



Structural Design Calculations

For

Christy's Sports Steamboat

2305 Mt. Werner Circle
Steamboat Springs CO 80487



05/03/2022

Studio DH Architecture

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Project:	Christy's Sports Steamboat
Client:	Studio DH Architecture
Engineer:	Rodney Miller
Date:	5/3/2022
Description:	Project Information Page

PROJECT INFORMATION PAGE

Client

Name	Studio DH Architecture
Address	1300 Jackson St Golden, CO 80401
Phone	303-458-9664
Email	logan@studio-dh.us

Project Name and Address

Name	Christy's Sports Steamboat
Address	2305 Mt. Werner Circle Steamboat Springs CO 80487

General Information

Building Code	2018 International Building Code
Bldg. Dept.	Steamboat Springs CO
Notes	

	Project: Client: Engineer: Date: Description:	Christy's Sports Steamboat Studio DH Architecture Rodney Miller 5/3/2022 Live Load Tables
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Occupancy or Use	Uniform, L_o (psf)	Live Load Reduction Permitted?	Multiple-Story Live Load Reduction Permitted?	Concentrated (lb)
Handrails and Guardrails	50 plf	—	—	200
Grab bars				250
Roofs				
Roof: Ordinary flat, pitched, and curved	20	Yes	—	
Stairs and exit ways	100	Yes	Yes	300
Stores				
Retail				
First Floor	100	Yes	Yes	1,000
Upper Floors	75	Yes	Yes	1,000
Wholesale, all Floors	125	No	Yes	1,000

	Project:	Christy's Sports Steamboat
	Client:	Studio DH Architecture
	Engineer:	Rodney Miller
	Date:	5/3/2022
	Description:	Seismic Load Development - Cover Page

SEISMIC DESIGN LOADS - ASCE 7-16, CHAPTER 12 EQUIVALENT LATERAL FORCE PROCEDURE

Site Classification

Site Classification = D (Section 11.4.3)

Spectral Response Acceleration Parameter

Short Period, $S_s = 0.596$ g (Section 11.4.2)
Coefficient at 0.2s, $F_a = 1.32$ (Table 11.4-1)
1s Period, $S_1 = 0.103$ g (Section 11.4.2)
Coefficient at 1s, $F_v = 2.39$ (Table 11.4-2)

Maximum Spectral Response Accelerations

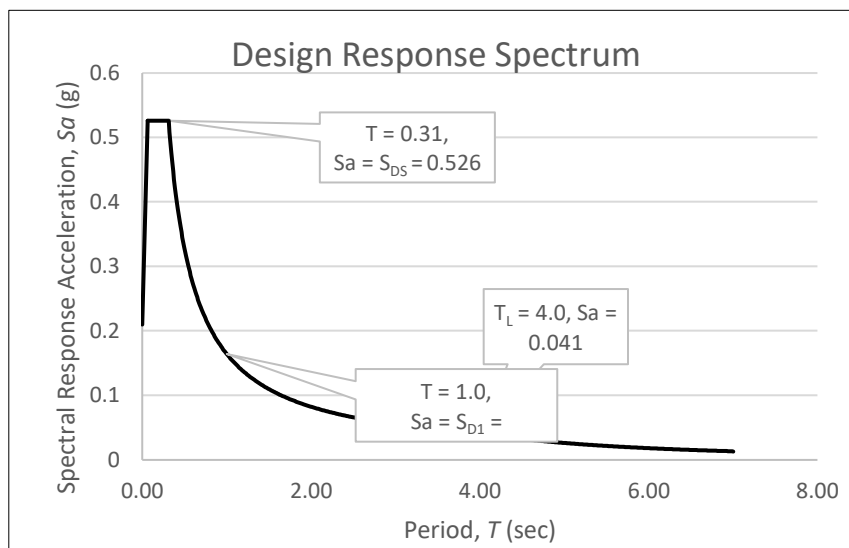
Short Period, $S_{MS} = F_a * S_s = 0.789$ g (Eq. 11.4-1)
1s Period, $S_{M1} = F_v * S_1 = 0.247$ g (Eq. 11.4-2)

Design Spectral Response Accelerations

Short Period, $S_{DS} = (2/3) * S_{MS} = 0.526$ g (Eq. 11.4-3)
1s Period, $S_{D1} = (2/3) * S_{M1} = 0.164$ g (Eq. 11.4-4)

Long-Period Transition Period

Long-Period Transition Period, $T_L = 4$ (Section 11.4.6)



	Project:	Christy's Sports Steamboat
	Client:	Studio DH Architecture
	Engineer:	Rodney Miller
	Date:	5/3/2022
	Description:	Sesimic Load Development - Main Building

SEISMIC DESIGN INFORMATION Building 1

Seismic Design Category

Risk Category =	II	(Table 1.5-1)
Importance Factor, I_e =	1.00	(Table 1.5-2)
Seismic Design Category =	D	(Section 11.6)

Building Parameters

Building Height, H =	20.42 ft	
Structure Type =	All other structural systems	(Table 12.8-2)
Approx. Fundamental Period, $T_a = C_t h_n^x$	0.192	(Eq. 12.8-7)
C_t =	0.02	(Table 12.8-2)
x =	0.75	(Table 12.8-2)
Vertical Distribution Exponent, k =	1.00	(Section 12.8.3)

Lateral Resisting System

A. BEARING WALL SYSTEMS

15. LIGHT-FRAME (WOOD) WALLS SHEATHED WITH WOOD STRUCTURAL PANELS RATED FOR SHEAR RESISTANCE OR STEEL SHEETS

Response Modification Coefficient, R =	6.5	(Table 12.2-1)
Deflection Amplification Factor, C_d =	4	(Table 12.2-1)
Overstrength Factor, Ω_o =	3	(Table 12.2-1)

Seismic Loads

C_s , Min =	0.0231	(Section 12.8.1.1)
C_s , Max =	0.1317	(Section 12.8.1.1)
Seismic Response Coefficient, C_s =	0.081	(Section 12.8.1.1)
Effective Seismic Weight, W =	9 k	(Section 12.7.2)
N/S Seismic Base Shear, $V_{N/S} = C_s W$ =	0.71 k	(Eq. 12.8-1)

Level	Weight (k)	Vertical Distribution of Seismic Load, F_x				Diaphragm Load, $F_{p,x}$		
		Height (ft)	$w_x h_x^k$	C_v, x	F_x	Σw	ΣF	$F_{p,x}$
Roof	8.7 k	12.8 ft	112.2	1.00	0.7 k	8.7 k	0.7 k	0.9 k
Sum	8.7 k		112.2					

	Project:	Christy's Sports Steamboat
	Client:	Studio DH Architecture
	Engineer:	Rodney Miller
	Date:	5/3/2022
	Description:	Sesimic Load Development - Main Building

East/West Lateral Resisting System

A. BEARING WALL SYSTEMS

15. LIGHT-FRAME (WOOD) WALLS SHEATHED WITH WOOD STRUCTURAL PANELS RATED FOR SHEAR RESISTANCE OR STEEL SHEETS

Response Modification Coefficient, $R =$	6.5	(Table 12.2-1)
Deflection Amplification Factor, $C_d =$	4	(Table 12.2-1)
Overstrength Factor, $\Omega_o =$	3	(Table 12.2-1)

East/West Seismic Loads

C_s , Min =	0.0231	(Section 12.8.1.1)
C_s , Max =	0.1317	(Section 12.8.1.1)
Seismic Response Coefficient, $C_s =$	0.0809	(Section 12.8.1.1)
Effective Seismic Weight, $W =$	9 k	(Section 12.7.2)
E/W Seismic Base Shear, $V_E/W = C_s W =$	0.71 k	(Eq. 12.8-1)

Level	Weight (k)	Height (ft)	Vertical Distribution of Seismic Load, F_x			Diaphragm Load, $F_{p,x}$		
			$w_x h_x^k$	$C_{v,x}$	F_x	Σw	ΣF	$F_{p,x}$
Roof	8.7 k	12.8 ft	112.2	1.00	0.7 k	8.7 k	0.7 k	0.9 k
Sum	8.7 k		112.2					

	Project: Client: Engineer: Date: Description:	Christy's Sports Steamboat Studio DH Architecture Rodney Miller 5/3/2022 Snow Load Development - Main Building
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SNOW DESIGN LOADS - ASCE 7-16, CHAPTER 7

Building 1

General Information

Risk Category =	II	(Table 1.5-1)
Importance Factor, I_s =	1.00	(Table 1.5-2)
Ground Snow Load, p_g =	105 psf	(Section 7.2)
Exposure Classification =	C	(Section 26.7)
Snow Density, $\gamma = 0.13p_g + 14$ =	28 pcf	(Eq. 7.7-1)

Building Information

Exposure to Roof =	Partially Exposed	(Table 7.3-1)
Thermal Condition =	Other	(Section 7.4)
Roof Slope =	5.00 : 12	
Roof Shape =	Hip	
Roof Surface =	Concrete Tile	
Surface Classification =	Slippery Surface	(Section 7.4)
Roof Obstructions =	No	(Section 7.4)

Snow Loads

Exposure Factor, C_e =	1.00	(Table 7.3-1)
Thermal Factor, C_t =	1.00	(Table 7.3-2)
Flat Roof Snow Load, $p_f = 0.7 \cdot C_e \cdot C_t \cdot I_s \cdot p_g$ =	73.5 psf	(Eq. 7.3-1)
Roof Angle =	22.62 °	
Slope Factor, C_s =	0.73	(Figure 7.4-1)
Sloped Surface Roof Snow Load, $p_s = C_s \cdot p_f$	53.6 psf	(Eq. 7.4-1)

Minimum Snow For Low-Slope Roofs

Min. Snow For Low-Slope Roofs, p_m =	N/A	(Section 7.3.4)
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	Project: Client: Engineer: Date: Description:	Christy's Sports Steamboat Studio DH Architecture Rodney Miller 5/3/2022 Snow Load Development - Main Building
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Project:	Christy's Sports Steamboat
Client:	Studio DH Architecture
Engineer:	Rodney Miller
Date:	5/3/2022
Description:	Project Soils Information

Project Soils Information

Foundation Overview

The foundation design provided is based off a minimum allowable presumptive load-bearing value as indicated by 2018 International Building Code in lieu of a site geotechnical evaluation.

