782 \text{ lb}$   
 $v = 249 \text{ PLF}$        $v = 414 \text{ PLF}$

Tributary Width (Upper Floor)  
**11.0** tributary width  
**38.0** total width  
 Tributary Width (Main Floor)  
**10.0** tributary width  
**42.0** total width  
 Tributary Width (Lower Floor)  
**1.0** tributary width  
**2.0** total width  
 Height of Shearwall = **4.0 ft**  
 Length of Shearwall = **1.8 ft**  
 Aspect Ratio OK  
 Use alternate R factor for seismic? **No**

Tributary Area (Upper Floor)  
**11.0** tributary area  
**38.0** total area  
 Tributary Area (Main Floor)  
**10.0** tributary area  
**42.0** total area  
 Tributary Area (Lower Floor)  
**1.0** tributary area  
**2.0** total area  
 Weight of Shearwall = **10.0 lbs**  
 Tributary width for dead load = **1.0 ft**  
 Length of adjoining wall = **1.0 ft**

3x framing required per IBC

SDPWS, Table 4.3A → (2w/h) x 0.93 x 595 = 498 PLF

USE **SW2**

Seismic controls shearwall design

$C_{TOTAL} =$  (floor above) + (this floor) = **1159 lbs** = 1159 lbs      Wind controls  
 $T_{TOTAL} =$  (floor above) + (this floor) = **1609 lbs** = 1609 lbs      Load case 8 controls - Seismic

Wind controls holdown design

Where overstrength factor is applicable, use this value for E in equations 5, 6, and 8: **E = 1656 lbs**

USE SIMPSON DESIGNED HOLDOWN: **CS14**  
 OR AT FOUNDATION / INTERIOR WALLS USE: **LSTHD8/RJ**

MAIN FL. LEFT (GARAGE, GUEST)

SHEARWALL

WIND

SEISMIC

**Floor Info**  
**Main** Floor Level, e.g. Upper, Main, Lower  
**Lt-Rt** Load Direction, e.g. Left-Right, Front-Rear  
 (For Left Wall, Use Front-Rear Load Direction)  
**CDX** Sheathing type  
 Values in accordance with AF&PA SDPWS-2015  
**U/FL** Resisting Dead Load  
 (e.g. Roof, Upper Floor, Main Floor)  
**39.00 ft** Total Length of Shearwalls  
 $V(\text{from upper}) = 3875 \text{ lb}$        $8634 \text{ lb}$   
 $V(\text{from main}) = 6519 \text{ lb}$        $5147 \text{ lb}$   
 $V(\text{from lower}) = 0 \text{ lb}$        $0 \text{ lb}$   
 $\Sigma (\text{Wind}) = 10,394 \text{ lb}$        $\Sigma (\text{Smc}) = 13,782 \text{ lb}$   
 $v = 133 \text{ PLF}$        $v = 177 \text{ PLF}$

Tributary Width (Upper Floor)  
**1.0** tributary width  
**2.0** total width  
 Tributary Width (Main Floor)  
**1.0** tributary width  
**2.0** total width  
 Tributary Width (Lower Floor)  
**1.0** tributary width  
**2.0** total width  
 Height of Shearwall = **9.0 ft**  
 Length of Shearwall = **17.0 ft**  
 Aspect Ratio OK  
 Use alternate R factor for seismic? **No**

Tributary Area (Upper Floor)  
**1.0** tributary area  
**2.0** total area  
 Tributary Area (Main Floor)  
**1.0** tributary area  
**2.0** total area  
 Tributary Area (Lower Floor)  
**1.0** tributary area  
**2.0** total area  
 Weight of Shearwall = **10.0 lbs**  
 Tributary width for dead load = **1.0 ft**  
 Length of adjoining wall = **1.0 ft**

SDPWS, Table 4.3A → 0.93 x 242 = 225 PLF

USE **SW6**

Seismic controls shearwall design

$C_{TOTAL} =$  (floor above) + (this floor) = **886** + 1199 lbs = 2085 lbs      Wind controls  
 $T_{TOTAL} =$  (floor above) + (this floor) = **478** + 1149 lbs = 1627 lbs      Load case 8 controls - Seismic

Seismic controls holdown design

Where overstrength factor is applicable, use this value for E in equations 5, 6, and 8: **E = 1590 lbs**

USE SIMPSON DESIGNED HOLDOWN: **CS14**  
 OR AT FOUNDATION / INTERIOR WALLS USE: **LSTHD8/RJ**

MAIN FL. RIGHT (DINING, KITCHEN)

SHEARWALL

WIND

SEISMIC

**Floor Info**  
**Main** Floor Level, e.g. Upper, Main, Lower  
**Lt-Rt** Load Direction, e.g. Left-Right, Front-Rear  
 (For Left Wall, Use Front-Rear Load Direction)  
**CDX** Sheathing type  
 Values in accordance with AF&PA SDPWS-2015  
**U/FL** Resisting Dead Load  
 (e.g. Roof, Upper Floor, Main Floor)  
**15.00 ft** Total Length of Shearwalls  
 $V(\text{from upper}) = 3875 \text{ lb}$        $8634 \text{ lb}$   
 $V(\text{from main}) = 6519 \text{ lb}$        $5147 \text{ lb}$   
 $V(\text{from lower}) = 0 \text{ lb}$        $0 \text{ lb}$   
 $\Sigma (\text{Wind}) = 10,394 \text{ lb}$        $\Sigma (\text{Smc}) = 13,782 \text{ lb}$   
 $v = 346 \text{ PLF}$        $v = 459 \text{ PLF}$

Tributary Width (Upper Floor)  
**1.0** tributary width  
**2.0** total width  
 Tributary Width (Main Floor)  
**1.0** tributary width  
**2.0** total width  
 Tributary Width (Lower Floor)  
**1.0** tributary width  
**2.0** total width  
 Height of Shearwall = **9.5 ft**  
 Length of Shearwall = **5.0 ft**  
 Aspect Ratio OK  
 Use alternate R factor for seismic? **No**

Tributary Area (Upper Floor)  
**1.0** tributary area  
**2.0** total area  
 Tributary Area (Main Floor)  
**1.0** tributary area  
**2.0** total area  
 Tributary Area (Lower Floor)  
**1.0** tributary area  
**2.0** total area  
 Weight of Shearwall = **10.0 lbs**  
 Tributary width for dead load = **1.0 ft**  
 Length of adjoining wall = **1.0 ft**

SDPWS, Table 4.3A → 0.93 x 595 = 553 PLF

USE **SW2**

Seismic controls shearwall design

$C_{TOTAL} =$  (floor above) + (this floor) = **1427** + 3292 lbs = 4719 lbs      Wind controls  
 $T_{TOTAL} =$  (floor above) + (this floor) = **1531** + 4194 lbs = 5725 lbs      Load case 8 controls - Seismic

Seismic controls holdown design

Where overstrength factor is applicable, use this value for E in equations 5, 6, and 8: **E = 4364 lbs**

USE SIMPSON DESIGNED HOLDOWN: **HDU11-SDS2.5**

MST72

UPPER FL. MID (MASTER CLOSET, LAUNDRY)

SHEARWALL

WIND

SEISMIC

Floor Info

**Upper** Floor Level, e.g. Upper, Main, Lower

**Li-Rt** Load Direction, e.g. Left-Right, Front-Rear  
(For Left Wall, Use Front-Rear Load Direction)

**CDX** Sheathing type  
Values in accordance with AF&PA SDPWS-2015

**Roof** Resisting Dead Load  
(e.g. Roof, Upper Floor, Main Floor)

**23.00 ft** Total Length of Shearwalls

V(from upper)=	3295 lb	8634 lb
V(from main)=	0 lb	0 lb
V(from lower)=	0 lb	0 lb
Σ (Wind) =	3,295 lb	Σ (Smc) = 8,634 lb
v =	72 PLF	v = 188 PLF

Tributary Width (Upper Floor)	
1.0	tributary width
2.0	total width
Tributary Width (Main Floor)	
1.0	tributary width
2.0	total width
Tributary Width (Lower Floor)	
1.0	tributary width
2.0	total width
Height of Shearwall =	8.5 ft
Length of Shearwall =	11.0 ft

Tributary Area (Upper Floor)	
1.0	tributary area
2.0	total area
Tributary Area (Main Floor)	
1.0	tributary area
2.0	total area
Tributary Area (Lower Floor)	
1.0	tributary area
2.0	total area
Weight of Shearwall =	10.0 lbs
Tributary width for dead load =	1.0 ft
Length of adjoining wall =	1.0 ft

Use alternate R factor for seismic? **No**

SDPWS, Table 4.3A → 0.93 x 242 = 225 PLF

USE **SW6**

*Seismic controls shearwall design*

C <sub>TOTAL</sub> =	(floor above) + (this floor) =		+ 1117 lbs	= 1117 lbs	Seismic controls
T <sub>TOTAL</sub> =	(floor above) + (this floor) =		+ 1308 lbs	= 1308 lbs	Load case 8 controls - Seismic

*Seismic controls holdown design*

Where overstrength factor is applicable, use this value for E in equations 5, 6, and 8: E = 1595 lbs

USE SIMPSON DESIGNED HOLDOWN: **CS14**  
OR AT FOUNDATION / INTERIOR WALLS USE: **LSTHD8/RJ**

MAIN FL. FRONT (DEN)

SHEARWALL

WIND

SEISMIC

Floor Info

**Main** Floor Level, e.g. Upper, Main, Lower

**Li-Rt** Load Direction, e.g. Left-Right, Front-Rear  
(For Left Wall, Use Front-Rear Load Direction)

**CDX** Sheathing type  
Values in accordance with AF&PA SDPWS-2015

**U/FL** Resisting Dead Load  
(e.g. Roof, Upper Floor, Main Floor)

**9.00 ft** Total Length of Shearwalls

V(from upper)=	3295 lb	8634 lb
V(from main)=	5411 lb	5147 lb
V(from lower)=	0 lb	0 lb
Σ (Wind) =	8,706 lb	Σ (Smc) = 13,782 lb
v =	249 PLF	v = 428 PLF

Tributary Width (Upper Floor)	
11.0	tributary width
38.0	total width
Tributary Width (Main Floor)	
10.0	tributary width
42.0	total width
Tributary Width (Lower Floor)	
1.0	tributary width
2.0	total width
Height of Shearwall =	9.0 ft
Length of Shearwall =	5.0 ft

Tributary Area (Upper Floor)	
11.0	tributary area
38.0	total area
Tributary Area (Main Floor)	
11.0	tributary area
42.0	total area
Tributary Area (Lower Floor)	
1.0	tributary area
2.0	total area
Weight of Shearwall =	10.0 lbs
Tributary width for dead load =	1.0 ft
Length of adjoining wall =	1.0 ft

Use alternate R factor for seismic? **No**

SDPWS, Table 4.3A → 0.93 x 595 = 553 PLF

USE **SW2**

*Seismic controls shearwall design*

C <sub>TOTAL</sub> =	(floor above) + (this floor) =	991	+ 2693 lbs	= 3684 lbs	Seismic controls
T <sub>TOTAL</sub> =	(floor above) + (this floor) =	1295	+ 3685 lbs	= 4980 lbs	Load case 8 controls - Seismic

*Seismic controls holdown design*

Where overstrength factor is applicable, use this value for E in equations 5, 6, and 8: E = 3848 lbs

USE SIMPSON DESIGNED HOLDOWN: **MST72**  
OR AT FOUNDATION / INTERIOR WALLS USE: **HDU8-SDS2.5**

LOW FL. REAR

SHEARWALL

WIND

SEISMIC

Floor Info

**Lower** Floor Level, e.g. Upper, Main, Lower

**Li-Rt** Load Direction, e.g. Left-Right, Front-Rear  
(For Left Wall, Use Front-Rear Load Direction)

**CDX** Sheathing type  
Values in accordance with AF&PA SDPWS-2015

**M/FL** Resisting Dead Load  
(e.g. Roof, Upper Floor, Main Floor)

**45.00 ft** Total Length of Shearwalls

V(from upper)=	3295 lb	8634 lb
V(from main)=	5411 lb	5147 lb
V(from lower)=	2350 lb	537 lb
Σ (Wind) =	11,056 lb	Σ (Smc) = 14,319 lb
v =	77 PLF	v = 86 PLF

Tributary Width (Upper Floor)	
10.0	tributary width
38.0	total width
Tributary Width (Main Floor)	
11.0	tributary width
42.0	total width
Tributary Width (Lower Floor)	
1.0	tributary width
2.0	total width
Height of Shearwall =	4.0 ft
Length of Shearwall =	45.0 ft

Tributary Area (Upper Floor)	
10.0	tributary area
38.0	total area
Tributary Area (Main Floor)	
11.0	tributary area
42.0	total area
Tributary Area (Lower Floor)	
1.0	tributary area
2.0	total area
Weight of Shearwall =	10.0 lbs
Tributary width for dead load =	1.0 ft
Length of adjoining wall =	1.0 ft

Use alternate R factor for seismic? **No**

SDPWS, Table 4.3A → 0.93 x 260 = 242 PLF

USE **SW6**

*Seismic controls shearwall design*

C <sub>TOTAL</sub> =	(floor above) + (this floor) =		+ 308 lbs	= 308 lbs	Wind controls
T <sub>TOTAL</sub> =	(floor above) + (this floor) =		+ -225 lbs	= -225 lbs	Load case 8 controls - Seismic

*Seismic controls holdown design*

Where overstrength factor is applicable, use this value for E in equations 5, 6, and 8: E = 346 lbs

NO HOLDOWNS REQUIRED **OK**

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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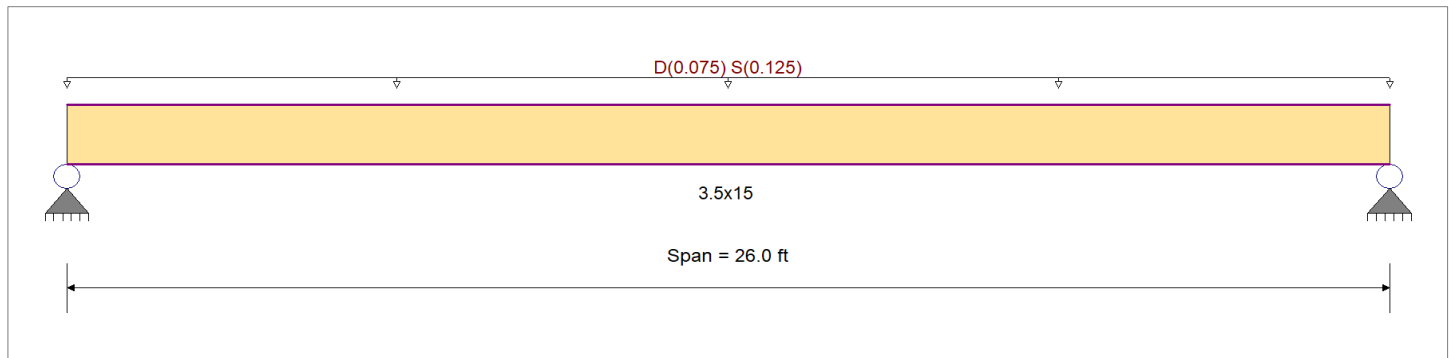
**DESCRIPTION:** HM#1 (REACTIONS ONLY)

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Species : DF/DF	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
Wood Grade : 24F-V4	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 5.0 ft, (ROOF)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.595</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.233</b> : 1
Section used for this span		<b>3.5x15</b>	Section used for this span		<b>3.5x15</b>
fb: Actual	=	1,633.05psi	fv: Actual	=	71.06 psi
Fb: Allowable	=	2,744.77psi	Fv: Allowable	=	304.75 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	13.000ft	Location of maximum on span	=	24.766 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.730 in	Ratio =	<b>427</b> >=360	Span: 1 : S Only
Max Upward Transient Deflection		0 in	Ratio =	<b>0</b> <360	n/a
Max Downward Total Deflection		1.234 in	Ratio =	<b>252</b> >=240	Span: 1 : +D+S
Max Upward Total Deflection		0 in	Ratio =	<b>0</b> <240	n/a

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values							
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v				
D Only	Length = 26.0 ft	1	0.311	0.122	0.90	0.994	1.00	1.00	1.00	1.00	1.00	1.00	7.30	667.34	2148.08	0.00	0.00	0.00	1.02	29.04	238.50
+D+S	Length = 26.0 ft	1	0.595	0.233	1.15	0.994	1.00	1.00	1.00	1.00	1.00	1.00	17.86	1,633.05	2744.77	0.00	0.00	0.00	2.49	71.06	304.75
+D+0.750S	Length = 26.0 ft	1	0.507	0.199	1.15	0.994	1.00	1.00	1.00	1.00	1.00	1.00	15.22	1,391.62	2744.77	0.00	0.00	0.00	2.12	60.56	304.75
+0.60D	Length = 26.0 ft	1	0.105	0.041	1.60	0.994	1.00	1.00	1.00	1.00	1.00	1.00	4.38	400.40	3818.80	0.00	0.00	0.00	0.61	17.42	424.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	1.2338	13.095		0.0000	0.000

Project Title:  
Engineer:  
Project ID:  
Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: HM#1 (REACTIONS ONLY)**

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.748	2.748
Overall MINimum	1.625	1.625
D Only	1.123	1.123
+D+S	2.748	2.748
+D+0.750S	2.342	2.342
+0.60D	0.674	0.674
S Only	1.625	1.625



## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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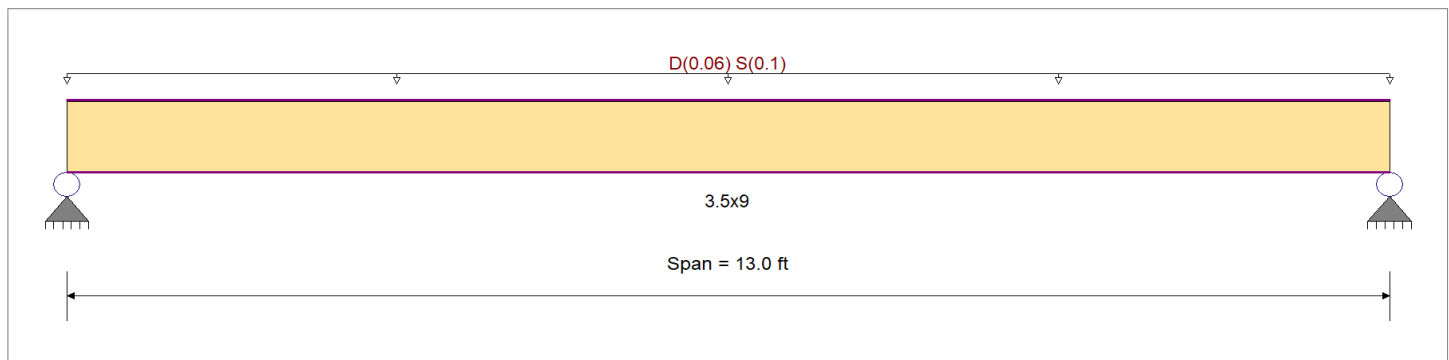
**DESCRIPTION:** HM#2 (REACTIONS ONLY)

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Species : DF/DF	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
Wood Grade : 24F-V4	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 4.0 ft, (ROOF)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.324</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.151</b> : 1
Section used for this span		<b>3.5x9</b>	Section used for this span		<b>3.5x9</b>
fb: Actual	=	895.04psi	fv: Actual	=	45.98 psi
Fb: Allowable	=	2,760.00psi	Fv: Allowable	=	304.75 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	6.500ft	Location of maximum on span	=	12.288 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.169 in	Ratio =	<b>923</b> >=360	Span: 1 : S Only
Max Upward Transient Deflection		0 in	Ratio =	<b>0</b> <360	n/a
Max Downward Total Deflection		0.282 in	Ratio =	<b>553</b> >=240	Span: 1 : +D+S
Max Upward Total Deflection		0 in	Ratio =	<b>0</b> <240	n/a

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 13.0 ft	1	0.166	0.077	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.41	358.53	2160.00	0.00	0.00	0.00	0.00	0.00	238.50
+D+S	Length = 13.0 ft	1	0.324	0.151	1.15	1.000	1.00	1.00	1.00	1.00	1.00	3.52	895.04	2760.00	0.00	0.00	0.00	0.00	0.00	0.00
+D+0.750S	Length = 13.0 ft	1	0.276	0.128	1.15	1.000	1.00	1.00	1.00	1.00	1.00	3.00	760.91	2760.00	0.00	0.00	0.00	0.00	0.00	0.00
+0.60D	Length = 13.0 ft	1	0.056	0.026	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.85	215.12	3840.00	0.00	0.00	0.00	0.00	0.00	0.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.2818	6.547		0.0000	0.000

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: HM#2 (REACTIONS ONLY)

#### Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.084	1.084
Overall MINimum	0.650	0.650
D Only	0.434	0.434
+D+S	1.084	1.084
+D+0.750S	0.922	0.922
+0.60D	0.261	0.261
S Only	0.650	0.650

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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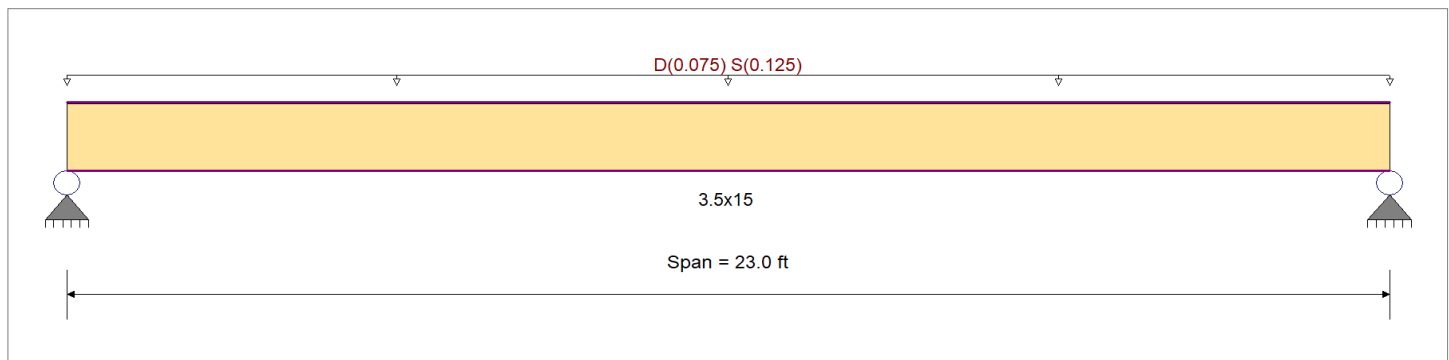
**DESCRIPTION:** HM#3 (REACTIONS ONLY)

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Species : DF/DF	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
Wood Grade : 24F-V4	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 5.0 ft, (ROOF)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.463</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.205</b> : 1
Section used for this span		<b>3.5x15</b>	Section used for this span		<b>3.5x15</b>
fb: Actual	=	1,277.93psi	fv: Actual	=	62.36 psi
Fb: Allowable	=	2,760.00psi	Fv: Allowable	=	304.75 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	11.500ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection	0.447 in	Ratio =	<b>617</b> >=360	Span: 1 : S Only	
Max Upward Transient Deflection	0 in	Ratio =	<b>0</b> <360	n/a	
Max Downward Total Deflection	0.756 in	Ratio =	<b>365</b> >=240	Span: 1 : +D+S	
Max Upward Total Deflection	0 in	Ratio =	<b>0</b> <240	n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values									
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v							
D Only	Length = 23.0 ft	1	0.242	0.107	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	5.71	522.22	2160.00	0.00	0.00	0.00	0.89	25.48	238.50
+D+S	Length = 23.0 ft	1	0.463	0.205	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	13.98	1,277.93	2760.00	0.00	0.00	0.00	2.18	62.36	304.75
+D+0.750S	Length = 23.0 ft	1	0.395	0.174	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	11.91	1,089.01	2760.00	0.00	0.00	0.00	1.86	53.14	304.75
+0.60D	Length = 23.0 ft	1	0.082	0.036	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.43	313.33	3840.00	0.00	0.00	0.00	0.54	15.29	424.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.7555	11.584		0.0000	0.000

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

(c) ENERCALC INC 1983-2022

### DESCRIPTION: HM#3 (REACTIONS ONLY)

#### Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.431	2.431
Overall MINimum	1.438	1.438
D Only	0.993	0.993
+D+S	2.431	2.431
+D+0.750S	2.071	2.071
+0.60D	0.596	0.596
S Only	1.438	1.438

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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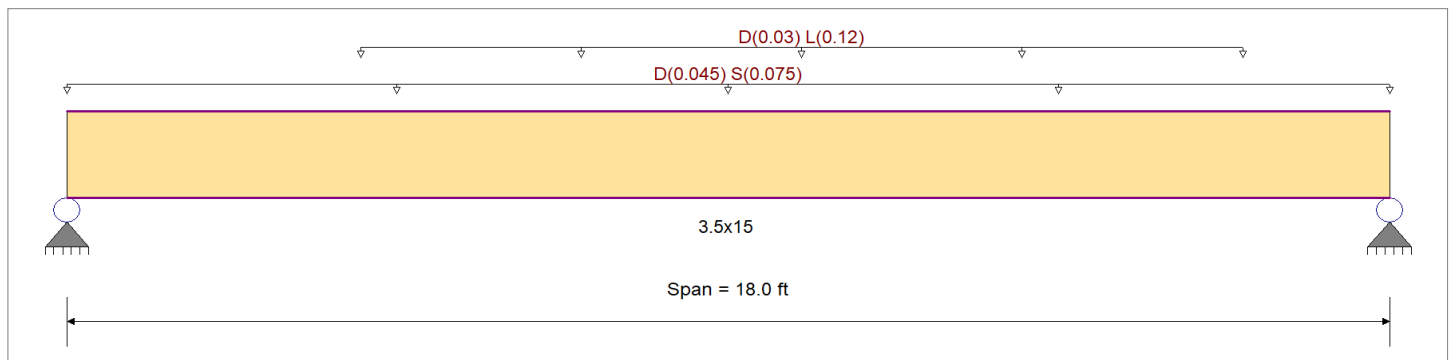
**DESCRIPTION: HM#4 (REACTIONS ONLY)**

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
Wood Species : DF/DF	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Grade : 24F-V4	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf



### Applied Loads

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

Beam self weight calculated and added to loading

Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 3.0 ft, (ROOF)

Uniform Load : D = 0.0150, L = 0.060 ksf, Extent = 4.0 --> 16.0 ft, Tributary Width = 2.0 ft, (DECK)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.292</b>	1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.157</b>	: 1
Section used for this span		<b>3.5x15</b>		Section used for this span		<b>3.5x15</b>	
fb: Actual	=	806.84psi		fv: Actual	=	47.80 psi	
Fb: Allowable	=	2,760.00psi		Fv: Allowable	=	304.75 psi	
Load Combination		+D+0.750L+0.750S		Load Combination		+D+0.750L+0.750S	
Location of maximum on span	=	9.197ft		Location of maximum on span	=	16.752 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.138 in	Ratio =	1568	>=	360	Span: 1 : L Only
Max Upward Transient Deflection		0 in	Ratio =	0	<	360	n/a
Max Downward Total Deflection		0.289 in	Ratio =	748	>=	240	Span: 1 : +D+0.750L+0.750S
Max Upward Total Deflection		0 in	Ratio =	0	<	240	n/a

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values								
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v					
D Only	Length = 18.0 ft	1	0.142	0.076	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.35	306.19	2160.00	0.00	0.00	0.00	0.64	18.20	238.50
+D+L	Length = 18.0 ft	1	0.290	0.155	1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.61	696.17	2400.00	0.00	0.00	0.00	1.44	41.06	265.00
+D+S	Length = 18.0 ft	1	0.212	0.114	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	6.39	583.88	2760.00	0.00	0.00	0.00	1.22	34.81	304.75
+D+0.750L	Length = 18.0 ft	1	0.200	0.107	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	6.55	598.66	3000.00	0.00	0.00	0.00	1.24	35.34	331.25
+D+0.750L+0.750S	Length = 18.0 ft	1	0.292	0.157	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	8.82	806.84	2760.00	0.00	0.00	0.00	1.67	47.80	304.75
+0.60D	Length = 18.0 ft	1	0.048	0.026	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.01	183.71	3840.00	0.00	0.00	0.00	0.38	10.92	424.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: HM#4 (REACTIONS ONLY)**

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S	1	0.2887	9.066		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.654	1.814
Overall MINimum	0.675	0.675
D Only	0.667	0.707
+D+L	1.307	1.507
+D+S	1.342	1.382
+D+0.750L	1.147	1.307
+D+0.750L+0.750S	1.654	1.814
+0.60D	0.400	0.424
L Only	0.640	0.800
S Only	0.675	0.675

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: HM#5 (REACTIONS ONLY)**

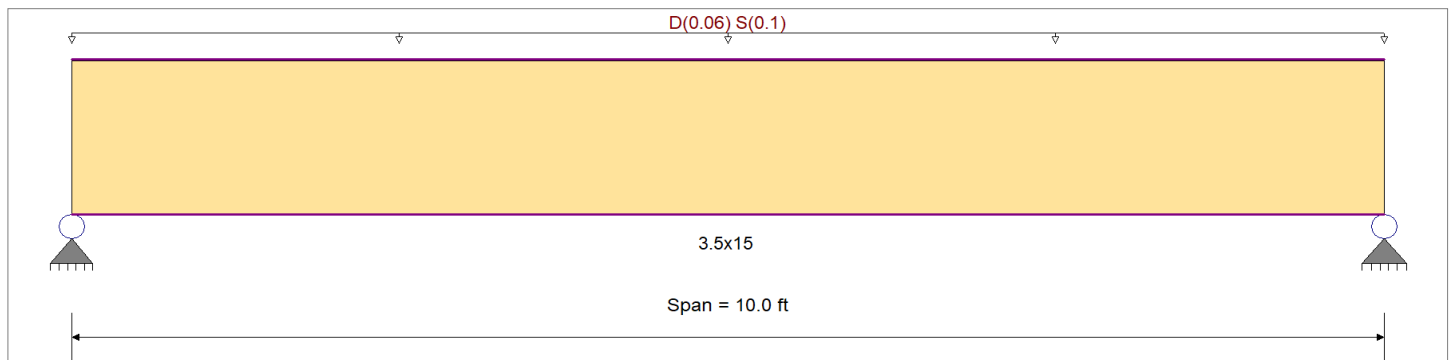
### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Species : DF/DF	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
Wood Grade : 24F-V4	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading

Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 4.0 ft, (ROOF)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.071</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.060</b> : 1
Section used for this span		<b>3.5x15</b>	Section used for this span		<b>3.5x15</b>
fb: Actual	=	195.86psi	fv: Actual	=	18.41 psi
Fb: Allowable	=	2,760.00psi	Fv: Allowable	=	304.75 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	5.000ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.013 in Ratio = 9395 >=360	Span: 1 : S Only		
Max Upward Transient Deflection		0 in Ratio = 0 <360	n/a		
Max Downward Total Deflection		0.022 in Ratio = 5482 >=240	Span: 1 : +D+S		
Max Upward Total Deflection		0 in Ratio = 0 <240	n/a		

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values					
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 10.0 ft	1	0.038	0.032	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
+D+S	Length = 10.0 ft	1	0.071	0.060	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
+D+0.750S	Length = 10.0 ft	1	0.061	0.052	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
+0.60D	Length = 10.0 ft	1	0.013	0.011	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
	Length = 10.0 ft	1	0.013	0.011	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.0219	5.036		0.0000	0.000



Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: HM#5 (REACTIONS ONLY)

#### Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.857	0.857
Overall MINimum	0.500	0.500
D Only	0.357	0.357
+D+S	0.857	0.857
+D+0.750S	0.732	0.732
+0.60D	0.214	0.214
S Only	0.500	0.500

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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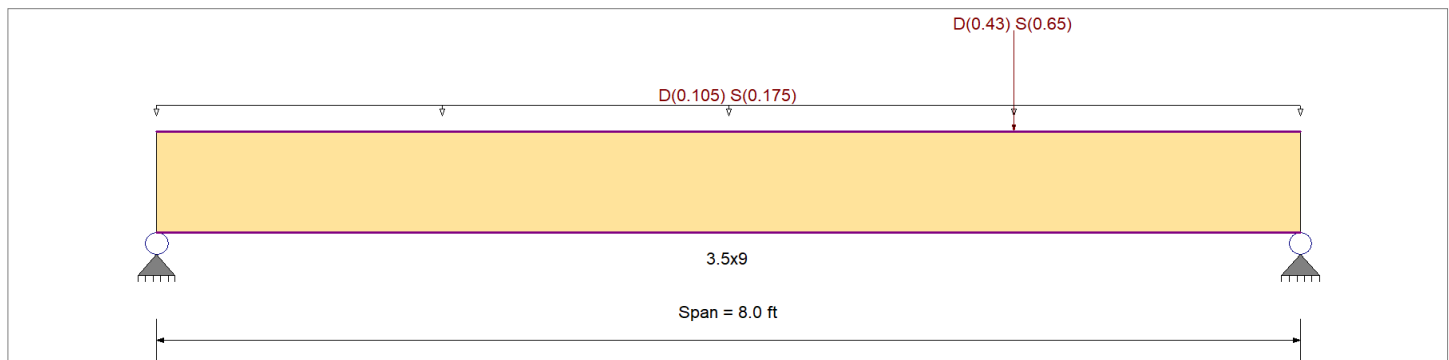
**DESCRIPTION:** GT#1 (REACTIONS ONLY)

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
Wood Species : DF/DF	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Grade : 24F-V4	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 7.0 ft, (ROOF)  
 Point Load : D = 0.430, S = 0.650 k @ 6.0 ft, (HM#1)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.322</b>	1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.273</b>	: 1
Section used for this span		<b>3.5x9</b>		Section used for this span		<b>3.5x9</b>	
fb: Actual	=	889.32psi		fv: Actual	=	83.24 psi	
Fb: Allowable	=	2,760.00psi		Fv: Allowable	=	304.75 psi	
Load Combination		+D+S		Load Combination		+D+S	
Location of maximum on span	=	4.934ft		Location of maximum on span	=	7.270 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.064 in	Ratio =	1496	>=360	Span: 1 : S Only	
Max Upward Transient Deflection		0 in	Ratio =	0	<360	n/a	
Max Downward Total Deflection		0.106 in	Ratio =	909	>=240	Span: 1 : +D+S	
Max Upward Total Deflection		0 in	Ratio =	0	<240	n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 8.0 ft	1	0.162	0.137	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.38	349.53	2160.00	0.00	0.00	0.00	0.69	32.77	238.50
+D+S	Length = 8.0 ft	1	0.322	0.273	1.15	1.000	1.00	1.00	1.00	1.00	1.00	3.50	889.32	2760.00	0.00	0.00	0.00	1.75	83.24	304.75
+D+0.75S	Length = 8.0 ft	1	0.273	0.232	1.15	1.000	1.00	1.00	1.00	1.00	1.00	2.97	754.37	2760.00	0.00	0.00	0.00	1.48	70.62	304.75
+0.60D	Length = 8.0 ft	1	0.055	0.046	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.83	209.72	3840.00	0.00	0.00	0.00	0.41	19.66	424.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.1056	4.175		0.0000	0.000

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: GT#1 (REACTIONS ONLY)

#### Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.417	1.957
Overall MINimum	0.863	1.188
D Only	0.555	0.770
+D+S	1.417	1.957
+D+0.750S	1.202	1.660
+0.60D	0.333	0.462
S Only	0.863	1.188

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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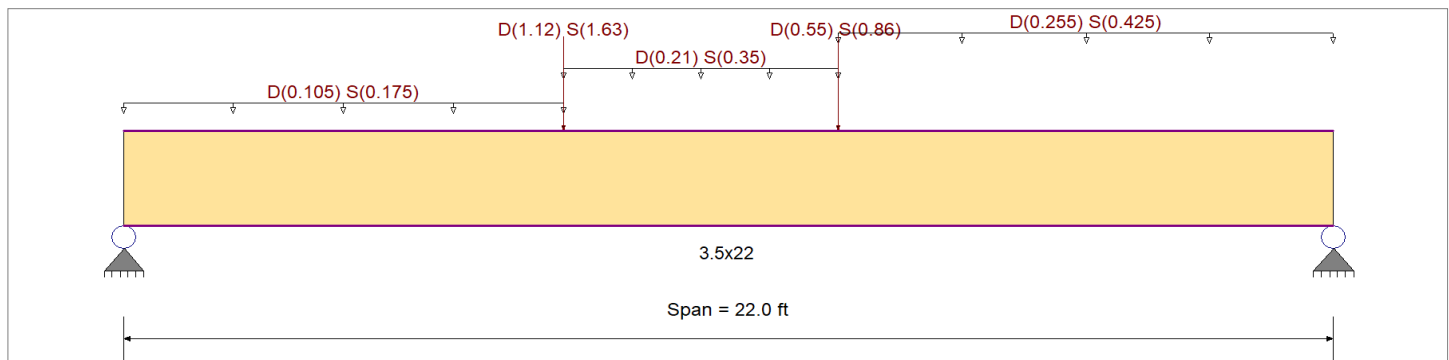
**DESCRIPTION:** GT#2 (REACTIONS ONLY)

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Species : DF/DF	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
Wood Grade : 24F-V4	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Load for Span Number 1

- Uniform Load : D = 0.0150, S = 0.0250 ksf, Extent = 0.0 --> 8.0 ft, Tributary Width = 7.0 ft, (ROOF)
- Uniform Load : D = 0.0150, S = 0.0250 ksf, Extent = 8.0 --> 13.0 ft, Tributary Width = 14.0 ft, (ROOF)
- Uniform Load : D = 0.0150, S = 0.0250 ksf, Extent = 13.0 --> 22.0 ft, Tributary Width = 17.0 ft, (ROOF)
- Point Load : D = 1.120, S = 1.630 k @ 8.0 ft, (HM#1)
- Point Load : D = 0.550, S = 0.860 k @ 13.0 ft, (GT#1)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.795</b>	1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.473</b>	1
Section used for this span		<b>3.5x22</b>		Section used for this span		<b>3.5x22</b>	
fb: Actual	=	2,134.53psi		fv: Actual	=	144.12 psi	
Fb: Allowable	=	2,686.13psi		Fv: Allowable	=	304.75 psi	
Load Combination		+D+S		Load Combination		+D+S	
Location of maximum on span	=	11.321 ft		Location of maximum on span	=	20.234 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.467 in	Ratio =	<b>565</b>	>=360	Span: 1 : S Only	
Max Upward Transient Deflection		0 in	Ratio =	<b>0</b>	<360	n/a	
Max Downward Total Deflection		0.774 in	Ratio =	<b>341</b>	>=240	Span: 1 : +D+S	
Max Upward Total Deflection		0 in	Ratio =	<b>0</b>	<240	n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values				
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v	
D Only	Length = 22.0 ft	1	0.402	0.238	0.90	0.973	1.00	1.00	1.00	1.00	1.00	19.91	846.11	2102.19	0.00	0.00	0.00	0.00
+D+S	Length = 22.0 ft	1	0.795	0.473	1.15	0.973	1.00	1.00	1.00	1.00	1.00	50.22	2,134.53	2686.13	0.00	7.40	144.12	304.75
+D+0.750S	Length = 22.0 ft	1	0.675	0.401	1.15	0.973	1.00	1.00	1.00	1.00	1.00	42.64	1,812.42	2686.13	0.00	6.28	122.28	304.75
+0.60D	Length = 22.0 ft	1	0.136	0.080	1.60	0.973	1.00	1.00	1.00	1.00	1.00	11.94	507.67	3737.23	0.00	1.75	34.08	424.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: GT#2 (REACTIONS ONLY)**

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.7737	11.080		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	7.059	8.629
Overall MINimum	4.232	5.233
D Only	2.827	3.395
+D+S	7.059	8.629
+D+0.750S	6.001	7.320
+0.60D	1.696	2.037
S Only	4.232	5.233

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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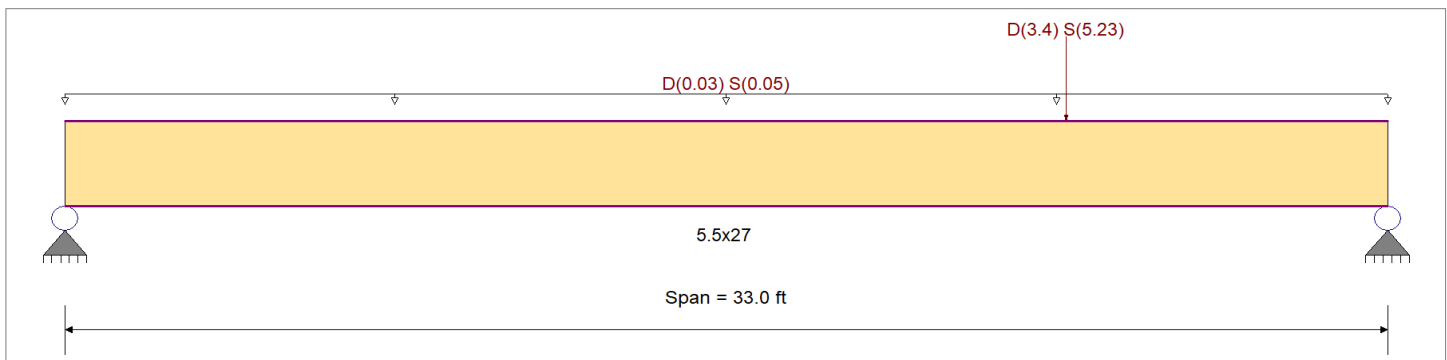
**DESCRIPTION:** GT#3 (REACTIONS ONLY)

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
Wood Species : DF/DF	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Grade : 24F-V4	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 2.0 ft, (ROOF)  
 Point Load : D = 3.40, S = 5.230 k @ 25.0 ft, (GT#2)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.472</b>	1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.270</b>	: 1
Section used for this span		<b>5.5x27</b>		Section used for this span		<b>5.5x27</b>	
fb: Actual	=	1,139.26psi		fv: Actual	=	82.28 psi	
Fb: Allowable	=	2,415.43psi		Fv: Allowable	=	304.75 psi	
Load Combination		+D+S		Load Combination		+D+S	
Location of maximum on span	=	24.931 ft		Location of maximum on span	=	30.832 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.367 in	Ratio =	<b>1079</b>	>=360	Span: 1 : S Only	
Max Upward Transient Deflection		0 in	Ratio =	<b>0</b>	<360	n/a	
Max Downward Total Deflection		0.654 in	Ratio =	<b>605</b>	>=240	Span: 1 : +D+S	
Max Upward Total Deflection		0 in	Ratio =	<b>0</b>	<240	n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values								
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v					
D Only	Length = 33.0 ft	1	0.255	0.147	0.90	0.875	1.00	1.00	1.00	1.00	1.00	1.00	1.00	26.80	481.33	1890.34	0.00	0.00	0.00	3.47	35.02	238.50
+D+S	Length = 33.0 ft	1	0.472	0.270	1.15	0.875	1.00	1.00	1.00	1.00	1.00	1.00	1.00	63.44	1,139.26	2415.43	0.00	0.00	0.00	8.15	82.28	304.75
+D+0.75S	Length = 33.0 ft	1	0.404	0.231	1.15	0.875	1.00	1.00	1.00	1.00	1.00	1.00	1.00	54.28	974.77	2415.43	0.00	0.00	0.00	6.98	70.47	304.75
+0.60D	Length = 33.0 ft	1	0.086	0.050	1.60	0.875	1.00	1.00	1.00	1.00	1.00	1.00	1.00	16.08	288.80	3360.60	0.00	0.00	0.00	2.08	21.01	424.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.6541	17.945		0.0000	0.000

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** GT#3 (REACTIONS ONLY)

### Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	3.943	8.389
Overall MINimum	2.093	4.787
D Only	1.850	3.602
+D+S	3.943	8.389
+D+0.750S	3.420	7.192
+0.60D	1.110	2.161
S Only	2.093	4.787



## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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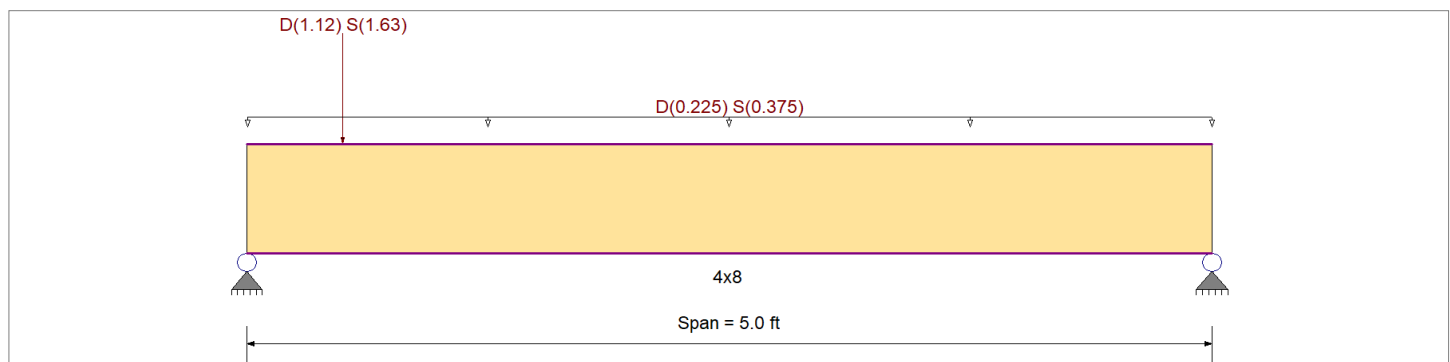
**DESCRIPTION:** HDR#1

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	875.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	875.0 psi	Ebend- xx	1,300.0ksi
	Fc - Prll	600.0 psi	Eminbend - xx	470.0ksi
Wood Species : Douglas Fir-Larch (North)	Fc - Perp	625.0 psi		
Wood Grade : No.2	Fv	170.0 psi		
	Ft	425.0 psi	Density	30.590pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 15.0 ft, (ROOF)  
 Point Load : D = 1.120, S = 1.630 k @ 0.50 ft, (HM#1)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.790</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.431</b> : 1
Section used for this span		<b>4x8</b>	Section used for this span		<b>4x8</b>
fb: Actual	=	1,033.92psi	fv: Actual	=	84.17 psi
Fb: Allowable	=	1,308.13psi	Fv: Allowable	=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	2.044ft	Location of maximum on span	=	4.398 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.052 in	Ratio =	<b>1154</b> >=360	Span: 1 : S Only
Max Upward Transient Deflection		0 in	Ratio =	<b>0</b> <360	n/a
Max Downward Total Deflection		0.085 in	Ratio =	<b>705</b> >=240	Span: 1 : +D+S
Max Upward Total Deflection		0 in	Ratio =	<b>0</b> <240	n/a

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 5.0 ft	1	0.393	0.212	0.90	1.300	1.00	1.00	1.00	1.00	1.00	1.03	402.01	1023.75	0.00	0.00	0.00	0.55	32.47	153.00
+D+S	Length = 5.0 ft	1	0.790	0.431	1.15	1.300	1.00	1.00	1.00	1.00	1.00	2.64	1,033.92	1308.13	0.00	0.00	0.00	1.42	84.17	195.50
+D+0.750S	Length = 5.0 ft	1	0.670	0.364	1.15	1.300	1.00	1.00	1.00	1.00	1.00	2.24	875.94	1308.13	0.00	0.00	0.00	1.21	71.25	195.50
+0.60D	Length = 5.0 ft	1	0.133	0.072	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.62	241.21	1820.00	0.00	0.00	0.00	0.33	19.48	272.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.0850	2.409		0.0000	0.000

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** HDR#1

### Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	3.988	1.788
Overall MINimum	2.405	1.101
D Only	1.584	0.688
+D+S	3.988	1.788
+D+0.750S	3.387	1.513
+0.60D	0.950	0.413
S Only	2.405	1.101

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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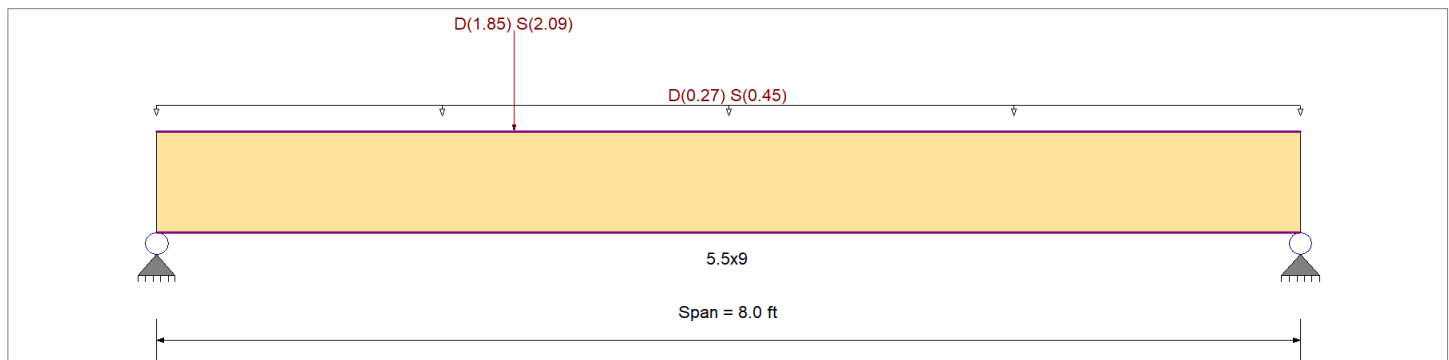
**DESCRIPTION:** HDR#2

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
Wood Species : DF/DF	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Grade : 24F-V4	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 18.0 ft, (ROOF)  
 Point Load : D = 1.850, S = 2.090 k @ 2.50 ft, (GT#3)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.691</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.507</b> : 1
Section used for this span		<b>5.5x9</b>	Section used for this span		<b>5.5x9</b>
fb: Actual	=	1,906.12psi	fv: Actual	=	154.49 psi
Fb: Allowable	=	2,760.00psi	Fv: Allowable	=	304.75 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	2.511 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.122 in	Ratio =	<b>785</b> >=360	Span: 1 : S Only
Max Upward Transient Deflection		0 in	Ratio =	<b>0</b> <360	n/a
Max Downward Total Deflection		0.212 in	Ratio =	<b>452</b> >=240	Span: 1 : +D+S
Max Upward Total Deflection		0 in	Ratio =	<b>0</b> <240	n/a

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values								
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v					
D Only	Length = 8.0 ft	1	0.382	0.278	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	5.11	825.53	2160.00	0.00	0.00	0.00	2.19	66.36	238.50
+D+S	Length = 8.0 ft	1	0.691	0.507	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	11.79	1,906.12	2760.00	0.00	0.00	0.00	5.10	154.49	304.75
+D+0.75S	Length = 8.0 ft	1	0.593	0.435	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	10.12	1,635.97	2760.00	0.00	0.00	0.00	4.37	132.46	304.75
+0.60D	Length = 8.0 ft	1	0.129	0.094	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.06	495.32	3840.00	0.00	0.00	0.00	1.31	39.82	424.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.2123	3.825		0.0000	0.000

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** HDR#2

### Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	5.632	4.154
Overall MINimum	3.237	2.453
D Only	2.395	1.701
+D+S	5.632	4.154
+D+0.750S	4.822	3.541
+0.60D	1.437	1.021
S Only	3.237	2.453

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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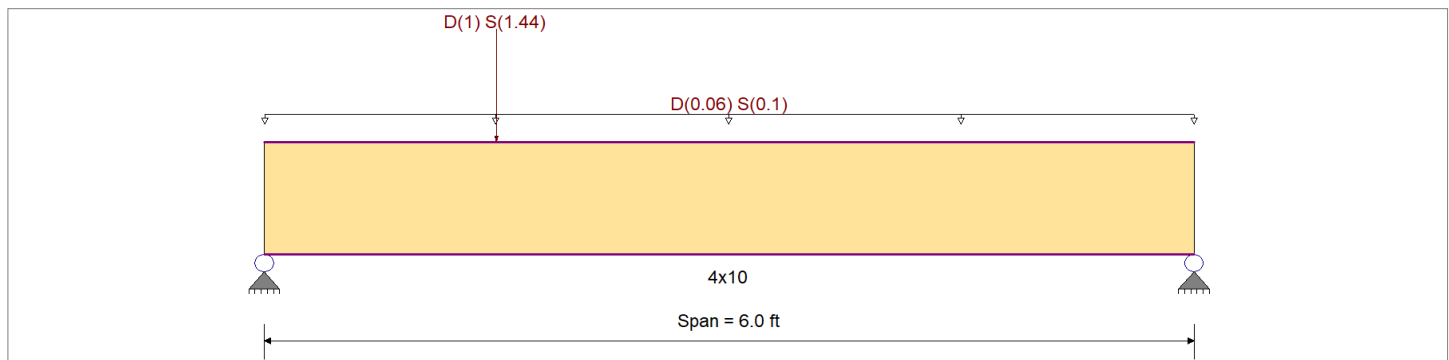
**DESCRIPTION:** HDR#3

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	875.0 psi	E : Modulus of Elasticity
Load Combination : IBC 2018	Fb -	875.0 psi	Ebend- xx
	Fc - Prll	600.0 psi	Eminbend - xx
Wood Species : Douglas Fir-Larch (North)	Fc - Perp	625.0 psi	
Wood Grade : No.2	Fv	170.0 psi	
	Ft	425.0 psi	Density
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			30.590pcf



### Applied Loads

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

Beam self weight calculated and added to loading

Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 4.0 ft, (ROOF)

Point Load : D = 1.0, S = 1.440 k @ 1.50 ft, (HM#3)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.658</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.522</b> : 1
Section used for this span		<b>4x10</b>	Section used for this span		<b>4x10</b>
fb: Actual	=	794.43psi	fv: Actual	=	102.06 psi
Fb: Allowable	=	1,207.50psi	Fv: Allowable	=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	1.511 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection	0.036 in	Ratio =	2005	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.061 in	Ratio =	1188	>=240	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0	<240	n/a

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 6.0 ft	1	0.343	0.272	0.90	1.200	1.00	1.00	1.00	1.00	1.00	1.35	324.35	945.00	0.00	0.00	0.00	0.00	41.67	153.00
+D+S	Length = 6.0 ft	1	0.658	0.522	1.15	1.200	1.00	1.00	1.00	1.00	1.00	3.30	794.43	1207.50	0.00	0.00	0.00	0.00	102.06	195.50
+D+0.75S	Length = 6.0 ft	1	0.561	0.445	1.15	1.200	1.00	1.00	1.00	1.00	1.00	2.82	676.91	1207.50	0.00	0.00	0.00	0.00	86.96	195.50
+0.60D	Length = 6.0 ft	1	0.116	0.092	1.60	1.200	1.00	1.00	1.00	1.00	1.00	0.81	194.61	1680.00	0.00	0.00	0.00	0.00	25.00	272.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.0606	2.759		0.0000	0.000

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** HDR#3

### Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.331	1.111
Overall MINimum	1.380	0.660
D Only	0.951	0.451
+D+S	2.331	1.111
+D+0.750S	1.986	0.946
+0.60D	0.570	0.270
S Only	1.380	0.660

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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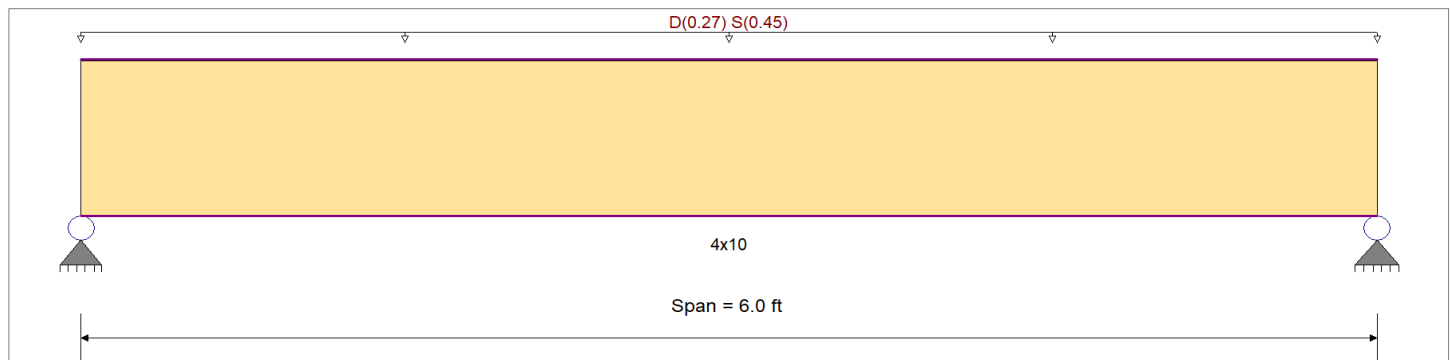
**DESCRIPTION:** HDR#4

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	875.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	875.0 psi	Ebend- xx	1,300.0ksi
	Fc - Prll	600.0 psi	Eminbend - xx	470.0ksi
Wood Species : Douglas Fir-Larch (North)	Fc - Perp	625.0 psi		
Wood Grade : No.2	Fv	170.0 psi		
	Ft	425.0 psi	Density	30.590pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 18.0 ft, (ROOF)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.651</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.385</b> : 1
Section used for this span		<b>4x10</b>	Section used for this span		<b>4x10</b>
fb: Actual	=	786.42psi	fv: Actual	=	75.22 psi
Fb: Allowable	=	1,207.50psi	Fv: Allowable	=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	3.000ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection	0.044 in	Ratio = 1637	>=360	Span: 1 : S Only	
Max Upward Transient Deflection	0 in	Ratio = 0	<360	n/a	
Max Downward Total Deflection	0.071 in	Ratio = 1013	>=240	Span: 1 : +D+S	
Max Upward Total Deflection	0 in	Ratio = 0	<240	n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values					
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v		
D Only																			
Length = 6.0 ft	1	0.317	0.187	0.90	1.200	1.00	1.00	1.00	1.00	1.00	1.25	299.56	945.00	0.00	0.00	0.00	0.62	28.65	153.00
+D+S																			
Length = 6.0 ft	1	0.651	0.385	1.15	1.200	1.00	1.00	1.00	1.00	1.00	3.27	786.42	1207.50	0.00	0.00	0.00	1.62	75.22	195.50
+D+0.750S																			
Length = 6.0 ft	1	0.550	0.325	1.15	1.200	1.00	1.00	1.00	1.00	1.00	2.76	664.70	1207.50	0.00	0.00	0.00	1.37	63.58	195.50
+0.60D																			
Length = 6.0 ft	1	0.107	0.063	1.60	1.200	1.00	1.00	1.00	1.00	1.00	0.75	179.73	1680.00	0.00	0.00	0.00	0.37	17.19	272.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.0710	3.022		0.0000	0.000

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** HDR#4

### Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.181	2.181
Overall MINimum	1.350	1.350
D Only	0.831	0.831
+D+S	2.181	2.181
+D+0.750S	1.843	1.843
+0.60D	0.498	0.498
S Only	1.350	1.350



## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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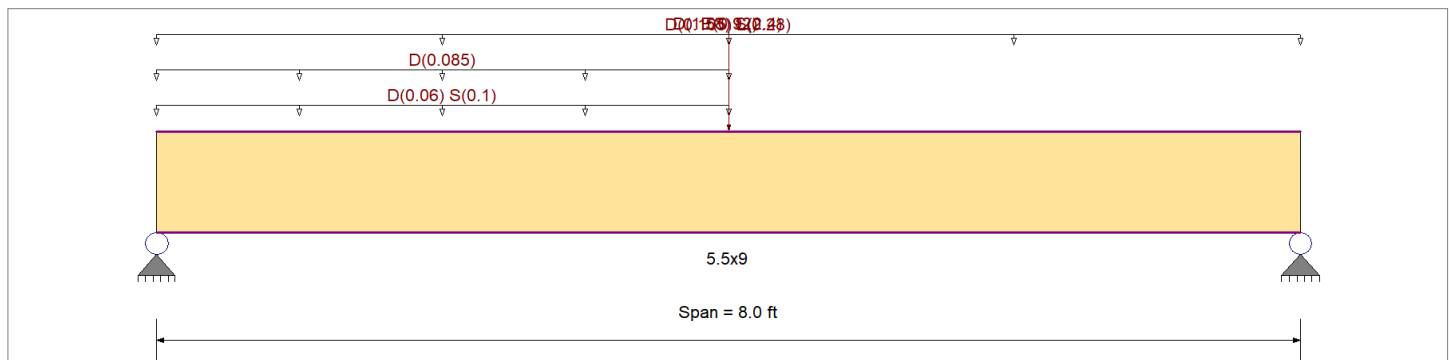
**DESCRIPTION:** HDR#5

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
Wood Species : DF/DF	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Grade : 24F-V4	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf



### Applied Loads

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

Beam self weight calculated and added to loading

Load for Span Number 1

Uniform Load : D = 0.0150, S = 0.0250 ksf, Extent = 0.0 -->> 4.0 ft, Tributary Width = 4.0 ft, (ROOF)

Point Load : D = 1.580, S = 2.40 k @ 4.0 ft, (HDR#1)

Uniform Load : D = 0.010 ksf, Extent = 0.0 -->> 4.0 ft, Tributary Width = 8.50 ft, (WALL)

Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 7.0 ft, (FLOOR)

Point Load : E = 0.920 k @ 4.0 ft, (SW6)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.719</b>	1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.357</b>	1
Section used for this span		<b>5.5x9</b>		Section used for this span		<b>5.5x9</b>	
fb: Actual	=	2,760.15psi		fv: Actual	=	151.58 psi	
Fb: Allowable	=	3,840.00psi		Fv: Allowable	=	424.00 psi	
Load Combination		+1.119D+0.750L+0.750S+3.413E		Load Combination		+1.119D+0.750L+0.750S+3.413E	
Location of maximum on span	=	4.000ft		Location of maximum on span	=	0.000 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.082 in	Ratio =	<b>1175</b>	>=	360	Span: 1 : S Only
Max Upward Transient Deflection		0 in	Ratio =	<b>0</b>	<	360	n/a
Max Downward Total Deflection		0.186 in	Ratio =	<b>515</b>	>=	240	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection		0 in	Ratio =	<b>0</b>	<	240	n/a

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values							
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v				
D Only	Length = 8.0 ft	1	0.349	0.190	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	4.67	754.07	2160.00	0.00	0.00	0.00	0.00
+D+L	Length = 8.0 ft	1	0.465	0.276	1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	6.91	1,116.09	2400.00	0.00	0.00	0.00	0.00
+D+S	Length = 8.0 ft	1	0.578	0.291	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	9.87	1,594.48	2760.00	0.00	0.00	0.00	0.00
+D+0.750L	Length = 8.0 ft	1	0.342	0.200	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	6.35	1,025.59	3000.00	0.00	0.00	0.00	0.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: HDR#5**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values		
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F'v
+D+0.750L+0.750S						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1		0.600	0.324	1.15	1.000	1.00	1.00	1.00	1.00	1.00	10.25	1,655.89	2760.00	3.25	98.62	304.75
+1.158D+4.550E						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1		0.580	0.274	1.60	1.000	1.00	1.00	1.00	1.00	1.00	13.78	2,226.42	3840.00	3.83	115.99	424.00
+1.119D+0.750L+0.750S+3.4						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1		0.719	0.357	1.60	1.000	1.00	1.00	1.00	1.00	1.00	17.08	2,760.15	3840.00	5.00	151.58	424.00
+0.60D						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1		0.118	0.064	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.80	452.44	3840.00	0.90	27.23	424.00
+0.4418D+4.550E						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.0 ft	1		0.439	0.197	1.60	1.000	1.00	1.00	1.00	1.00	1.00	10.43	1,686.20	3840.00	2.75	83.47	424.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S+0.5250E	1	0.1862	4.000		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	3.894	3.454
Overall MINimum	0.460	0.460
D Only	1.688	1.398
+D+L	2.808	2.518
+D+S	3.188	2.698
+D+0.750L	2.528	2.238
+D+0.750L+0.750S	3.653	3.213
+D+0.70E	2.010	1.720
+D+0.750L+0.750S+0.5250E	3.894	3.454
+0.60D	1.013	0.839
+0.60D+0.70E	1.335	1.161
L Only	1.120	1.120
S Only	1.500	1.300
E Only	0.460	0.460

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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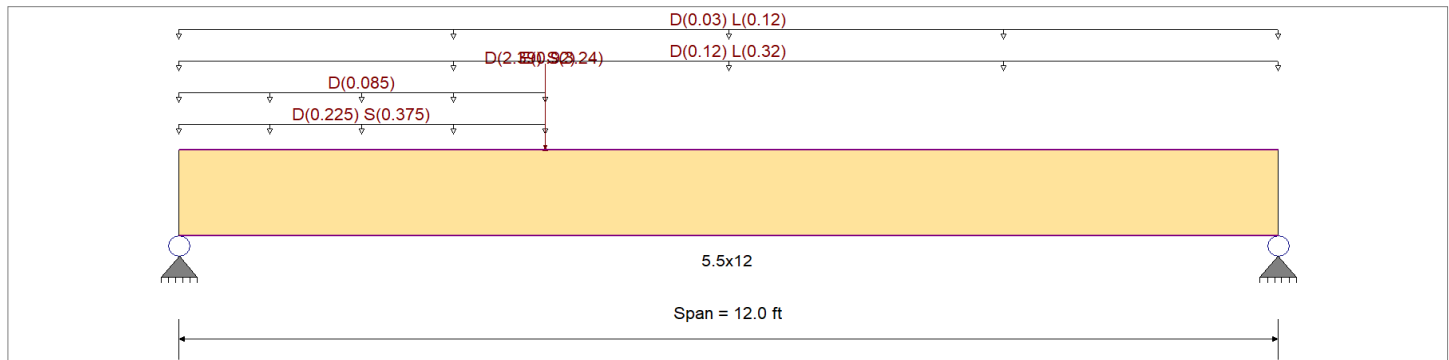
**DESCRIPTION:** HDR#6

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
Wood Species : DF/DF	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Grade : 24F-V4	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf



### Applied Loads

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

Beam self weight calculated and added to loading  
 Load for Span Number 1

- Uniform Load : D = 0.0150, S = 0.0250 ksf, Extent = 0.0 --> 4.0 ft, Tributary Width = 15.0 ft, (ROOF)
- Point Load : D = 2.390, S = 3.240 k @ 4.0 ft, (HDR#2)
- Uniform Load : D = 0.010 ksf, Extent = 0.0 --> 4.0 ft, Tributary Width = 8.50 ft, (WALL)
- Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 8.0 ft, (FLOOR)
- Point Load : E = 0.920 k @ 4.0 ft, (SW6)
- Uniform Load : D = 0.0150, L = 0.060 ksf, Tributary Width = 2.0 ft, (DECK)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.793</b>	1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.530</b>	: 1
Section used for this span		<b>5.5x12</b>		Section used for this span		<b>5.5x12</b>	
fb: Actual	=	3,044.47 psi		fv: Actual	=	161.46 psi	
Fb: Allowable	=	3,840.00 psi		Fv: Allowable	=	304.75 psi	
Load Combination		+1.119D+0.750L+0.750S+3.413E		Load Combination		+D+0.750L+0.750S	
Location of maximum on span	=	4.029 ft		Location of maximum on span	=	0.000 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.153 in	Ratio =	<b>938</b>	>=	360	Span: 1 : S Only
Max Upward Transient Deflection		0 in	Ratio =	<b>0</b>	<	360	n/a
Max Downward Total Deflection		0.411 in	Ratio =	<b>350</b>	>=	240	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection		0 in	Ratio =	<b>0</b>	<	240	n/a

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values					
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 12.0 ft	1	0.448	0.301	0.90	1.000	1.00	1.00	1.00	1.00	1.00	10.64	966.89	2160.00	0.00	0.00	0.00	0.00	0.00	238.50
+D+L	Length = 12.0 ft	1	0.672	0.461	1.00	1.000	1.00	1.00	1.00	1.00	1.00	17.73	1,611.85	2400.00	0.00	0.00	0.00	0.00	0.00	265.00
+D+S	Length = 12.0 ft	1	0.700	0.463	1.15	1.000	1.00	1.00	1.00	1.00	1.00	21.24	1,931.14	2760.00	0.00	0.00	0.00	0.00	0.00	304.75
+D+0.750L	Length = 12.0 ft	1				1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: HDR#6**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values			
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>
Length = 12.0 ft	1	1	0.483	0.331	1.25	1.000	1.00	1.00	1.00	1.00	1.00	15.93	1,448.63	3000.00	4.82	109.49	331.25
+D+0.750L+0.750S						1.000	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00		
Length = 12.0 ft	1	1	0.787	0.530	1.15	1.000	1.00	1.00	1.00	1.00	1.00	23.89	2,171.43	2760.00	7.10	161.46	304.75
+1.158D+4.550E						1.000	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00		
Length = 12.0 ft	1	1	0.555	0.345	1.60	1.000	1.00	1.00	1.00	1.00	1.00	23.44	2,130.93	3840.00	6.45	146.49	424.00
+1.119D+0.750L+0.750S+3.4						1.000	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00		
Length = 12.0 ft	1	1	0.793	0.513	1.60	1.000	1.00	1.00	1.00	1.00	1.00	33.49	3,044.47	3840.00	9.57	217.53	424.00
+0.60D						1.000	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00		
Length = 12.0 ft	1	1	0.151	0.101	1.60	1.000	1.00	1.00	1.00	1.00	1.00	6.38	580.13	3840.00	1.89	43.03	424.00
+0.4418D+4.550E						1.000	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00		
Length = 12.0 ft	1	1	0.375	0.224	1.60	1.000	1.00	1.00	1.00	1.00	1.00	15.82	1,438.26	3840.00	4.18	95.11	424.00
						1.000	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00		

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S+0.5250E	1	0.4109	5.693		0.0000	0.000

**Vertical Reactions**

Load Combination	Support notation : Far left is #1		Values in KIPS	
	Support 1	Support 2		
Overall MAXimum	8.472	5.128		
Overall MINimum	0.613	0.307		
D Only	3.612	1.989		
+D+L	6.252	4.629		
+D+S	7.022	3.319		
+D+0.750L	5.592	3.969		
+D+0.750L+0.750S	8.150	4.967		
+D+0.70E	4.042	2.204		
+D+0.750L+0.750S+0.5250E	8.472	5.128		
+0.60D	2.167	1.193		
+0.60D+0.70E	2.597	1.408		
L Only	2.640	2.640		
S Only	3.410	1.330		
E Only	0.613	0.307		

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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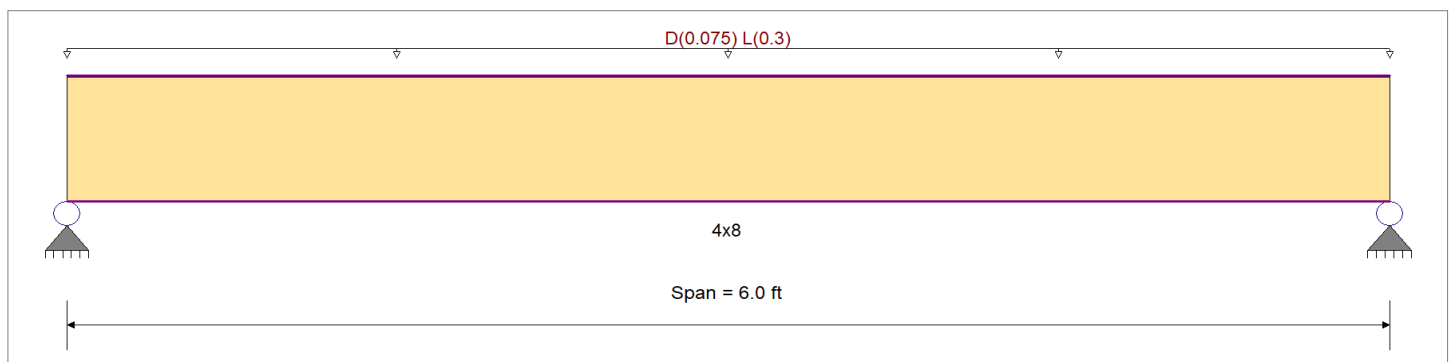
**DESCRIPTION:** HDR#7

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	875 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	875 psi	Ebend- xx	1300ksi
	Fc - Prll	600 psi	Eminbend - xx	470ksi
Wood Species : Douglas Fir-Larch (North)	Fc - Perp	625 psi		
Wood Grade : No.2	Fv	170 psi		
	Ft	425 psi	Density	30.59pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, L = 0.060 ksf, Tributary Width = 5.0 ft, (DECK)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.589</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.319</b> : 1
Section used for this span		<b>4x8</b>	Section used for this span		<b>4x8</b>
fb: Actual	=	669.93psi	fv: Actual	=	54.16 psi
Fb: Allowable	=	1,137.50psi	Fv: Allowable	=	170.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	3.000ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.061 in	Ratio =	<b>1182</b> >=360	Span: 1 : L Only
Max Upward Transient Deflection		0 in	Ratio =	<b>0</b> <360	n/a
Max Downward Total Deflection		0.077 in	Ratio =	<b>932</b> >=240	Span: 1 : +D+L
Max Upward Total Deflection		0 in	Ratio =	<b>0</b> <240	n/a

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 6.0 ft	1	0.138	0.075	0.90	1.300	1.00	1.00	1.00	1.00	1.00	0.36	141.58	1023.75	0.00	0.00	0.00	0.19	11.45	153.00
+D+L	Length = 6.0 ft	1	0.589	0.319	1.00	1.300	1.00	1.00	1.00	1.00	1.00	1.71	669.93	1137.50	0.00	0.00	0.00	0.92	54.16	170.00
+D+0.750L	Length = 6.0 ft	1	0.378	0.205	1.25	1.300	1.00	1.00	1.00	1.00	1.00	1.37	537.84	1421.88	0.00	0.00	0.00	0.74	43.48	212.50
+0.60D	Length = 6.0 ft	1	0.047	0.025	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.22	84.95	1820.00	0.00	0.00	0.00	0.12	6.87	272.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.0772	3.022		0.0000	0.000

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** HDR#7

### Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.141	1.141
Overall MINimum	0.900	0.900
D Only	0.241	0.241
+D+L	1.141	1.141
+D+0.750L	0.916	0.916
+0.60D	0.145	0.145
L Only	0.900	0.900

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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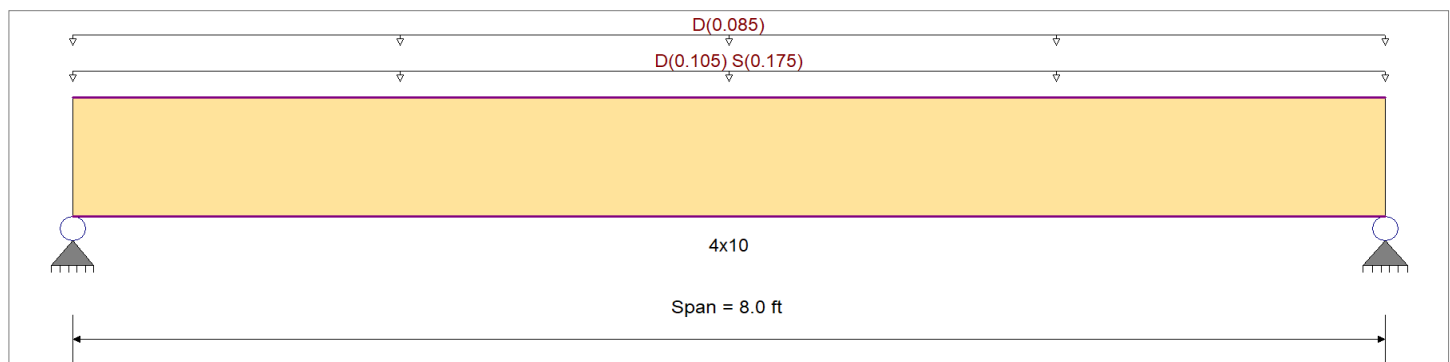
**DESCRIPTION:** HDR#8