Type	Shallow Foundations
Sulfate Levels	Negligible Sulfate
Frost Depth	48 in
Site Class	D

Foundation Design Information

Shallow Foundation

Isolated Footing Pressure:	1500 psf
Minimum Pad Dimension:	24 in
Continuous Footing Pressure:	1500 psf
Minimum Wall Footing Width:	18 in
Minimum Bearing Pressure:	0 psf

Deep Foundation

Minimum Pier Embedment:	10 ft
Minimum Pier Length:	30 ft
Pier End Bearing Pressure:	50000 psf
Pier Side Shear:	40 psf
Min. Pier End Bearing Pressure:	60 psf

Horizontal Soil Design

Active Pressure:	40 psf/ft
At-Rest Pressure:	60 psf/ft
Passive Pressure:	200 psf/ft
Lateral Sliding Resistance Means:	Coefficient of friction
Lateral Sliding Resistance μ :	0.35

Project:	Christy's Sports Steamboat
Client:	Studio DH Architecture
Engineer:	Rodney Miller
Date:	5/3/2022
Description:	Wind Load Development - Components and Cladding - Main Building

WIND DESIGN LOADS - ASCE 7-16, CHAPTER 30
COMPONENTS AND CLADDING - PART 1, $H \leq 60$ FT
Building 1

Site Parameters

Risk Category =	II	
Exposure Category =	C	(Section 26.7.3)
Topographic Factor, K_{zt} =	1.00	(Section 26.8.2)
Elevation Reduction Factor, K_e =	1.00	(Table 26.9-1)

Building Parameters

Buildings

Structure Type =	Buildings	
Directionality factor, K_d =	0.85	(Table 26.6-1)
Enclosure Classification =	Enclosed Buildings	
Internal Pressure Coefficient, GC_{pi} =	0.18	(Table 26.13-1)
Ch. 30, Minimum Wall Pressure, $P_{min.}$ =	16 psf	(Section 30.2.2)
Basic Wind Speed, V =	115 mph	(Section 26.5.1)

Region Parameters

Region 1

Region Length, L =	106.50 ft	
Region Width, W =	64.00 ft	
Mean Roof Height, H =	20.42 ft	
Roof Angle =	22.62 °	
Ch. 30, Edge Strip, a =	6.40 ft	(Figure 30.3-1)
Velocity Pressure Exposure Coefficient, K_z =	0.91	
Velocity Pressure, $q_h = 0.00256 K_e K_z K_{zt} K_d V^2 =$	26 psf	

Project:	Christy's Sports Steamboat
Client:	Studio DH Architecture
Engineer:	Rodney Miller
Date:	5/3/2022
Description:	Wind Load Development - Components and Cladding - Main Building

Wall Design Pressures for Components and Cladding

$$p = q_h[(GC_p) - (GC_{pi})]$$

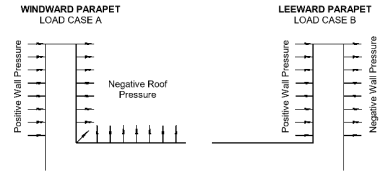
Zones	10 ft ²	20 ft ²	50 ft ²	100 ft ²	200 ft ²
4 & 5	31 psf	29 psf	28 psf	26 psf	25 psf
4	-33 psf	-32 psf	-30 psf	-29 psf	-27 psf
5	-41 psf	-38 psf	-35 psf	-32 psf	-29 psf

Parapet Design Pressures for Components and Cladding - Part 6

Velocity Pressure Exposure Coefficient, $K_z = 0.97$

Velocity Pressure, $q_h = 0.00256 K_e K_z K_{zt} K_d V^2 = 28 \text{ psf}$

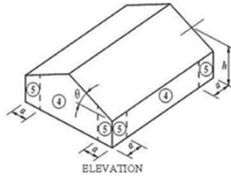
Zones	10 ft ²	20 ft ²	50 ft ²	100 ft ²	200 ft ²
4 PAR - A	92 psf	86 psf	78 psf	72 psf	66 psf
5 PAR - A	117 psf	107 psf	93 psf	83 psf	72 psf
4 PAR - B	59 psf	56 psf	52 psf	49 psf	46 psf
5 PAR - B	67 psf	62 psf	57 psf	52 psf	48 psf



Load Case A shall consist of applying the applicable positive wall pressure to the front surface of the parapet while applying the applicable negative edge or corner zone roof pressure to the back surface.

Load Case B shall consist of applying the applicable positive wall pressure to the back of the parapet surface and applying the applicable negative wall pressure to the front surface.

Diagram



Notation

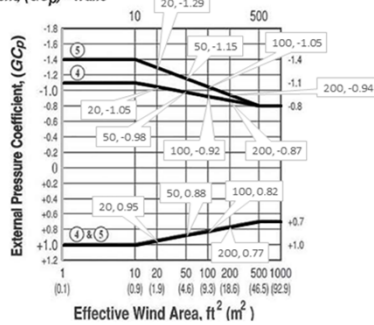
$a = 10\%$ of least horizontal dimension or $0.4h$, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m).

Exception: For buildings with $\theta = 0^\circ$ to 7° and a least horizontal dimension greater than 300 ft (90 m), dimension a shall be limited to a maximum of $0.8h$.

h = Mean roof height, in ft (m), except that eave height shall be used for $\theta \leq 10^\circ$.

θ = Angle of plane of roof from horizontal, in degrees.

External Pressure Coefficient, (GC_p) - Walls



Notes

- Vertical scale denotes (GC_p) to be used with q_h .
- Horizontal scale denotes effective wind area, in ft^2 (m^2).
- Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
- Each component shall be designed for maximum positive and negative pressures.
- Values of (GC_p) for walls shall be reduced by 10% when $\theta \leq 10^\circ$.

FIGURE 30.3-1 Components and Cladding ($h \leq 60 \text{ ft}$ [$h \leq 18.3 \text{ m}$]): External Pressure Coefficients, (GC_p) , for Enclosed and Partially Enclosed Buildings—Walls

Project:	Christy's Sports Steamboat
Client:	Studio DH Architecture
Engineer:	Rodney Miller
Date:	5/3/2022
Description:	Wind Load Development - Components and Cladding - Main Building

Roof Design Pressures for Components and Cladding

$$p = q_h[(GC_p) - (GC_{pi})]$$

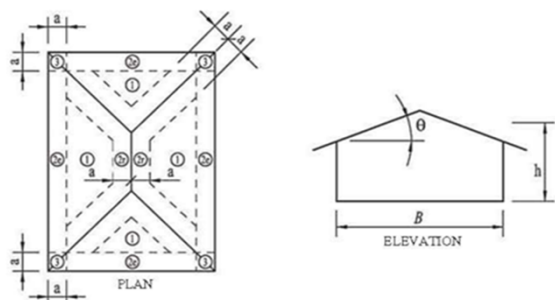
Region 1 Roof Pressures, p

Bldg 1 Region 1 - Roof
Bldg 1 Region 1 - Angle

Hip
22.62 °

Zone	10 ft²	20 ft²	50 ft²	100 ft²	200 ft²
All Zones	23 psf	20 psf	16 psf	16 psf	16 psf
1	-41 psf	-36 psf	-30 psf	-26 psf	-26 psf
2e, 2r & 3	-57 psf	-51 psf	-43 psf	-37 psf	-31 psf
1 OH	-50 psf	-49 psf	-48 psf	-48 psf	-47 psf
2e & 2r OH	-64 psf	-61 psf	-58 psf	-55 psf	-52 psf
3 OH	-76 psf	-68 psf	-56 psf	-48 psf	-39 psf

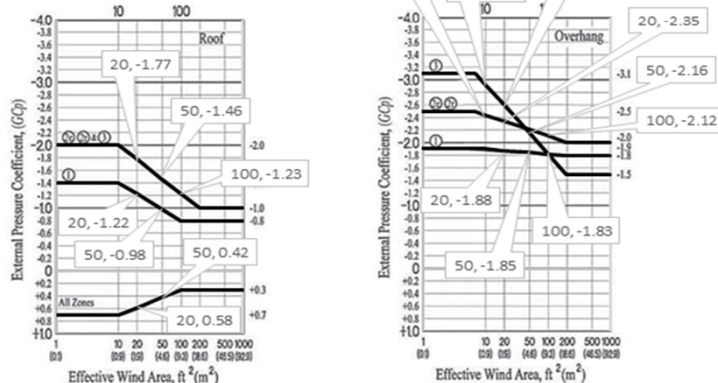
Diagrams



Notation

a = 10% of least horizontal dimension or $0.4h$, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m). If an overhang exists, the edge distance shall be measured from the outside edge of the overhang. The horizontal dimensions used to compute the edge distance shall not include any overhang distances.
 B = Horizontal dimension of building measured normal to wind direction, in ft (m).
 h = Mean roof height, in ft (m).
 θ = Angle of plane of roof from horizontal, in degrees.

External Pressure Coefficients



Notes

- Vertical scale denotes (GC_p) to be used with q_p .
- Horizontal scale denotes effective wind area, in ft² (m²).
- Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
- Each component shall be designed for maximum positive and negative pressures.
- Values of (GC_p) for roof overhangs include pressure contributions from both upper and lower surfaces.
- If overhangs exist, the lesser horizontal dimension of the building shall not include any overhang dimension, but the edge distance, a , shall be measured from the outside edge of the overhang.