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	875.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	875.0 psi	Ebend- xx	1,300.0ksi
	Fc - Prll	600.0 psi	Eminbend - xx	470.0ksi
Wood Species : Douglas Fir-Larch (North)	Fc - Perp	625.0 psi		
Wood Grade : No.2	Fv	170.0 psi		
	Ft	425.0 psi	Density	30.590pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 7.0 ft, (ROOF)  
 Uniform Load : D = 0.010 ksf, Tributary Width = 8.50 ft, (WALL)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.592</b> 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.286</b> : 1
Section used for this span		<b>4x10</b>	Section used for this span		<b>4x10</b>
fb: Actual	=	715.27psi	fv: Actual	=	55.84 psi
Fb: Allowable	=	1,207.50psi	Fv: Allowable	=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	4.000ft	Location of maximum on span	=	7.241 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection	0.054 in	Ratio =	1775 >=360	Span: 1 : S Only	
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a	
Max Downward Total Deflection	0.115 in	Ratio =	835 >=240	Span: 1 : +D+S	
Max Upward Total Deflection	0 in	Ratio =	0 <240	n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 8.0 ft	1	0.401	0.193	0.90	1.200	1.00	1.00	1.00	1.00	1.00	1.58	378.68	945.00	0.00	0.00	0.00	0.64	29.56	153.00
+D+S	Length = 8.0 ft	1	0.592	0.286	1.15	1.200	1.00	1.00	1.00	1.00	1.00	2.98	715.27	1207.50	0.00	0.00	0.00	1.21	55.84	195.50
+D+0.750S	Length = 8.0 ft	1	0.523	0.252	1.15	1.200	1.00	1.00	1.00	1.00	1.00	2.63	631.12	1207.50	0.00	0.00	0.00	1.06	49.27	195.50
+0.60D	Length = 8.0 ft	1	0.135	0.065	1.60	1.200	1.00	1.00	1.00	1.00	1.00	0.95	227.21	1680.00	0.00	0.00	0.00	0.38	17.74	272.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.1149	4.029		0.0000	0.000

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** HDR#8

### Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.488	1.488
Overall MINimum	0.700	0.700
D Only	0.788	0.788
+D+S	1.488	1.488
+D+0.750S	1.313	1.313
+0.60D	0.473	0.473
S Only	0.700	0.700



## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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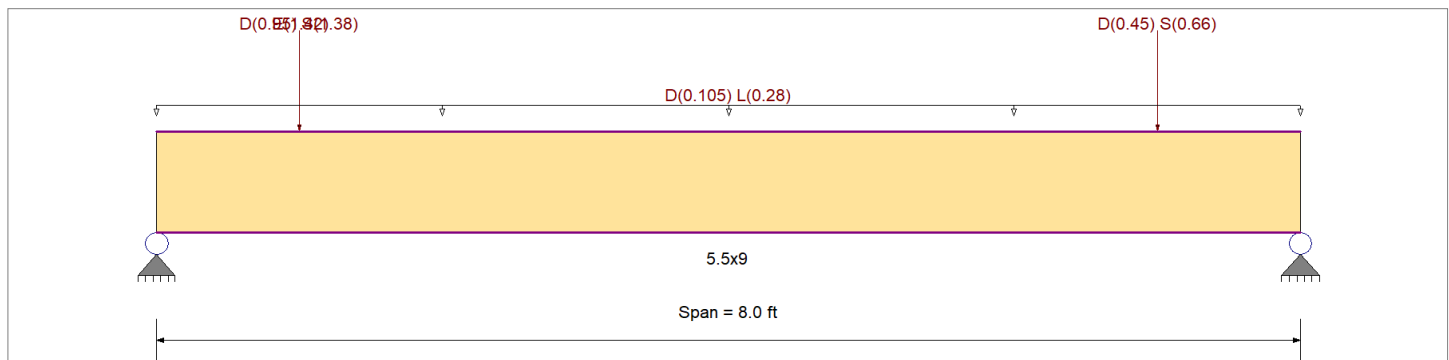
**DESCRIPTION:** HDR#9

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2400 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1850 psi	Ebend- xx	1800ksi
	Fc - Prll	1650 psi	Eminbend - xx	950ksi
Wood Species : DF/DF	Fc - Perp	650 psi	Ebend- yy	1600ksi
Wood Grade : 24F-V4	Fv	265 psi	Eminbend - yy	850ksi
	Ft	1100 psi	Density	31.21 pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 7.0 ft, (FLOOR)  
 Point Load : D = 0.950, S = 1.380 k @ 1.0 ft, (HDR#3)  
 Point Load : D = 0.450, S = 0.660 k @ 7.0 ft, (HDR#3)  
 Point Load : E = 1.420 k @ 1.0 ft, (SW6)

### DESIGN SUMMARY

**Design OK**

Maximum Bending Stress Ratio = <b>0.316</b> < 1	Maximum Shear Stress Ratio = <b>0.522</b> < 1
Section used for this span = <b>5.5x9</b>	Section used for this span = <b>5.5x9</b>
fb: Actual = 1,212.13psi	fv: Actual = 221.53 psi
Fb: Allowable = 3,840.00psi	Fv: Allowable = 424.00 psi
Load Combination +1.119D+0.750L+0.750S+3.413E	Load Combination +1.119D+0.750L+0.750S+3.413E
Location of maximum on span = 1.810ft	Location of maximum on span = 0.000ft
Span # where maximum occurs = Span # 1	Span # where maximum occurs = Span # 1
<b>Maximum Deflection</b>	
Max Downward Transient Deflection = 0.043 in Ratio = <b>2224</b> >=360	Span: 1 : L Only
Max Upward Transient Deflection = 0 in Ratio = <b>0</b> <360	n/a
Max Downward Total Deflection = 0.092 in Ratio = <b>1043</b> >=240	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection = 0 in Ratio = <b>0</b> <240	n/a

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values					
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v		
D Only	Length = 8.0 ft	1	0.123	0.161	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.64	265.49	2160.00	0.00	0.00	0.00	0.00	238.50
+D+L	Length = 8.0 ft	1	0.261	0.249	1.00	1.000	1.00	1.00	1.00	1.00	1.00	3.87	625.57	2400.00	0.00	0.00	0.00	0.00	265.00
+D+S	Length = 8.0 ft	1	0.161	0.254	1.15	1.000	1.00	1.00	1.00	1.00	1.00	2.75	443.85	2760.00	0.00	0.00	0.00	0.00	304.75
+D+0.750L	Length = 8.0 ft	1	0.178	0.179	1.25	1.000	1.00	1.00	1.00	1.00	1.00	3.31	535.24	3000.00	0.00	0.00	0.00	0.00	331.25
+D+0.750L+0.750S	Length = 8.0 ft	1	0.240	0.290	1.15	1.000	1.00	1.00	1.00	1.00	1.00	4.10	662.10	2760.00	0.00	0.00	0.00	0.00	304.75

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: HDR#9**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values								
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>						
+1.158D+4.550E Length = 8.0 ft		1	0.301	0.509	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.14	1,153.92	3840.00	0.00	0.00	0.00	7.12	215.75	424.00
+1.119D+0.750L+0.750S+3.4 Length = 8.0 ft		1	0.316	0.522	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.50	1,212.13	3840.00	0.00	0.00	0.00	7.31	221.53	424.00
+0.60D Length = 8.0 ft		1	0.041	0.054	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	159.29	3840.00	0.00	0.00	0.00	0.76	23.02	424.00
+0.4418D+4.550E Length = 8.0 ft		1	0.261	0.444	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	6.21	1,003.55	3840.00	0.00	0.00	0.00	6.21	188.26	424.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S+0.5250E	1	0.0920	3.883		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	3.810	2.471
Overall MINimum	1.243	0.178
D Only	1.350	0.975
+D+L	2.470	2.095
+D+S	2.640	1.725
+D+0.750L	2.190	1.815
+D+0.750L+0.750S	3.158	2.378
+D+0.70E	2.220	1.100
+D+0.750L+0.750S+0.5250E	3.810	2.471
+0.60D	0.810	0.585
+0.60D+0.70E	1.680	0.709
L Only	1.120	1.120
S Only	1.290	0.750
E Only	1.243	0.178

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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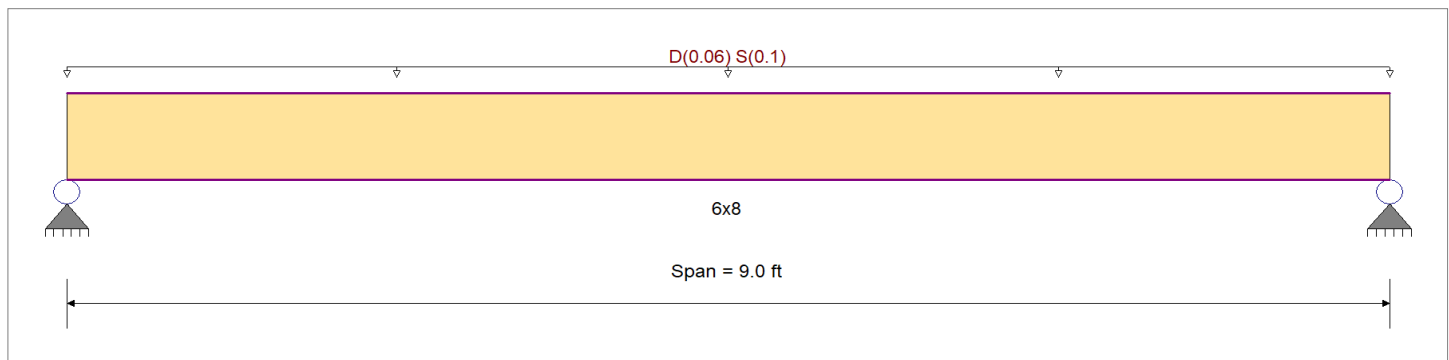
**DESCRIPTION: HDR#10**

**CODE REFERENCES**

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

**Material Properties**

Analysis Method : Allowable Stress Design	Fb +	875.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	875.0 psi	Ebend- xx	1,300.0ksi
	Fc - Prll	600.0 psi	Eminbend - xx	470.0ksi
Wood Species : Douglas Fir-Larch (North)	Fc - Perp	625.0 psi		
Wood Grade : No.2	Fv	170.0 psi		
	Ft	425.0 psi	Density	30.590pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



**Applied Loads**

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 4.0 ft, (ROOF)

**DESIGN SUMMARY**

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.395</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.122</b> : 1
Section used for this span		<b>6x8</b>	Section used for this span		<b>6x8</b>
fb: Actual	=	397.67 psi	fv: Actual	=	23.79 psi
Fb: Allowable	=	1,006.25 psi	Fv: Allowable	=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	4.500 ft	Location of maximum on span	=	8.376 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection	0.059 in	Ratio = 1828	>=360	Span: 1 : S Only	
Max Upward Transient Deflection	0 in	Ratio = 0	<360	n/a	
Max Downward Total Deflection	0.100 in	Ratio = 1083	>=240	Span: 1 : +D+S	
Max Upward Total Deflection	0 in	Ratio = 0	<240	n/a	

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 9.0 ft	1	0.206	0.063	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.70	162.03	787.50	0.00	0.00	0.00	0.00	0.00	153.00
+D+S	Length = 9.0 ft	1	0.395	0.122	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.71	397.67	1006.25	0.00	0.00	0.00	0.00	0.00	0.00
+D+0.750S	Length = 9.0 ft	1	0.337	0.104	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.46	338.76	1006.25	0.00	0.00	0.00	0.00	0.00	0.00
+1.158D	Length = 9.0 ft	1	0.134	0.041	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.81	187.66	1400.00	0.00	0.00	0.00	0.00	0.00	0.00
+1.119D+0.750S	Length = 9.0 ft	1	0.256	0.079	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.54	357.98	1400.00	0.00	0.00	0.00	0.00	0.00	0.00
+0.60D	Length = 9.0 ft	1	0.069	0.021	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.42	97.22	1400.00	0.00	0.00	0.00	0.00	0.00	0.00
+0.4418D	Length = 9.0 ft	1			1.00	1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: HDR#10**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values		
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>
	Length = 9.0 ft	1	0.051	0.016	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.31	71.58	1400.00	0.12	4.28	272.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.0997	4.533		0.0000	0.000

**Vertical Reactions**

Load Combination	Support notation : Far left is #1		Values in KIPS	
	Support 1	Support 2		
Overall MAXimum	0.759	0.759		
Overall MINimum	0.450	0.450		
D Only	0.309	0.309		
+D+S	0.759	0.759		
+D+0.750S	0.647	0.647		
+0.60D	0.186	0.186		
S Only	0.450	0.450		

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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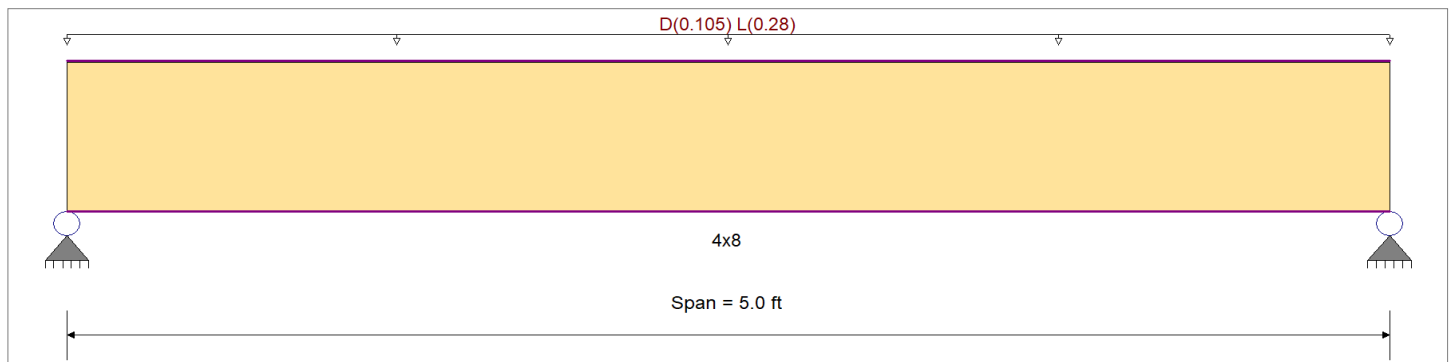
**DESCRIPTION: HDR#11**

**CODE REFERENCES**

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

**Material Properties**

Analysis Method : Allowable Stress Design	Fb +	875.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	875.0 psi	Ebend- xx	1,300.0ksi
	Fc - Prll	600.0 psi	Eminbend - xx	470.0ksi
Wood Species : Douglas Fir-Larch (North)	Fc - Perp	625.0 psi		
Wood Grade : No.2	Fv	170.0 psi		
	Ft	425.0 psi	Density	30.590pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



**Applied Loads**

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 7.0 ft, (FLOOR)

**DESIGN SUMMARY**

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.420</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.258</b> : 1
Section used for this span		<b>4x8</b>	Section used for this span		<b>4x8</b>
fb: Actual	=	477.46psi	fv: Actual	=	43.80 psi
Fb: Allowable	=	1,137.50psi	Fv: Allowable	=	170.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	2.500ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection	0.027 in	Ratio = 2189 >=360	Span: 1 : L Only		
Max Upward Transient Deflection	0 in	Ratio = 0 <360	n/a		
Max Downward Total Deflection	0.038 in	Ratio = 1570 >=240	Span: 1 : +D+L		
Max Upward Total Deflection	0 in	Ratio = 0 <240	n/a		

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 5.0 ft	1	0.132	0.081	0.90	1.300	1.00	1.00	1.00	1.00	1.00	0.34	135.01	1023.75	0.00	0.00	0.00	0.21	12.38	153.00
+D+L	Length = 5.0 ft	1	0.420	0.258	1.00	1.300	1.00	1.00	1.00	1.00	1.00	1.22	477.46	1137.50	0.00	0.00	0.00	0.00	0.00	0.00
+D+0.750L	Length = 5.0 ft	1	0.276	0.169	1.25	1.300	1.00	1.00	1.00	1.00	1.00	1.00	391.85	1421.88	0.00	0.00	0.00	0.61	35.94	212.50
+1.158D	Length = 5.0 ft	1	0.086	0.053	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.40	156.37	1820.00	0.00	0.00	0.00	0.24	14.34	272.00
+1.119D+0.750L	Length = 5.0 ft	1	0.224	0.138	1.60	1.300	1.00	1.00	1.00	1.00	1.00	1.04	407.87	1820.00	0.00	0.00	0.00	0.63	37.41	272.00
+0.60D	Length = 5.0 ft	1	0.045	0.027	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.21	81.01	1820.00	0.00	0.00	0.00	0.13	7.43	272.00
+0.4418D	Length = 5.0 ft	1				1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: HDR#11**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values		
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>
	Length = 5.0 ft	1	0.033	0.020	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.15	59.65	1820.00	0.09	5.47	272.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.0382	2.518		0.0000	0.000

**Vertical Reactions**

Load Combination	Support notation : Far left is #1		Values in KIPS	
	Support 1	Support 2		
Overall MAXimum	0.976	0.976		
Overall MINimum	0.700	0.700		
D Only	0.276	0.276		
+D+L	0.976	0.976		
+D+0.750L	0.801	0.801		
+0.60D	0.166	0.166		
L Only	0.700	0.700		

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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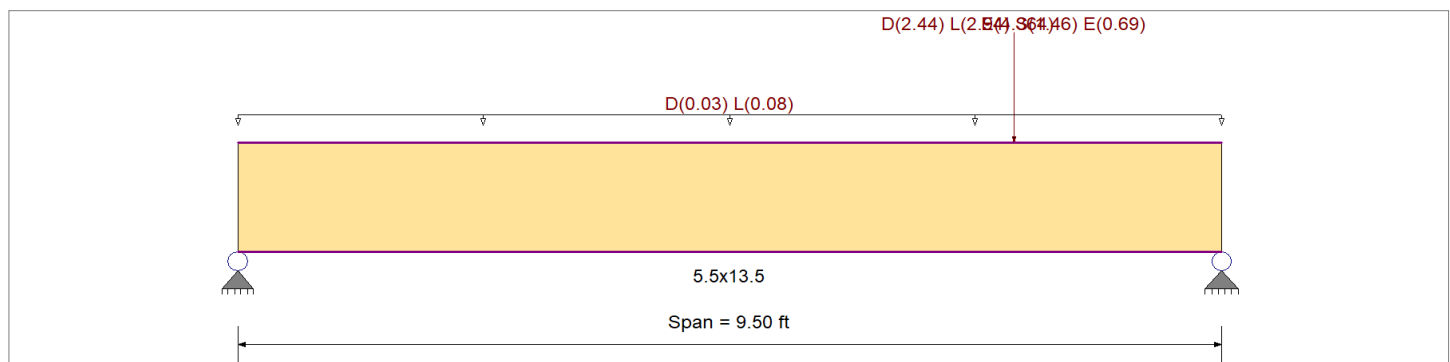
**DESCRIPTION:** HDR#12

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
Wood Species : DF/DF	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Grade : 24F-V4	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading

Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 2.0 ft, (FLOOR)

Point Load : D = 2.440, L = 2.940, S = 1.460, E = 0.690 k @ 7.50 ft, (BM#3)

Point Load : E = 4.364 k @ 7.50 ft, (SW2)

### DESIGN SUMMARY

**Design OK**

Maximum Bending Stress Ratio	=	<b>0.769</b>	1	Maximum Shear Stress Ratio	=	<b>0.981</b>	1
Section used for this span		<b>5.5x13.5</b>		Section used for this span		<b>5.5x13.5</b>	
fb: Actual	=	2,953.16psi		fv: Actual	=	415.76 psi	
Fb: Allowable	=	3,840.00psi		Fv: Allowable	=	424.00 psi	
Load Combination		+1.158D+4.550E		Load Combination		+1.158D+4.550E	
Location of maximum on span	=	7.489ft		Location of maximum on span	=	8.391 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.047 in	Ratio =	<b>2437</b>	>=360	Span: 1 : E Only	
Max Upward Transient Deflection		0 in	Ratio =	<b>0</b>	<360	n/a	
Max Downward Total Deflection		0.087 in	Ratio =	<b>1308</b>	>=240	Span: 1 : +D+0.750L+0.750S+0.5250E	
Max Upward Total Deflection		0 in	Ratio =	<b>0</b>	<240	n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values							
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v				
D Only	Length = 9.50 ft	1	0.139	0.177	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	238.50
+D+L	Length = 9.50 ft	1	0.282	0.359	1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
+D+S	Length = 9.50 ft	1	0.169	0.215	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
+D+0.750L	Length = 9.50 ft	1	0.194	0.247	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
+D+0.750L+0.750S	Length = 9.50 ft	1	0.256	0.326	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
+1.158D+4.550E						1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: HDR#12**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values					
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>			
Length = 9.50 ft	1		0.769	0.981	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	41.11	2,953.16	3840.00	20.58	415.76	424.00
+1.119D+0.750L+0.750S+3.4						1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00			0.00		0.00	0.00	0.00
Length = 9.50 ft	1		0.702	0.895	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	37.54	2,696.36	3840.00	18.78	379.44	424.00
+0.60D						1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00			0.00		0.00	0.00	0.00
Length = 9.50 ft	1		0.047	0.060	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.52	180.76	3840.00	1.26	25.38	424.00
+0.4418D+4.550E						1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00			0.00		0.00	0.00	0.00
Length = 9.50 ft	1		0.713	0.909	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	38.11	2,737.34	3840.00	19.08	385.45	424.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S+0.5250E	1	0.0871	5.305		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.271	7.130
Overall MINimum	1.064	3.990
D Only	0.733	2.145
+D+L	1.732	4.846
+D+S	1.040	3.298
+D+0.750L	1.482	4.171
+D+0.750L+0.750S	1.712	5.036
+D+0.70E	1.477	4.938
+D+0.750L+0.750S+0.5250E	2.271	7.130
+0.60D	0.440	1.287
+0.60D+0.70E	1.184	4.080
L Only	0.999	2.701
S Only	0.307	1.153
E Only	1.064	3.990



## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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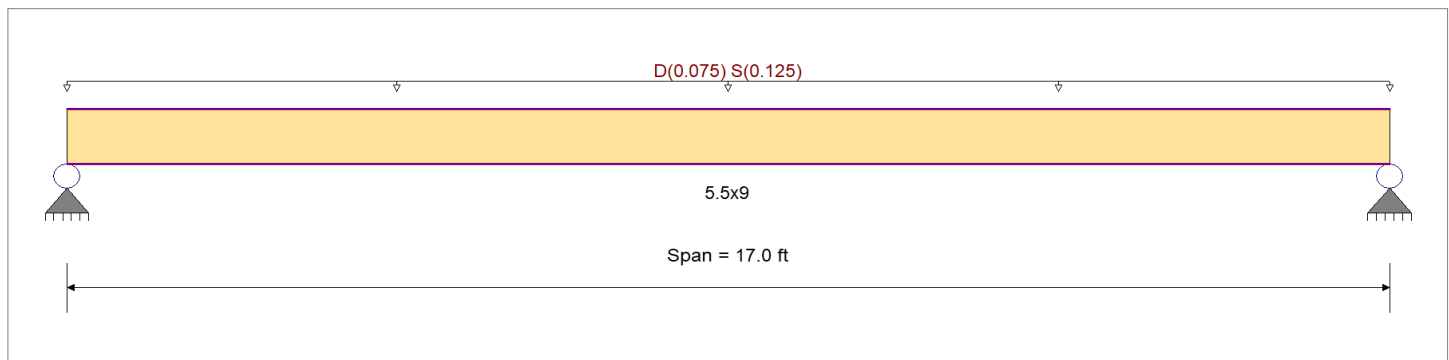
**DESCRIPTION:** BM#1

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Species : DF/DF	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
Wood Grade : 24F-V4	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 5.0 ft, (ROOF)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.446</b> 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.163</b> : 1
Section used for this span		<b>5.5x9</b>	Section used for this span		<b>5.5x9</b>
fb: Actual	=	1,230.31 psi	fv: Actual	=	49.52 psi
Fb: Allowable	=	2,760.00 psi	Fv: Allowable	=	304.75 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	8.500ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection	0.393 in	Ratio =	<b>519</b> >=360	Span: 1 : S Only	
Max Upward Transient Deflection	0 in	Ratio =	<b>0</b> <360	n/a	
Max Downward Total Deflection	0.662 in	Ratio =	<b>308</b> >=240	Span: 1 : +D+S	
Max Upward Total Deflection	0 in	Ratio =	<b>0</b> <240	n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 17.0 ft	1	0.232	0.084	0.90	1.000	1.00	1.00	1.00	1.00	1.00	3.10	500.52	2160.00	0.00	0.00	0.00	0.66	20.15	238.50
+D+S	Length = 17.0 ft	1	0.446	0.163	1.15	1.000	1.00	1.00	1.00	1.00	1.00	7.61	1,230.31	2760.00	0.00	0.00	0.00	1.63	49.52	304.75
+D+0.750S	Length = 17.0 ft	1	0.380	0.138	1.15	1.000	1.00	1.00	1.00	1.00	1.00	6.48	1,047.86	2760.00	0.00	0.00	0.00	1.39	42.18	304.75
+1.158D	Length = 17.0 ft	1	0.151	0.055	1.60	1.000	1.00	1.00	1.00	1.00	1.00	3.59	579.70	3840.00	0.00	0.00	0.00	0.77	23.33	424.00
+1.119D+0.750S	Length = 17.0 ft	1	0.288	0.105	1.60	1.000	1.00	1.00	1.00	1.00	1.00	6.85	1,107.25	3840.00	0.00	0.00	0.00	1.47	44.57	424.00
+0.60D	Length = 17.0 ft	1	0.078	0.029	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.86	300.31	3840.00	0.00	0.00	0.00	0.40	12.09	424.00
+0.4418D	Length = 17.0 ft	1				1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00	0.00	

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: BM#1**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Span #	Max Stress Ratios										Moment Values			Shear Values		
		M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>	
Length = 17.0 ft	1	0.058	0.021	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.37	221.13	3840.00	0.29	8.90	424.00	

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.6623	8.562		0.0000	0.000

**Vertical Reactions**

Load Combination	Support notation : Far left is #1		Values in KIPS	
	Support 1	Support 2		
Overall MAXimum	1.791	1.791		
Overall MINimum	1.063	1.063		
D Only	0.729	0.729		
+D+S	1.791	1.791		
+D+0.750S	1.526	1.526		
+0.60D	0.437	0.437		
S Only	1.063	1.063		

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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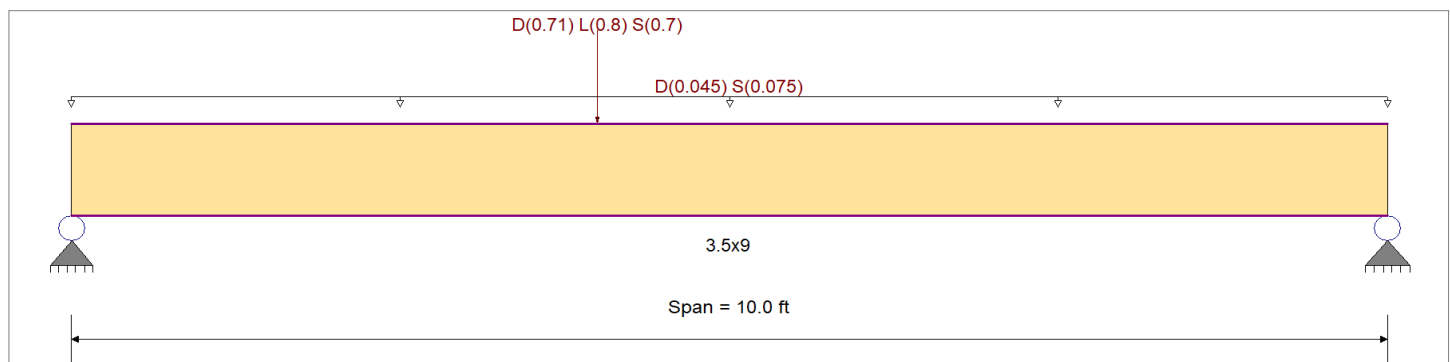
**DESCRIPTION:** BM#2

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2400 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1850 psi	Ebend- xx	1800ksi
	Fc - Prll	1650 psi	Eminbend - xx	950ksi
Wood Species : DF/DF	Fc - Perp	650 psi	Ebend- yy	1600ksi
Wood Grade : 24F-V4	Fv	265 psi	Eminbend - yy	850ksi
	Ft	1100 psi	Density	31.21 pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 3.0 ft, (ROOF)  
 Point Load : D = 0.710, L = 0.80, S = 0.70 k @ 4.0 ft, (HM#4)

### DESIGN SUMMARY

**Design OK**

Maximum Bending Stress Ratio	=	<b>0.524</b> : 1	Maximum Shear Stress Ratio	=	<b>0.244</b> : 1
Section used for this span		<b>3.5x9</b>	Section used for this span		<b>3.5x9</b>
fb: Actual	=	1,445.53psi	fv: Actual	=	74.40 psi
Fb: Allowable	=	2,760.00psi	Fv: Allowable	=	304.75 psi
Load Combination	=	+D+0.750L+0.750S	Load Combination	=	+D+0.750L+0.750S
Location of maximum on span	=	4.015ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.107 in	Ratio =	<b>1121</b> >=360	Span: 1 : S Only
Max Upward Transient Deflection		0 in	Ratio =	<b>0</b> <360	n/a
Max Downward Total Deflection		0.228 in	Ratio =	<b>525</b> >=240	Span: 1 : +D+0.750L+0.750S
Max Upward Total Deflection		0 in	Ratio =	<b>0</b> <240	n/a

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values								
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v					
D Only	Length = 10.0 ft	1	0.273	0.129	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.32	589.85	2160.00	0.00	0.00	0.00	0.65	30.82	238.50
+D+L	Length = 10.0 ft	1	0.448	0.203	1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	4.24	1,076.28	2400.00	0.00	0.00	0.00	1.13	53.68	265.00
+D+S	Length = 10.0 ft	1	0.451	0.217	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	4.90	1,244.33	2760.00	0.00	0.00	0.00	1.39	66.07	304.75
+D+0.750L	Length = 10.0 ft	1	0.318	0.145	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.76	954.67	3000.00	0.00	0.00	0.00	1.01	47.97	331.25
+D+0.750L+0.750S	Length = 10.0 ft	1	0.524	0.244	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	5.69	1,445.53	2760.00	0.00	0.00	0.00	1.56	74.40	304.75
+1.158D	Length = 10.0 ft	1	0.178	0.084	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.69	683.16	3840.00	0.00	0.00	0.00	0.75	35.70	424.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: BM#2**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values								
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>						
+1.119D+0.750L+0.750S	Length = 10.0 ft	1	0.395	0.184	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	5.97	1,515.52	3840.00	0.00	0.00	0.00	1.64	78.06	424.00
+0.60D	Length = 10.0 ft	1	0.092	0.044	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.39	353.91	3840.00	0.00	0.00	0.00	0.39	18.49	424.00
+0.4418D	Length = 10.0 ft	1	0.068	0.032	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.03	260.60	3840.00	0.00	0.00	0.00	0.29	13.62	424.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S	1	0.2284	4.818		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.641	1.274
Overall MINimum	0.795	0.655
D Only	0.685	0.543
+D+L	1.165	0.863
+D+S	1.480	1.198
+D+0.750L	1.045	0.783
+D+0.750L+0.750S	1.641	1.274
+0.60D	0.411	0.326
L Only	0.480	0.320
S Only	0.795	0.655

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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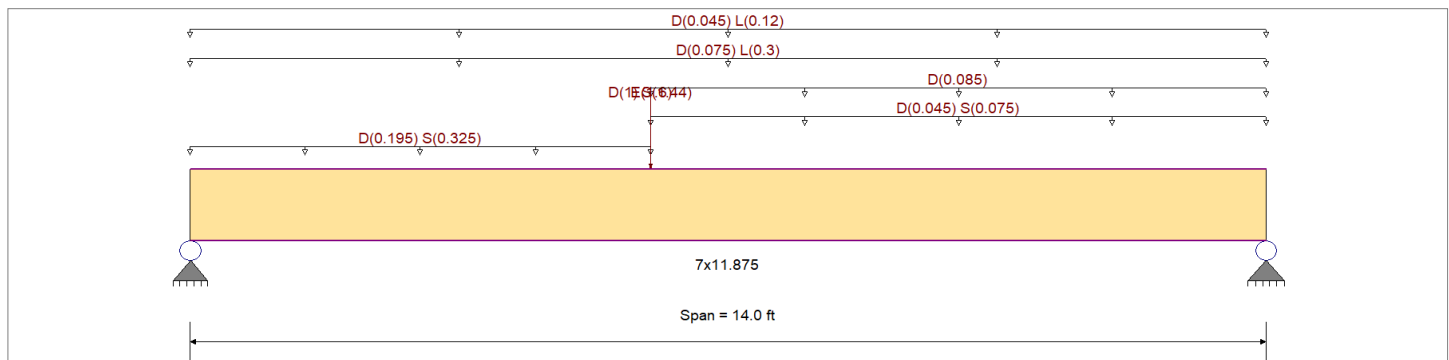
**DESCRIPTION:** BM#3

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,900.0 psi	<i>E : Modulus of Elasticity</i>
Load Combination : IBC 2018	Fb -	2,900.0 psi	Ebend- xx 2,000.0ksi
	Fc - Prll	2,900.0 psi	Eminbend - xx 1,016.54ksi
Wood Species : iLevel Truss Joist	Fc - Perp	750.0 psi	
Wood Grade : Parallam PSL 2.0E	Fv	290.0 psi	
	Ft	2,025.0 psi	Density 45.070pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			



### Applied Loads

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

Beam self weight calculated and added to loading  
 Load for Span Number 1

- Uniform Load : D = 0.0150, S = 0.0250 ksf, Extent = 0.0 --> 6.0 ft, Tributary Width = 13.0 ft, (ROOF)
- Uniform Load : D = 0.0150, S = 0.0250 ksf, Extent = 6.0 --> 14.0 ft, Tributary Width = 3.0 ft, (ROOF)
- Uniform Load : D = 0.010 ksf, Extent = 6.0 --> 14.0 ft, Tributary Width = 8.50 ft, (WALL)
- Uniform Load : D = 0.0150, L = 0.060 ksf, Tributary Width = 5.0 ft, (DECK)
- Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 3.0 ft, (FLOOR)
- Point Load : D = 1.0, S = 1.440 k @ 6.0 ft, (HM#4)
- Point Load : E = 1.60 k @ 6.0 ft, (SW6)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b> = <b>0.710</b> : 1	<b>Maximum Shear Stress Ratio</b> = <b>0.368</b> : 1
Section used for this span = <b>7x11.875</b>	Section used for this span = <b>7x11.875</b>
fb: Actual = 3,294.64psi	fv: Actual = 170.53 psi
Fb: Allowable = 4,640.00psi	Fv: Allowable = 464.00 psi
Load Combination +1.119D+0.750L+0.750S+3.413E	Load Combination +1.119D+0.750L+0.750S+3.413E
Location of maximum on span = 6.029ft	Location of maximum on span = 0.000 ft
Span # where maximum occurs = Span # 1	Span # where maximum occurs = Span # 1
<b>Maximum Deflection</b>	
Max Downward Transient Deflection 0.187 in Ratio = 898 >= 360	Span: 1 : L Only
Max Upward Transient Deflection 0 in Ratio = 0 < 360	n/a
Max Downward Total Deflection 0.476 in Ratio = 352 >= 240	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection 0 in Ratio = 0 < 240	n/a

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values								
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v						
D Only	Length = 14.0 ft	1	0.299	0.171	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	10.71	781.52	2610.00	0.00	0.00	0.00	2.48	44.73	261.00
+D+L	Length = 14.0 ft	1				1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	20.83	1,519.03	2900.00	0.00	0.00	0.00	0.00	0.00	0.00
+D+S	Length = 14.0 ft	1	0.524	0.312	1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				0.00	0.00	0.00	0.00	0.00	0.00
	Length = 14.0 ft	1	0.437	0.254	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	20.00	1,458.85	3335.00	0.00	0.00	0.00	4.69	84.63	333.50

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: BM#3**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values			
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>
+D+0.750L						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 14.0 ft	1		0.368	0.218	1.25	1.000	1.00	1.00	1.00	1.00	1.00	18.29	1,333.84	3625.00	4.38	79.00	362.50
+D+0.750L+0.750S						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 14.0 ft	1		0.552	0.327	1.15	1.000	1.00	1.00	1.00	1.00	1.00	25.25	1,841.46	3335.00	6.04	108.93	333.50
+1.158D+4.550E						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 14.0 ft	1		0.586	0.273	1.60	1.000	1.00	1.00	1.00	1.00	1.00	37.28	2,719.10	4640.00	7.03	126.88	464.00
+1.119D+0.750L+0.750S+3.4						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 14.0 ft	1		0.710	0.368	1.60	1.000	1.00	1.00	1.00	1.00	1.00	45.17	3,294.64	4640.00	9.45	170.53	464.00
+0.60D						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 14.0 ft	1		0.101	0.058	1.60	1.000	1.00	1.00	1.00	1.00	1.00	6.43	468.91	4640.00	1.49	26.84	464.00
+0.4418D+4.550E						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 14.0 ft	1		0.465	0.204	1.60	1.000	1.00	1.00	1.00	1.00	1.00	29.60	2,159.22	4640.00	5.26	94.83	464.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S+0.5250E	1	0.4760	6.847		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	7.390	6.107
Overall MINimum	0.914	0.686
D Only	2.810	2.444
+D+L	5.750	5.384
+D+S	5.336	3.908
+D+0.750L	5.015	4.649
+D+0.750L+0.750S	6.910	5.747
+D+0.70E	3.450	2.924
+D+0.750L+0.750S+0.5250E	7.390	6.107
+0.60D	1.686	1.467
+0.60D+0.70E	2.326	1.947
L Only	2.940	2.940
S Only	2.526	1.464
E Only	0.914	0.686

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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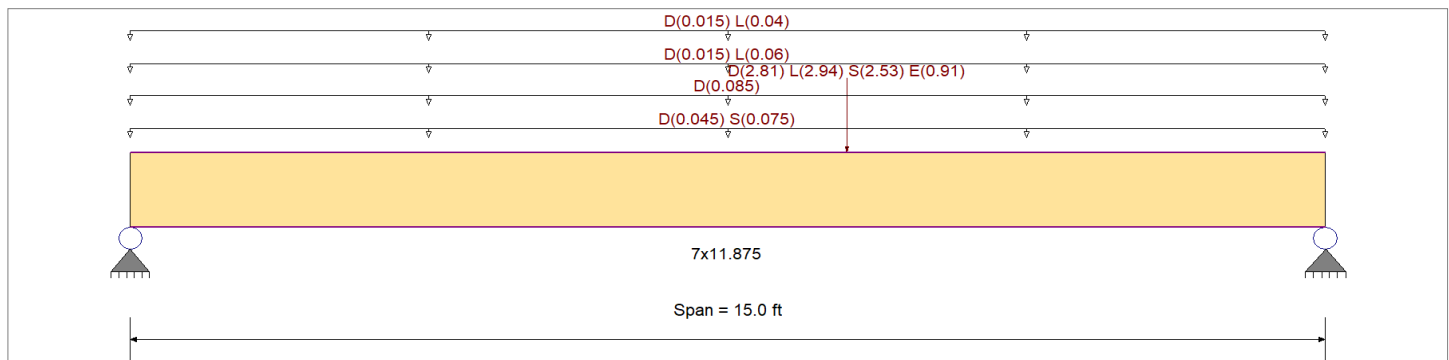
**DESCRIPTION:** BM#4

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,900.0 psi	E : Modulus of Elasticity
Load Combination : IBC 2018	Fb -	2,900.0 psi	Ebend- xx
	Fc - Prll	2,900.0 psi	Eminbend - xx
Wood Species : iLevel Truss Joist	Fc - Perp	750.0 psi	
Wood Grade : Parallam PSL 2.0E	Fv	290.0 psi	
	Ft	2,025.0 psi	Density
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			45.070pcf



### Applied Loads

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

Beam self weight calculated and added to loading

- Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 3.0 ft, (ROOF)
- Uniform Load : D = 0.010 ksf, Tributary Width = 8.50 ft, (WALL)
- Uniform Load : D = 0.0150, L = 0.060 ksf, Tributary Width = 1.0 ft, (DECK)
- Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 1.0 ft, (FLOOR)
- Point Load : D = 2.810, L = 2.940, S = 2.530, E = 0.910 k @ 9.0 ft, (BM#3)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.731</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.336</b> : 1
Section used for this span		<b>7x11.875</b>	Section used for this span		<b>7x11.875</b>
fb: Actual	=	2,436.28psi	fv: Actual	=	112.14 psi
Fb: Allowable	=	3,335.00psi	Fv: Allowable	=	333.50 psi
Load Combination	=	+D+0.750L+0.750S	Load Combination	=	+D+0.750L+0.750S
Location of maximum on span	=	8.978ft	Location of maximum on span	=	14.015 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection	0.233 in	Ratio = <b>773</b> >=360	Span: 1 : L Only		
Max Upward Transient Deflection	0 in	Ratio = <b>0</b> <360	n/a		
Max Downward Total Deflection	0.624 in	Ratio = <b>288</b> >=240	Span: 1 : +D+0.750L+0.750S+0.5250E		
Max Upward Total Deflection	0 in	Ratio = <b>0</b> <240	n/a		

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 15.0 ft	1	0.423	0.200	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	15.12	1,102.85	2610.00	0.00	0.00	0.00	0.00
+D+L	Length = 15.0 ft	1	0.714	0.331	1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	28.38	2,070.15	2900.00	0.00	0.00	0.00	0.00
+D+S	Length = 15.0 ft	1	0.574	0.265	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	26.23	1,913.46	3335.00	0.00	0.00	0.00	0.00
+D+0.750L	Length = 15.0 ft	1	0.504	0.234	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	25.07	1,828.32	3625.00	0.00	0.00	0.00	0.00
+D+0.750L+0.750S	Length = 15.0 ft	1				1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: BM#4**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values			
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>	
Length = 15.0 ft	1	0.731	0.336	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	33.40	2,436.28	3335.00	6.21	112.14	333.50
+1.158D+4.550E					1.000	1.00	1.00	1.00	1.00	1.00	1.00			0.00		0.00	0.00	0.00
Length = 15.0 ft	1	0.509	0.227	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	32.38	2,361.91	4640.00	5.84	105.39	464.00	
+1.119D+0.750L+0.750S+3.4					1.000	1.00	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	
Length = 15.0 ft	1	0.729	0.328	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	46.35	3,380.57	4640.00	8.42	151.97	464.00	
+0.60D					1.000	1.00	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	
Length = 15.0 ft	1	0.143	0.068	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	9.07	661.71	4640.00	1.74	31.37	464.00	
+0.4418D+4.550E					1.000	1.00	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	
Length = 15.0 ft	1	0.339	0.146	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	21.55	1,571.83	4640.00	3.76	67.93	464.00	

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S+0.5250E	1	0.6236	7.828		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	5.336	6.814
Overall MINimum	0.364	0.546
D Only	2.519	3.081
+D+L	4.445	5.595
+D+S	4.094	5.162
+D+0.750L	3.964	4.967
+D+0.750L+0.750S	5.145	6.527
+D+0.70E	2.774	3.463
+D+0.750L+0.750S+0.5250E	5.336	6.814
+0.60D	1.511	1.849
+0.60D+0.70E	1.766	2.231
L Only	1.926	2.514
S Only	1.575	2.081
E Only	0.364	0.546



## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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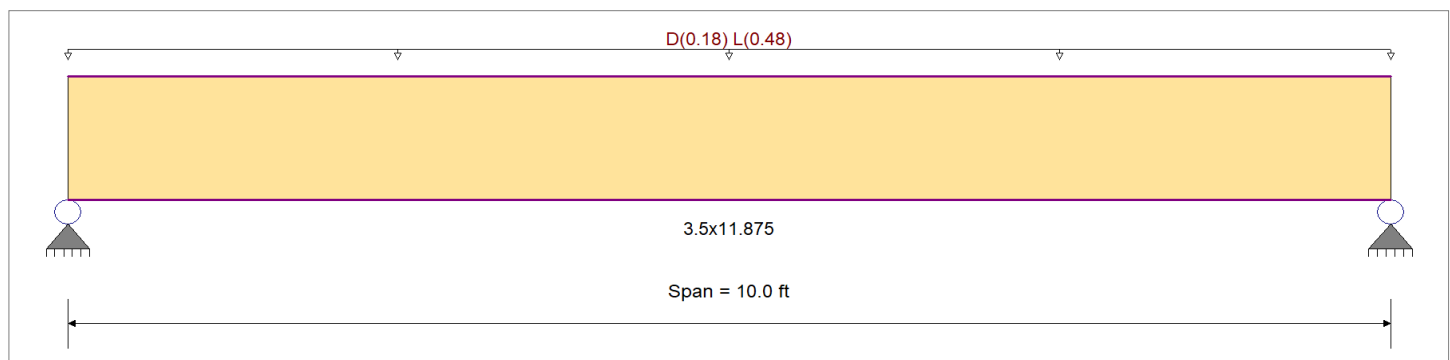
**DESCRIPTION:** BM#5

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,900.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	2,900.0 psi	Ebend- xx	2,000.0ksi
	Fc - Prll	2,900.0 psi	Eminbend - xx	1,016.54ksi
Wood Species : iLevel Truss Joist	Fc - Perp	750.0 psi		
Wood Grade : Parallam PSL 2.0E	Fv	290.0 psi		
	Ft	2,025.0 psi	Density	45.070pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 12.0 ft, (FLOOR)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.423</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.336</b> : 1
Section used for this span		<b>3.5x11.875</b>	Section used for this span		<b>3.5x11.875</b>
fb: Actual	=	1,227.24psi	fv: Actual	=	97.51 psi
Fb: Allowable	=	2,900.00psi	Fv: Allowable	=	290.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	5.000ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.111 in Ratio = 1079 >=360	Span: 1 : L Only		
Max Upward Transient Deflection		0 in Ratio = 0 <360	n/a		
Max Downward Total Deflection		0.156 in Ratio = 769 >=240	Span: 1 : +D+L		
Max Upward Total Deflection		0 in Ratio = 0 <240	n/a		

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values								
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v					
D Only	Length = 10.0 ft	1	0.135	0.107	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
+D+L	Length = 10.0 ft	1	0.423	0.336	1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
+D+0.750L	Length = 10.0 ft	1	0.278	0.221	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
+1.158D	Length = 10.0 ft	1	0.088	0.070	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
+1.119D+0.750L	Length = 10.0 ft	1	0.226	0.180	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
+0.60D	Length = 10.0 ft	1	0.046	0.036	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
+0.4418D	Length = 10.0 ft	1			1.000	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: BM#5**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values		
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>
	Length = 10.0 ft	1	0.034	0.027	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.07	155.49	4640.00	0.34	12.35	464.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.1559	5.036		0.0000	0.000

**Vertical Reactions**

Load Combination	Support notation : Far left is #1		Values in KIPS	
	Support 1	Support 2		
Overall MAXimum	3.365	3.365		
Overall MINimum	2.400	2.400		
D Only	0.965	0.965		
+D+L	3.365	3.365		
+D+0.750L	2.765	2.765		
+0.60D	0.579	0.579		
L Only	2.400	2.400		

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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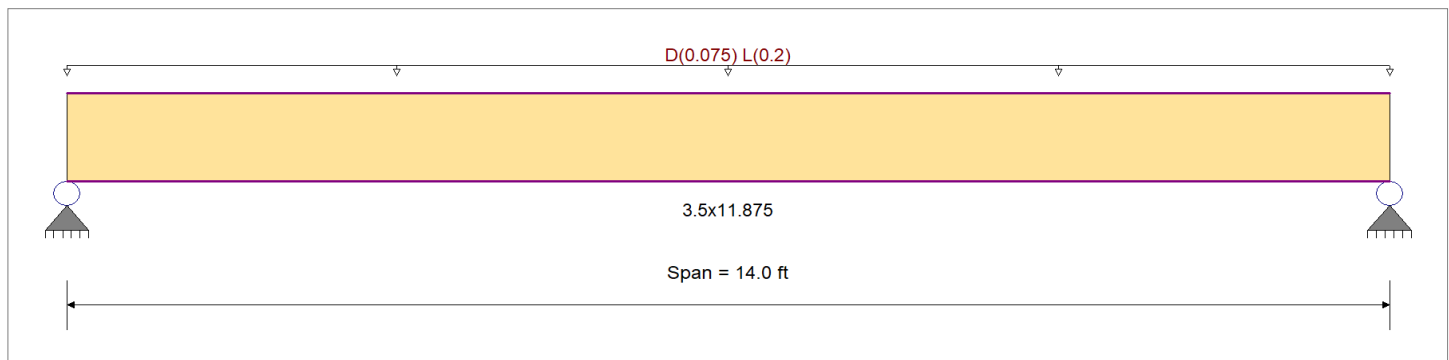
**DESCRIPTION:** BM#6

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,900.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	2,900.0 psi	Ebend- xx	2,000.0ksi
	Fc - Prll	2,900.0 psi	Eminbend - xx	1,016.54ksi
Wood Species : iLevel Truss Joist	Fc - Perp	750.0 psi		
Wood Grade : Parallam PSL 2.0E	Fv	290.0 psi		
	Ft	2,025.0 psi	Density	45.070pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 5.0 ft, (FLOOR)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.355</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.216</b> : 1
Section used for this span		<b>3.5x11.875</b>	Section used for this span		<b>3.5x11.875</b>
fb: Actual	=	1,029.36psi	fv: Actual	=	62.67 psi
Fb: Allowable	=	2,900.00psi	Fv: Allowable	=	290.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	7.000ft	Location of maximum on span	=	13.029 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.178 in	Ratio =	<b>943</b> >=360	Span: 1 : L Only
Max Upward Transient Deflection		0 in	Ratio =	<b>0</b> <360	n/a
Max Downward Total Deflection		0.256 in	Ratio =	<b>655</b> >=240	Span: 1 : +D+L
Max Upward Total Deflection		0 in	Ratio =	<b>0</b> <240	n/a

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 14.0 ft	1	0.121	0.073	0.90	1.000	1.00	1.00	1.00	1.00	1.00	2.16	314.55	2610.00	0.00	0.00	0.00	0.53	19.15	261.00
+D+L	Length = 14.0 ft	1	0.355	0.216	1.00	1.000	1.00	1.00	1.00	1.00	1.00	7.06	1,029.36	2900.00	0.00	0.00	0.00	1.74	62.67	290.00
+D+0.750L	Length = 14.0 ft	1	0.235	0.143	1.25	1.000	1.00	1.00	1.00	1.00	1.00	5.83	850.66	3625.00	0.00	0.00	0.00	1.44	51.79	362.50
+1.158D	Length = 14.0 ft	1	0.079	0.048	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.50	364.31	4640.00	0.00	0.00	0.00	0.61	22.18	464.00
+1.119D+0.750L	Length = 14.0 ft	1	0.191	0.117	1.60	1.000	1.00	1.00	1.00	1.00	1.00	6.09	887.98	4640.00	0.00	0.00	0.00	1.50	54.06	464.00
+0.60D	Length = 14.0 ft	1	0.041	0.025	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.29	188.73	4640.00	0.00	0.00	0.00	0.32	11.49	464.00
+0.4418D	Length = 14.0 ft	1			1.000	1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00	0.00	

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

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**DESCRIPTION: BM#6**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values		
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>
	Length = 14.0 ft	1	0.030	0.018	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.95	138.97	4640.00	0.23	8.46	464.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.2563	7.051		0.0000	0.000

**Vertical Reactions**

Load Combination	Support notation : Far left is #1		Values in KIPS	
	Support 1	Support 2		
Overall MAXimum	2.016	2.016		
Overall MINimum	1.400	1.400		
D Only	0.616	0.616		
+D+L	2.016	2.016		
+D+0.750L	1.666	1.666		
+0.60D	0.370	0.370		
L Only	1.400	1.400		

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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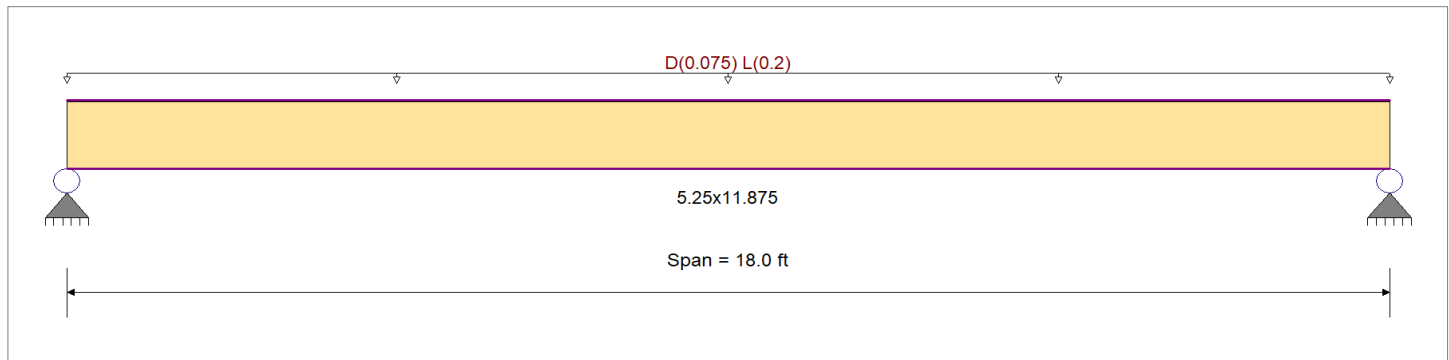
**DESCRIPTION:** BM#7

**CODE REFERENCES**

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

**Material Properties**

Analysis Method : Allowable Stress Design	Fb +	2,900.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	2,900.0 psi	Ebend- xx	2,000.0ksi
	Fc - Prll	2,900.0 psi	Eminbend - xx	1,016.54ksi
Wood Species : iLevel Truss Joist	Fc - Perp	750.0 psi		
Wood Grade : Parallam PSL 2.0E	Fv	290.0 psi		
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	Ft	2,025.0 psi	Density	45.070pcf



**Applied Loads**

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 5.0 ft, (FLOOR)

**DESIGN SUMMARY**

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.400</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.196</b> : 1
Section used for this span	=	<b>5.25x11.875</b>	Section used for this span	=	<b>5.25x11.875</b>
fb: Actual	=	1,160.02psi	fv: Actual	=	56.79 psi
Fb: Allowable	=	2,900.00psi	Fv: Allowable	=	290.00 psi
Load Combination	=	+D+L	Load Combination	=	+D+L
Location of maximum on span	=	9.000ft	Location of maximum on span	=	17.015 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection	0.324 in	Ratio =	666	>=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.478 in	Ratio =	452	>=240	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0	<240	n/a

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values										
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v							
D Only	Length = 18.0 ft	1	0.143	0.070	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.83	372.26	2610.00	0.00	0.00	0.00	0.76	18.23	261.00
+D+L	Length = 18.0 ft	1	0.400	0.196	1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	11.93	1,160.02	2900.00	0.00	0.00	0.00	2.36	56.79	290.00
+D+0.750L	Length = 18.0 ft	1	0.266	0.130	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	9.90	963.08	3625.00	0.00	0.00	0.00	1.96	47.15	362.50
+1.158D	Length = 18.0 ft	1	0.093	0.045	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	4.43	431.16	4640.00	0.00	0.00	0.00	0.88	21.11	464.00
+1.119D+0.750L	Length = 18.0 ft	1	0.217	0.106	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	10.36	1,007.25	4640.00	0.00	0.00	0.00	2.05	49.31	464.00
+0.60D	Length = 18.0 ft	1	0.048	0.024	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.30	223.36	4640.00	0.00	0.00	0.00	0.45	10.94	464.00
+0.4418D	Length = 18.0 ft	1			1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: BM#7**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values		
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>
	Length = 18.0 ft	1	0.035	0.017	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.69	164.47	4640.00	0.33	8.05	464.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.4775	9.066		0.0000	0.000

**Vertical Reactions**

Load Combination	Support notation : Far left is #1		Values in KIPS	
	Support 1	Support 2		
Overall MAXimum	2.651	2.651		
Overall MINimum	1.800	1.800		
D Only	0.851	0.851		
+D+L	2.651	2.651		
+D+0.750L	2.201	2.201		
+0.60D	0.510	0.510		
L Only	1.800	1.800		

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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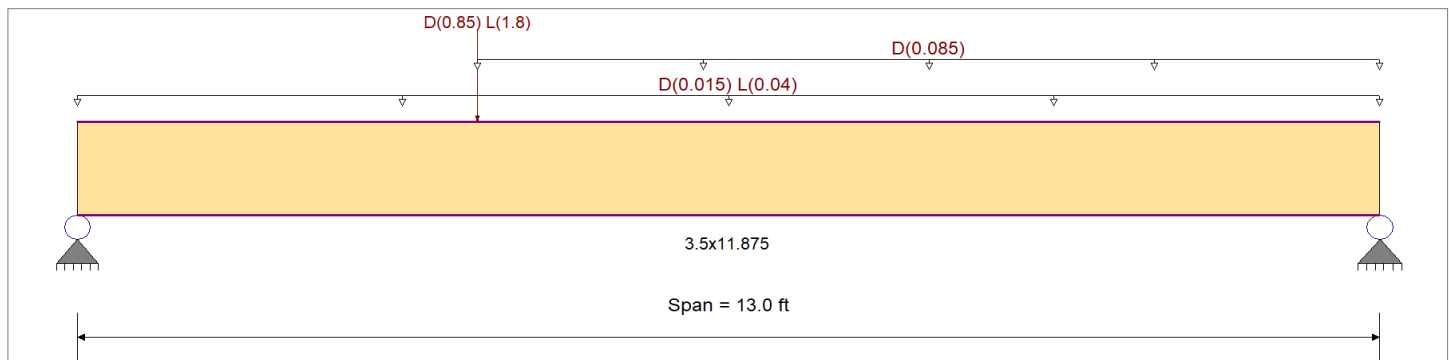
**DESCRIPTION: BM#8**

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,900.0 psi	E : Modulus of Elasticity
Load Combination : IBC 2018	Fb -	2,900.0 psi	Ebend- xx
	Fc - Prll	2,900.0 psi	Eminbend - xx
Wood Species : iLevel Truss Joist	Fc - Perp	750.0 psi	
Wood Grade : Parallam PSL 2.0E	Fv	290.0 psi	
	Ft	2,025.0 psi	Density
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			45.070pcf



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 1.0 ft, (FLOOR)  
 Point Load : D = 0.850, L = 1.80 k @ 4.0 ft, (BM#7)  
 Uniform Load : D = 0.010 ksf, Extent = 4.0 --> 13.0 ft, Tributary Width = 8.50 ft, (WALL)

### DESIGN SUMMARY

**Design OK**

Maximum Bending Stress Ratio	=	<b>0.483</b>	1	Maximum Shear Stress Ratio	=	<b>0.308</b>	: 1
Section used for this span		<b>3.5x11.875</b>		Section used for this span		<b>3.5x11.875</b>	
fb: Actual	=	1,401.80psi		fv: Actual	=	89.39 psi	
Fb: Allowable	=	2,900.00psi		Fv: Allowable	=	290.00 psi	
Load Combination		+D+L		Load Combination		+D+L	
Location of maximum on span	=	4.033ft		Location of maximum on span	=	0.000 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.146 in	Ratio =	<b>1069</b>	>=360	Span: 1 : L Only	
Max Upward Transient Deflection		0 in	Ratio =	<b>0</b>	<360	n/a	
Max Downward Total Deflection		0.265 in	Ratio =	<b>589</b>	>=240	Span: 1 : +D+L	
Max Upward Total Deflection		0 in	Ratio =	<b>0</b>	<240	n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 13.0 ft	1	0.220	0.139	0.90	1.000	1.00	1.00	1.00	1.00	1.00	3.94	574.91	2610.00	0.00	0.00	0.00	0.00	36.41	261.00
+D+L	Length = 13.0 ft	1	0.483	0.308	1.00	1.000	1.00	1.00	1.00	1.00	1.00	9.61	1,401.80	2900.00	2.48	89.39	290.00	0.00	0.00	0.00
+D+0.750L	Length = 13.0 ft	1	0.329	0.210	1.25	1.000	1.00	1.00	1.00	1.00	1.00	8.19	1,194.30	3625.00	2.11	76.15	362.50	0.00	0.00	0.00
+1.158D	Length = 13.0 ft	1	0.144	0.091	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.56	665.87	4640.00	1.17	42.17	464.00	0.00	0.00	0.00
+1.119D+0.750L	Length = 13.0 ft	1	0.272	0.173	1.60	1.000	1.00	1.00	1.00	1.00	1.00	8.65	1,262.14	4640.00	2.23	80.47	464.00	0.00	0.00	0.00
+0.60D						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: BM#8**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values					
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>			
Length = 13.0 ft +0.4418D	13.0 ft	1	0.074	0.047	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.36	344.95	4640.00	0.61	21.84	464.00
Length = 13.0 ft	13.0 ft	1	0.055	0.035	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.74	254.00	4640.00	0.45	16.08	464.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.2646	6.120		0.0000	0.000

**Vertical Reactions**

Load Combination	Support notation : Far left is #1		Values in KIPS	
	Support 1	Support 2		
Overall MAXimum	2.541	1.758		
Overall MINimum	1.506	0.814		
D Only	1.035	0.944		
+D+L	2.541	1.758		
+D+0.750L	2.165	1.554		
+0.60D	0.621	0.566		
L Only	1.506	0.814		



## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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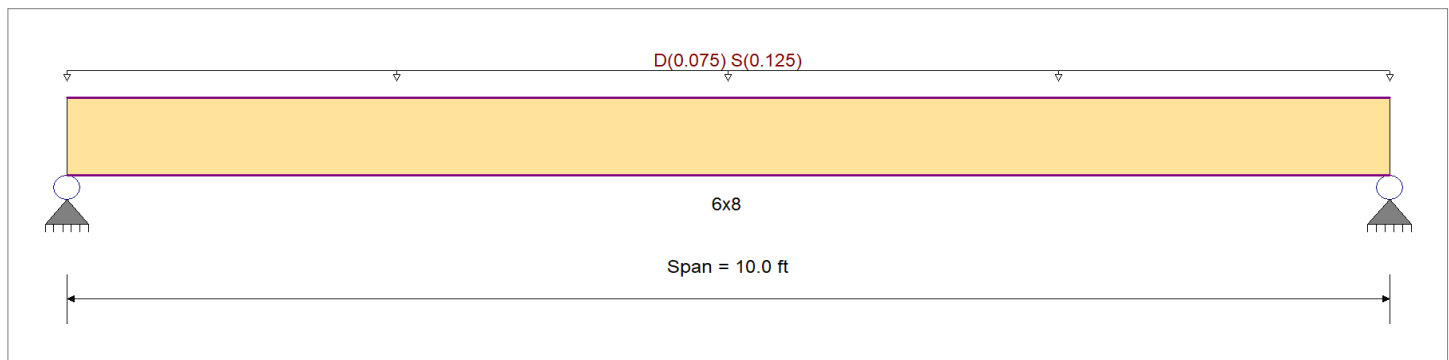
**DESCRIPTION:** BM#9

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	875 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	875 psi	Ebend- xx	1300ksi
	Fc - Prll	600 psi	Eminbend - xx	470ksi
Wood Species : Douglas Fir-Larch (North)	Fc - Perp	625 psi		
Wood Grade : No.2	Fv	170 psi		
	Ft	425 psi	Density	30.59pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading

Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 5.0 ft, (ROOF)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.604</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.170</b> : 1
Section used for this span		<b>6x8</b>	Section used for this span		<b>6x8</b>
fb: Actual	=	607.31 psi	fv: Actual	=	33.25 psi
Fb: Allowable	=	1,006.25psi	Fv: Allowable	=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	5.000ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection	0.113 in	Ratio = 1066	>=360	Span: 1 : S Only	
Max Upward Transient Deflection	0 in	Ratio = 0	<360	n/a	
Max Downward Total Deflection	0.188 in	Ratio = 638	>=240	Span: 1 : +D+S	
Max Upward Total Deflection	0 in	Ratio = 0	<240	n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values				
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v		
D Only																			
Length = 10.0 ft	1	0.309	0.087	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.05	243.67	787.50	0.00	0.00	0.00	0.00	13.34	153.00
+D+S																			
Length = 10.0 ft	1	0.604	0.170	1.15	1.000	1.00	1.00	1.00	1.00	1.00	2.61	607.31	1006.25	0.00	0.00	0.00	0.00	33.25	195.50
+D+0.750S																			
Length = 10.0 ft	1	0.513	0.145	1.15	1.000	1.00	1.00	1.00	1.00	1.00	2.22	516.40	1006.25	0.00	0.00	0.00	0.00	28.27	195.50
+1.158D																			
Length = 10.0 ft	1	0.202	0.057	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.21	282.22	1400.00	0.00	0.00	0.00	0.00	15.45	272.00
+1.119D+0.750S																			
Length = 10.0 ft	1	0.390	0.110	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.34	545.31	1400.00	0.00	0.00	0.00	0.00	29.85	272.00
+0.60D																			
Length = 10.0 ft	1	0.104	0.029	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.63	146.20	1400.00	0.00	0.00	0.00	0.00	8.00	272.00
+0.4418D																			
Length = 10.0 ft	1				1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: BM#9**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values		
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>
Length = 10.0 ft		1	0.077	0.022	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.46	107.65	1400.00	0.16	5.89	272.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.1880	5.036		0.0000	0.000

**Vertical Reactions**

Load Combination	Support notation : Far left is #1		Values in KIPS	
	Support 1	Support 2		
Overall MAXimum	1.044	1.044		
Overall MINimum	0.625	0.625		
D Only	0.419	0.419		
+D+S	1.044	1.044		
+D+0.750S	0.888	0.888		
+0.60D	0.251	0.251		
S Only	0.625	0.625		

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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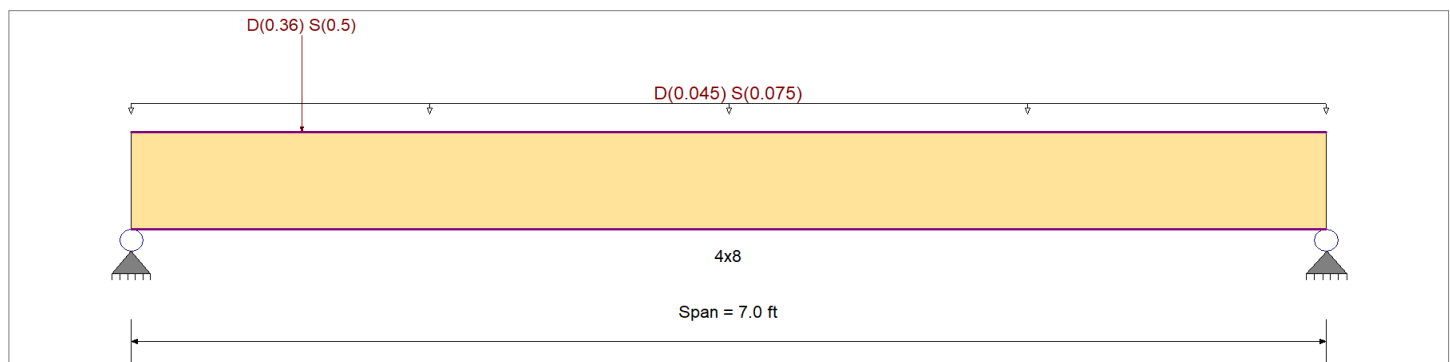
**DESCRIPTION:** BM#10

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	875.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	875.0 psi	Ebend- xx	1,300.0ksi
	Fc - Prll	600.0 psi	Eminbend - xx	470.0ksi
Wood Species : Douglas Fir-Larch (North)	Fc - Perp	625.0 psi		
Wood Grade : No.2	Fv	170.0 psi		
	Ft	425.0 psi	Density	30.590pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 3.0 ft, (ROOF)  
 Point Load : D = 0.360, S = 0.50 k @ 1.0 ft, (HM#5)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.376</b>	1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.333</b>	: 1
Section used for this span		<b>4x8</b>		Section used for this span		<b>4x8</b>	
fb: Actual	=	492.42psi		fv: Actual	=	65.16 psi	
Fb: Allowable	=	1,308.13psi		Fv: Allowable	=	195.50 psi	
Load Combination		+D+S		Load Combination		+D+S	
Location of maximum on span	=	2.529ft		Location of maximum on span	=	0.000ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.046 in	Ratio =	1813	>=360	Span: 1 : S Only	
Max Upward Transient Deflection		0 in	Ratio =	0	<360	n/a	
Max Downward Total Deflection		0.078 in	Ratio =	1072	>=240	Span: 1 : +D+S	
Max Upward Total Deflection		0 in	Ratio =	0	<240	n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 7.0 ft	1	0.197	0.176	0.90	1.300	1.00	1.00	1.00	1.00	1.00	0.51	201.51	1023.75	0.00	0.00	0.00	0.46	26.92	153.00
+D+S	Length = 7.0 ft	1	0.376	0.333	1.15	1.300	1.00	1.00	1.00	1.00	1.00	1.26	492.42	1308.13	0.00	0.00	0.00	1.10	65.16	195.50
+D+0.750S	Length = 7.0 ft	1	0.321	0.284	1.15	1.300	1.00	1.00	1.00	1.00	1.00	1.07	419.69	1308.13	0.00	0.00	0.00	0.94	55.60	195.50
+1.158D	Length = 7.0 ft	1	0.128	0.115	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.60	233.39	1820.00	0.00	0.00	0.00	0.53	31.17	272.00
+1.119D+0.750S	Length = 7.0 ft	1	0.244	0.216	1.60	1.300	1.00	1.00	1.00	1.00	1.00	1.13	443.60	1820.00	0.00	0.00	0.00	0.99	58.79	272.00
+0.60D	Length = 7.0 ft	1	0.066	0.059	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.31	120.91	1820.00	0.00	0.00	0.00	0.27	16.15	272.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: BM#10**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values				
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>	
+0.4418D						1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00
Length = 7.0 ft	<b>1</b>		0.049	0.044	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.23	89.03	1820.00	0.20	11.89	272.00	

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.0783	3.321		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.176	0.562
Overall MINimum	0.691	0.334
D Only	0.485	0.228
+D+S	1.176	0.562
+D+0.750S	1.003	0.478
+0.60D	0.291	0.137
S Only	0.691	0.334

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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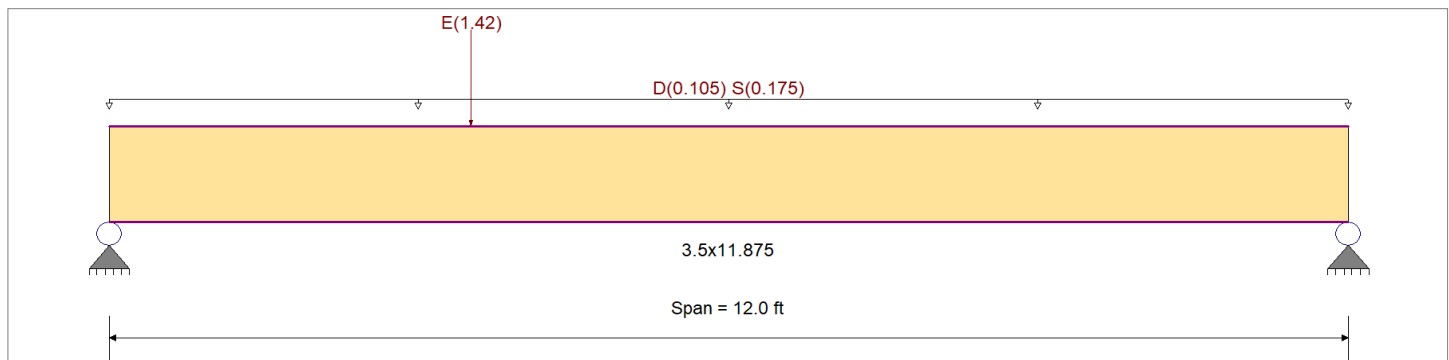
**DESCRIPTION:** BM#11

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,900.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	2,900.0 psi	Ebend- xx	2,000.0ksi
	Fc - Prll	2,900.0 psi	Eminbend - xx	1,016.54ksi
Wood Species : iLevel Truss Joist	Fc - Perp	750.0 psi		
Wood Grade : Parallam PSL 2.0E	Fv	290.0 psi		
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	Ft	2,025.0 psi	Density	45.070pcf



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 7.0 ft, (ROOF)  
 Point Load : E = 1.420 k @ 3.50 ft, (SW6)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.567 : 1</b>	<b>Maximum Shear Stress Ratio</b>	=	<b>0.410 : 1</b>
Section used for this span		<b>3.5x11.875</b>	Section used for this span		<b>3.5x11.875</b>
fb: Actual	=	2,632.46psi	fv: Actual	=	190.01 psi
Fb: Allowable	=	4,640.00psi	Fv: Allowable	=	464.00 psi
Load Combination	=	+1.158D+4.550E	Load Combination	=	+1.158D+4.550E
Location of maximum on span	=	3.504ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.084 in	Ratio =	1712	>=360
Max Upward Transient Deflection		0 in	Ratio =	0	<360
Max Downward Total Deflection		0.157 in	Ratio =	917	>=240
Max Upward Total Deflection		0 in	Ratio =	0	<240

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values								
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v					
D Only	Length = 12.0 ft	1	0.119	0.082	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.12	309.87	2610.00	0.00	0.00	0.00	0.59	21.45	261.00
+D+S	Length = 12.0 ft	1	0.231	0.160	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	5.27	769.40	3335.00	0.00	0.00	0.00	1.48	53.26	333.50
+D+0.750S	Length = 12.0 ft	1	0.196	0.136	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	4.49	654.52	3335.00	0.00	0.00	0.00	1.26	45.31	333.50
+1.158D+4.550E	Length = 12.0 ft	1	0.567	0.410	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	18.05	2,632.46	4640.00	0.00	0.00	0.00	5.26	190.01	464.00
+1.119D+0.750S+3.413E	Length = 12.0 ft	1	0.501	0.370	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	15.93	2,323.39	4640.00	0.00	0.00	0.00	4.76	171.73	464.00
+0.60D	Length = 12.0 ft	1	0.040	0.028	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.27	185.92	4640.00	0.00	0.00	0.00	0.36	12.87	464.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** BM#11

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F'v			
+0.4418D+4.550E	Length = 12.0 ft	1	0.528	0.376	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	16.79	2,448.90	4640.00	0.00	0.00	0.00	0.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750S+0.5250E	1	0.1569	5.869		0.0000	0.000

### Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.024	1.758
Overall MINimum	1.006	0.414
D Only	0.708	0.708
+D+S	1.758	1.758
+D+0.750S	1.496	1.496
+D+0.70E	1.412	0.998
+D+0.750S+0.5250E	2.024	1.713
+0.60D	0.425	0.425
+0.60D+0.70E	1.129	0.715
S Only	1.050	1.050
E Only	1.006	0.414

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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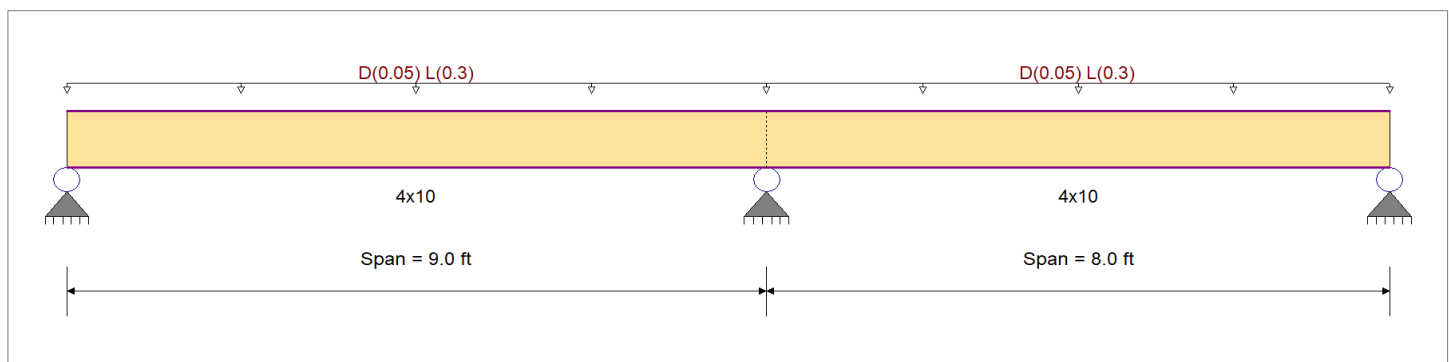
**DESCRIPTION:** BM#12