	Project:	Christy's Sports Steamboat
	Client:	Studio DH Architecture
	Engineer:	Rodney Miller
	Date:	5/3/2022
	Description:	Wind Load Development - Componenets and Cladding - Main Building

FIGURE 30.3-2G Components and Cladding [$h \leq 60$ ft ($h \leq 18.3$ m)]: External Pressure Coefficients, (GC_p), for Enclosed and Partially Enclosed Buildings—Hip Roofs, $20^\circ < \theta \leq 27^\circ$ (Roof and Overhang)

	Project:	Christy's Sports Steamboat
	Client:	Studio DH Architecture
	Engineer:	Rodney Miller
	Date:	5/3/2022
	Description:	Wind Load Development - Componenets and Cladding - Main Building

	Project: Client: Engineer: Date: Description:	Christy's Sports Steamboat Studio DH Architecture Rodney Miller 5/3/2022 Wind Load Development - Directional Procedure - Main Building
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**WIND DESIGN LOADS - ASCE 7-16, CHAPTER 27 (MWFRS)
DIRECTIONAL PROCEDURE - PART 1, ALL HEIGHTS METHOD
Building 1**

Wind Load Site Parameters

Risk Category =	II	
Exposure Category =	C	(Section 26.7.3)
Topographic Factor, K_{zt} =	1.00	(Section 26.8.2)
Elevation Reduction Factor, K_e =	1.00	(Table 26.9-1)

Wind Load Building Parameters

Structure Type =	Buildings	
Directionality factor, K_d =	0.85	(Table 26.6-1)
Gust Factor, G =	0.85	
Enclosure Classification =	Enclosed Buildings	
Internal Pressure Coefficient, GC_{pi} =	± 0.18	(Table 26.13-1)
Ch. 27, Minimum Wall Pressure, $P_{min.}$ =	16 psf	(Section 27.1.5)
Basic Wind Speed, V =	115 mph	(Section 26.5.1)

Region Parameters

	Region 1
Region Length, L =	106.50 ft
Region Width, W =	64.00 ft
Mean Roof Height, H =	20.42 ft
Roof Angle =	22.62 °
Velocity Pressure Exposure Coefficient, K_z =	0.91
Velocity Pressure, $q_h = 0.00256 K_e K_z K_{zt} K_d V^2 =$	26 psf
Building Length / Building Width, L/B =	1.66
Building Height/Length, h/L =	0.19
Building Height/Width, h/W =	0.32

	Project:	Christy's Sports Steamboat
	Client:	Studio DH Architecture
	Engineer:	Rodney Miller
	Date:	5/3/2022
	Description:	Wind Load Development - Directional Procedure - Main Building

Wind Loads: Main Wind Force Resisting System

Pressure, $p=qGCp \pm qi(GCpi)$

Region 1

Region 1 Load Application Cases

Walls

Surface	Cp
Windward	0.80
Leeward L/W	-0.37
Leeward W/L	-0.50
Side	-0.70

qGCp	± qi(GCpi)
Ref Table	5 psf
-8.1 psf	5 psf
-11.1 psf	5 psf
-15.5 psf	5 psf

CASE 1

CASE 3

Hip 22.62 °

Roof Pressures along Length

Surface	Cp
Windward Case 1	-0.25
Windward Case 2	0.25
Leeward	-0.60

Pext
-10.2 psf
0.9 psf
-18.0 psf

CASE 2

CASE 4

$$M_T = 0.75 (P_{wX} + P_{LX}) B_X e_X \quad M_T = 0.75 (P_{wY} + P_{LY}) B_Y e_Y \quad M_T = 0.563 (P_{wX} - P_{LX}) B_X e_X + 0.563 (P_{wY} - P_{LY}) B_Y e_Y$$

$$e_X = \pm 0.15 B_X \quad e_Y = \pm 0.15 B_Y \quad e_X = \pm 0.15 B_X \quad e_Y = \pm 0.15 B_Y$$

Roof Pressures along Width

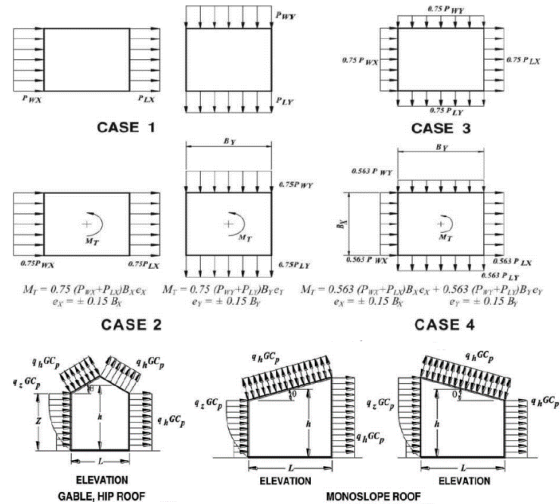
Surface	Cp Case 1	Cp Case 2
0 to h/2	-0.90	-0.18
h/2 to h	-0.90	-0.18
h to 2h	-0.50	-0.18
>2h	-0.30	-0.18

Pext Case 1	Pext Case 2
-24.6 psf	0.7 psf
-24.6 psf	0.7 psf
-15.8 psf	0.7 psf
-11.3 psf	0.7 psf

ELEVATION
GABLE, HIP ROOF

ELEVATION
MONOSLOPE ROOF

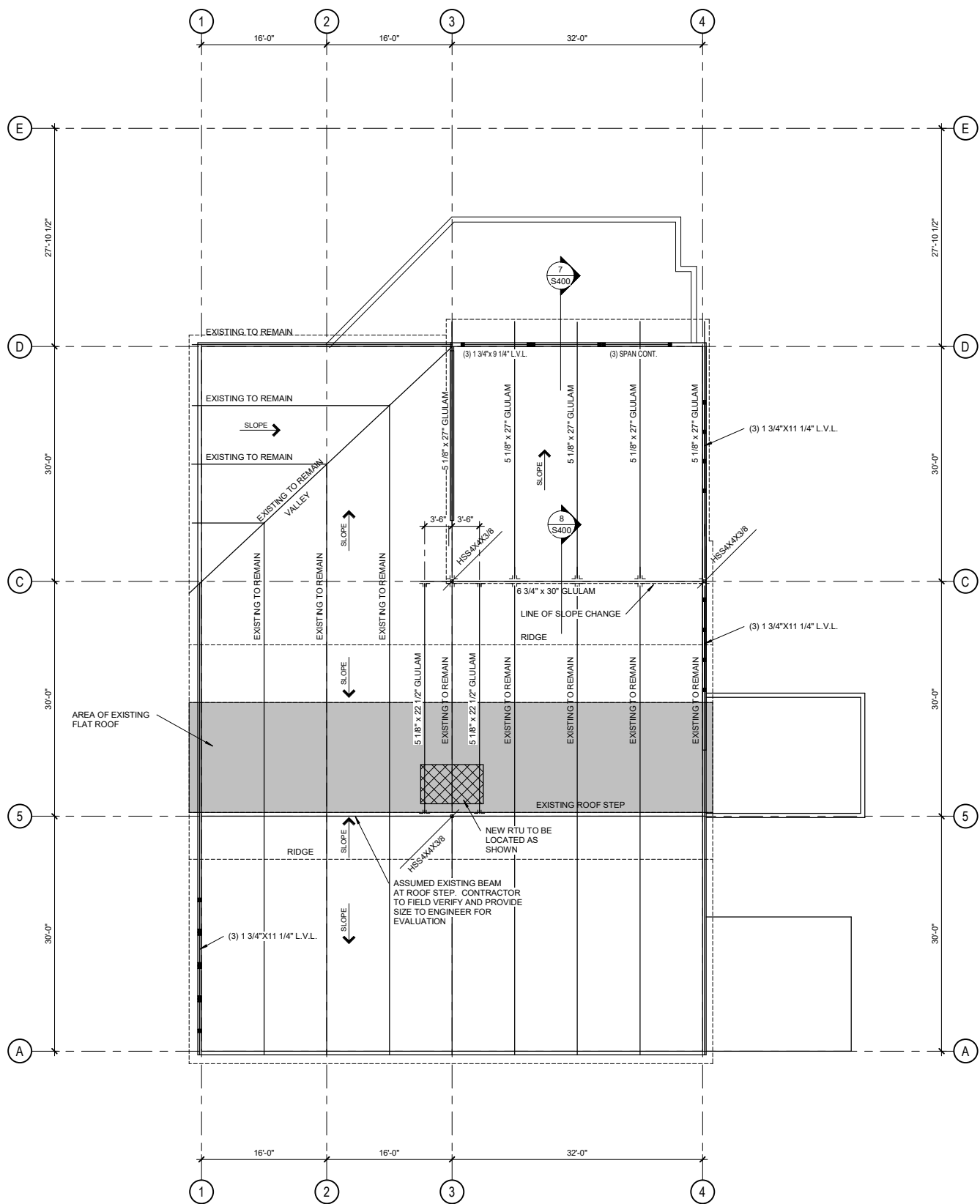
ELEVATION
MONOSLOPE ROOF



☐ Hide Combined Wall Loads

Region 1			Windward Wall Pressures		Leeward Wall	Combined Wall	
Level	Height	Wall Trib	Kz	qz	Pext	Pressure	Uniform Load
Base	0.00 ft	6.42 ft	0.85	24.4 psf	16.6 psf	27.7 psf	178 plf
Roof	12.83 ft	6.42 ft	0.85	24.4 psf	16.6 psf	27.7 psf	178 plf
Roof Proj.	28.00 ft	15.17 ft	0.97	27.9 psf	0.3 psf	7.3 psf	111 plf

 APEX ENGINEERS INC.	Project: Client: Engineer: Date: Description:	Christy's Sports Steamboat Studio DH Architecture Rodney Miller 5/3/2022 Wind Load Development - Directional Procedure - Main Building
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Wood Beam

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File: Enercalc_Christy Sports.ec6