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	875.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	875.0 psi	Ebend- xx	1,300.0ksi
	Fc - Prll	600.0 psi	Eminbend - xx	470.0ksi
Wood Species : Douglas Fir-Larch (North)	Fc - Perp	625.0 psi		
Wood Grade : No.2	Fv	170.0 psi		
	Ft	425.0 psi	Density	30.590pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



### Applied Loads

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

Beam self weight calculated and added to loading

Load for Span Number 1

Uniform Load : D = 0.010, L = 0.060 ksf, Tributary Width = 5.0 ft, (DECK)

Load for Span Number 2

Uniform Load : D = 0.010, L = 0.060 ksf, Tributary Width = 5.0 ft, (DECK)

### DESIGN SUMMARY

**Design OK**

Maximum Bending Stress Ratio	=	<b>0.932</b>	1	Maximum Shear Stress Ratio	=	<b>0.579</b>	: 1
Section used for this span		<b>4x10</b>		Section used for this span		<b>4x10</b>	
fb: Actual	=	782.95psi		fv: Actual	=	78.70 psi	
Fb: Allowable	=	840.00psi		Fv: Allowable	=	136.00 psi	
Load Combination		+D+L		Load Combination		+D+L	
Location of maximum on span	=	9.000ft		Location of maximum on span	=	8.246 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.074 in	Ratio =	<b>1460</b>	>=	360	Span: 2 : L Only
Max Upward Transient Deflection		-0.001 in	Ratio =	<b>88509</b>	>=	360	Span: 2 : L Only
Max Downward Total Deflection		0.088 in	Ratio =	<b>1227</b>	>=	240	Span: 2 : +D+L
Max Upward Total Deflection		-0.001 in	Ratio =	<b>74403</b>	>=	240	Span: 2 : +D+L

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values				
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v		
D Only																			
Length = 9.0 ft	1		0.165	0.102	0.90	1.200	0.80	1.00	1.00	1.00	1.00	0.52	124.78	756.00	0.27	12.54	122.40		
Length = 8.0 ft	2		0.165	0.102	0.90	1.200	0.80	1.00	1.00	1.00	1.00	0.52	124.78	756.00	0.25	12.54	122.40		
+D+L																			
Length = 9.0 ft	1		0.932	0.579	1.00	1.200	0.80	1.00	1.00	1.00	1.00	3.26	782.95	840.00	1.70	78.70	136.00		
Length = 8.0 ft	2		0.932	0.579	1.00	1.200	0.80	1.00	1.00	1.00	1.00	3.26	782.95	840.00	1.56	78.70	136.00		
+D+0.750L																			
Length = 9.0 ft	1		0.589	0.366	1.25	1.200	0.80	1.00	1.00	1.00	1.00	2.57	618.41	1050.00	1.34	62.16	170.00		
Length = 8.0 ft	2		0.589	0.366	1.25	1.200	0.80	1.00	1.00	1.00	1.00	2.57	618.41	1050.00	1.23	62.16	170.00		
+1.158D																			

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: BM#12**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values		
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>
Length = 9.0 ft	1	0.108	0.067	1.60	1.200	0.80	1.00	1.00	1.00	1.00	0.60	144.52	1344.00	0.31	14.53	217.60	
	2	0.108	0.067	1.60	1.200	0.80	1.00	1.00	1.00	1.00	0.60	144.52	1344.00	0.29	14.53	217.60	
+1.119D+0.750L					1.200	0.80	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	
Length = 9.0 ft	1	0.471	0.293	1.60	1.200	0.80	1.00	1.00	1.00	1.00	2.63	633.21	1344.00	1.37	63.65	217.60	
	2	0.471	0.293	1.60	1.200	0.80	1.00	1.00	1.00	1.00	2.63	633.21	1344.00	1.26	63.65	217.60	
+0.60D					1.200	0.80	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	
Length = 9.0 ft	1	0.056	0.035	1.60	1.200	0.80	1.00	1.00	1.00	1.00	0.31	74.87	1344.00	0.16	7.53	217.60	
	2	0.056	0.035	1.60	1.200	0.80	1.00	1.00	1.00	1.00	0.31	74.87	1344.00	0.15	7.53	217.60	
+0.4418D					1.200	0.80	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	
Length = 9.0 ft	1	0.041	0.025	1.60	1.200	0.80	1.00	1.00	1.00	1.00	0.23	55.13	1344.00	0.12	5.54	217.60	
	2	0.041	0.025	1.60	1.200	0.80	1.00	1.00	1.00	1.00	0.23	55.13	1344.00	0.11	5.54	217.60	

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.0880	3.922		0.0000	0.000
+D+L	2	0.0390	4.827	+D+L	-0.0013	0.402

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	1.244	3.802	1.020
Overall MINimum	1.046	3.196	0.858
D Only	0.198	0.606	0.163
+D+L	1.244	3.802	1.020
+D+0.750L	0.983	3.003	0.806
+0.60D	0.119	0.364	0.098
L Only	1.046	3.196	0.858



## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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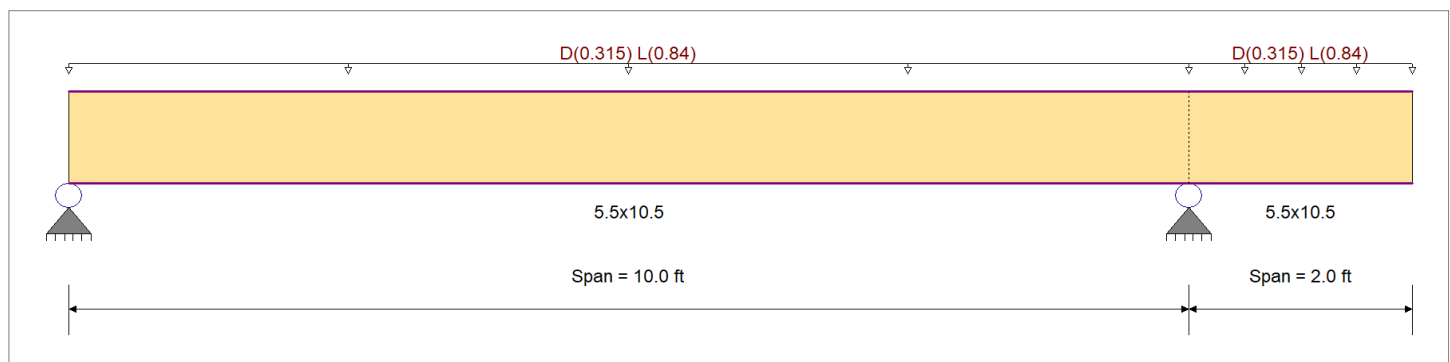
**DESCRIPTION:** BM#13

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2400 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1850 psi	Ebend- xx	1800ksi
Wood Species : DF/DF	Fc - Prll	1650 psi	Eminbend - xx	950ksi
Wood Grade : 24F-V4	Fc - Perp	650 psi	Ebend- yy	1600ksi
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	Fv	265 psi	Eminbend - yy	850ksi
	Ft	1100 psi	Density	31.21 pcf



### Applied Loads

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

Beam self weight calculated and added to loading

Load for Span Number 1

Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 21.0 ft, (FLOOR)

Load for Span Number 2

Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 21.0 ft, (FLOOR)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.665</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.499</b> : 1
Section used for this span		<b>5.5x10.5</b>	Section used for this span		<b>5.5x10.5</b>
fb: Actual	=	1,597.01 psi	fv: Actual	=	132.28 psi
Fb: Allowable	=	2,400.00 psi	Fv: Allowable	=	265.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	4.804ft	Location of maximum on span	=	9.162 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.181 in	Ratio =	<b>664</b> >=360	Span: 1 : L Only
Max Upward Transient Deflection		-0.103 in	Ratio =	<b>464</b> >=360	Span: 2 : L Only
Max Downward Total Deflection		0.251 in	Ratio =	<b>478</b> >=240	Span: 1 : +D+L
Max Upward Total Deflection		-0.144 in	Ratio =	<b>334</b> >=240	Span: 2 : +D+L

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values					
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only																				
Length = 10.0 ft	1	1	0.207	0.156	0.90	1.000	1.00	1.00	1.00	1.00	1.00	3.77	448.00	2160.00	0.00	0.00	0.00	1.43	37.11	238.50
Length = 2.0 ft	2	2	0.047	0.156	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.66	77.78	1665.00	0.00	0.00	0.00	0.37	37.11	238.50
+D+L																				
Length = 10.0 ft	1	1	0.665	0.499	1.00	1.000	1.00	1.00	1.00	1.00	1.00	13.45	1,597.01	2400.00	0.00	0.00	0.00	5.09	132.28	265.00
Length = 2.0 ft	2	2	0.150	0.499	1.00	1.000	1.00	1.00	1.00	1.00	1.00	2.34	277.26	1850.00	0.00	0.00	0.00	1.32	132.28	265.00
+D+0.750L																				
Length = 10.0 ft	1	1	0.437	0.328	1.25	1.000	1.00	1.00	1.00	1.00	1.00	11.03	1,309.75	3000.00	0.00	0.00	0.00	4.18	108.49	331.25
Length = 2.0 ft	2	2	0.098	0.328	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.92	227.39	2312.50	0.00	0.00	0.00	1.08	108.49	331.25
+1.158D																				

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

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**DESCRIPTION: BM#13**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values		
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>
Length = 10.0 ft	1	0.135	0.101	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.37	518.87	3840.00	1.65	42.98	424.00
	2	0.030	0.101	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.76	90.08	2960.00	0.43	42.98	424.00
+1.119D+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 10.0 ft	1	0.355	0.266	1.60	1.000	1.00	1.00	1.00	1.00	1.00	11.48	1,362.91	3840.00	4.35	112.89	424.00
	2	0.080	0.266	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.99	236.62	2960.00	1.12	112.89	424.00
+0.60D					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 10.0 ft	1	0.070	0.053	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.26	268.80	3840.00	0.86	22.26	424.00
	2	0.016	0.053	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.39	46.67	2960.00	0.22	22.26	424.00
+0.4418D					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 10.0 ft	1	0.052	0.039	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.67	197.93	3840.00	0.63	16.39	424.00
	2	0.012	0.039	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.29	34.36	2960.00	0.16	16.39	424.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.2510	4.972		0.0000	0.000
	2	0.0000	4.972	+D+L	-0.1437	2.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	5.604	8.406	
Overall MINimum	4.032	6.048	
D Only	1.572	2.358	
+D+L	5.604	8.406	
+D+0.750L	4.596	6.894	
+0.60D	0.943	1.415	
L Only	4.032	6.048	



Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: BM#14**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values		
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>
+0.4418D					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 13.0 ft	<b>1</b>		0.072	0.045	1.60	1.000	1.00	1.00	1.00	1.00	3.85	276.46	3840.00	0.95	19.14	424.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.4428	6.642		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	7.836	8.613
Overall MINimum	5.603	6.157
D Only	2.233	2.457
+D+L	7.836	8.613
+D+0.750L	6.435	7.074
+0.60D	1.340	1.474
L Only	5.603	6.157

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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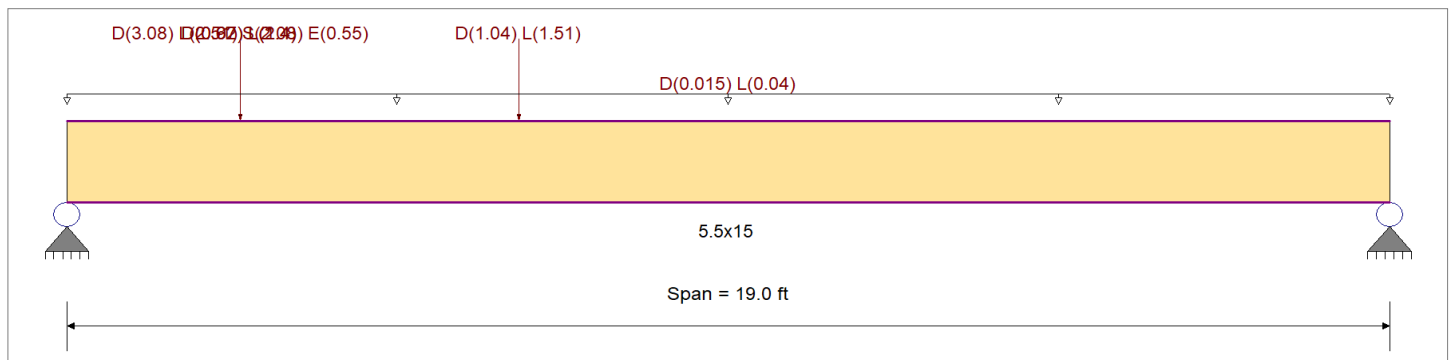
**DESCRIPTION:** BM#15

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : IBC 2018	Fb -	1,850.0 psi	Ebend- xx	1,800.0ksi
Wood Species : DF/DF	Fc - Prll	1,650.0 psi	Eminbend - xx	950.0ksi
Wood Grade : 24F-V4	Fc - Perp	650.0 psi	Ebend- yy	1,600.0ksi
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	Fv	265.0 psi	Eminbend - yy	850.0ksi
	Ft	1,100.0 psi	Density	31.210pcf



### Applied Loads

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

Beam self weight calculated and added to loading

- Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 1.0 ft, (FLOOR)
- Point Load : D = 3.080, L = 2.510, S = 2.080, E = 0.550 k @ 2.50 ft, (BM#4)
- Point Load : D = 0.620, L = 1.40 k @ 2.50 ft, (BM#5)
- Point Load : D = 0.970, L = 2.40 k @ 2.50 ft, (BM#6)
- Point Load : D = 1.040, L = 1.510 k @ 6.50 ft, (BM#8)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.788</b> : 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.811</b> : 1
Section used for this span		<b>5.5x15</b>	Section used for this span		<b>5.5x15</b>
fb: Actual	=	1,856.08psi	fv: Actual	=	214.81 psi
Fb: Allowable	=	2,353.96psi	Fv: Allowable	=	265.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	6.449ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection	0.382 in	Ratio =	<b>597</b> >=360	Span: 1 : L Only	
Max Upward Transient Deflection	0 in	Ratio =	<b>0</b> <360	n/a	
Max Downward Total Deflection	0.662 in	Ratio =	<b>344</b> >=240	Span: 1 : +D+L	
Max Upward Total Deflection	0 in	Ratio =	<b>0</b> <240	n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values					
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v		
D Only	Length = 19.0 ft	1	0.370	0.382	0.90	0.981	1.00	1.00	1.00	1.00	1.00	1.00	13.46	782.86	2118.57	0.00	0.00	0.00	0.00
+D+L	Length = 19.0 ft	1	0.788	0.811	1.00	0.981	1.00	1.00	1.00	1.00	1.00	1.00	31.90	1,856.08	2353.96	0.00	0.00	0.00	0.00
+D+S	Length = 19.0 ft	1	0.367	0.407	1.15	0.981	1.00	1.00	1.00	1.00	1.00	1.00	17.05	992.22	2707.06	0.00	0.00	0.00	0.00
+D+0.750L	Length = 19.0 ft	1	0.540	0.555	1.25	0.981	1.00	1.00	1.00	1.00	1.00	1.00	27.29	1,587.78	2942.46	0.00	0.00	0.00	0.00
+D+0.750L+0.750S	Length = 19.0 ft	1				0.981	1.00	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: BM#15**

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values			
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	f <sub>v</sub>	F <sub>v</sub>
Length = 19.0 ft	1	0.642	0.684	1.15	0.981	1.00	1.00	1.00	1.00	1.00	1.00	29.87	1,737.67	2707.06	11.47	208.51	304.75
+1.158D+4.550E					0.981	1.00	1.00	1.00	1.00	1.00			0.00		0.00	0.00	0.00
Length = 19.0 ft	1	0.308	0.342	1.60	0.981	1.00	1.00	1.00	1.00	1.00	19.95	1,160.54	3766.34	7.98	145.04	424.00	
+1.119D+0.750L+0.750S+3.4					0.981	1.00	1.00	1.00	1.00	1.00			0.00		0.00	0.00	
Length = 19.0 ft	1	0.534	0.587	1.60	0.981	1.00	1.00	1.00	1.00	1.00	34.58	2,011.90	3766.34	13.69	248.96	424.00	
+0.60D					0.981	1.00	1.00	1.00	1.00	1.00			0.00		0.00	0.00	
Length = 19.0 ft	1	0.125	0.129	1.60	0.981	1.00	1.00	1.00	1.00	1.00	8.07	469.72	3766.34	3.01	54.67	424.00	
+0.4418D+4.550E					0.981	1.00	1.00	1.00	1.00	1.00			0.00		0.00	0.00	
Length = 19.0 ft	1	0.169	0.188	1.60	0.981	1.00	1.00	1.00	1.00	1.00	10.95	637.37	3766.34	4.39	79.77	424.00	

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.6616	8.529		0.0000	0.000

**Vertical Reactions**

Load Combination	Support notation : Far left is #1		Values in KIPS	
	Support 1	Support 2		
Overall MAXimum	11.905	3.009		
Overall MINimum	0.478	0.072		
D Only	5.052	1.283		
+D+L	11.905	3.009		
+D+S	6.858	1.556		
+D+0.750L	10.192	2.578		
+D+0.750L+0.750S	11.547	2.783		
+D+0.70E	5.386	1.333		
+D+0.750L+0.750S+0.5250E	11.797	2.821		
+0.60D	3.031	0.770		
+0.60D+0.70E	3.366	0.820		
L Only	6.853	1.727		
S Only	1.806	0.274		
E Only	0.478	0.072		

## Wood Column

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

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**DESCRIPTION:** COL#1

### Code References

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combinations Used : IBC 2018

### General Information

Analysis Method	Allowable Stress Design			Wood Section Name	<b>6x8</b>
End Fixities	Top & Bottom Pinned			Wood Grading/Manuf.	Graded Lumber
Overall Column Height	9 ft			Wood Member Type	Sawn
<i>( Used for non-slender calculations )</i>					
Wood Species	Douglas Fir-Larch (North)			Exact Width	<b>5.50</b> in
Wood Grade	No.2			Exact Depth	<b>7.50</b> in
Fb +	725 psi	Fv	170 psi	Area	41.250 in^2
Fb -	725 psi	Ft	475 psi	Ix	193.359 in^4
Fc - Prll	700 psi	Density	30.59 pcf	Iy	<b>103.984</b> in^4
Fc - Perp	625 psi			Allow Stress Modification Factors	
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial	Cf or Cv for Bending 1.0	
	Basic	1300	1300	1300 ksi	Cf or Cv for Compression 1.0
	Minimum	470	470		Cf or Cv for Tension 1.0
					Cm : Wet Use Factor 1.0
					Ct : Temperature Fact 1.0
					Cfu : Flat Use Factor 1.0
					Kf : Built-up columns 1.0 <i>NDS 15.3.2</i>
					Use Cr : Repetitive ? No
Brace condition for deflection (buckling) along columns :					
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 9 ft, K					
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 9 ft, K					

### Applied Loads

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

Column self weight included : 78.865 lbs \* Dead Load Factor

AXIAL LOADS . . .

BM#4,5 &6: Axial Load at 9.0 ft, D = 4.70, L = 6.310, E = 0.550 k

### DESIGN SUMMARY

#### Bending & Shear Check Results

<b>PASS</b> Max. Axial+Bending Stress Ratio =	<b>0.4809 : 1</b>	<b>Maximum SERVICE Lateral Load Reactions . .</b>	
Load Combination	+D+L	Top along Y-Y	0.0 k
Governing NDS Formula	Comp Only, fc/Fc'	Bottom along Y-Y	0.0 k
Location of max.above base	0.0 ft	Top along X-X	0.0 k
Bottom along X-X		Bottom along X-X	0.0 k
At maximum location values are .		<b>Maximum SERVICE Load Lateral Deflections . . .</b>	
Applied Axial	11.089 k	Along Y-Y	0.0 in at 0.0 ft above base
Applied Mx	0.0 k-ft	for load combination :	n/a
Applied My	0.0 k-ft	Along X-X	0.0 in at 0.0 ft above base
Fc : Allowable	558.95 psi	for load combination :	n/a
<b>PASS</b> Maximum Shear Stress Ratio =	<b>0.0 : 1</b>	<b>Other Factors used to calculate allowable stresses . . .</b>	
Load Combination	+0.4418D+4.550E	<u>Bending</u>	<u>Compression</u>
Location of max.above base	9.0 ft	<u>Tension</u>	
Applied Design Shear	0.0 psi		
Allowable Shear	272.0 psi		

### Load Combination Results

Load Combination	C <sub>D</sub>	C <sub>P</sub>	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.823	0.2234	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+L	1.000	0.799	0.4809	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L	1.250	0.736	0.3582	PASS	0.0 ft	0.0	PASS	9.0 ft
+1.158D+4.550E	1.600	0.651	0.2671	PASS	0.0 ft	0.0	PASS	9.0 ft
+1.119D+0.750L+3.413E	1.600	0.651	0.3973	PASS	0.0 ft	0.0	PASS	9.0 ft
+0.60D	1.600	0.651	0.09529	PASS	0.0 ft	0.0	PASS	9.0 ft
+0.4418D+4.550E	1.600	0.651	0.1533	PASS	0.0 ft	0.0	PASS	9.0 ft

## Wood Column

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

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**DESCRIPTION:** COL#1

### Maximum Reactions

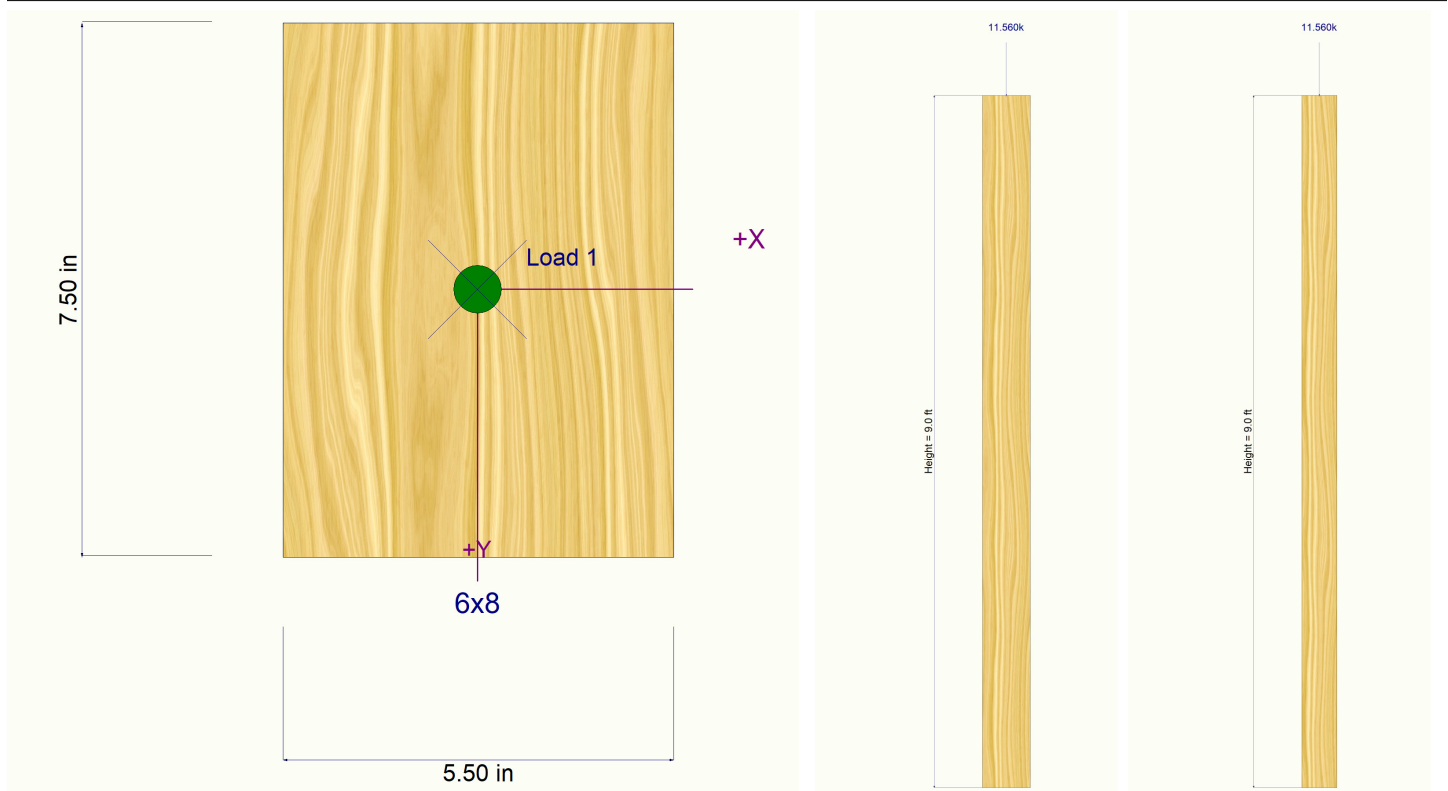
Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top	@ Base	@ Top
D Only						4.779				
+D+L						11.089				
+D+0.750L						9.511				
+D+0.70E						5.164				
+D+0.750L+0.5250E						9.800				
+0.60D						2.867				
+0.60D+0.70E						3.252				
L Only						6.310				
E Only						0.550				

### Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000ft	0.000 in	0.000ft
+D+L	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.750L	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.70E	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.750L+0.5250E	0.0000 in	0.000ft	0.000 in	0.000ft
+0.60D	0.0000 in	0.000ft	0.000 in	0.000ft
+0.60D+0.70E	0.0000 in	0.000ft	0.000 in	0.000ft
L Only	0.0000 in	0.000ft	0.000 in	0.000ft
E Only	0.0000 in	0.000ft	0.000 in	0.000ft

### Sketches





## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

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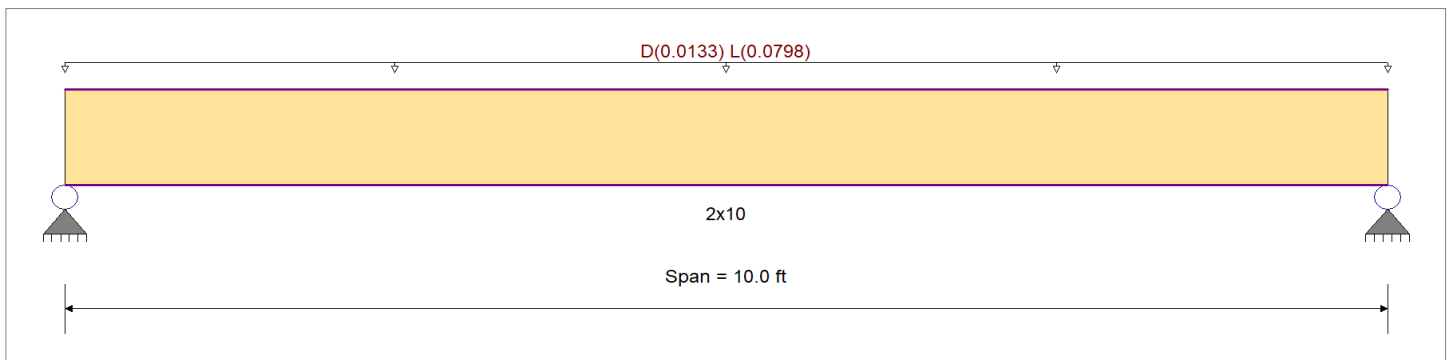
**DESCRIPTION:** MAIN FL. DECK JOIST

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	850.0 psi	<i>E : Modulus of Elasticity</i>
Load Combination : IBC 2018	Fb -	850.0 psi	Ebend- xx 1,300.0ksi
	Fc - Prll	1,300.0 psi	Eminbend - xx 470.0ksi
Wood Species : Hem-Fir	Fc - Perp	405.0 psi	
Wood Grade : No.2	Fv	150.0 psi	
	Ft	525.0 psi	Density 26.840pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			Repetitive Member Stress Increase



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.010, L = 0.060 ksf, Tributary Width = 1.330 ft, (DECK)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.780</b> < 1	<b>Maximum Shear Stress Ratio</b>	=	<b>0.365</b> < 1
Section used for this span		<b>2x10</b>	Section used for this span		<b>2x10</b>
fb: Actual	=	670.99psi	fv: Actual	=	43.79 psi
Fb: Allowable	=	860.20psi	Fv: Allowable	=	120.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	5.000ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection	0.148 in	Ratio = 811	>=360	Span: 1 : L Only	
Max Upward Transient Deflection	0 in	Ratio = 0	<360	n/a	
Max Downward Total Deflection	0.177 in	Ratio = 677	>=180	Span: 1 : +D+L	
Max Upward Total Deflection	0 in	Ratio = 0	<180	n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values				
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v		
D Only	Length = 10.0 ft	1	0.144	0.067	0.90	1.100	0.80	1.15	1.00	1.00	1.00	0.20	111.40	774.18	0.00	0.00	0.00	0.00	108.00
+D+L	Length = 10.0 ft	1	0.780	0.365	1.00	1.100	0.80	1.15	1.00	1.00	1.00	1.20	670.99	860.20	0.00	0.00	0.00	0.00	0.00
+D+0.750L	Length = 10.0 ft	1	0.494	0.231	1.25	1.100	0.80	1.15	1.00	1.00	1.00	0.95	531.09	1075.25	0.00	0.00	0.00	0.00	0.00
+0.60D	Length = 10.0 ft	1	0.049	0.023	1.60	1.100	0.80	1.15	1.00	1.00	1.00	0.12	66.84	1376.32	0.00	0.00	0.00	0.00	0.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.1772	5.036		0.0000	0.000

Project Title:  
Engineer:  
Project ID:  
Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: MAIN FL. DECK JOIST**

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.478	0.478
Overall MINimum	0.399	0.399
D Only	0.079	0.079
+D+L	0.478	0.478
+D+0.750L	0.379	0.379
+0.60D	0.048	0.048
L Only	0.399	0.399

## Wood Beam

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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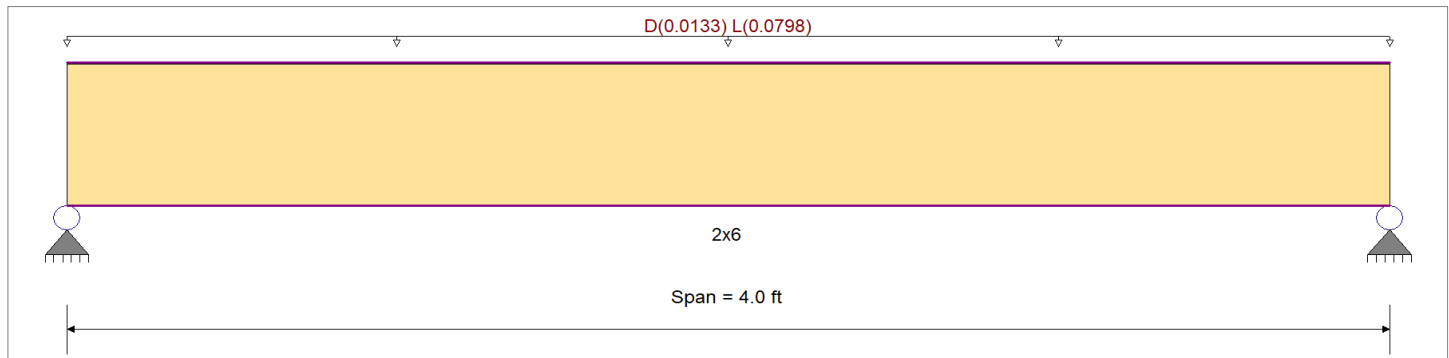
**DESCRIPTION:** UPPER FL. DECK JOIST

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Stress Design	Fb +	850.0 psi	<i>E : Modulus of Elasticity</i>
Load Combination : IBC 2018	Fb -	850.0 psi	Ebend- xx 1,300.0ksi
	Fc - Prll	1,300.0 psi	Eminbend - xx 470.0ksi
Wood Species : Hem-Fir	Fc - Perp	405.0 psi	
Wood Grade : No.2	Fv	150.0 psi	
	Ft	525.0 psi	Density 26.840pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			Repetitive Member Stress Increase



### Applied Loads

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

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.010, L = 0.060 ksf, Tributary Width = 1.330 ft, (DECK)

### DESIGN SUMMARY

**Design OK**

<b>Maximum Bending Stress Ratio</b>	=	<b>0.236</b>	<b>1</b>	<b>Maximum Shear Stress Ratio</b>	=	<b>0.178</b>	<b>: 1</b>
Section used for this span		<b>2x6</b>		Section used for this span		<b>2x6</b>	
fb: Actual	=	300.34psi		fv: Actual	=	26.63 psi	
Fb: Allowable	=	1,270.75psi		Fv: Allowable	=	150.00 psi	
Load Combination		+D+L		Load Combination		+D+L	
Location of maximum on span	=	2.000ft		Location of maximum on span	=	3.547 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.017 in	Ratio = 2806	>=360		Span: 1 : L Only	
Max Upward Transient Deflection		0 in	Ratio = 0	<360		n/a	
Max Downward Total Deflection		0.020 in	Ratio = 2366	>=180		Span: 1 : +D+L	
Max Upward Total Deflection		0 in	Ratio = 0	<180		n/a	

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values					
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v		
D Only	Length = 4.0 ft	1	0.041	0.031	0.90	1.300	1.00	1.15	1.00	1.00	1.00	0.03	47.09	1143.68	0.00	0.00	0.00	0.00	135.00
+D+L	Length = 4.0 ft	1	0.236	0.178	1.00	1.300	1.00	1.15	1.00	1.00	1.00	0.19	300.34	1270.75	0.00	0.00	0.00	0.00	150.00
+D+0.750L	Length = 4.0 ft	1	0.149	0.112	1.25	1.300	1.00	1.15	1.00	1.00	1.00	0.15	237.03	1588.44	0.00	0.00	0.00	0.00	187.50
+0.60D	Length = 4.0 ft	1	0.014	0.010	1.60	1.300	1.00	1.15	1.00	1.00	1.00	0.02	28.25	2033.20	0.00	0.00	0.00	0.00	240.00

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.0203	2.015		0.0000	0.000

Project Title:  
Engineer:  
Project ID:  
Project Descr:

**Wood Beam**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: UPPER FL. DECK JOIST**

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.189	0.189
Overall MINimum	0.160	0.160
D Only	0.030	0.030
+D+L	0.189	0.189
+D+0.750L	0.149	0.149
+0.60D	0.018	0.018
L Only	0.160	0.160

## General Footing

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** FTNG#1

### Code References

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

### General Information

#### Material Properties

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	40.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

#### Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	150.0 pcf
Soil/Concrete Friction Coeff.	=	0.250

#### Analysis Settings

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

#### Increases based on footing depth

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

#### Increases based on footing plan dimension

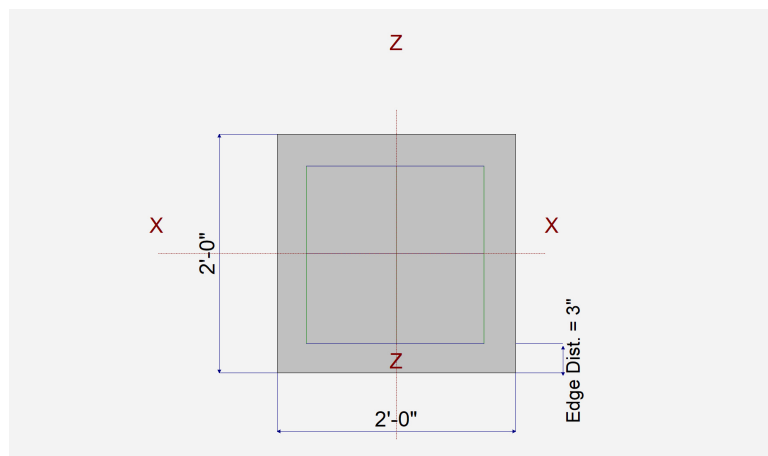
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
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### Dimensions

Width parallel to X-X Axis	=	2.0 ft
Length parallel to Z-Z Axis	=	2.0 ft
Footing Thickness	=	10.0 in

#### Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



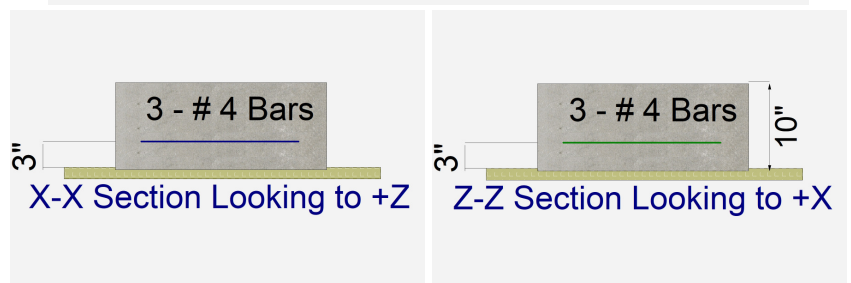
### Reinforcing

Bars parallel to X-X Axis		
Number of Bars	=	3.0
Reinforcing Bar Size	=	# 4
Bars parallel to Z-Z Axis		
Number of Bars	=	3.0
Reinforcing Bar Size	=	# 4

#### Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

# Bars required within zone  
 # Bars required on each side of zone



### Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	1.0		0.860	1.060		k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k

**General Footing**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** FTNG#1

**DESIGN SUMMARY**

Design N.G.

Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	Soil Bearing	ksf	ksf	
FAIL	Overturning - X-X	k-ft	k-ft	
FAIL	Overturning - Z-Z	k-ft	k-ft	
FAIL	Sliding - X-X	k	k	
FAIL	Sliding - Z-Z	k	k	
FAIL	Uplift	k	k	
PASS	Z Flexure (+X)	k-ft/ft	k-ft/ft	
PASS	Z Flexure (-X)	k-ft/ft	k-ft/ft	
PASS	X Flexure (+Z)	k-ft/ft	k-ft/ft	
PASS	X Flexure (-Z)	k-ft/ft	k-ft/ft	
PASS	1-way Shear (+X)	psi	psi	
PASS	1-way Shear (-X)	psi	psi	
PASS	1-way Shear (+Z)	psi	psi	
PASS	1-way Shear (-Z)	psi	psi	
PASS	2-way Punching	psi	psi	

**Detailed Results**

**Soil Bearing**

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.50	n/a	0.0	0.3708	0.3708	n/a	n/a	0.247
X-X, +D+L	1.50	n/a	0.0	0.5858	0.5858	n/a	n/a	0.391
X-X, +D+S	1.50	n/a	0.0	0.6358	0.6358	n/a	n/a	0.424
X-X, +D+0.750L	1.50	n/a	0.0	0.5321	0.5321	n/a	n/a	0.355
X-X, +D+0.750L+0.750S	1.50	n/a	0.0	0.7308	0.7308	n/a	n/a	0.487
X-X, +0.60D	1.50	n/a	0.0	0.2225	0.2225	n/a	n/a	0.148
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.3708	0.3708	0.247
Z-Z, +D+L	1.50	0.0	n/a	n/a	n/a	0.5858	0.5858	0.391
Z-Z, +D+S	1.50	0.0	n/a	n/a	n/a	0.6358	0.6358	0.424
Z-Z, +D+0.750L	1.50	0.0	n/a	n/a	n/a	0.5321	0.5321	0.355
Z-Z, +D+0.750L+0.750S	1.50	0.0	n/a	n/a	n/a	0.7308	0.7308	0.487
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.2225	0.2225	0.148

**Overturning Stability**

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

**Sliding Stability**

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.1750	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.40D	0.1750	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+1.60L	0.3220	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+1.60L	0.3220	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+1.60L+0.50S	0.3883	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+1.60L+0.50S	0.3883	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+0.50L	0.2038	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+0.50L	0.2038	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D	0.150	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D	0.150	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+0.50L+1.60S	0.4158	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+0.50L+1.60S	0.4158	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+1.60S	0.3620	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**General Footing**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: FTNG#1**

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.20D+1.60S	0.3620	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+0.50L+0.50S	0.270	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+0.50L+0.50S	0.270	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+0.50L+0.70S	0.2965	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+0.50L+0.70S	0.2965	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +0.90D	0.1125	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +0.90D	0.1125	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.40D	0.1750	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.40D	0.1750	+X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+1.60L	0.3220	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+1.60L	0.3220	+X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+1.60L+0.50S	0.3883	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+1.60L+0.50S	0.3883	+X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+0.50L	0.2038	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+0.50L	0.2038	+X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D	0.150	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D	0.150	+X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+0.50L+1.60S	0.4158	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+0.50L+1.60S	0.4158	+X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+1.60S	0.3620	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+1.60S	0.3620	+X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+0.50L+0.50S	0.270	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+0.50L+0.50S	0.270	+X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+0.50L+0.70S	0.2965	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+0.50L+0.70S	0.2965	+X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +0.90D	0.1125	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +0.90D	0.1125	+X	Bottom	0.2160	AsMin	0.30	6.088	OK

**One Way Shear**

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	1.75 psi	1.75 psi	1.75 psi	1.75 psi	1.75 psi	75.00 psi	0.02	OK
+1.20D+1.60L	3.22 psi	3.22 psi	3.22 psi	3.22 psi	3.22 psi	75.00 psi	0.04	OK
+1.20D+1.60L+0.50S	3.88 psi	3.88 psi	3.88 psi	3.88 psi	3.88 psi	75.00 psi	0.05	OK
+1.20D+0.50L	2.04 psi	2.04 psi	2.04 psi	2.04 psi	2.04 psi	75.00 psi	0.03	OK
+1.20D	1.50 psi	1.50 psi	1.50 psi	1.50 psi	1.50 psi	75.00 psi	0.02	OK
+1.20D+0.50L+1.60S	4.16 psi	4.16 psi	4.16 psi	4.16 psi	4.16 psi	75.00 psi	0.06	OK
+1.20D+1.60S	3.62 psi	3.62 psi	3.62 psi	3.62 psi	3.62 psi	75.00 psi	0.05	OK
+1.20D+0.50L+0.50S	2.70 psi	2.70 psi	2.70 psi	2.70 psi	2.70 psi	75.00 psi	0.04	OK
+1.20D+0.50L+0.70S	2.97 psi	2.97 psi	2.97 psi	2.97 psi	2.97 psi	75.00 psi	0.04	OK
+0.90D	1.13 psi	1.13 psi	1.13 psi	1.13 psi	1.13 psi	75.00 psi	0.02	OK

**Two-Way "Punching" Shear**

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	6.50 psi	150.00psi	0.04333	OK
+1.20D+1.60L	11.96 psi	150.00psi	0.07973	OK
+1.20D+1.60L+0.50S	14.42 psi	150.00psi	0.09614	OK
+1.20D+0.50L	7.57 psi	150.00psi	0.05045	OK
+1.20D	5.57 psi	150.00psi	0.03714	OK
+1.20D+0.50L+1.60S	15.44 psi	150.00psi	0.1029	OK
+1.20D+1.60S	13.45 psi	150.00psi	0.08964	OK
+1.20D+0.50L+0.50S	10.03 psi	150.00psi	0.06686	OK
+1.20D+0.50L+0.70S	11.01 psi	150.00psi	0.07342	OK
+0.90D	4.18 psi	150.00psi	0.02786	OK

## General Footing

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** FTNG#2

### Code References

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

### General Information

#### Material Properties

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	40.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

#### Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	150.0 pcf
Soil/Concrete Friction Coeff.	=	0.250

#### Analysis Settings

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

#### Increases based on footing depth

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

#### Increases based on footing plan dimension

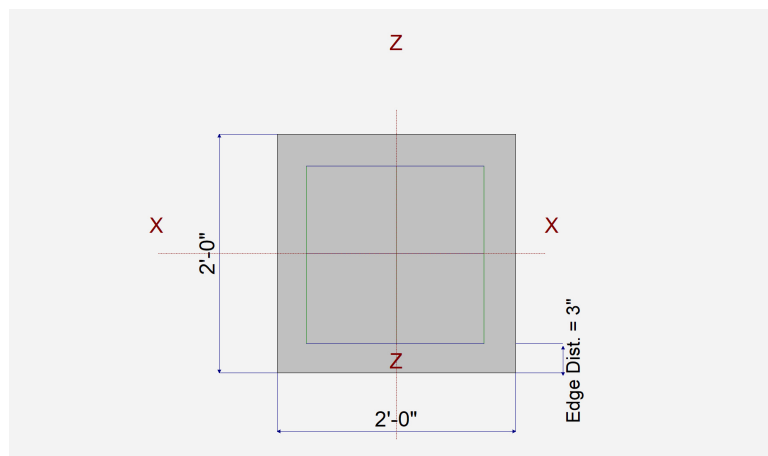
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
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### Dimensions

Width parallel to X-X Axis	=	2.0 ft
Length parallel to Z-Z Axis	=	2.0 ft
Footing Thickness	=	10.0 in

#### Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



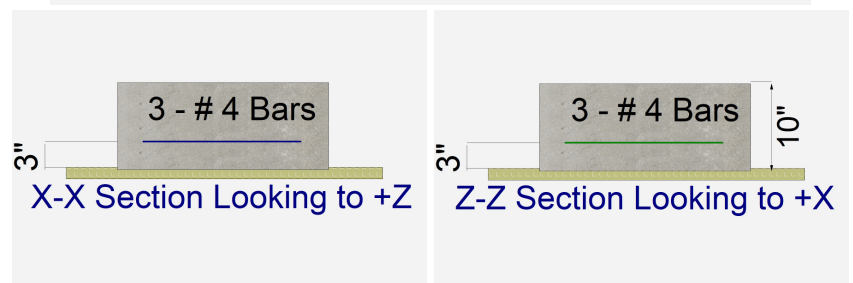
### Reinforcing

Bars parallel to X-X Axis		
Number of Bars	=	3.0
Reinforcing Bar Size	=	# 4

Bars parallel to Z-Z Axis		
Number of Bars	=	3.0
Reinforcing Bar Size	=	# 4

#### Bandwidth Distribution Check (ACI 15.4.4.2)

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



### Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	1.0		3.20	0.0		k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k



**General Footing**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: FTNG#2**

**DESIGN SUMMARY**

**Design OK**

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.7807	Soil Bearing	1.171 ksf	1.50 ksf	+D+L about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.1298	Z Flexure (+X)	0.790 k-ft/ft	6.088 k-ft/ft	+1.20D+1.60L
PASS	0.1298	Z Flexure (-X)	0.790 k-ft/ft	6.088 k-ft/ft	+1.20D+1.60L
PASS	0.1298	X Flexure (+Z)	0.790 k-ft/ft	6.088 k-ft/ft	+1.20D+1.60L
PASS	0.1298	X Flexure (-Z)	0.790 k-ft/ft	6.088 k-ft/ft	+1.20D+1.60L
PASS	0.1053	1-way Shear (+X)	7.90 psi	75.0 psi	+1.20D+1.60L
PASS	0.1053	1-way Shear (-X)	7.90 psi	75.0 psi	+1.20D+1.60L
PASS	0.1053	1-way Shear (+Z)	7.90 psi	75.0 psi	+1.20D+1.60L
PASS	0.1053	1-way Shear (-Z)	7.90 psi	75.0 psi	+1.20D+1.60L
PASS	0.1956	2-way Punching	29.343 psi	150.0 psi	+1.20D+1.60L

**Detailed Results**

**Soil Bearing**

Rotation Axis & Load Combination...	Gross Allowable	Xecc		Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
		Zecc (in)		Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.50	n/a	0.0	0.3708	0.3708	n/a	n/a	0.247
X-X, +D+L	1.50	n/a	0.0	1.171	1.171	n/a	n/a	0.781
X-X, +D+0.750L	1.50	n/a	0.0	0.9708	0.9708	n/a	n/a	0.647
X-X, +0.60D	1.50	n/a	0.0	0.2225	0.2225	n/a	n/a	0.148
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.3708	0.3708	0.247
Z-Z, +D+L	1.50	0.0	n/a	n/a	n/a	1.171	1.171	0.781
Z-Z, +D+0.750L	1.50	0.0	n/a	n/a	n/a	0.9708	0.9708	0.647
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.2225	0.2225	0.148

**Overturning Stability**

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

**Sliding Stability**

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.1750	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.40D	0.1750	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+1.60L	0.790	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+1.60L	0.790	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+0.50L	0.350	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D+0.50L	0.350	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D	0.150	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +1.20D	0.150	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +0.90D	0.1125	+Z	Bottom	0.2160	AsMin	0.30	6.088	OK
X-X, +0.90D	0.1125	-Z	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.40D	0.1750	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.40D	0.1750	+X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+1.60L	0.790	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+1.60L	0.790	+X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+0.50L	0.350	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D+0.50L	0.350	+X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +1.20D	0.150	-X	Bottom	0.2160	AsMin	0.30	6.088	OK

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## General Footing

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** FTNG#2

### Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in <sup>2</sup>	Gvrn. As in <sup>2</sup>	Actual As in <sup>2</sup>	Phi*Mn k-ft	Status
Z-Z, +1.20D	0.150	+X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +0.90D	0.1125	-X	Bottom	0.2160	AsMin	0.30	6.088	OK
Z-Z, +0.90D	0.1125	+X	Bottom	0.2160	AsMin	0.30	6.088	OK

### One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	1.75 psi	1.75 psi	1.75 psi	1.75 psi	1.75 psi	75.00 psi	0.02	OK
+1.20D+1.60L	7.90 psi	7.90 psi	7.90 psi	7.90 psi	7.90 psi	75.00 psi	0.11	OK
+1.20D+0.50L	3.50 psi	3.50 psi	3.50 psi	3.50 psi	3.50 psi	75.00 psi	0.05	OK
+1.20D	1.50 psi	1.50 psi	1.50 psi	1.50 psi	1.50 psi	75.00 psi	0.02	OK
+0.90D	1.13 psi	1.13 psi	1.13 psi	1.13 psi	1.13 psi	75.00 psi	0.02	OK

### Two-Way "Punching" Shear

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	6.50 psi	150.00psi	0.04333	OK
+1.20D+1.60L	29.34 psi	150.00psi	0.1956	OK
+1.20D+0.50L	13.00 psi	150.00psi	0.08667	OK
+1.20D	5.57 psi	150.00psi	0.03714	OK
+0.90D	4.18 psi	150.00psi	0.02786	OK

All units k

## General Footing

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** FTNG#3

### Code References

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

### General Information

#### Material Properties

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	40.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

#### Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	150.0 pcf
Soil/Concrete Friction Coeff.	=	0.250

#### Analysis Settings

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

#### Increases based on footing depth

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

#### Increases based on footing plan dimension

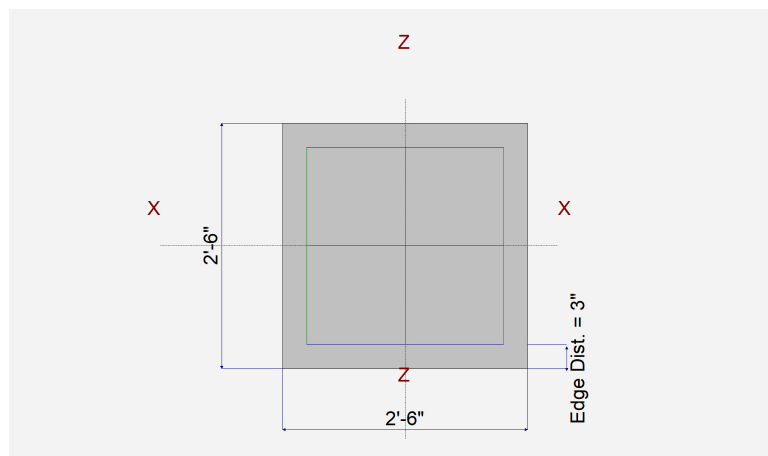
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
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### Dimensions

Width parallel to X-X Axis	=	2.50 ft
Length parallel to Z-Z Axis	=	2.50 ft
Footing Thickness	=	10.0 in

#### Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



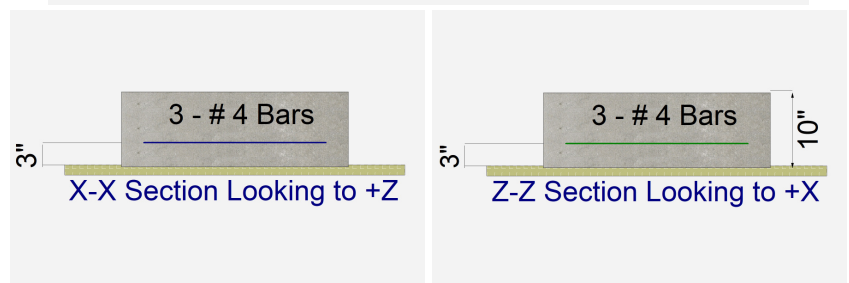
### Reinforcing

Bars parallel to X-X Axis	=	
Number of Bars	=	3.0
Reinforcing Bar Size	=	# 4

Bars parallel to Z-Z Axis	=	
Number of Bars	=	3.0
Reinforcing Bar Size	=	# 4

#### Bandwidth Distribution Check (ACI 15.4.4.2)

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



### Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	2.230		5.60			k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k

**General Footing**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: FTNG#3**

**DESIGN SUMMARY**

**Design OK**

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.9160	Soil Bearing	1.374 ksf	1.50 ksf	+D+L about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.2966	Z Flexure (+X)	1.455 k-ft/ft	4.904 k-ft/ft	+1.20D+1.60L
PASS	0.2966	Z Flexure (-X)	1.455 k-ft/ft	4.904 k-ft/ft	+1.20D+1.60L
PASS	0.2966	X Flexure (+Z)	1.455 k-ft/ft	4.904 k-ft/ft	+1.20D+1.60L
PASS	0.2966	X Flexure (-Z)	1.455 k-ft/ft	4.904 k-ft/ft	+1.20D+1.60L
PASS	0.1995	1-way Shear (+X)	14.961 psi	75.0 psi	+1.20D+1.60L
PASS	0.1995	1-way Shear (-X)	14.961 psi	75.0 psi	+1.20D+1.60L
PASS	0.1995	1-way Shear (+Z)	14.961 psi	75.0 psi	+1.20D+1.60L
PASS	0.1995	1-way Shear (-Z)	14.961 psi	75.0 psi	+1.20D+1.60L
PASS	0.3730	2-way Punching	55.948 psi	150.0 psi	+1.20D+1.60L

**Detailed Results**

**Soil Bearing**

Rotation Axis & Load Combination...	Gross Allowable	Xecc		Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
		Zecc (in)		Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.50	n/a	0.0	0.4776	0.4776	n/a	n/a	0.318
X-X, +D+L	1.50	n/a	0.0	1.374	1.374	n/a	n/a	0.916
X-X, +D+0.750L	1.50	n/a	0.0	1.150	1.150	n/a	n/a	0.767
X-X, +0.60D	1.50	n/a	0.0	0.2866	0.2866	n/a	n/a	0.191
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.4776	0.4776	0.318
Z-Z, +D+L	1.50	0.0	n/a	n/a	n/a	1.374	1.374	0.916
Z-Z, +D+0.750L	1.50	0.0	n/a	n/a	n/a	1.150	1.150	0.767
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.2866	0.2866	0.191

**Overturning Stability**

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

**Sliding Stability**

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.3903	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.40D	0.3903	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+1.60L	1.455	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+1.60L	1.455	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+0.50L	0.6845	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+0.50L	0.6845	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D	0.3345	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D	0.3345	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +0.90D	0.2509	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +0.90D	0.2509	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.40D	0.3903	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.40D	0.3903	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+1.60L	1.455	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+1.60L	1.455	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+0.50L	0.6845	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+0.50L	0.6845	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D	0.3345	-X	Bottom	0.2160	AsMin	0.240	4.904	OK

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**General Footing**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: FTNG#3**

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
Z-Z, +1.20D	0.3345	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +0.90D	0.2509	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +0.90D	0.2509	+X	Bottom	0.2160	AsMin	0.240	4.904	OK

**One Way Shear**

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	4.01 psi	4.01 psi	4.01 psi	4.01 psi	4.01 psi	75.00 psi	0.05	OK
+1.20D+1.60L	14.96 psi	14.96 psi	14.96 psi	14.96 psi	14.96 psi	75.00 psi	0.20	OK
+1.20D+0.50L	7.04 psi	7.04 psi	7.04 psi	7.04 psi	7.04 psi	75.00 psi	0.09	OK
+1.20D	3.44 psi	3.44 psi	3.44 psi	3.44 psi	3.44 psi	75.00 psi	0.05	OK
+0.90D	2.58 psi	2.58 psi	2.58 psi	2.58 psi	2.58 psi	75.00 psi	0.03	OK

All units k

**Two-Way "Punching" Shear**

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	15.01 psi	150.00psi	0.1001	OK
+1.20D+1.60L	55.95 psi	150.00psi	0.373	OK
+1.20D+0.50L	26.33 psi	150.00psi	0.1755	OK
+1.20D	12.87 psi	150.00psi	0.08578	OK
+0.90D	9.65 psi	150.00psi	0.06433	OK

## General Footing

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** FTNG#4

### Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : IBC 2018

### General Information

#### Material Properties

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	40.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

#### Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	150.0 pcf
Soil/Concrete Friction Coeff.	=	0.250

#### Analysis Settings

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

#### Increases based on footing depth

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

#### Increases based on footing plan dimension

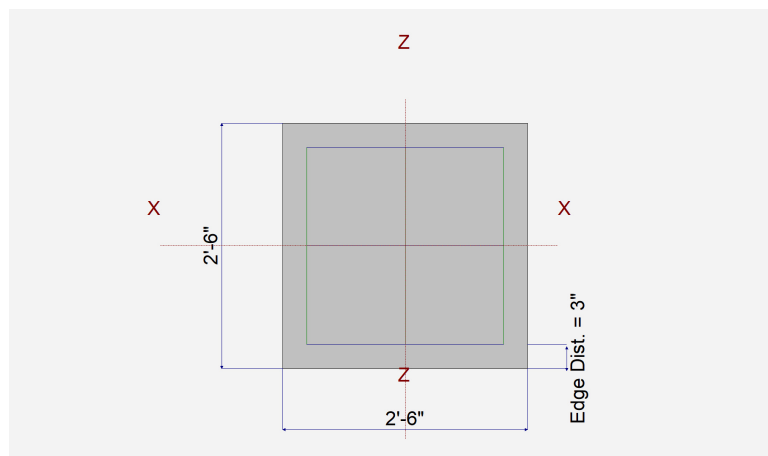
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
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### Dimensions

Width parallel to X-X Axis	=	2.50 ft
Length parallel to Z-Z Axis	=	2.50 ft
Footing Thickness	=	10.0 in

#### Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



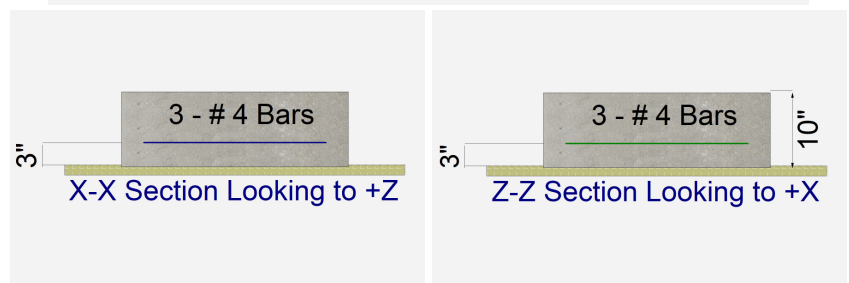
### Reinforcing

Bars parallel to X-X Axis	=	
Number of Bars	=	3.0
Reinforcing Bar Size	=	# 4

Bars parallel to Z-Z Axis	=	
Number of Bars	=	3.0
Reinforcing Bar Size	=	# 4

#### Bandwidth Distribution Check (ACI 15.4.4.2)

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



### Applied Loads

	D	Lr	L	S	W	E	H	
P : Column Load	=	2.150		2.70	1.150		3.990	k
OB : Overburden	=							ksf
M-xx	=							k-ft
M-zz	=							k-ft
V-x	=							k
V-z	=							k

**General Footing**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: FTNG#4**

**DESIGN SUMMARY**

**Design OK**

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.8413	Soil Bearing	1.262 ksf	1.50 ksf	+D+0.750L+0.750S+0.5250E about Z-
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.7941	Z Flexure (+X)	3.894 k-ft/ft	4.904 k-ft/ft	+1.426D+0.50L+0.70S+6.50E
PASS	0.7941	Z Flexure (-X)	3.894 k-ft/ft	4.904 k-ft/ft	+1.426D+0.50L+0.70S+6.50E
PASS	0.7941	X Flexure (+Z)	3.894 k-ft/ft	4.904 k-ft/ft	+1.426D+0.50L+0.70S+6.50E
PASS	0.7941	X Flexure (-Z)	3.894 k-ft/ft	4.904 k-ft/ft	+1.426D+0.50L+0.70S+6.50E
PASS	0.5341	1-way Shear (+X)	40.058 psi	75.0 psi	+1.426D+0.50L+0.70S+6.50E
PASS	0.5341	1-way Shear (-X)	40.058 psi	75.0 psi	+1.426D+0.50L+0.70S+6.50E
PASS	0.5341	1-way Shear (+Z)	40.058 psi	75.0 psi	+1.426D+0.50L+0.70S+6.50E
PASS	0.5341	1-way Shear (-Z)	40.058 psi	75.0 psi	+1.426D+0.50L+0.70S+6.50E
PASS	0.9987	2-way Punching	149.803 psi	150.0 psi	+1.426D+0.50L+0.70S+6.50E

**Detailed Results**

**Soil Bearing**

Rotation Axis & Load Combination...	Gross Allowable	Xeccc	Zeccc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.50	n/a	0.0	0.4648	0.4648	n/a	n/a	0.310
X-X, +D+L	1.50	n/a	0.0	0.8968	0.8968	n/a	n/a	0.598
X-X, +D+S	1.50	n/a	0.0	0.6488	0.6488	n/a	n/a	0.433
X-X, +D+0.750L	1.50	n/a	0.0	0.7888	0.7888	n/a	n/a	0.526
X-X, +D+0.750L+0.750S	1.50	n/a	0.0	0.9268	0.9268	n/a	n/a	0.618
X-X, +D+0.70E	1.50	n/a	0.0	0.9117	0.9117	n/a	n/a	0.608
X-X, +D+0.750L+0.750S+0.5250E	1.50	n/a	0.0	1.262	1.262	n/a	n/a	0.841
X-X, +0.60D	1.50	n/a	0.0	0.2789	0.2789	n/a	n/a	0.186
X-X, +0.60D+0.70E	1.50	n/a	0.0	0.7258	0.7258	n/a	n/a	0.484
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.4648	0.4648	0.310
Z-Z, +D+L	1.50	0.0	n/a	n/a	n/a	0.8968	0.8968	0.598
Z-Z, +D+S	1.50	0.0	n/a	n/a	n/a	0.6488	0.6488	0.433
Z-Z, +D+0.750L	1.50	0.0	n/a	n/a	n/a	0.7888	0.7888	0.526
Z-Z, +D+0.750L+0.750S	1.50	0.0	n/a	n/a	n/a	0.9268	0.9268	0.618
Z-Z, +D+0.70E	1.50	0.0	n/a	n/a	n/a	0.9117	0.9117	0.608
Z-Z, +D+0.750L+0.750S+0.5250E	1.50	0.0	n/a	n/a	n/a	1.262	1.262	0.841
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.2789	0.2789	0.186
Z-Z, +0.60D+0.70E	1.50	0.0	n/a	n/a	n/a	0.7258	0.7258	0.484

**Overturning Stability**

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

**Sliding Stability**

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

All units k

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.3763	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.40D	0.3763	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+1.60L	0.8625	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+1.60L	0.8625	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+1.60L+0.50S	0.9344	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+1.60L+0.50S	0.9344	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+0.50L	0.4913	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## General Footing

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: FTNG#4

#### Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.20D+0.50L	0.4913	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D	0.3225	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D	0.3225	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+0.50L+1.60S	0.7213	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+0.50L+1.60S	0.7213	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+1.60S	0.5525	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+1.60S	0.5525	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+0.50L+0.50S	0.5631	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.20D+0.50L+0.50S	0.5631	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.426D+0.50L+0.70S+6.50E	3.894	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +1.426D+0.50L+0.70S+6.50E	3.894	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +0.90D	0.2419	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +0.90D	0.2419	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +0.6740D+6.50E	3.423	+Z	Bottom	0.2160	AsMin	0.240	4.904	OK
X-X, +0.6740D+6.50E	3.423	-Z	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.40D	0.3763	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.40D	0.3763	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+1.60L	0.8625	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+1.60L	0.8625	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+1.60L+0.50S	0.9344	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+1.60L+0.50S	0.9344	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+0.50L	0.4913	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+0.50L	0.4913	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D	0.3225	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D	0.3225	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+0.50L+1.60S	0.7213	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+0.50L+1.60S	0.7213	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+1.60S	0.5525	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+1.60S	0.5525	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+0.50L+0.50S	0.5631	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.20D+0.50L+0.50S	0.5631	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.426D+0.50L+0.70S+6.50E	3.894	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +1.426D+0.50L+0.70S+6.50E	3.894	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +0.90D	0.2419	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +0.90D	0.2419	+X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +0.6740D+6.50E	3.423	-X	Bottom	0.2160	AsMin	0.240	4.904	OK
Z-Z, +0.6740D+6.50E	3.423	+X	Bottom	0.2160	AsMin	0.240	4.904	OK

#### One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	3.87 psi	3.87 psi	3.87 psi	3.87 psi	3.87 psi	75.00 psi	0.05	OK
+1.20D+1.60L	8.87 psi	8.87 psi	8.87 psi	8.87 psi	8.87 psi	75.00 psi	0.12	OK
+1.20D+1.60L+0.50S	9.61 psi	9.61 psi	9.61 psi	9.61 psi	9.61 psi	75.00 psi	0.13	OK
+1.20D+0.50L	5.05 psi	5.05 psi	5.05 psi	5.05 psi	5.05 psi	75.00 psi	0.07	OK
+1.20D	3.32 psi	3.32 psi	3.32 psi	3.32 psi	3.32 psi	75.00 psi	0.04	OK
+1.20D+0.50L+1.60S	7.42 psi	7.42 psi	7.42 psi	7.42 psi	7.42 psi	75.00 psi	0.10	OK
+1.20D+1.60S	5.68 psi	5.68 psi	5.68 psi	5.68 psi	5.68 psi	75.00 psi	0.08	OK
+1.20D+0.50L+0.50S	5.79 psi	5.79 psi	5.79 psi	5.79 psi	5.79 psi	75.00 psi	0.08	OK
+1.426D+0.50L+0.70S+6.50E	40.06 psi	40.06 psi	40.06 psi	40.06 psi	40.06 psi	75.00 psi	0.53	OK
+0.90D	2.49 psi	2.49 psi	2.49 psi	2.49 psi	2.49 psi	75.00 psi	0.03	OK
+0.6740D+6.50E	35.21 psi	35.21 psi	35.21 psi	35.21 psi	35.21 psi	75.00 psi	0.47	OK

#### Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	14.47 psi	150.00psi	0.09648	OK
+1.20D+1.60L	33.18 psi	150.00psi	0.2212	OK
+1.20D+1.60L+0.50S	35.94 psi	150.00psi	0.2396	OK
+1.20D+0.50L	18.90 psi	150.00psi	0.126	OK
+1.20D	12.41 psi	150.00psi	0.0827	OK
+1.20D+0.50L+1.60S	27.74 psi	150.00psi	0.185	OK
+1.20D+1.60S	21.25 psi	150.00psi	0.1417	OK
+1.20D+0.50L+0.50S	21.66 psi	150.00psi	0.1444	OK
+1.426D+0.50L+0.70S+6.50E	149.80 psi	150.00psi	0.9987	OK



Project Title:  
Engineer:  
Project ID:  
Project Descr:

## General Footing

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** FTNG#4

### Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+0.90D	9.30 psi	150.00 psi	0.06203	OK
+0.6740D+6.50E	131.67 psi	150.00 psi	0.8778	OK

## General Footing

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** FTNG#5

### Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : IBC 2018

### General Information

#### Material Properties

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	40.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

#### Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	150.0 pcf
Soil/Concrete Friction Coeff.	=	0.250

#### Analysis Settings

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

#### Increases based on footing depth

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

#### Increases based on footing plan dimension

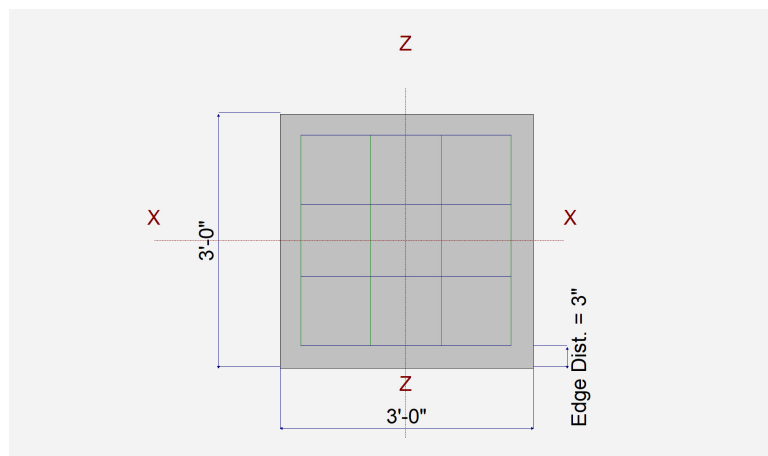
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
---	---	-----------

### Dimensions

Width parallel to X-X Axis	=	3.0 ft
Length parallel to Z-Z Axis	=	3.0 ft
Footing Thickness	=	10.0 in

#### Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



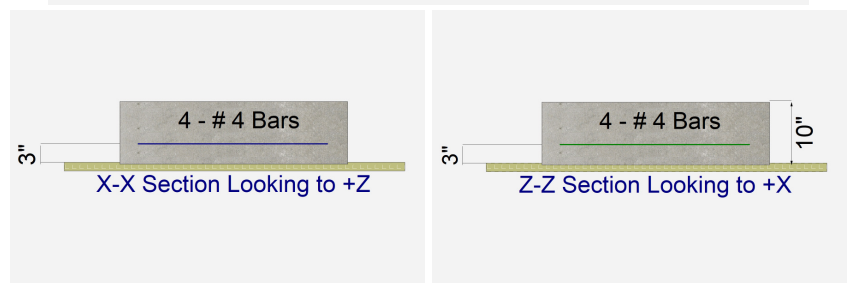
### Reinforcing

Bars parallel to X-X Axis	=	
Number of Bars	=	4
Reinforcing Bar Size	=	# 4

Bars parallel to Z-Z Axis	=	
Number of Bars	=	4
Reinforcing Bar Size	=	# 4

#### Bandwidth Distribution Check (ACI 15.4.4.2)

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



### Applied Loads

	D	Lr	L	S	W	E	H	
P : Column Load	=	5.050		6.850	1.810		0.480	k
OB : Overburden	=							ksf
M-xx	=							k-ft
M-zz	=							k-ft
V-x	=							k
V-z	=							k

**General Footing**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: FTNG#5**

**DESIGN SUMMARY**

**Design OK**

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.9620	Soil Bearing	1.443 ksf	1.50 ksf	+D+L about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.4124	Z Flexure (+X)	2.241 k-ft/ft	5.433 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.4124	Z Flexure (-X)	2.241 k-ft/ft	5.433 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.4124	X Flexure (+Z)	2.241 k-ft/ft	5.433 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.4124	X Flexure (-Z)	2.241 k-ft/ft	5.433 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.2940	1-way Shear (+X)	22.051 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.2940	1-way Shear (-X)	22.051 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.2940	1-way Shear (+Z)	22.051 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.2940	1-way Shear (-Z)	22.051 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.5853	2-way Punching	87.796 psi	150.0 psi	+1.20D+1.60L+0.50S

**Detailed Results**

**Soil Bearing**

Rotation Axis & Load Combination...	Gross Allowable	Xeccc	Zeccc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.50	n/a	0.0	0.6819	0.6819	n/a	n/a	0.455
X-X, +D+L	1.50	n/a	0.0	1.443	1.443	n/a	n/a	0.962
X-X, +D+S	1.50	n/a	0.0	0.8831	0.8831	n/a	n/a	0.589
X-X, +D+0.750L	1.50	n/a	0.0	1.253	1.253	n/a	n/a	0.835
X-X, +D+0.750L+0.750S	1.50	n/a	0.0	1.404	1.404	n/a	n/a	0.936
X-X, +D+0.70E	1.50	n/a	0.0	0.7193	0.7193	n/a	n/a	0.480
X-X, +D+0.750L+0.750S+0.5250E	1.50	n/a	0.0	1.432	1.432	n/a	n/a	0.955
X-X, +0.60D	1.50	n/a	0.0	0.4092	0.4092	n/a	n/a	0.273
X-X, +0.60D+0.70E	1.50	n/a	0.0	0.4465	0.4465	n/a	n/a	0.298
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.6819	0.6819	0.455
Z-Z, +D+L	1.50	0.0	n/a	n/a	n/a	1.443	1.443	0.962
Z-Z, +D+S	1.50	0.0	n/a	n/a	n/a	0.8831	0.8831	0.589
Z-Z, +D+0.750L	1.50	0.0	n/a	n/a	n/a	1.253	1.253	0.835
Z-Z, +D+0.750L+0.750S	1.50	0.0	n/a	n/a	n/a	1.404	1.404	0.936
Z-Z, +D+0.70E	1.50	0.0	n/a	n/a	n/a	0.7193	0.7193	0.480
Z-Z, +D+0.750L+0.750S+0.5250E	1.50	0.0	n/a	n/a	n/a	1.432	1.432	0.955
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.4092	0.4092	0.273
Z-Z, +0.60D+0.70E	1.50	0.0	n/a	n/a	n/a	0.4465	0.4465	0.298

**Overturning Stability**

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

**Sliding Stability**

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

All units k

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.8838	+Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.40D	0.8838	-Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.20D+1.60L	2.128	+Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.20D+1.60L	2.128	-Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.20D+1.60L+0.50S	2.241	+Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.20D+1.60L+0.50S	2.241	-Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.20D+0.50L	1.186	+Z	Bottom	0.2160	AsMin	0.2667	5.433	OK

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**General Footing**

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: FTNG#5**

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.20D+0.50L	1.186	-Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.20D	0.7575	+Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.20D	0.7575	-Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.20D+0.50L+1.60S	1.548	+Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.20D+0.50L+1.60S	1.548	-Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.20D+1.60S	1.120	+Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.20D+1.60S	1.120	-Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.20D+0.50L+0.50S	1.299	+Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.20D+0.50L+0.50S	1.299	-Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.426D+0.50L+0.70S+6.50E	1.877	+Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +1.426D+0.50L+0.70S+6.50E	1.877	-Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +0.90D	0.5681	+Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +0.90D	0.5681	-Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +0.6740D+6.50E	0.8155	+Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
X-X, +0.6740D+6.50E	0.8155	-Z	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.40D	0.8838	-X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.40D	0.8838	+X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D+1.60L	2.128	-X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D+1.60L	2.128	+X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D+1.60L+0.50S	2.241	-X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D+1.60L+0.50S	2.241	+X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D+0.50L	1.186	-X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D+0.50L	1.186	+X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D	0.7575	-X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D	0.7575	+X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D+0.50L+1.60S	1.548	-X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D+0.50L+1.60S	1.548	+X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D+1.60S	1.120	-X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D+1.60S	1.120	+X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D+0.50L+0.50S	1.299	-X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.20D+0.50L+0.50S	1.299	+X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.426D+0.50L+0.70S+6.50E	1.877	-X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +1.426D+0.50L+0.70S+6.50E	1.877	+X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +0.90D	0.5681	-X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +0.90D	0.5681	+X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +0.6740D+6.50E	0.8155	-X	Bottom	0.2160	AsMin	0.2667	5.433	OK
Z-Z, +0.6740D+6.50E	0.8155	+X	Bottom	0.2160	AsMin	0.2667	5.433	OK

**One Way Shear**

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	8.70 psi	8.70 psi	8.70 psi	8.70 psi	8.70 psi	75.00 psi	0.12	OK
+1.20D+1.60L	20.94 psi	20.94 psi	20.94 psi	20.94 psi	20.94 psi	75.00 psi	0.28	OK
+1.20D+1.60L+0.50S	22.05 psi	22.05 psi	22.05 psi	22.05 psi	22.05 psi	75.00 psi	0.29	OK
+1.20D+0.50L	11.67 psi	11.67 psi	11.67 psi	11.67 psi	11.67 psi	75.00 psi	0.16	OK
+1.20D	7.46 psi	7.46 psi	7.46 psi	7.46 psi	7.46 psi	75.00 psi	0.10	OK
+1.20D+0.50L+1.60S	15.23 psi	15.23 psi	15.23 psi	15.23 psi	15.23 psi	75.00 psi	0.20	OK
+1.20D+1.60S	11.02 psi	11.02 psi	11.02 psi	11.02 psi	11.02 psi	75.00 psi	0.15	OK
+1.20D+0.50L+0.50S	12.78 psi	12.78 psi	12.78 psi	12.78 psi	12.78 psi	75.00 psi	0.17	OK
+1.426D+0.50L+0.70S+6.50E	18.47 psi	18.47 psi	18.47 psi	18.47 psi	18.47 psi	75.00 psi	0.25	OK
+0.90D	5.59 psi	5.59 psi	5.59 psi	5.59 psi	5.59 psi	75.00 psi	0.07	OK
+0.6740D+6.50E	8.03 psi	8.03 psi	8.03 psi	8.03 psi	8.03 psi	75.00 psi	0.11	OK

**Two-Way "Punching" Shear**

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	34.63 psi	150.00psi	0.2309	OK
+1.20D+1.60L	83.36 psi	150.00psi	0.5558	OK
+1.20D+1.60L+0.50S	87.80 psi	150.00psi	0.5853	OK
+1.20D+0.50L	46.46 psi	150.00psi	0.3097	OK
+1.20D	29.68 psi	150.00psi	0.1979	OK
+1.20D+0.50L+1.60S	60.64 psi	150.00psi	0.4043	OK
+1.20D+1.60S	43.87 psi	150.00psi	0.2924	OK
+1.20D+0.50L+0.50S	50.89 psi	150.00psi	0.3393	OK
+1.426D+0.50L+0.70S+6.50E	73.54 psi	150.00psi	0.4902	OK

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## General Footing

Project File: 22-028.ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION:** FTNG#5

### Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+0.90D	22.26 psi	150.00psi	0.1484	OK
+0.6740D+6.50E	31.95 psi	150.00psi	0.213	OK

Use menu item Settings > Printing & Title Block  
to set these five lines of information  
for your program.

Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description...  
4ft wall

Page : 1  
Date: 27 FEB 2021

This Wall in File: C:\Users\pasko\Dropbox\CK projects\Design\Retaining Walls\1500 psf\1500 psf wall.

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### Cantilevered Retaining Wall

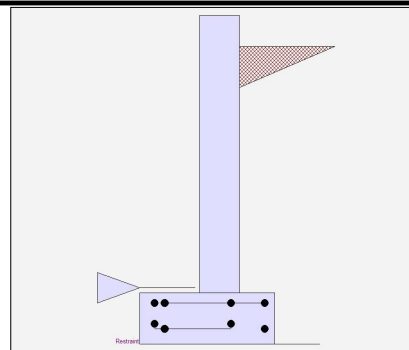
Code: IBC 2018, ACI 318-14, TMS 402-16

#### Criteria

Retained Height = 4.00 ft  
Wall height above soil = 0.50 ft  
Slope Behind Wall = 0.00  
Height of Soil over Toe = 0.00 in  
Water height over heel = 0.0 ft

#### Soil Data

Allow Soil Bearing = 1,500.0 psf  
Equivalent Fluid Pressure Method  
Active Heel Pressure = 35.0 psf/ft  
  
Passive Pressure = 150.0 psf/ft  
Soil Density, Heel = 110.00 pcf  
Soil Density, Toe = 0.00 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 = 500.0 lbs  
Axial Live Load = 0.0 lbs  
Axial Load Eccentricity = 0.0 in

#### Earth Pressure Seismic Load

Method : Uniform  
Multiplier Used = 6.000  
(Multiplier used on soil density)

#### 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  
(Service 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 = Line Load  
Base Above/Below Soil  
at Back of Wall = 0.0 ft  
Poisson's Ratio = 0.300

#### Stem Weight Seismic Load

$F_p / W_p$  Weight Multiplier = 0.200 g Added seismic base force 63.0 lbs

Use menu item Settings > Printing & Title Block  
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Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description....  
4ft wall

Page : 2  
Date: 27 FEB 2021

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## Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

### Design Summary

#### Wall Stability Ratios

Overturning = 1.91 OK  
Slab Resists All Sliding !

Total Bearing Load = 1,488 lbs  
...resultant ecc. = 5.47 in

Soil Pressure @ Toe = 1,482 psf OK  
Soil Pressure @ Heel = 0 psf OK  
Allowable = 1,500 psf  
Soil Pressure Less Than Allowable

ACI Factored @ Toe = 2,075 psf  
ACI Factored @ Heel = 0 psf  
Footing Shear @ Toe = 9.9 psi OK  
Footing Shear @ Heel = 4.4 psi OK  
Allowable = 75.0 psi

#### Sliding Calcs

Lateral Sliding Force = 569.9 lbs

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

#### Load Factors

Building Code IBC 2018,ACI  
Dead Load 1.200  
Live Load 1.600  
Earth, H 1.600  
Wind, W 1.000  
Seismic, E 1.000

### Stem Construction

Design Height Above Ftg ft = 0.00  
Wall Material Above "Ht" = Concrete  
Design Method = LRFD  
Thickness = 8.00  
Rebar Size = # 4  
Rebar Spacing = 12.00  
Rebar Placed at = Edge

#### Design Data

fb/FB + fa/Fa = 0.282

#### Total Force @ Section

Service Level lbs =  
Strength Level lbs = 654.0

#### Moment....Actual

Service Level ft-# =  
Strength Level ft-# = 1,031.8  
Moment.....Allowable = 3,655.6

#### Shear.....Actual

Service Level psi =  
Strength Level psi = 8.7  
Shear.....Allowable psi = 75.0  
Anet (Masonry) in2 =  
Rebar Depth 'd' in = 6.25

#### Masonry Data

f'm psi =  
Fs psi =  
Solid Grouting =  
Modular Ratio 'n' =  
Wall Weight psf = 100.0  
Short Term Factor =  
Equiv. Solid Thick. =  
Masonry Block Type = Medium Weight  
Masonry Design Method = ASD

#### Concrete Data

f'c psi = 2,500.0  
Fy psi = 40,000.0

### Bottom

Stem OK

Use menu item Settings > Printing & Title Block  
to set these five lines of information  
for your program.

Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description....  
4ft wall

Page : 3  
Date: 27 FEB 2021

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### Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

#### Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.058 in <sup>2</sup> /ft		
(4/3) * As :	0.0773 in <sup>2</sup> /ft	Min Stem T&S Reinf Area 0.864 in <sup>2</sup>	
200bd/fy : 200(12)(6.25)/40000 :	0.375 in <sup>2</sup> /ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in <sup>2</sup> /ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in <sup>2</sup> /ft	Horizontal Reinforcing Options :	
	=====	One layer of :	Two layers of :
Required Area :	0.1728 in <sup>2</sup> /ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in <sup>2</sup> /ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.27 in <sup>2</sup> /ft	#6@ 27.50 in	#6@ 55.00 in

#### Footing Data

Toe Width	=	1.00 ft
Heel Width	=	1.25
Total Footing Width	=	2.25
Footing Thickness	=	10.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft
f'c =	2,500 psi	Fy = 40,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top	2.00	@ Btm= 3.00 in

#### Footing Design Results

	<u>Toe</u>	<u>Heel</u>
Factored Pressure	= 2,075	0 psf
Mu' : Upward	= 10,384	0 ft-#
Mu' : Downward	= 900	115 ft-#
Mu: Design	= 790	115 ft-#
Actual 1-Way Shear	= 9.92	4.39 psi
Allow 1-Way Shear	= 75.00	75.00 psi
Toe Reinforcing	= # 4 @ 11.11 in	
Heel Reinforcing	= # 4 @ 11.11 in	
Key Reinforcing	= None Spec'd	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

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

#### Other Acceptable Sizes & Spacings

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5  
Heel: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5  
Key: No key defined

Min footing T&S reinf Area	0.49	in <sup>2</sup>
Min footing T&S reinf Area per foot	0.22	in <sup>2</sup> /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 11.11 in		#4@ 22.22 in
#5@ 17.22 in		#5@ 34.44 in
#6@ 24.44 in		#6@ 48.89 in



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Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description....  
4ft wall

Page : 4  
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## Cantilevered Retaining Wall

Code: IBC 2018, ACI 318-14, TMS 402-16

### 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)	408.8	1.61	658.7	Soil Over HL (ab. water tbl)	256.7	1.96	502.6
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		1.96	502.6
Hydrostatic Force				Watre 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 =	500.0	1.33	666.7
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =			
Seismic Earth Load =	98.1	2.42	237.1	Surcharge Over Toe =			
Seismic Stem Self Wt =	63.0	3.08	194.3	Stem Weight(s) =	450.0	1.33	600.0
<b>Total</b> =	<b>569.9</b>	<b>O.T.M. =</b>	<b>1,090.0</b>	Earth @ Stem Transitions =			
				Footing Weight =	281.3	1.13	316.4
				Key Weight =		2.50	
				Vert. Component =			
<b>Resisting/Overturning Ratio</b> =			<b>1.91</b>	<b>Total =</b>	<b>1,487.9 lbs</b>	<b>R.M.=</b>	<b>2,085.7</b>
Vertical Loads used for Soil Pressure =		1,487.9 lbs					

\* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.082 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.



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Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description....  
6ft wall

Page : 1  
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### Cantilevered Retaining Wall

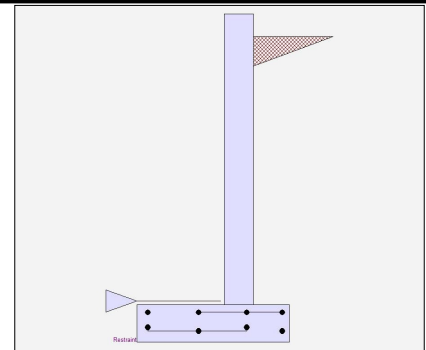
Code: IBC 2018, ACI 318-14, TMS 402-16

#### Criteria

Retained Height = 6.00 ft  
Wall height above soil = 0.50 ft  
Slope Behind Wall = 0.00  
Height of Soil over Toe = 0.00 in  
Water height over heel = 0.0 ft

#### Soil Data

Allow Soil Bearing = 1,500.0 psf  
Equivalent Fluid Pressure Method  
Active Heel Pressure = 35.0 psf/ft  
  
Passive Pressure = 150.0 psf/ft  
Soil Density, Heel = 110.00 pcf  
Soil Density, Toe = 0.00 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

#### 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  
(Service 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 = Line Load  
Base Above/Below Soil  
at Back of Wall = 0.0 ft  
Poisson's Ratio = 0.300

#### Axial Load Applied to Stem

Axial Dead Load = 500.0 lbs  
Axial Live Load = 0.0 lbs  
Axial Load Eccentricity = 0.0 in

#### Earth Pressure Seismic Load

Method : Uniform  
Multiplier Used = 6.000  
(Multiplier used on soil density)  
Uniform Seismic Force = 41.000  
Total Seismic Force = 280.167

#### Stem Weight Seismic Load

$F_p / W_p$  Weight Multiplier = 0.200 g Added seismic base force 91.0 lbs

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Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description....  
6ft wall

Page : 2  
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## Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

### Design Summary

#### Wall Stability Ratios

Overturning = 1.77 OK  
Slab Resists All Sliding !

Total Bearing Load = 2,138 lbs  
...resultant ecc. = 8.41 in

Soil Pressure @ Toe = 1,359 psf OK  
Soil Pressure @ Heel = 0 psf OK  
Allowable = 1,500 psf  
Soil Pressure Less Than Allowable

ACI Factored @ Toe = 1,902 psf  
ACI Factored @ Heel = 0 psf  
Footing Shear @ Toe = 24.5 psi OK  
Footing Shear @ Heel = 7.9 psi OK  
Allowable = 75.0 psi

#### Sliding Calcs

Lateral Sliding Force = 1,104.3 lbs

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

#### Load Factors

Building Code IBC 2018,ACI  
Dead Load 1.200  
Live Load 1.600  
Earth, H 1.600  
Wind, W 1.000  
Seismic, E 1.000

### Stem Construction

Design Height Above Ftg ft = 0.00  
Wall Material Above "Ht" = Concrete  
Design Method = LRFD  
Thickness = 8.00  
Rebar Size = # 4  
Rebar Spacing = 10.00  
Rebar Placed at = Edge

#### Design Data

fb/FB + fa/Fa = 0.727

#### Total Force @ Section

Service Level lbs =  
Strength Level lbs = 1,384.0

#### Moment....Actual

Service Level ft-# =  
Strength Level ft-# = 3,176.5  
Moment.....Allowable = 4,364.1

#### Shear.....Actual

Service Level psi =  
Strength Level psi = 18.5  
Shear.....Allowable psi = 75.0  
Anet (Masonry) in2 =  
Rebar Depth 'd' in = 6.25

#### Masonry Data

f'm psi =  
Fs psi =  
Solid Grouting =  
Modular Ratio 'n' =  
Wall Weight psf = 100.0  
Short Term Factor =  
Equiv. Solid Thick. =  
Masonry Block Type = Medium Weight  
Masonry Design Method = ASD

#### Concrete Data

f'c psi = 2,500.0  
Fy psi = 40,000.0

### Bottom

Stem OK

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Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description....  
6ft wall

Page : 3  
Date: 27 FEB 2021

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### Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

#### Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1785 in2/ft		
(4/3) * As :	0.238 in2/ft	Min Stem T&S Reinf Area 1.248 in2	
200bd/fy : 200(12)(6.25)/40000 :	0.375 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of :	Two layers of :
Required Area :	0.238 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.24 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.27 in2/ft	#6@ 27.50 in	#6@ 55.00 in

#### Footing Data

Toe Width	=	2.00 ft
Heel Width	=	1.50
Total Footing Width	=	3.50
Footing Thickness	=	10.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft
f'c =	2,500 psi	Fy = 40,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top	2.00	@ Btm.= 3.00 in

#### Footing Design Results

	<u>Toe</u>	<u>Heel</u>
Factored Pressure	= 1,902	0 psf
Mu' : Upward	= 35,979	11 ft-#
Mu' : Downward	= 3,600	327 ft-#
Mu: Design	= 2,698	316 ft-#
Actual 1-Way Shear	= 24.52	7.95 psi
Allow 1-Way Shear	= 75.00	75.00 psi
Toe Reinforcing	= # 4 @ 10.00 in	
Heel Reinforcing	= # 4 @ 11.11 in	
Key Reinforcing	= None Spec'd	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

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

#### Other Acceptable Sizes & Spacings

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5  
Heel: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5  
Key: No key defined

Min footing T&S reinf Area	0.76	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 11.11 in		#4@ 22.22 in
#5@ 17.22 in		#5@ 34.44 in
#6@ 24.44 in		#6@ 48.89 in

Use menu item Settings > Printing & Title Block  
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Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description....  
6ft wall

Page : 4  
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## Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

### 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)	817.2	2.28	1,861.3	Soil Over HL (ab. water tbl)	550.0	3.08	1,695.8
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.08	1,695.8
Hydrostatic Force				Watre 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 =	500.0	2.33	1,166.7
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =			
Seismic Earth Load =	196.1	3.42	670.1	Surcharge Over Toe =			
Seismic Stem Self Wt =	91.0	4.08	371.6	Stem Weight(s) =	650.0	2.33	1,516.7
<b>Total</b> =	<b>1,104.3</b>	<b>O.T.M. =</b>	<b>2,902.9</b>	Earth @ Stem Transitions =			
				Footing Weight =	437.5	1.75	765.6
				Key Weight =		2.50	
				Vert. Component =			
<b>Resisting/Overturning Ratio</b> =			<b>1.77</b>	<b>Total =</b>	<b>2,137.5 lbs</b>	<b>R.M.=</b>	<b>5,144.8</b>
Vertical Loads used for Soil Pressure =		2,137.5 lbs					

\* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.070 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.

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Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description....  
6ft wall

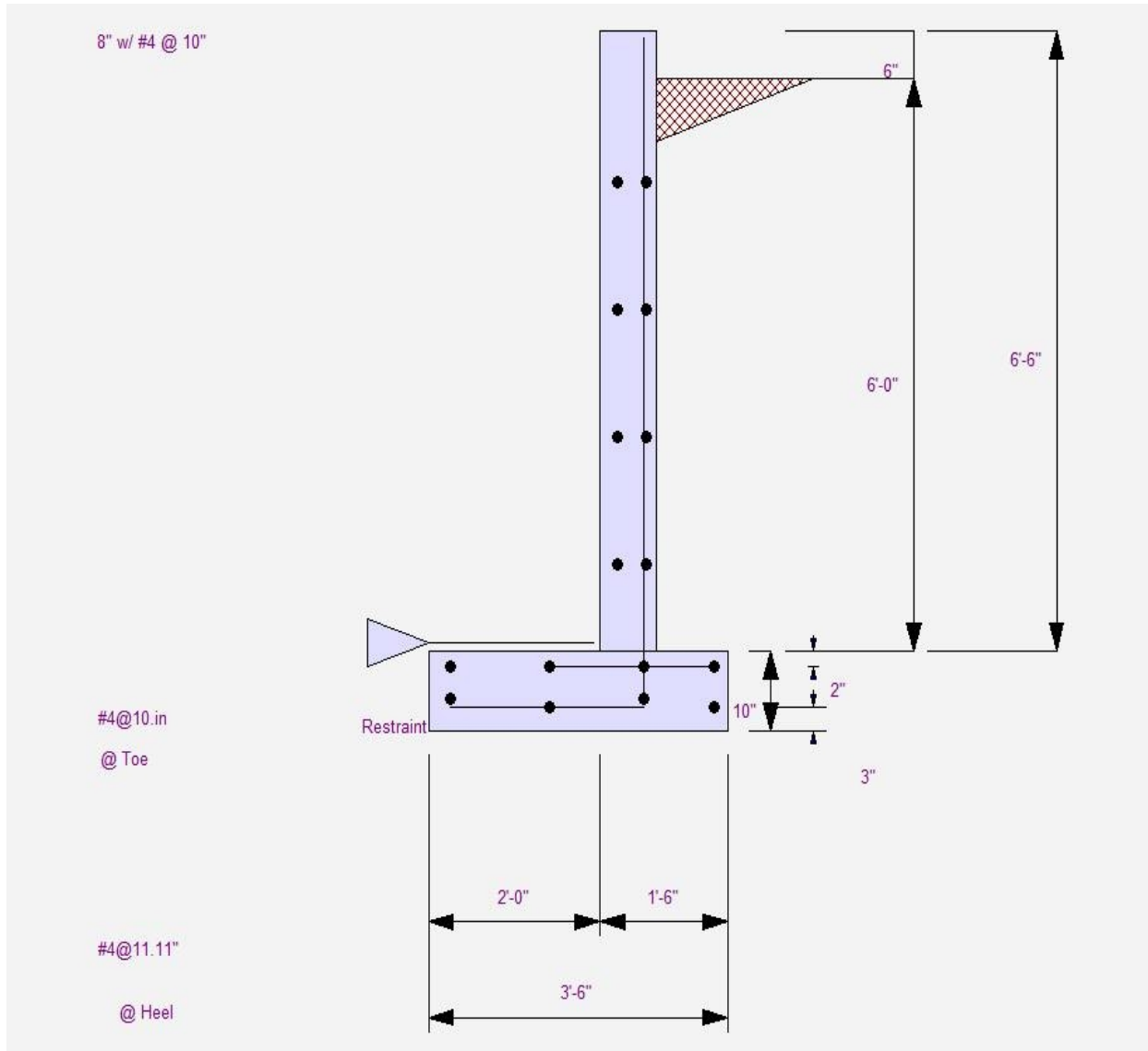
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### Cantilevered Retaining Wall

Code: IBC 2018, ACI 318-14, TMS 402-16



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Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description....  
8ft wall

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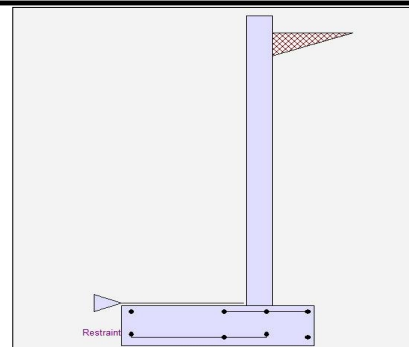
Code: IBC 2018, ACI 318-14, TMS 402-16

#### Criteria

Retained Height = 8.00 ft  
Wall height above soil = 0.50 ft  
Slope Behind Wall = 0.00  
Height of Soil over Toe = 0.00 in  
Water height over heel = 0.0 ft

#### Soil Data

Allow Soil Bearing = 1,500.0 psf  
Equivalent Fluid Pressure Method  
Active Heel Pressure = 35.0 psf/ft  
  
Passive Pressure = 150.0 psf/ft  
Soil Density, Heel = 110.00 pcf  
Soil Density, Toe = 0.00 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 = 500.0 lbs  
Axial Live Load = 0.0 lbs  
Axial Load Eccentricity = 0.0 in

#### Earth Pressure Seismic Load

Method : Uniform  
Multiplier Used = 6.000  
(Multiplier used on soil density)

#### 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  
(Service 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 = Line Load  
Base Above/Below Soil at Back of Wall = 0.0 ft  
Poisson's Ratio = 0.300

#### Stem Weight Seismic Load

$F_p / W_p$  Weight Multiplier = 0.200 g Added seismic base force 119.0 lbs



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Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description...  
8ft wall

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## Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

### Design Summary

#### Wall Stability Ratios

Overturning = 1.67 OK  
Slab Resists All Sliding !

Total Bearing Load = 3,178 lbs  
...resultant ecc. = 12.93 in

Soil Pressure @ Toe = 1,490 psf OK  
Soil Pressure @ Heel = 0 psf OK  
Allowable = 1,500 psf  
Soil Pressure Less Than Allowable

ACI Factored @ Toe = 2,086 psf  
ACI Factored @ Heel = 0 psf  
Footing Shear @ Toe = 24.4 psi OK  
Footing Shear @ Heel = 9.7 psi OK  
Allowable = 75.0 psi

#### Sliding Calcs

Lateral Sliding Force = 1,942.4 lbs

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

#### Load Factors

Building Code IBC 2018,ACI  
Dead Load 1.200  
Live Load 1.600  
Earth, H 1.600  
Wind, W 1.000  
Seismic, E 1.000

### Stem Construction

Design Height Above Ftg ft = 0.00  
Wall Material Above "Ht" = Concrete  
Design Method = LRFD  
Thickness = 8.00  
Rebar Size = # 5  
Rebar Spacing = 12.00  
Rebar Placed at = Edge

#### Design Data

fb/FB + fa/Fa = 0.894

#### Total Force @ Section

Service Level lbs =  
Strength Level lbs = 2,402.0

#### Moment....Actual

Service Level ft-# =  
Strength Level ft-# = 7,261.2

Moment....Allowable = 8,121.3

#### Shear.....Actual

Service Level psi =  
Strength Level psi = 32.4

Shear.....Allowable psi = 75.0

Anet (Masonry) in2 =

Rebar Depth 'd' in = 6.19

#### Masonry Data

f'm psi =

Fs psi =

Solid Grouting =

Modular Ratio 'n' =

Wall Weight psf = 100.0

Short Term Factor =

Equiv. Solid Thick. =

Masonry Block Type = Medium Weight

Masonry Design Method = ASD

#### Concrete Data

f'c psi = 2,500.0

Fy psi = 60,000.0

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Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description....  
8ft wall

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### Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

#### Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2749 in2/ft		
(4/3) * As :	0.3666 in2/ft	Min Stem T&S Reinf Area 1.632 in2	
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of :	Two layers of :
Required Area :	0.2749 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in	#6@ 55.00 in

#### Footing Data

Toe Width	=	3.25 ft
Heel Width	=	1.75
Total Footing Width	=	5.00
Footing Thickness	=	14.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft
f'c =	2,500 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	=	2,086	0 psf
Mu' : Upward	=	98,628	3 ft-#
Mu' : Downward	=	13,309	743 ft-#
Mu: Design	=	7,110	739 ft-#
Actual 1-Way Shear	=	24.42	9.72 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	# 5 @ 12.30 in	
Heel Reinforcing	=	# 5 @ 12.30 in	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

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

#### Other Acceptable Sizes & Spacings

Toe: #4@ 7.93 in, #5@ 12.30 in, #6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39  
Heel: #4@ 7.93 in, #5@ 12.30 in, #6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39  
Key: No key defined

Min footing T&S reinf Area	1.51	in2
Min footing T&S reinf Area per foot	0.30	in2 /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 7.94 in		#4@ 15.87 in
#5@ 12.30 in		#5@ 24.60 in
#6@ 17.46 in		#6@ 34.92 in

Use menu item Settings > Printing & Title Block  
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Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description....  
8ft wall

Page : 4  
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## Cantilevered Retaining Wall

Code: IBC 2018, ACI 318-14, TMS 402-16

### 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)	1,470.5	3.06	4,493.2	Soil Over HL (ab. water tbl)	953.3	4.46	4,250.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		4.46	4,250.3
Hydrostatic Force				Watre 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 =	500.0	3.58	1,791.7
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =			
Seismic Earth Load =	352.9	4.58	1,617.5	Surcharge Over Toe =			
Seismic Stem Self Wt =	119.0	5.42	644.6	Stem Weight(s) =	850.0	3.58	3,045.8
<b>Total</b> =	<b>1,942.4</b>	<b>O.T.M. =</b>	<b>6,755.3</b>	Earth @ Stem Transitions =			
				Footing Weight =	875.0	2.50	2,187.5
				Key Weight =		2.50	
				Vert. Component =			
<b>Resisting/Overturning Ratio</b> =			<b>1.67</b>	<b>Total =</b>	<b>3,178.3 lbs</b>	<b>R.M.=</b>	<b>11,275.3</b>
Vertical Loads used for Soil Pressure =		3,178.3 lbs					

\* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.070 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.



Use menu item Settings > Printing & Title Block  
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Project Name/Number : 1500 psf wall

Title :

Dsgnr: PK

Description...

9ft wall (surcharge)

Page : 1  
Date: 6 AUG 2021

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### Cantilevered Retaining Wall

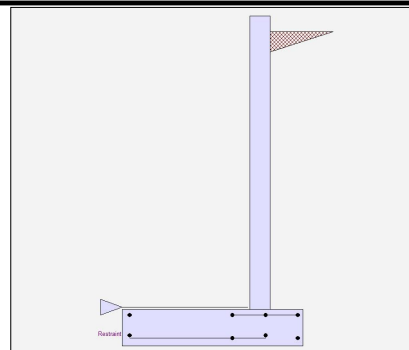
Code: IBC 2018, ACI 318-14, TMS 402-16

#### Criteria

Retained Height = 9.00 ft  
Wall height above soil = 0.50 ft  
Slope Behind Wall = 0.00  
Height of Soil over Toe = 0.00 in  
Water height over heel = 0.0 ft

#### Soil Data

Allow Soil Bearing = 1,500.0 psf  
Equivalent Fluid Pressure Method  
Active Heel Pressure = 35.0 psf/ft  
  
Passive Pressure = 150.0 psf/ft  
Soil Density, Heel = 110.00 pcf  
Soil Density, Toe = 0.00 pcf  
Footing||Soil Friction = 0.400  
Soil height to ignore  
for passive pressure = 12.00 in



#### Surcharge Loads

Surcharge Over Heel = 100.0 psf  
Used To Resist Sliding & Overturning  
Surcharge Over Toe = 0.0  
Used for Sliding & Overturning

#### Axial Load Applied to Stem

Axial Dead Load = 500.0 lbs  
Axial Live Load = 0.0 lbs  
Axial Load Eccentricity = 0.0 in

#### Earth Pressure Seismic Load

Method : Uniform  
Multiplier Used = 4.000  
(Multiplier used on soil density)

#### 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  
(Service Level)

Uniform Seismic Force = 40.667  
Total Seismic Force = 413.444

#### 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 = Line Load  
Base Above/Below Soil  
at Back of Wall = 0.0 ft  
Poisson's Ratio = 0.300

#### Stem Weight Seismic Load

$F_p / W_p$  Weight Multiplier = 0.200 g Added seismic base force 133.0 lbs

Use menu item Settings > Printing & Title Block  
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for your program.

Project Name/Number : 1500 psf wall

Title :  
Dsgnr: PK  
Description...  
9ft wall (surcharge)

Page : 2  
Date: 6 AUG 2021

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## Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

### Design Summary

#### Wall Stability Ratios

Overturning = 1.62 OK  
Slab Resists All Sliding !

Total Bearing Load = 3,681 lbs  
...resultant ecc. = 15.76 in

Soil Pressure @ Toe = 1,455 psf OK  
Soil Pressure @ Heel = 0 psf OK  
Allowable = 1,500 psf  
Soil Pressure Less Than Allowable

ACI Factored @ Toe = 2,037 psf  
ACI Factored @ Heel = 0 psf  
Footing Shear @ Toe = 30.7 psi OK  
Footing Shear @ Heel = 12.2 psi OK  
Allowable = 75.0 psi

#### Sliding Calcs

Lateral Sliding Force = 2,554.7 lbs

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

#### Load Factors

Building Code IBC 2018,ACI  
Dead Load 1.200  
Live Load 1.600  
Earth, H 1.600  
Wind, W 1.000  
Seismic, E 1.000

### Stem Construction

Design Height Above Ftg ft = 0.00  
Wall Material Above "Ht" = Concrete  
Design Method = LRFD  
Thickness = 8.00  
Rebar Size = # 5  
Rebar Spacing = 8.00  
Rebar Placed at = Edge

#### Design Data

fb/FB + fa/Fa = 0.967

#### Total Force @ Section

Service Level lbs =  
Strength Level lbs = 3,282.2

#### Moment....Actual

Service Level ft-# =  
Strength Level ft-# = 11,415.3  
Moment.....Allowable = 11,799.2

#### Shear.....Actual

Service Level psi =  
Strength Level psi = 44.2  
Shear.....Allowable psi = 75.0  
Anet (Masonry) in2 =  
Rebar Depth 'd' in = 6.19

#### Masonry Data

f'm psi =  
Fs psi =  
Solid Grouting =  
Modular Ratio 'n' =  
Wall Weight psf = 100.0  
Short Term Factor =  
Equiv. Solid Thick. =  
Masonry Block Type = Medium Weight  
Masonry Design Method = ASD

#### Concrete Data

f'c psi = 2,500.0  
Fy psi = 60,000.0

### Bottom

Stem OK

Use menu item Settings > Printing & Title Block  
to set these five lines of information  
for your program.

Project Name/Number : 1500 psf wall

Title :

Dsgnr: PK

Description....

9ft wall (surcharge)

Page : 3  
Date: 6 AUG 2021

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## Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

### Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.4322 in2/ft		
(4/3) * As :	0.5763 in2/ft	Min Stem T&S Reinf Area 1.824 in2	
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of :	Two layers of :
Required Area :	0.4322 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.465 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in	#6@ 55.00 in

### Footing Data

Toe Width	=	4.25 ft
Heel Width	=	1.75
Total Footing Width	=	6.00
Footing Thickness	=	14.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft
f'c =	2,500 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

	<u>Toe</u>	<u>Heel</u>
Factored Pressure	= 2,037	0 psf
Mu' : Upward	= 158,931	0 ft-#
Mu' : Downward	= 22,759	914 ft-#
Mu: Design	= 11,348	914 ft-#
Actual 1-Way Shear	= 30.74	12.20 psi
Allow 1-Way Shear	= 75.00	75.00 psi
Toe Reinforcing	= # 5 @ 11.26 in	
Heel Reinforcing	= # 5 @ 12.30 in	
Key Reinforcing	= None Spec'd	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

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

#### Other Acceptable Sizes & Spacings

Toe: #4@ 7.26 in, #5@ 11.26 in, #6@ 15.98 in, #7@ 21.80 in, #8@ 28.70 in, #9@ 36  
Heel: #4@ 7.93 in, #5@ 12.30 in, #6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39  
Key: No key defined

Min footing T&S reinf Area	1.81	in2
Min footing T&S reinf Area per foot	0.30	in2 /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 7.94 in		#4@ 15.87 in
#5@ 12.30 in		#5@ 24.60 in
#6@ 17.46 in		#6@ 34.92 in

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Project Name/Number : 1500 psf wall

Title :

Dsgnr: PK

Description....

9ft wall (surcharge)

Page : 4  
Date: 6 AUG 2021

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## Cantilevered Retaining Wall

Code: IBC 2018, ACI 318-14, TMS 402-16

### 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)	1,808.8	3.39	6,129.9	Soil Over HL (ab. water tbl)	1,072.5	5.46	5,854.1		
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		5.46	5,854.1		
Hydrostatic Force				Watre Table					
Buoyant Force	=			Sloped Soil Over Heel	=				
Surcharge over Heel	=	323.5	5.08	1,644.4	Surcharge Over Heel	=	108.3	5.46	591.3
Surcharge Over Toe	=			Adjacent Footing Load	=				
Adjacent Footing Load	=			Axial Dead Load on Stem	=	500.0	4.58	2,291.7	
Added Lateral Load	=			* Axial Live Load on Stem	=				
Load @ Stem Above Soil	=			Soil Over Toe	=				
Seismic Earth Load	=	289.4	5.08	1,471.2	Surcharge Over Toe	=			
Seismic Stem Self Wt	=	133.0	5.92	786.9	Stem Weight(s)	=	950.0	4.58	4,354.2
<b>Total</b>	=	<b>2,554.7</b>	<b>O.T.M. =</b>	<b>10,032.4</b>	Earth @ Stem Transitions	=			
					Footing Weight	=	1,050.0	3.00	3,150.0
					Key Weight	=		2.50	
					Vert. Component	=			
<b>Resisting/Overturning Ratio</b>			=	<b>1.62</b>	<b>Total =</b>	<b>3,680.8 lbs</b>	<b>R.M.=</b>	<b>16,241.2</b>	
Vertical Loads used for Soil Pressure =		3,680.8	lbs						

\* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.064 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.



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Project Name/Number : 1500 psf wall

Title :

Dsgnr: PK

Description....