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APEX ENGINEERS INC

DESCRIPTION: new shallow slope roof beams

CODE REFERENCES

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

Load Combination Set : IBC 2015

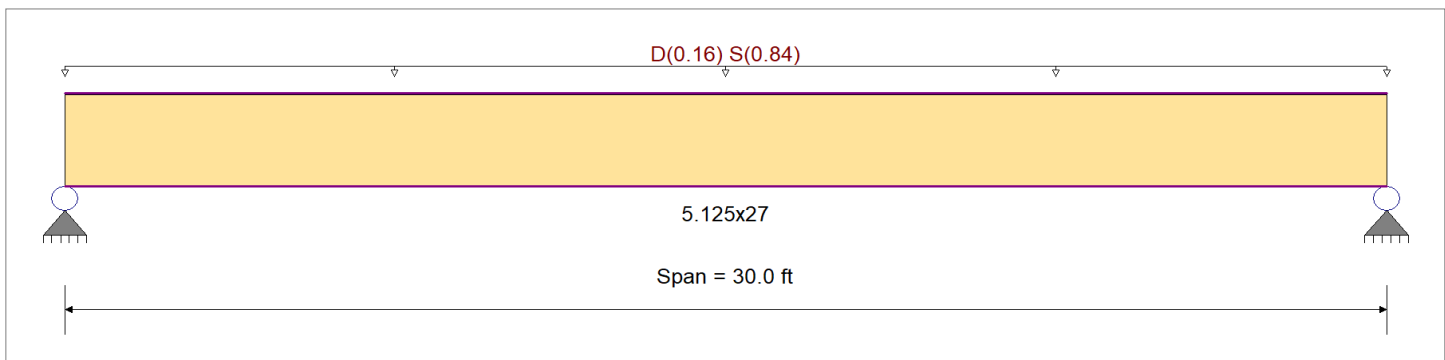
Material Properties

Analysis Method : Allowable Stress Design
Load Combination IBC 2015

Wood Species : SP/SP
Wood Grade : 24F-V8

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

Fb +	2,400.0 psi	E : Modulus of Elasticity	
Fb -	2,400.0 psi	Ebend- xx	1,800.0 ksi
Fc - Prll	1,650.0 psi	Eminbend - xx	950.0 ksi
Fc - Perp	740.0 psi	Ebend- yy	1,600.0 ksi
Fv	300.0 psi	Eminbend - yy	850.0 ksi
Ft	1,150.0 psi	Density	34.330 pcf



Applied Loads

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

Uniform Load : D = 0.020, S = 0.1050 ksf, Tributary Width = 8.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.883	1	Maximum Shear Stress Ratio	=	0.403	1
Section used for this span		5.125x27		Section used for this span		5.125x27	
fb: Actual	=	2,168.02	psi	fv: Actual	=	138.86	psi
Fb: Allowable	=	2,455.84	psi	Fv: Allowable	=	345.00	psi
Load Combination		+D+S+H		Load Combination		+D+S+H	
Location of maximum on span	=	15.000	ft	Location of maximum on span	=	27.810	ft
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
Maximum Deflection							
Max Downward Transient Deflection		1.018	in	Ratio =		353	>=295
Max Upward Transient Deflection		0.000	in	Ratio =		0	<295
Max Downward Total Deflection		1.211	in	Ratio =		297	>=240
Max Upward Total Deflection		0.000	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 _d	C _{FV}	C _i	C _r	C _m	C _t	C _L		M	fb	F'b	V	fv	Fv
+D+H														0.00			
Length = 30.0 ft	1	0.180	0.082	0.90	0.890	1.00	1.00	1.00	1.00	1.00		18.00	346.88	1921.96	2.05	22.22	270.00
+D+L+H					0.890	1.00	1.00	1.00	1.00	1.00				0.00			
Length = 30.0 ft	1	0.162	0.074	1.00	0.890	1.00	1.00	1.00	1.00	1.00		18.00	346.88	2135.52	2.05	22.22	300.00
+D+Lr+H					0.890	1.00	1.00	1.00	1.00	1.00				0.00			
Length = 30.0 ft	1	0.130	0.059	1.25	0.890	1.00	1.00	1.00	1.00	1.00		18.00	346.88	2669.39	2.05	22.22	375.00
+D+S+H					0.890	1.00	1.00	1.00	1.00	1.00				0.00			
Length = 30.0 ft	1	0.883	0.403	1.15	0.890	1.00	1.00	1.00	1.00	1.00		112.50	2,168.02	2455.84	12.81	138.86	345.00
+D+0.750Lr+0.750L+H					0.890	1.00	1.00	1.00	1.00	1.00				0.00			
Length = 30.0 ft	1	0.130	0.059	1.25	0.890	1.00	1.00	1.00	1.00	1.00		18.00	346.88	2669.39	2.05	22.22	375.00
+D+0.750L+0.750S+H					0.890	1.00	1.00	1.00	1.00	1.00				0.00			
Length = 30.0 ft	1	0.697	0.318	1.15	0.890	1.00	1.00	1.00	1.00	1.00		88.88	1,712.74	2455.84	10.12	109.70	345.00
+D+0.60W+H					0.890	1.00	1.00	1.00	1.00	1.00				0.00			
Length = 30.0 ft	1	0.102	0.046	1.60	0.890	1.00	1.00	1.00	1.00	1.00		18.00	346.88	3416.83	2.05	22.22	480.00

Wood Beam

File: Enercalc_Christy Sports.ec6

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Lic. #: KW-06005244

APEX ENGINEERS INC

DESCRIPTION: new shallow slope roof beams

Load Combination Segment Length	Span #	Max Stress Ratios		C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	Moment Values			Shear Values		
		M	V								M	fb	F'b	V	fv	Fv
+D+0.70E+H Length = 30.0 ft	1	0.102	0.046	1.60	0.890	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
+D+0.750Lr+0.750L+0.450W+H Length = 30.0 ft	1	0.102	0.046	1.60	0.890	1.00	1.00	1.00	1.00	1.00	18.00	346.88	3416.83	2.05	22.22	480.00
+D+0.750L+0.750S+0.450W+H Length = 30.0 ft	1	0.102	0.046	1.60	0.890	1.00	1.00	1.00	1.00	1.00	18.00	346.88	3416.83	2.05	22.22	480.00
+D+0.750L+0.750S+0.5250E+H Length = 30.0 ft	1	0.501	0.229	1.60	0.890	1.00	1.00	1.00	1.00	1.00	88.88	1,712.74	3416.83	10.12	109.70	480.00
+D+0.750L+0.750S+0.5250E+H Length = 30.0 ft	1	0.501	0.229	1.60	0.890	1.00	1.00	1.00	1.00	1.00	88.88	1,712.74	3416.83	10.12	109.70	480.00
+0.60D+0.60W+0.60H Length = 30.0 ft	1	0.061	0.028	1.60	0.890	1.00	1.00	1.00	1.00	1.00	10.80	208.13	3416.83	1.23	13.33	480.00
+0.60D+0.70E+0.60H Length = 30.0 ft	1	0.061	0.028	1.60	0.890	1.00	1.00	1.00	1.00	1.00	10.80	208.13	3416.83	1.23	13.33	480.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	1.2115	15.109		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	15.000	15.000
Overall MINimum	12.600	12.600
+D+H	2.400	2.400
+D+L+H	2.400	2.400
+D+Lr+H	2.400	2.400
+D+S+H	15.000	15.000
+D+0.750Lr+0.750L+H	2.400	2.400
+D+0.750L+0.750S+H	11.850	11.850
+D+0.60W+H	2.400	2.400
+D+0.70E+H	2.400	2.400
+D+0.750Lr+0.750L+0.450W+H	2.400	2.400
+D+0.750L+0.750S+0.450W+H	11.850	11.850
+D+0.750L+0.750S+0.5250E+H	11.850	11.850
+0.60D+0.60W+0.60H	1.440	1.440
+0.60D+0.70E+0.60H	1.440	1.440
D Only	2.400	2.400
S Only	12.600	12.600
H Only		

Wood Beam

Lic. #: KW-06005244

File: Enercalc_Christy Sports.ec6

Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.24

APEX ENGINEERS INC

DESCRIPTION: new beam at slope change

CODE REFERENCES

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

Load Combination Set : IBC 2015

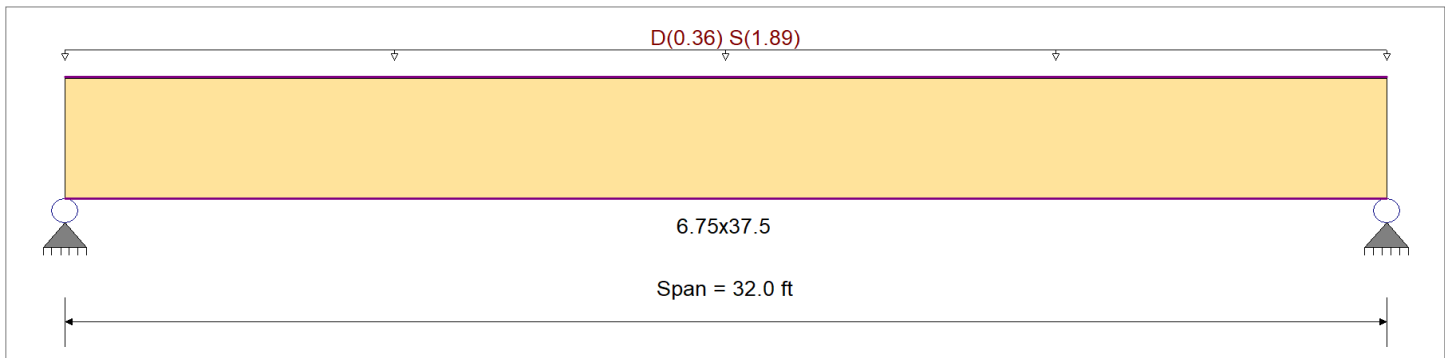
Material Properties

Analysis Method : Allowable Stress Design
Load Combination IBC 2015

Wood Species : SP/SP
Wood Grade : 24F-V8

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

Fb +	2,400.0 psi	E : Modulus of Elasticity	
Fb -	2,400.0 psi	Ebend- xx	1,800.0 ksi
Fc - Prll	1,650.0 psi	Eminbend - xx	950.0 ksi
Fc - Perp	740.0 psi	Ebend- yy	1,600.0 ksi
Fv	300.0 psi	Eminbend - yy	850.0 ksi
Ft	1,150.0 psi	Density	34.330 pcf