9ft wall (surcharge)

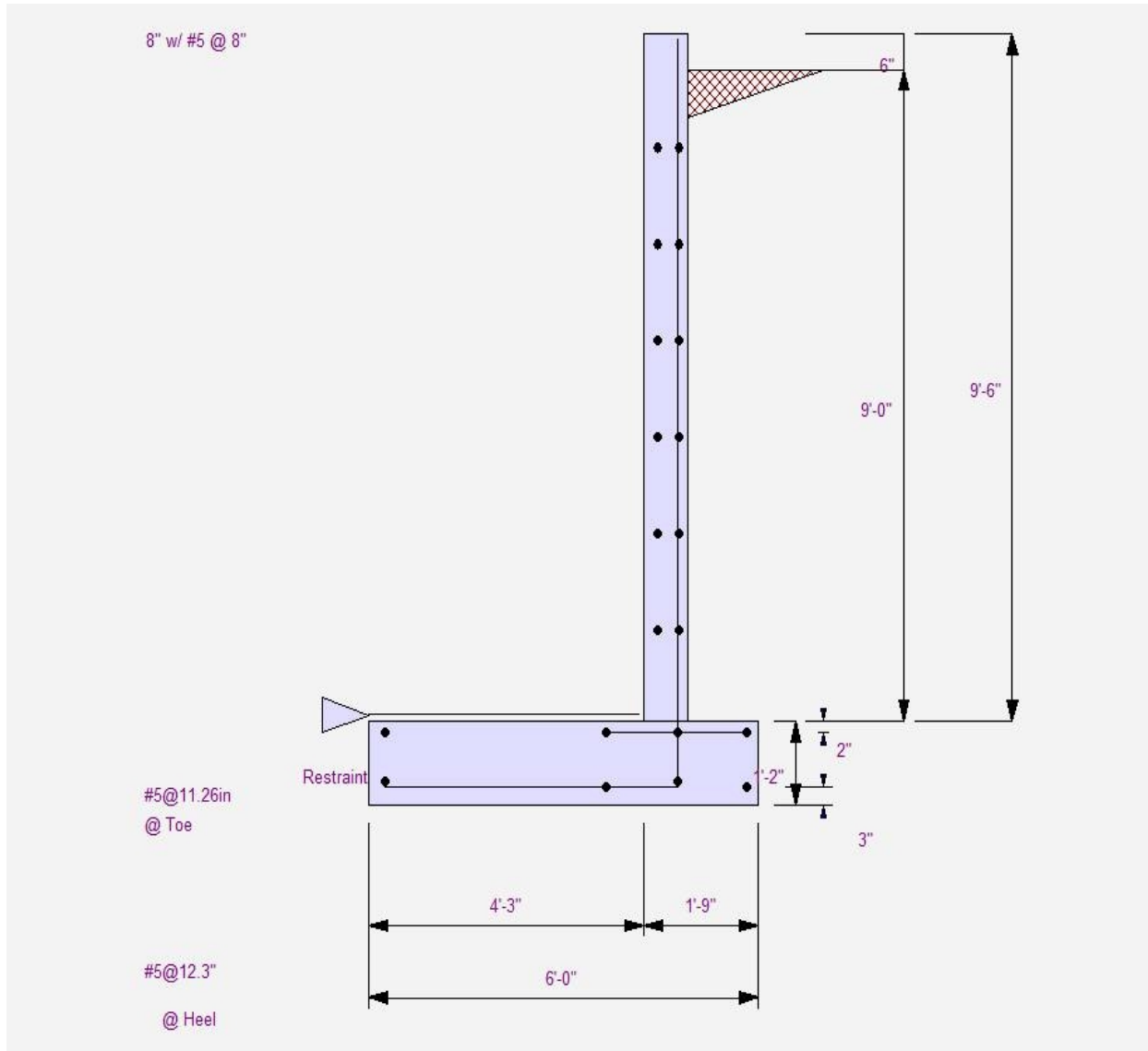
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### Cantilevered Retaining Wall

Code: IBC 2018, ACI 318-14, TMS 402-16



Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: 4FT WALL

#### Code Reference:

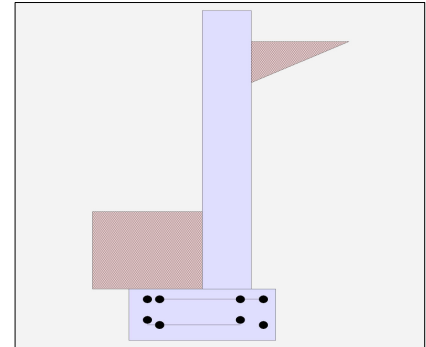
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

#### Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	15.00 in
Water height over heel	=	0.0 ft

#### Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	150.0 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

#### Earth Pressure Seismic Load

Method	:	Uniform
Multiplier Used	=	0.200
(Multiplier used on soil density)		

#### 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)

Uniform Seismic Force	=	0.967
Total Seismic Force	=	4.672

#### 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

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: 4FT WALL

#### Design Summary

##### Wall Stability Ratios

Overturning	=	1.78	OK
Sliding	=	1.56	OK
Global Stability	=	2.68	
Total Bearing Load	=	984 lbs	
...resultant ecc.	=	5.65 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	1,239 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,735 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	6.5 psi	OK
Footing Shear @ Heel	=	2.5 psi	OK
Allowable	=	75.0 psi	

##### Sliding Calcs

Lateral Sliding Force	=	412.1 lbs	
less 100% Passive Force	=	250.5 lbs	
less 100% Friction Force	=	393.7 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	SD SD
Thickness	=	8.00	
Rebar Size	=	# 4	
Rebar Spacing	=	12.00	
Rebar Placed at	=	Edge	

##### Design Data

fb/FB + fa/Fa	=	0.165
---------------	---	-------

##### Total Force @ Section

Service Level	lbs =	
Strength Level	lbs =	451.9

##### Moment....Actual

Service Level	ft-# =	
Strength Level	ft-# =	605.1

Moment.....Allowable	=	3,655.6
----------------------	---	---------

##### Shear.....Actual

Service Level	psi =	
Strength Level	psi =	6.0

Shear.....Allowable	psi =	75.0
---------------------	-------	------

Anet (Masonry)	in2 =	
----------------	-------	--

Wall Weight	psf =	100.0
-------------	-------	-------

Rebar Depth 'd'	in =	6.25
-----------------	------	------

##### 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 =	2,500.0
Fy	psi =	40,000.0

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: 4FT WALL

### Concrete Stem Rebar Area Details

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>
Bottom Stem		
As (based on applied moment) :	0.034 in <sup>2</sup> /ft	
(4/3) * As :	0.0453 in <sup>2</sup> /ft	Min Stem T&S Reinf Area 0.864 in <sup>2</sup>
200bd/fy : 200(12)(6.25)/40000 :	0.375 in <sup>2</sup> /ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in <sup>2</sup> /ft
0.0018bh : 0.0018(12)(8) :	0.1728 in <sup>2</sup> /ft	Horizontal Reinforcing Options :
	=====	<u>One layer of :</u> <u>Two layers of :</u>
Required Area :	0.1728 in <sup>2</sup> /ft	#4@ 12.50 in      #4@ 25.00 in
Provided Area :	0.2 in <sup>2</sup> /ft	#5@ 19.38 in      #5@ 38.75 in
Maximum Area :	1.27 in <sup>2</sup> /ft	#6@ 27.50 in      #6@ 55.00 in

### Footing Data

Toe Width	=	1.00 ft
Heel Width	=	1.00
Total Footing Width	=	2.00
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c = 2,500 psi	Fy =	40,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top      2.00	@ Btm.=	3.00 in

### Footing Design Results

	<u>Toe</u>	<u>Heel</u>
Factored Pressure	= 1,735	0 psf
Mu' : Upward	= 685	0 ft-#
Mu' : Downward	= 158	38 ft-#
Mu: Design	= 528 OK	38 ft-#      OK
phiMn	= 4,264	4,912 ft-#
Actual 1-Way Shear	= 6.55	2.51 psi
Allow 1-Way Shear	= 75.00	75.00 psi
Toe Reinforcing	= # 4 @ 11.11 in	
Heel Reinforcing	= # 4 @ 11.11 in	
Key Reinforcing	= None Spec'd	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

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

#### Other Acceptable Sizes & Spacings

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 55.55 in, #10@ 70.55 in

Heel: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 55.55 in, #10@ 70.55 in

Key: No key defined

Min footing T&S reinf Area	0.43 in <sup>2</sup>
Min footing T&S reinf Area per foot	0.22 in <sup>2</sup> /ft

#### If one layer of horizontal bars:

#4@ 11.11 in  
 #5@ 17.22 in  
 #6@ 24.44 in

#### If two layers of horizontal bars:

#4@ 22.22 in  
 #5@ 34.44 in  
 #6@ 48.89 in

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: 4FT WALL

### 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)	408.8	1.61	658.7	Soil Over HL (ab. water tbl)	146.7	1.83	268.9
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		1.83	268.9
Hydrostatic Force				Watre 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 =	137.5	0.50	68.8
Seismic Earth Load =	3.3	2.42	7.9	Surcharge Over Toe =			
=				Stem Weight(s) =	450.0	1.33	600.0
<b>Total</b> =	412.1	<b>O.T.M.</b>	666.6	Earth @ Stem Transitions =			
				Footing Weight =	250.0	1.00	250.0
				Key Weight =			
				Vert. Component =			
<b>Resisting/Overturning Ratio</b>		=	<b>1.78</b>	<b>Total =</b>	984.2 lbs	<b>R.M.=</b>	1,187.6
Vertical Loads used for Soil Pressure =		984.2 lbs					

\* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.077 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.

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: 4FT WALL**

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### Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment =	15.60 in
Development length for #4 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.00 in
As Provided =	0.2000 in <sup>2</sup> /ft
As Required =	0.1728 in <sup>2</sup> /ft

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Cantilevered Retaining Wall

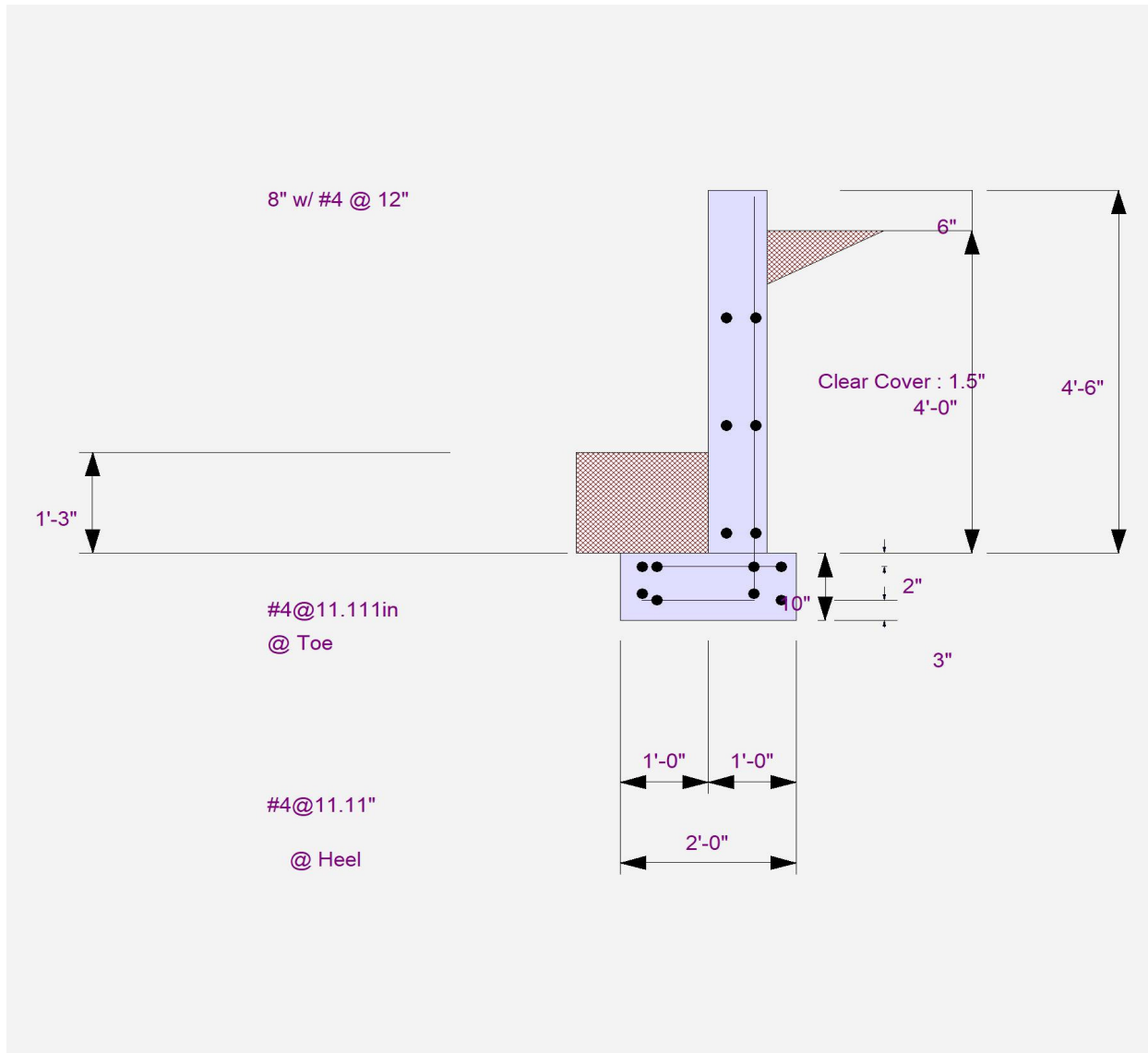
Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: 4FT WALL**



# Cantilevered Retaining Wall

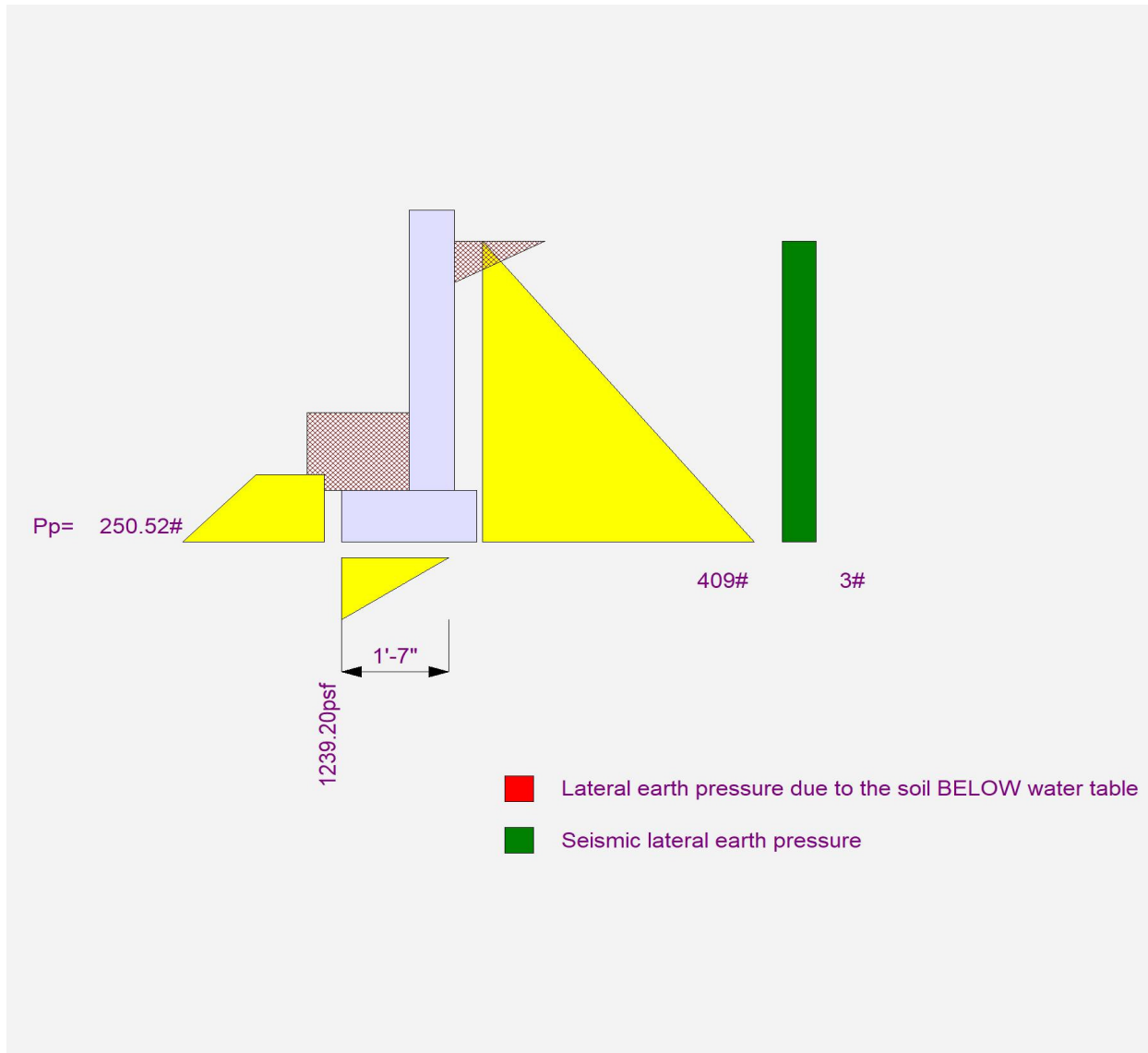
Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: 4FT WALL**





Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: 6FT WALL

#### Code Reference:

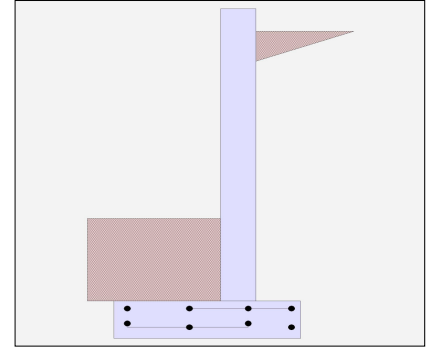
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

#### Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	22.00 in
Water height over heel	=	0.0 ft

#### Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footings  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

#### Earth Pressure Seismic Load

Method	:	Uniform
Multiplier Used	=	0.200
(Multiplier used on soil density)		

#### 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)

Uniform Seismic Force	=	1.367
Total Seismic Force	=	9.339

#### 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

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: 6FT WALL

#### Design Summary

##### Wall Stability Ratios

Overturning	=	2.33	OK
Sliding	=	1.55	OK
Global Stability	=	2.30	
Total Bearing Load	=	2,041 lbs	
...resultant ecc.	=	6.31 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	1,109 psf	OK
Soil Pressure @ Heel	=	57 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,553 psf	
ACI Factored @ Heel	=	80 psf	
Footing Shear @ Toe	=	14.5 psi	OK
Footing Shear @ Heel	=	6.4 psi	OK
Allowable	=	75.0 psi	

##### Sliding Calcs

Lateral Sliding Force	=	823.7 lbs	
less 100% Passive Force	= -	458.3 lbs	
less 100% Friction Force	= -	816.3 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 =	Stem OK	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	10.00
Rebar Placed at	=	Edge

##### Design Data

fb/FB + fa/Fa	=	0.467
---------------	---	-------

##### Total Force @ Section

Service Level	lbs =	
Strength Level	lbs =	1,016.2

##### Moment....Actual

Service Level	ft-# =	
Strength Level	ft-# =	2,040.6

Moment.....Allowable	=	4,364.1
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##### Shear.....Actual

Service Level	psi =	
Strength Level	psi =	13.5

Shear.....Allowable	psi =	75.0
---------------------	-------	------

Anet (Masonry)	in2 =	
----------------	-------	--

Wall Weight	psf =	100.0
-------------	-------	-------

Rebar Depth 'd'	in =	6.25
-----------------	------	------

##### 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 =	2,500.0
Fy	psi =	40,000.0

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: 6FT WALL

### Concrete Stem Rebar Area Details

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>	
Bottom Stem			
As (based on applied moment) :	0.1147 in2/ft		
(4/3) * As :	0.1529 in2/ft	Min Stem T&S Reinf Area 1.248 in2	
200bd/fy : 200(12)(6.25)/40000 :	0.375 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	<u>One layer of :</u> <u>Two layers of :</u>	
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.24 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.27 in2/ft	#6@ 27.50 in	#6@ 55.00 in

### Footing Data

Toe Width	=	2.00 ft
Heel Width	=	1.50
Total Footing Width	=	3.50
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c = 2,500 psi	Fy =	40,000 psi
Footing Concrete Density =		150.00 pcf
Min. As %	=	0.0018
Cover @ Top 2.00	@ Btm.=	3.00 in

### Footing Design Results

	<u>Toe</u>	<u>Heel</u>	
Factored Pressure	= 1,553	80 psf	
Mu' : Upward	= 2,544	68 ft-#	
Mu' : Downward	= 784	327 ft-#	
Mu: Design	= 1,760 OK	259 ft-#	OK
phiMn	= 4,264	4,912 ft-#	
Actual 1-Way Shear	= 14.45	6.36 psi	
Allow 1-Way Shear	= 75.00	75.00 psi	
Toe Reinforcing	= # 4 @ 11.11 in		
Heel Reinforcing	= # 4 @ 11.11 in		
Key Reinforcing	= None Spec'd		
Footing Torsion, Tu	=	0.00 ft-lbs	
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs	

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

#### Other Acceptable Sizes & Spacings

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 55.55 in, #10@ 70.55 in

Heel: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 55.55 in, #10@ 70.55 in

Key: No key defined

Min footing T&S reinf Area	0.76	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft

#### If one layer of horizontal bars:

#4@ 11.11 in  
 #5@ 17.22 in  
 #6@ 24.44 in

#### If two layers of horizontal bars:

#4@ 22.22 in  
 #5@ 34.44 in  
 #6@ 48.89 in

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

(c) ENERCALC INC 1983-2022

### DESCRIPTION: 6FT WALL

### 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)	817.2	2.28	1,861.3	Soil Over HL (ab. water tbl)	550.0	3.08	1,695.8
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.08	1,695.8
Hydrostatic Force				Watre 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 =	403.3	1.00	403.3
Seismic Earth Load =	6.5	3.42	22.3	Surcharge Over Toe =			
=				Stem Weight(s) =	650.0	2.33	1,516.7
<b>Total</b> =	<b>823.7</b>	<b>O.T.M. =</b>	<b>1,883.6</b>	Earth @ Stem Transitions =			
				Footing Weight =	437.5	1.75	765.6
				Key Weight =			
				Vert. Component =			
<b>Resisting/Overturning Ratio</b> =			<b>2.33</b>	<b>Total =</b>	<b>2,040.8 lbs</b>	<b>R.M.=</b>	<b>4,381.5</b>
Vertical Loads used for Soil Pressure =		2,040.8 lbs					

\* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.057 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.

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

(c) ENERCALC INC 1983-2022

**DESCRIPTION: 6FT WALL**

---

### Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment =	15.60 in
Development length for #4 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.00 in
As Provided =	0.2400 in <sup>2</sup> /ft
As Required =	0.1728 in <sup>2</sup> /ft

Project Title:  
Engineer:  
Project ID:  
Project Descr:

# Cantilevered Retaining Wall

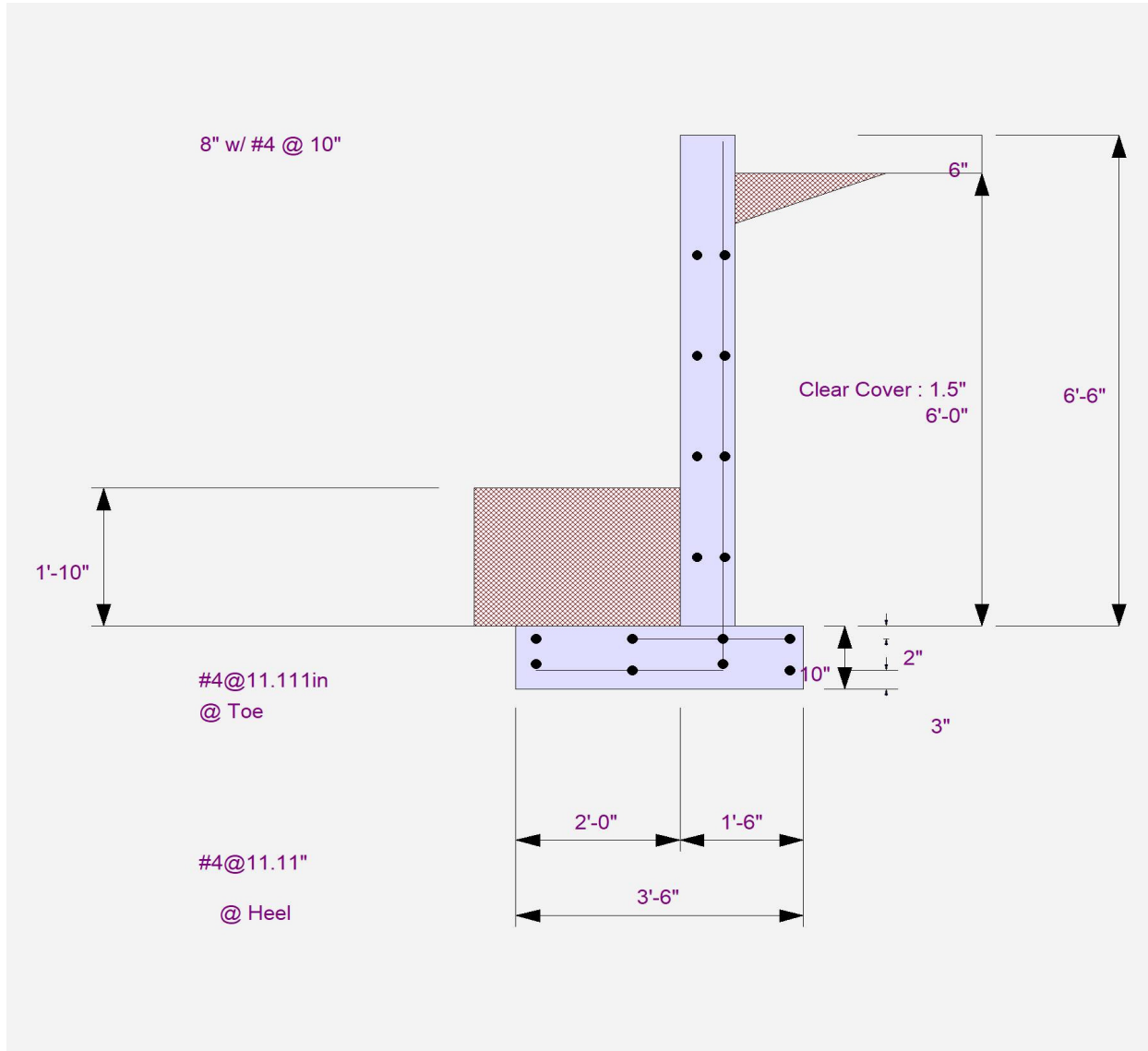
Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: 6FT WALL**



Project Title:  
Engineer:  
Project ID:  
Project Descr:

# Cantilevered Retaining Wall

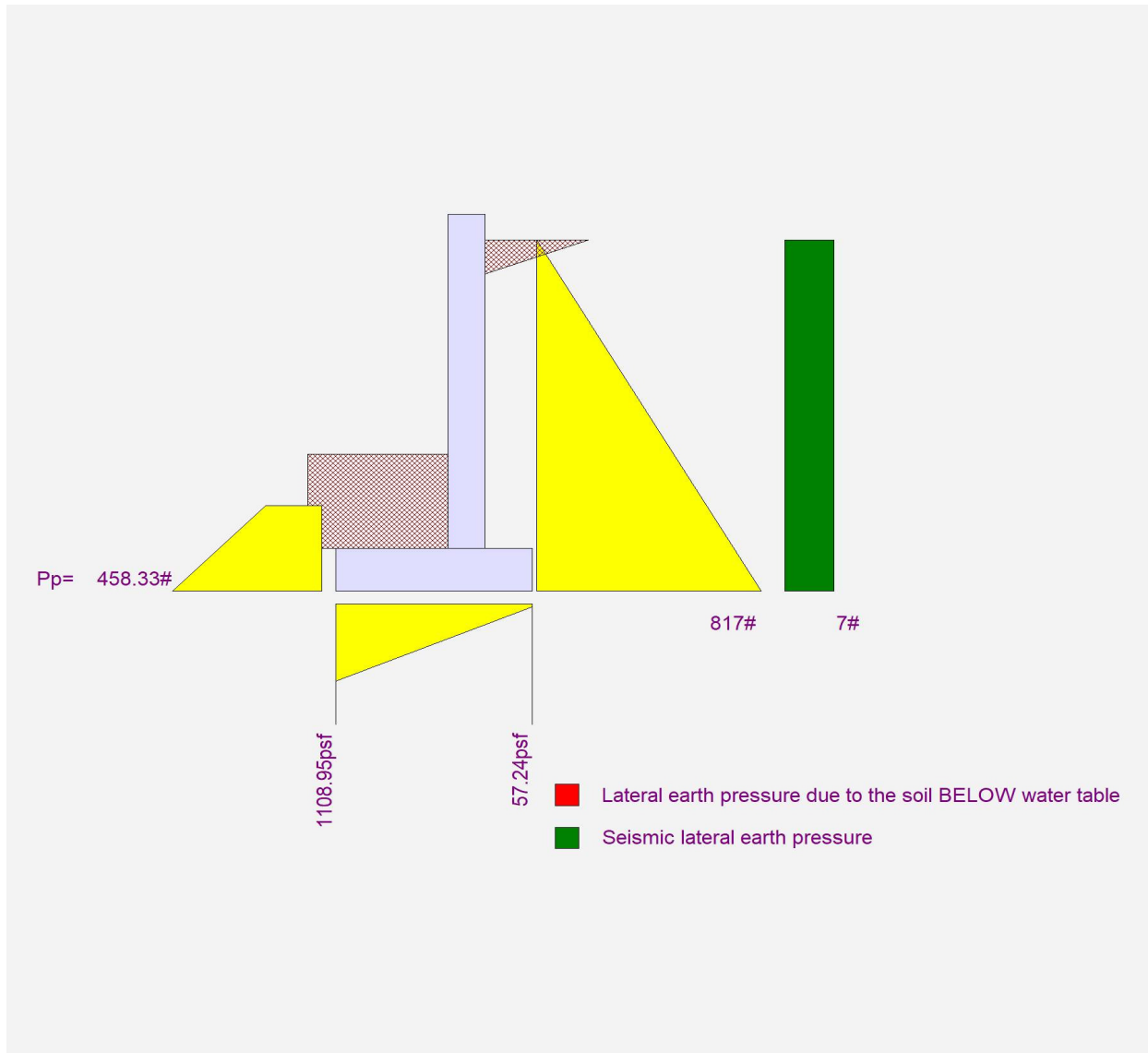
Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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**DESCRIPTION: 6FT WALL**



Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: 8FT WALL

#### Code Reference:

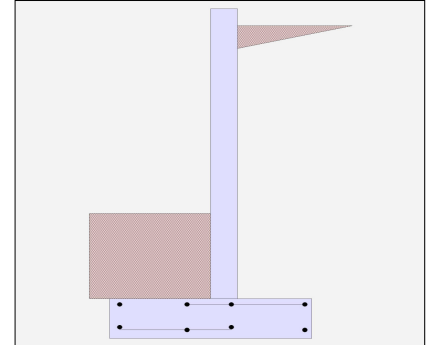
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

#### Criteria

Retained Height	=	8.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	30.00 in
Water height over heel	=	0.0 ft

#### Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	150.0 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	=	500.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

#### Earth Pressure Seismic Load

Method	:	Uniform
Multiplier Used	=	0.200
(Multiplier used on soil density)		

#### 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)

Uniform Seismic Force	=	1.833
Total Seismic Force	=	16.806

#### 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



Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: 8FT WALL

#### Design Summary

##### Wall Stability Ratios

Overturning	=	2.96	OK
Sliding	=	1.85	OK
Global Stability	=	2.52	

Total Bearing Load	=	4,526	lbs
...resultant ecc.	=	6.37	in

Eccentricity within middle third

Soil Pressure @ Toe	=	1,482	psf	OK
Soil Pressure @ Heel	=	329	psf	OK
Allowable	=	1,500	psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	2,074	psf	
ACI Factored @ Heel	=	460	psf	
Footing Shear @ Toe	=	15.0	psi	OK
Footing Shear @ Heel	=	6.8	psi	OK
Allowable	=	75.0	psi	

##### Sliding Calcs

Lateral Sliding Force	=	1,482.3	lbs	
less 100% Passive Force	=	933.3	lbs	
less 100% Friction Force	=	1,810.3	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 =	Stem OK	0.00
Wall Material Above "Ht"	=	Concrete	
Design Method	=	SD	SD
Thickness	=	8.00	
Rebar Size	=	# 5	
Rebar Spacing	=	12.00	
Rebar Placed at	=	Edge	

##### Design Data

fb/FB + fa/Fa	=	0.595
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##### Total Force @ Section

Service Level	lbs =	
Strength Level	lbs =	1,806.7

##### Moment....Actual

Service Level	ft-# =	
Strength Level	ft-# =	4,837.3

Moment.....Allowable	=	8,121.3
----------------------	---	---------

##### Shear.....Actual

Service Level	psi =	
Strength Level	psi =	24.3

Shear.....Allowable	psi =	75.0
---------------------	-------	------

Anet (Masonry)	in2 =	
----------------	-------	--

Wall Weight	psf =	100.0
-------------	-------	-------

Rebar Depth 'd'	in =	6.19
-----------------	------	------

##### 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 =	2,500.0
Fy	psi =	60,000.0

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: 8FT WALL

### Concrete Stem Rebar Area Details

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>	
Bottom Stem			
As (based on applied moment) :	0.1832 in2/ft		
(4/3) * As :	0.2442 in2/ft	Min Stem T&S Reinf Area 1.632 in2	
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	<u>One layer of :</u> <u>Two layers of :</u>	
Required Area :	0.2442 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in	#6@ 55.00 in

### Footing Data

Toe Width	=	2.50 ft
Heel Width	=	2.50
Total Footing Width	=	5.00
Footing Thickness	=	14.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c =	2,500 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

	<u>Toe</u>	<u>Heel</u>	
Factored Pressure	= 2,074	460 psf	
Mu' : Upward	= 5,642	1,105 ft-#	
Mu' : Downward	= 1,688	2,128 ft-#	
Mu: Design	= 3,954 OK	1,023 ft-#	OK
phiMn	= 14,059	15,420 ft-#	
Actual 1-Way Shear	= 14.99	6.77 psi	
Allow 1-Way Shear	= 75.00	75.00 psi	
Toe Reinforcing	= # 5 @ 12.30 in		
Heel Reinforcing	= # 5 @ 12.30 in		
Key Reinforcing	= None Spec'd		
Footing Torsion, Tu	=	0.00 ft-lbs	
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs	

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

#### Other Acceptable Sizes & Spacings

Toe: #4@ 7.93 in, #5@ 12.30 in, #6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39.68 in, #10@ 50.39 in

Heel: #4@ 7.93 in, #5@ 12.30 in, #6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39.68 in, #10@ 50.39 in

Key: No key defined

Min footing T&S reinf Area      1.51    in2  
 Min footing T&S reinf Area per foot      0.30    in2 /ft

#### If one layer of horizontal bars:

#4@ 7.94 in  
 #5@ 12.30 in  
 #6@ 17.46 in

#### If two layers of horizontal bars:

#4@ 15.87 in  
 #5@ 24.60 in  
 #6@ 34.92 in

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

CK Engineering LLC

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### DESCRIPTION: 8FT WALL

### 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)	1,470.5	3.06	4,493.2	Soil Over HL (ab. water tbl)	1,613.3	4.08	6,587.8
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		4.08	6,587.8
Hydrostatic Force				Watre 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 =	500.0	2.83	1,416.7
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	687.5	1.25	859.4
Seismic Earth Load =	11.8	4.58	53.9	Surcharge Over Toe =			
=				Stem Weight(s) =	850.0	2.83	2,408.3
<b>Total</b> =	<b>1,482.3</b>	<b>O.T.M. =</b>	<b>4,547.1</b>	Earth @ Stem Transitions =			
				Footing Weight =	875.0	2.50	2,187.5
				Key Weight =			
				Vert. Component =			
<b>Resisting/Overturning Ratio</b> =			<b>2.96</b>	<b>Total =</b>	<b>4,525.8 lbs</b>	<b>R.M.=</b>	<b>13,459.7</b>
Vertical Loads used for Soil Pressure =		4,525.8 lbs					

\* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.070 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.

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Cantilevered Retaining Wall

Project File: 1500 PSF RET. WALL (NO SLAB).ec6

LIC# : KW-06016495, Build:20.22.5.16

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**DESCRIPTION: 8FT WALL**

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### 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 = 23.40 in

Development length for #5 bar specified in this stem design segment = 18.00 in

Hooked embedment length into footing for #5 bar specified in this stem design segment = 10.50 in

As Provided = 0.3100 in<sup>2</sup>/ft

As Required = 0.2442 in<sup>2</sup>/ft

Project Title:  
Engineer:  
Project ID:  
Project Descr:

### Cantilevered Retaining Wall

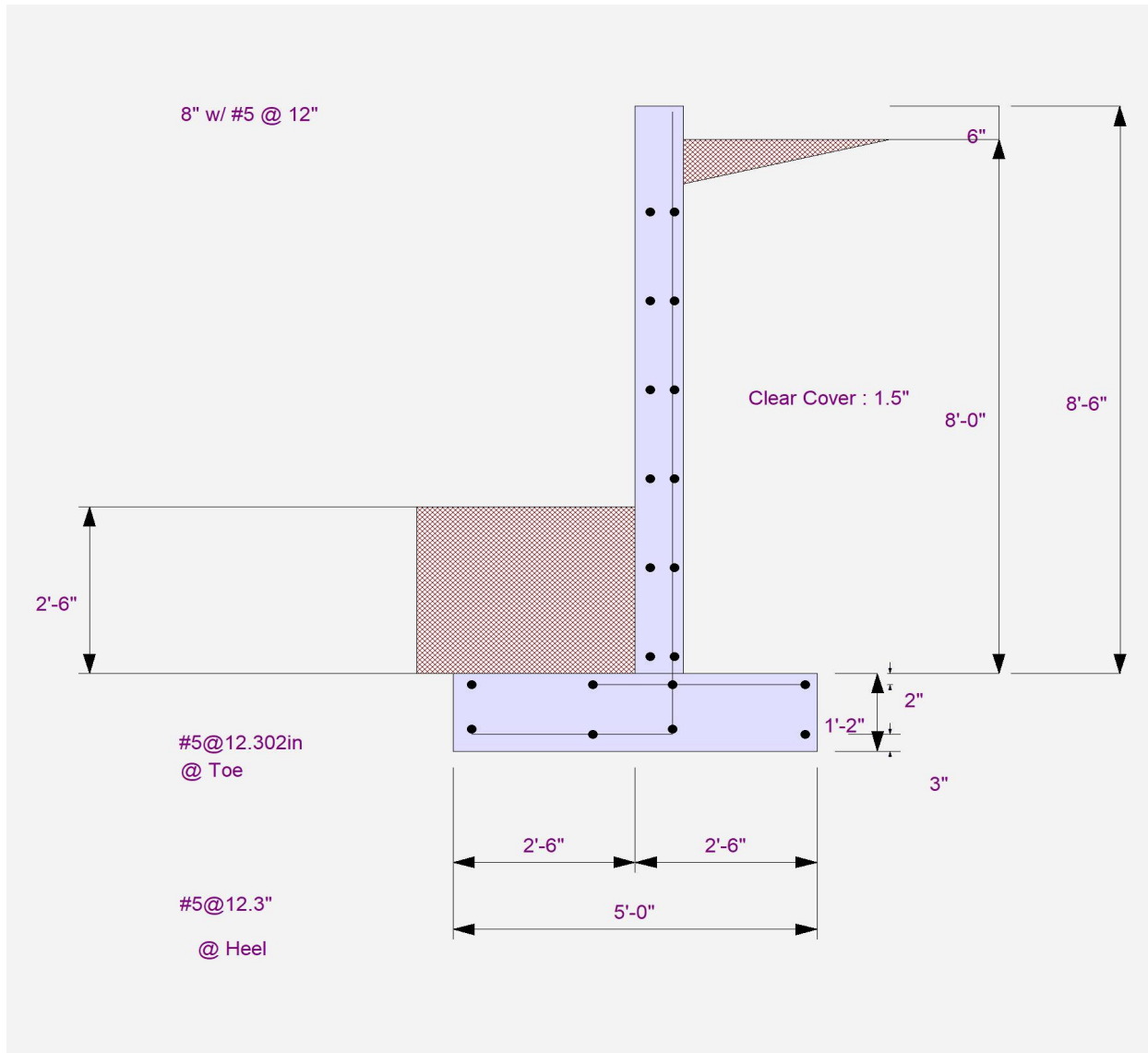
Project File: 1500 PSF RET. WALL (NO SLAB).ec6

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