Applied Loads

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

Uniform Load : D = 0.020, S = 0.1050 ksf, Tributary Width = 18.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.951 : 1	Maximum Shear Stress Ratio	=	0.501 : 1
Section used for this span	=	6.75x37.5	Section used for this span	=	6.75x37.5
fb: Actual	=	2,184.53 psi	fv: Actual	=	172.85 psi
Fb: Allowable	=	2,297.05 psi	Fv: Allowable	=	345.00 psi
Load Combination	=	+D+S+H	Load Combination	=	+D+S+H
Location of maximum on span	=	16.000 ft	Location of maximum on span	=	28.964 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
Maximum Deflection					
Max Downward Transient Deflection		0.840 in	Ratio =		457 >= 360
Max Upward Transient Deflection		0.000 in	Ratio =		0 < 360
Max Downward Total Deflection		1.000 in	Ratio =		383 >= 240
Max Upward Total Deflection		0.000 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 _d	C _{FV}	C _i	C _r	C _m	C _t	C _L		M	fb	F'b	V	fv	Fv
+D+H														0.00			
Length = 32.0 ft	1	0.194	0.102	0.90	0.832	1.00	1.00	1.00	1.00	1.00		46.08	349.53	1797.69	4.67	27.66	270.00
+D+L+H					0.832	1.00	1.00	1.00	1.00	1.00				0.00	0.00	0.00	0.00
Length = 32.0 ft	1	0.175	0.092	1.00	0.832	1.00	1.00	1.00	1.00	1.00		46.08	349.53	1997.43	4.67	27.66	300.00
+D+Lr+H					0.832	1.00	1.00	1.00	1.00	1.00				0.00	0.00	0.00	0.00
Length = 32.0 ft	1	0.140	0.074	1.25	0.832	1.00	1.00	1.00	1.00	1.00		46.08	349.53	2496.79	4.67	27.66	375.00
+D+S+H					0.832	1.00	1.00	1.00	1.00	1.00				0.00	0.00	0.00	0.00
Length = 32.0 ft	1	0.951	0.501	1.15	0.832	1.00	1.00	1.00	1.00	1.00		288.00	2,184.53	2297.05	29.17	172.85	345.00
+D+0.750Lr+0.750L+H					0.832	1.00	1.00	1.00	1.00	1.00				0.00	0.00	0.00	0.00
Length = 32.0 ft	1	0.140	0.074	1.25	0.832	1.00	1.00	1.00	1.00	1.00		46.08	349.53	2496.79	4.67	27.66	375.00
+D+0.750L+0.750S+H					0.832	1.00	1.00	1.00	1.00	1.00				0.00	0.00	0.00	0.00
Length = 32.0 ft	1	0.751	0.396	1.15	0.832	1.00	1.00	1.00	1.00	1.00		227.52	1,725.78	2297.05	23.04	136.55	345.00
+D+0.60W+H					0.832	1.00	1.00	1.00	1.00	1.00				0.00	0.00	0.00	0.00
Length = 32.0 ft	1	0.109	0.058	1.60	0.832	1.00	1.00	1.00	1.00	1.00		46.08	349.53	3195.89	4.67	27.66	480.00

Wood Beam

File: Enercalc_Christy Sports.ec6

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Lic. #: KW-06005244

APEX ENGINEERS INC

DESCRIPTION: new beam at slope change

Load Combination Segment Length	Span #	Max Stress Ratios		C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	Moment Values			Shear Values		
		M	V								M	fb	F'b	V	fv	Fv
+D+0.70E+H Length = 32.0 ft	1	0.109	0.058	1.60	0.832	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
+D+0.750Lr+0.750L+0.450W+H Length = 32.0 ft	1	0.109	0.058	1.60	0.832	1.00	1.00	1.00	1.00	1.00	46.08	349.53	3195.89	4.67	27.66	480.00
+D+0.750Lr+0.750L+0.450W+H Length = 32.0 ft	1	0.109	0.058	1.60	0.832	1.00	1.00	1.00	1.00	1.00	46.08	349.53	3195.89	4.67	27.66	480.00
+D+0.750L+0.750S+0.450W+H Length = 32.0 ft	1	0.540	0.284	1.60	0.832	1.00	1.00	1.00	1.00	1.00	227.52	1,725.78	3195.89	23.04	136.55	480.00
+D+0.750L+0.750S+0.5250E+H Length = 32.0 ft	1	0.540	0.284	1.60	0.832	1.00	1.00	1.00	1.00	1.00	227.52	1,725.78	3195.89	23.04	136.55	480.00
+0.60D+0.60W+0.60H Length = 32.0 ft	1	0.066	0.035	1.60	0.832	1.00	1.00	1.00	1.00	1.00	27.65	209.72	3195.89	2.80	16.59	480.00
+0.60D+0.70E+0.60H Length = 32.0 ft	1	0.066	0.035	1.60	0.832	1.00	1.00	1.00	1.00	1.00	27.65	209.72	3195.89	2.80	16.59	480.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	1.0000	16.117		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	36.000	36.000
Overall MINimum	30.240	30.240
+D+H	5.760	5.760
+D+L+H	5.760	5.760
+D+Lr+H	5.760	5.760
+D+S+H	36.000	36.000
+D+0.750Lr+0.750L+H	5.760	5.760
+D+0.750L+0.750S+H	28.440	28.440
+D+0.60W+H	5.760	5.760
+D+0.70E+H	5.760	5.760
+D+0.750Lr+0.750L+0.450W+H	5.760	5.760
+D+0.750L+0.750S+0.450W+H	28.440	28.440
+D+0.750L+0.750S+0.5250E+H	28.440	28.440
+0.60D+0.60W+0.60H	3.456	3.456
+0.60D+0.70E+0.60H	3.456	3.456
D Only	5.760	5.760
S Only	30.240	30.240
H Only		

Wood Beam

Lic. #: KW-06005244

File: Enercalc_Christy Sports.ec6

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APEX ENGINEERS INC

DESCRIPTION: new header

CODE REFERENCES

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

Load Combination Set : IBC 2015

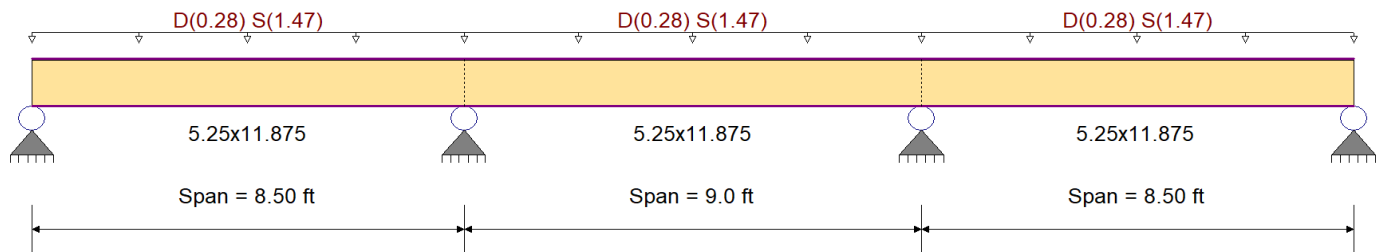
Material Properties

Analysis Method : Allowable Stress Design
Load Combination IBC 2015

Wood Species : iLevel Truss Joist
Wood Grade : MicroLam LVL 2.0 E

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

Fb + 2,600.0 psi
Fb - 2,600.0 psi
Fc - Prll 2,510.0 psi
Fc - Perp 750.0 psi
Fv 285.0 psi
Ft 1,555.0 psi
E : Modulus of Elasticity
Ebend- xx 2,000.0 ksi
Eminbend - xx 1,016.54 ksi
Density 42.010 pcf



Applied Loads

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

Load for Span Number 1

Uniform Load : D = 0.020, S = 0.1050 ksf, Tributary Width = 14.0 ft

Load for Span Number 2

Uniform Load : D = 0.020, S = 0.1050 ksf, Tributary Width = 14.0 ft

Load for Span Number 3

Uniform Load : D = 0.020, S = 0.1050 ksf, Tributary Width = 14.0 ft

DESIGN SUMMARY

Maximum Bending Stress Ratio	=	0.434	1	Maximum Shear Stress Ratio	=	0.542	: 1
Section used for this span		5.25x11.875		Section used for this span		5.25x11.875	
fb: Actual	=	1,298.82	psi	fv: Actual	=	177.65	psi
Fb: Allowable	=	2,990.00	psi	Fv: Allowable	=	327.75	psi
Load Combination		+D+S+H		Load Combination		+D+S+H	
Location of maximum on span	=	8.500	ft	Location of maximum on span	=	7.571	ft
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
Maximum Deflection							
Max Downward Transient Deflection		0.060	in	Ratio =		1694	>=360
Max Upward Transient Deflection		-0.002	in	Ratio =		47206	>=360
Max Downward Total Deflection		0.072	in	Ratio =		1423	>=240
Max Upward Total Deflection		-0.003	in	Ratio =		39653	>=240

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values					
			M	V	C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	M	fb	F'b	V	fv	Fv		
+D+H																0.00	0.00	0.00	0.00
Length = 8.50 ft	1	0.089	0.111	0.90	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	2340.00	1.18	28.42	256.50			
Length = 9.0 ft	2	0.089	0.111	0.90	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	2340.00	1.18	28.42	256.50			
Length = 8.50 ft	3	0.089	0.111	0.90	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	2340.00	1.18	28.42	256.50			
+D+L+H																0.00	0.00	0.00	0.00
Length = 8.50 ft	1	0.080	0.100	1.00	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	2600.00	1.18	28.42	285.00			
Length = 9.0 ft	2	0.080	0.100	1.00	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	2600.00	1.18	28.42	285.00			
Length = 8.50 ft	3	0.080	0.100	1.00	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	2600.00	1.18	28.42	285.00			
+D+Lr+H																0.00	0.00	0.00	0.00

Wood Beam

File: Enercalc_Christy Sports.ec6

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Lic. # : KW-06005244

APEX ENGINEERS INC

DESCRIPTION: new header

Load Combination	Segment Length	Span #	Max Stress Ratios		C _d	C _{FV}	C _i	C _r	C _m	C _t	C _L	Moment Values			Shear Values		
			M	V								M	fb	F'b	V	fv	Fv
Length = 8.50 ft	1		0.064	0.080	1.25	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	3250.00	1.18	28.42	356.25
Length = 9.0 ft	2		0.064	0.080	1.25	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	3250.00	1.18	28.42	356.25
Length = 8.50 ft	3		0.064	0.080	1.25	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	3250.00	1.18	28.42	356.25
+D+S+H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.50 ft	1		0.434	0.542	1.15	1.000	1.00	1.00	1.00	1.00	1.00	13.35	1,298.82	2990.00	7.38	177.65	327.75
Length = 9.0 ft	2		0.434	0.542	1.15	1.000	1.00	1.00	1.00	1.00	1.00	13.35	1,298.82	2990.00	7.38	177.65	327.75
Length = 8.50 ft	3		0.434	0.542	1.15	1.000	1.00	1.00	1.00	1.00	1.00	13.35	1,298.82	2990.00	7.38	177.65	327.75
+D+0.750Lr+0.750L+H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.50 ft	1		0.064	0.080	1.25	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	3250.00	1.18	28.42	356.25
Length = 9.0 ft	2		0.064	0.080	1.25	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	3250.00	1.18	28.42	356.25
Length = 8.50 ft	3		0.064	0.080	1.25	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	3250.00	1.18	28.42	356.25
+D+0.750L+0.750S+H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.50 ft	1		0.343	0.428	1.15	1.000	1.00	1.00	1.00	1.00	1.00	10.55	1,026.06	2990.00	5.83	140.35	327.75
Length = 9.0 ft	2		0.343	0.428	1.15	1.000	1.00	1.00	1.00	1.00	1.00	10.55	1,026.06	2990.00	5.83	140.35	327.75
Length = 8.50 ft	3		0.343	0.428	1.15	1.000	1.00	1.00	1.00	1.00	1.00	10.55	1,026.06	2990.00	5.83	140.35	327.75
+D+0.60W+H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.50 ft	1		0.050	0.062	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	4160.00	1.18	28.42	456.00
Length = 9.0 ft	2		0.050	0.062	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	4160.00	1.18	28.42	456.00
Length = 8.50 ft	3		0.050	0.062	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	4160.00	1.18	28.42	456.00
+D+0.70E+H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.50 ft	1		0.050	0.062	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	4160.00	1.18	28.42	456.00
Length = 9.0 ft	2		0.050	0.062	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	4160.00	1.18	28.42	456.00
Length = 8.50 ft	3		0.050	0.062	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	4160.00	1.18	28.42	456.00
+D+0.750Lr+0.750L+0.450W+H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.50 ft	1		0.050	0.062	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	4160.00	1.18	28.42	456.00
Length = 9.0 ft	2		0.050	0.062	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	4160.00	1.18	28.42	456.00
Length = 8.50 ft	3		0.050	0.062	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.14	207.81	4160.00	1.18	28.42	456.00
+D+0.750L+0.750S+0.450W+H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.50 ft	1		0.247	0.308	1.60	1.000	1.00	1.00	1.00	1.00	1.00	10.55	1,026.06	4160.00	5.83	140.35	456.00
Length = 9.0 ft	2		0.247	0.308	1.60	1.000	1.00	1.00	1.00	1.00	1.00	10.55	1,026.06	4160.00	5.83	140.35	456.00
Length = 8.50 ft	3		0.247	0.308	1.60	1.000	1.00	1.00	1.00	1.00	1.00	10.55	1,026.06	4160.00	5.83	140.35	456.00
+D+0.750L+0.750S+0.5250E+H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.50 ft	1		0.247	0.308	1.60	1.000	1.00	1.00	1.00	1.00	1.00	10.55	1,026.06	4160.00	5.83	140.35	456.00
Length = 9.0 ft	2		0.247	0.308	1.60	1.000	1.00	1.00	1.00	1.00	1.00	10.55	1,026.06	4160.00	5.83	140.35	456.00
Length = 8.50 ft	3		0.247	0.308	1.60	1.000	1.00	1.00	1.00	1.00	1.00	10.55	1,026.06	4160.00	5.83	140.35	456.00
+0.60D+0.60W+0.60H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.50 ft	1		0.030	0.037	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.28	124.69	4160.00	0.71	17.05	456.00
Length = 9.0 ft	2		0.030	0.037	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.28	124.69	4160.00	0.71	17.05	456.00
Length = 8.50 ft	3		0.030	0.037	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.28	124.69	4160.00	0.71	17.05	456.00
+0.60D+0.70E+0.60H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.50 ft	1		0.030	0.037	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.28	124.69	4160.00	0.71	17.05	456.00
Length = 9.0 ft	2		0.030	0.037	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.28	124.69	4160.00	0.71	17.05	456.00
Length = 8.50 ft	3		0.030	0.037	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.28	124.69	4160.00	0.71	17.05	456.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.0717	3.786		0.0000	0.000
+D+S+H	2	0.0165	4.538	+D+S+H	-0.0027	0.681
+D+S+H	3	0.0709	4.786		0.0000	0.681

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
Overall MAXimum	5.866	16.884	16.884	5.866
Overall MINimum	4.928	14.182	14.182	4.928
+D+H	0.939	2.701	2.701	0.939
+D+L+H	0.939	2.701	2.701	0.939
+D+Lr+H	0.939	2.701	2.701	0.939
+D+S+H	5.866	16.884	16.884	5.866
+D+0.750Lr+0.750L+H	0.939	2.701	2.701	0.939
+D+0.750L+0.750S+H	4.634	13.338	13.338	4.634

Wood Beam

Lic. # : KW-06005244

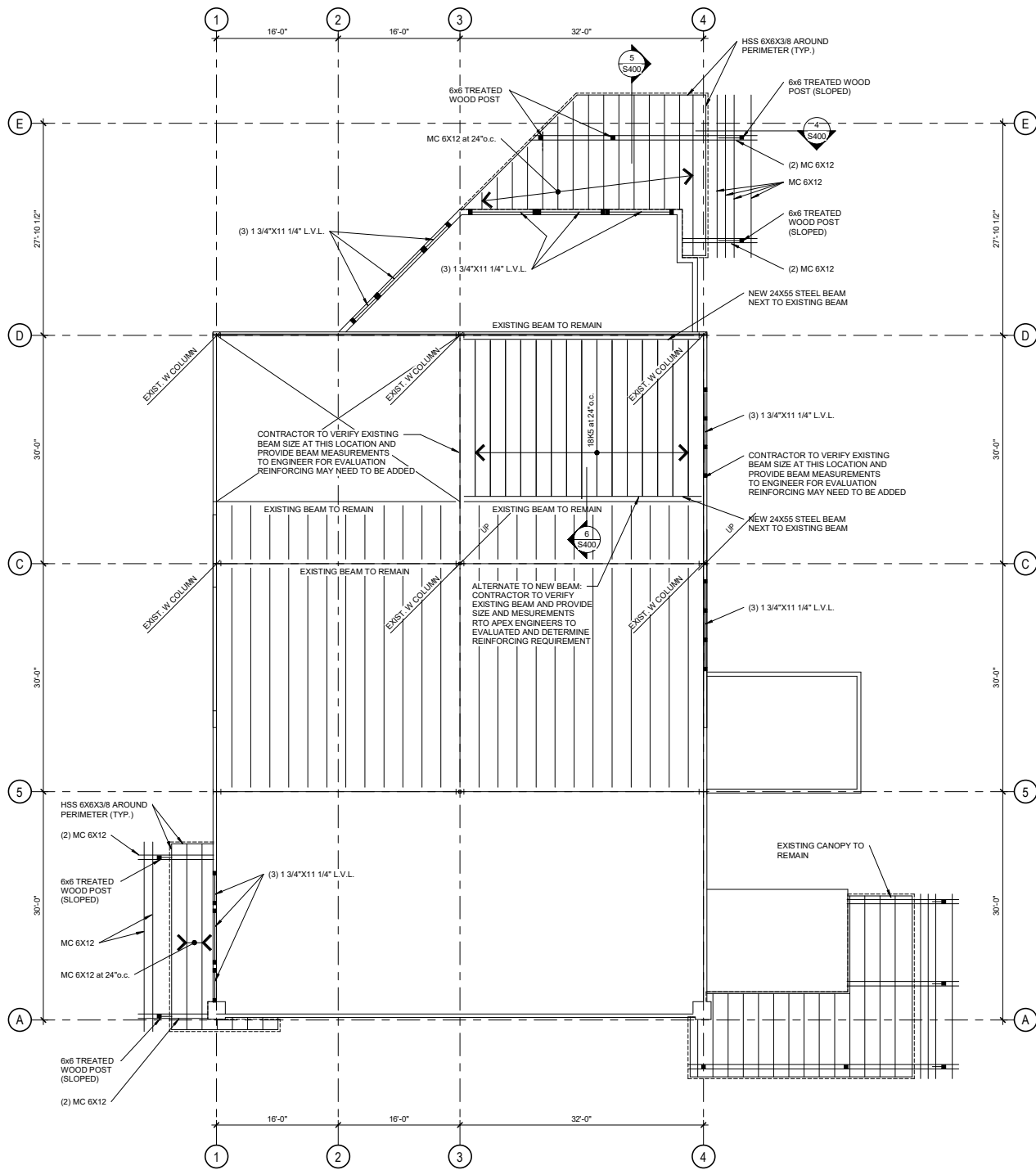
DESCRIPTION: new header

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
+D+0.60W+H	0.939	2.701	2.701	0.939
+D+0.70E+H	0.939	2.701	2.701	0.939
+D+0.750Lr+0.750L+0.450W+H	0.939	2.701	2.701	0.939
+D+0.750L+0.750S+0.450W+H	4.634	13.338	13.338	4.634
+D+0.750L+0.750S+0.5250E+H	4.634	13.338	13.338	4.634
+0.60D+0.60W+0.60H	0.563	1.621	1.621	0.563
+0.60D+0.70E+0.60H	0.563	1.621	1.621	0.563
D Only	0.939	2.701	2.701	0.939
S Only	4.928	14.182	14.182	4.928
H Only				



Steel Beam

Lic. #: KW-06005244

File: Enercalc_Christy Sports.ec6

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APEX ENGINEERS INC

DESCRIPTION: **NEW STEEL BEARING SECOND FLOOR**

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16

Load Combination Set : IBC 2015

Material Properties

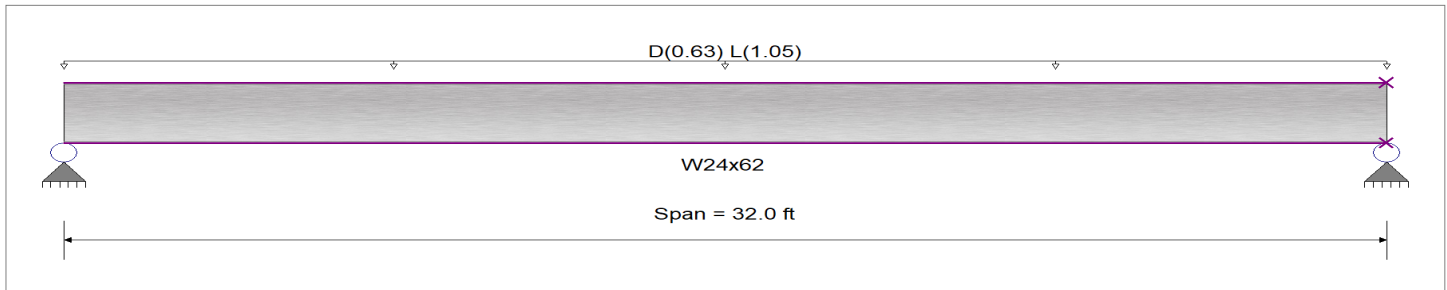
Analysis Method : **Allowable Strength Design**

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

Bending Axis : **Major Axis Bending**

Fy : Steel Yield : **50.0 ksi**

E: Modulus : **29,000.0 ksi**



Applied Loads

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

Beam self weight NOT internally calculated and added

Uniform Load : D = 0.060, L = 0.10 ksf, Tributary Width = 10.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.563 : 1	Maximum Shear Stress Ratio =	0.132 : 1
Section used for this span	W24x62	Section used for this span	W24x62
Ma : Applied	215.040 k-ft	Va : Applied	26.880 k
Mn / Omega : Allowable	381.737 k-ft	Vn / Omega : Allowable	203.820 k
Load Combination	+D+L+H	Load Combination	+D+L+H
Location of maximum on span	16.000 ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Maximum Deflection			
Max Downward Transient Deflection	0.553 in	Ratio =	693 >=480.
Max Upward Transient Deflection	0.000 in	Ratio =	0 <480.0
Max Downward Total Deflection	0.886 in	Ratio =	433 >=360.
Max Upward Total Deflection	0.000 in	Ratio =	0 <360.0

Maximum Forces & Stresses for Load Combinations

Load Combination		Span #	Max Stress Ratios		Summary of Moment Values						Summary of Shear Values			
Segment	Length		M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
+D+H														
Dsgn.	L = 32.00 ft	1	0.211	0.049	80.64		80.64	637.50	381.74	1.00	1.00	10.08	305.73	203.82
+D+L+H														
Dsgn.	L = 32.00 ft	1	0.563	0.132	215.04		215.04	637.50	381.74	1.00	1.00	26.88	305.73	203.82
+D+Lr+H														
Dsgn.	L = 32.00 ft	1	0.211	0.049	80.64		80.64	637.50	381.74	1.00	1.00	10.08	305.73	203.82
+D+S+H														
Dsgn.	L = 32.00 ft	1	0.211	0.049	80.64		80.64	637.50	381.74	1.00	1.00	10.08	305.73	203.82
+D+0.750Lr+0.750L+H														
Dsgn.	L = 32.00 ft	1	0.475	0.111	181.44		181.44	637.50	381.74	1.00	1.00	22.68	305.73	203.82
+D+0.750L+0.750S+H														
Dsgn.	L = 32.00 ft	1	0.475	0.111	181.44		181.44	637.50	381.74	1.00	1.00	22.68	305.73	203.82
+D+0.60W+H														
Dsgn.	L = 32.00 ft	1	0.211	0.049	80.64		80.64	637.50	381.74	1.00	1.00	10.08	305.73	203.82
+D+0.70E+H														
Dsgn.	L = 32.00 ft	1	0.211	0.049	80.64		80.64	637.50	381.74	1.00	1.00	10.08	305.73	203.82
+D+0.750Lr+0.750L+0.450W+H														
Dsgn.	L = 32.00 ft	1	0.475	0.111	181.44		181.44	637.50	381.74	1.00	1.00	22.68	305.73	203.82
+D+0.750L+0.750S+0.450W+H														
Dsgn.	L = 32.00 ft	1	0.475	0.111	181.44		181.44	637.50	381.74	1.00	1.00	22.68	305.73	203.82
+D+0.750L+0.750S+0.5250E+H														
Dsgn.	L = 32.00 ft	1	0.475	0.111	181.44		181.44	637.50	381.74	1.00	1.00	22.68	305.73	203.82
+0.60D+0.60W+0.60H														
Dsgn.	L = 32.00 ft	1	0.127	0.030	48.38		48.38	637.50	381.74	1.00	1.00	6.05	305.73	203.82

Steel Beam

File: Enercalc_Christy Sports.ec6

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Lic. # : KW-06005244

APEX ENGINEERS INC

DESCRIPTION: NEW STEEL BEARING SECOND FLOOR

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
+0.60D+0.70E+0.60H													
Dsgn. L = 32.00 ft	1	0.127	0.030	48.38		48.38	637.50	381.74	1.00	1.00	6.05	305.73	203.82

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.8858	16.091		0.0000	0.000

Vertical Reactions

Load Combination	Support 1	Support 2
Overall MAXimum	26.880	26.880
Overall MINimum	6.048	6.048
+D+H	10.080	10.080
+D+L+H	26.880	26.880
+D+Lr+H	10.080	10.080
+D+S+H	10.080	10.080
+D+0.750Lr+0.750L+H	22.680	22.680
+D+0.750L+0.750S+H	22.680	22.680
+D+0.60W+H	10.080	10.080
+D+0.70E+H	10.080	10.080
+D+0.750Lr+0.750L+0.450W+H	22.680	22.680
+D+0.750L+0.750S+0.450W+H	22.680	22.680
+D+0.750L+0.750S+0.5250E+H	22.680	22.680
+0.60D+0.60W+0.60H	6.048	6.048
+0.60D+0.70E+0.60H	6.048	6.048
D Only	10.080	10.080
L Only	16.800	16.800
H Only		

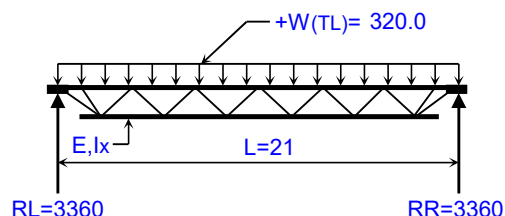
K-SERIES JOIST ANALYSIS

**For Uniformly Loaded, Open-Web Steel Joists
Using Steel Joist Institute (SJI) Standard Load Tables**

Job Name:	Christy's Sports	Subject:	New Floor Joists
Job Number:	43526	Originator:	RAM
		Checker:	RAM

Input Data:

Joist Designation (Size) =	18K3	
Joist Span, L =	21.0	ft.
Joist Spacing, S =	2.0000	ft.
Unif. Dead Load, w(DL) =	60.00	psf
Unif. Live Load, w(LL) =	100.00	psf
Deflect. Factor, DF(LL) =	360	



Results:

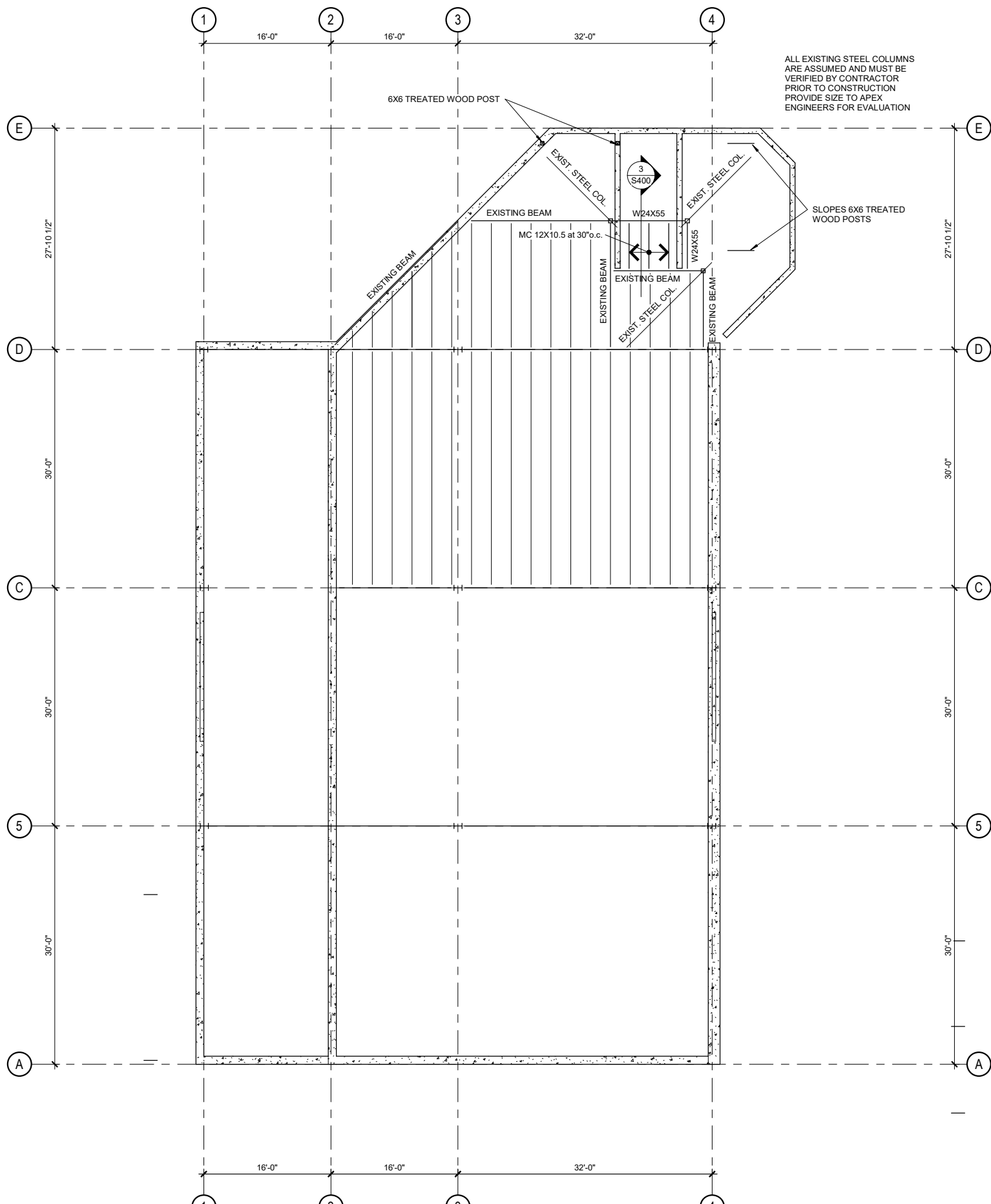
Required Loads:			
Dead Load, W(DL) =	120.0	plf	$W(DL) = w(DL) \cdot S$
Live Load, W(LL) =	200.0	plf	$W(LL) = w(LL) \cdot S$
Total Load, W(TL) =	320.0	plf	$W(TL) = W(DL) + W(LL)$
Reactions, RL & RR =	3360.0	lbs.	$RL = RR = W(TL) \cdot L / 2$

Nomenclature

For Joist Selected							
Joist Size	Joist Weight (plf)	Joist Inertia, I _x (in. ⁴)	Allowable Loads and Stress Ratios				# Rows of Bridging
			W(TL) (plf)	Flexure Ratio	W(LL) (plf)	Deflect. Ratio	
18K3	6.6	86.0	420	0.762	364	0.549	2

For 15 Lightest Acceptable K-series Joist Systems								
	Joist Sizes	Joist Weight (plf)	Joist Inertia, I _x (in.^4)	Allowable Loads and Stress Ratios				# Rows of Bridging
				W(TL) (plf)	Flexure Ratio	W(LL) (plf)	Deflect. Ratio	
1	16K2	5.5	60.3	333	0.961	255	0.784	2
2	14K3	6.0	50.1	322	0.994	212	0.943	2
3	16K3	6.3	67.4	371	0.863	285	0.702	2
4	18K3	6.6	86.0	420	0.762	364	0.549	2
5	14K4	6.7	58.6	388	0.825	248	0.806	2
6	20K3	6.7	107.1	468	0.684	453	0.442	2
7	16K4	7.0	78.7	447	0.716	333	0.601	2
8	18K4	7.2	100.7	506	0.632	426	0.469	2
9	16K5	7.5	88.2	503	0.636	373	0.536	2
10	20K4	7.6	122.9	550	0.582	520	0.385	2
11	14K6	7.7	70.7	475	0.674	299	0.669	2
12	18K5	7.7	108.7	550	0.582	460	0.435	2
13	16K6	8.1	95.7	548	0.584	405	0.494	2
14	20K5	8.2	122.9	550	0.582	520	0.385	2
15	18K6	8.5	108.7	550	0.582	460	0.435	2
**(1-5) Denotes row of bridging nearest mid-span required to be diagonal bridging.								

- Notes:**
1. OSHA is interpreting Section 29CFR-1926.751(c)2 to mean all joists whose length $\geq 40'$ require bolted diagonal bridging in place before slackening of hoisting lines.
 2. For point loads on K-series joists, the magnitude and location of load should be indicated on the design drawings and "SP" must be added to the joist designation.



Steel Beam

Lic. #: KW-06005244

File: Enercalc_Christy Sports.ec6

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APEX ENGINEERS INC

DESCRIPTION: **new first floor beam**

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16

Load Combination Set : IBC 2015

Material Properties

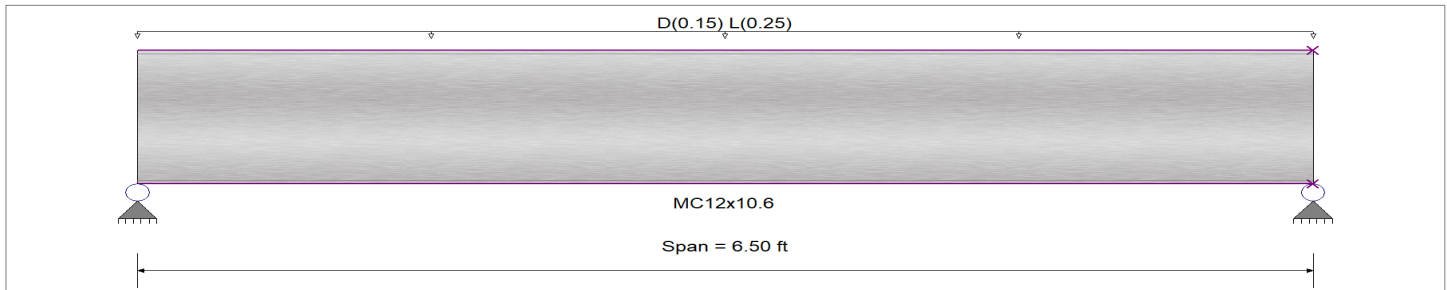
Analysis Method : **Allowable Strength Design**

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

Bending Axis : **Major Axis Bending**

Fy : Steel Yield : **46.0 ksi**

E: Modulus : **29,000.0 ksi**



Applied Loads

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

Beam self weight NOT internally calculated and added

Uniform Load : D = 0.060, L = 0.10 ksf, Tributary Width = 2.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.079 : 1	Maximum Shear Stress Ratio =	0.034 : 1
Section used for this span	MC12x10.6	Section used for this span	MC12x10.6
Ma : Applied	2.113 k-ft	Va : Applied	1.30 k
Mn / Omega : Allowable	26.627 k-ft	Vn / Omega : Allowable	37.681 k
Load Combination	+D+L+H	Load Combination	+D+L+H
Location of maximum on span	3.250 ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Maximum Deflection			
Max Downward Transient Deflection	0.006 in	Ratio =	12,401 >=480.
Max Upward Transient Deflection	0.000 in	Ratio =	0 <480.0
Max Downward Total Deflection	0.010 in	Ratio =	7751 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values						Summary of Shear Values			
			M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
+D+H	Dsgn. L = 6.50 ft	1	0.030	0.013	0.79		0.79	44.47	26.63	1.00	1.00	0.49	62.93	37.68
+D+L+H	Dsgn. L = 6.50 ft	1	0.079	0.034	2.11		2.11	44.47	26.63	1.00	1.00	1.30	62.93	37.68
+D+Lr+H	Dsgn. L = 6.50 ft	1	0.030	0.013	0.79		0.79	44.47	26.63	1.00	1.00	0.49	62.93	37.68
+D+S+H	Dsgn. L = 6.50 ft	1	0.030	0.013	0.79		0.79	44.47	26.63	1.00	1.00	0.49	62.93	37.68
+D+0.750Lr+0.750L+H	Dsgn. L = 6.50 ft	1	0.030	0.013	0.79		0.79	44.47	26.63	1.00	1.00	0.49	62.93	37.68
+D+0.750L+0.750S+H	Dsgn. L = 6.50 ft	1	0.067	0.029	1.78		1.78	44.47	26.63	1.00	1.00	1.10	62.93	37.68
+D+0.750L+0.750S+H	Dsgn. L = 6.50 ft	1	0.067	0.029	1.78		1.78	44.47	26.63	1.00	1.00	1.10	62.93	37.68
+D+0.60W+H	Dsgn. L = 6.50 ft	1	0.030	0.013	0.79		0.79	44.47	26.63	1.00	1.00	0.49	62.93	37.68
+D+0.70E+H	Dsgn. L = 6.50 ft	1	0.030	0.013	0.79		0.79	44.47	26.63	1.00	1.00	0.49	62.93	37.68
+D+0.750Lr+0.750L+0.450W+H	Dsgn. L = 6.50 ft	1	0.030	0.013	0.79		0.79	44.47	26.63	1.00	1.00	0.49	62.93	37.68
+D+0.750L+0.750S+0.450W+H	Dsgn. L = 6.50 ft	1	0.067	0.029	1.78		1.78	44.47	26.63	1.00	1.00	1.10	62.93	37.68
+D+0.750L+0.750S+0.450W+H	Dsgn. L = 6.50 ft	1	0.067	0.029	1.78		1.78	44.47	26.63	1.00	1.00	1.10	62.93	37.68
+D+0.750L+0.750S+0.5250E+H	Dsgn. L = 6.50 ft	1	0.067	0.029	1.78		1.78	44.47	26.63	1.00	1.00	1.10	62.93	37.68
+D+0.750L+0.750S+0.5250E+H	Dsgn. L = 6.50 ft	1	0.067	0.029	1.78		1.78	44.47	26.63	1.00	1.00	1.10	62.93	37.68
+0.60D+0.60W+0.60H	Dsgn. L = 6.50 ft	1	0.018	0.008	0.48		0.48	44.47	26.63	1.00	1.00	0.29	62.93	37.68

Steel Beam

File: Enercalc_Christy Sports.ec6

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Lic. # : KW-06005244

APEX ENGINEERS INC

DESCRIPTION: new first floor beam

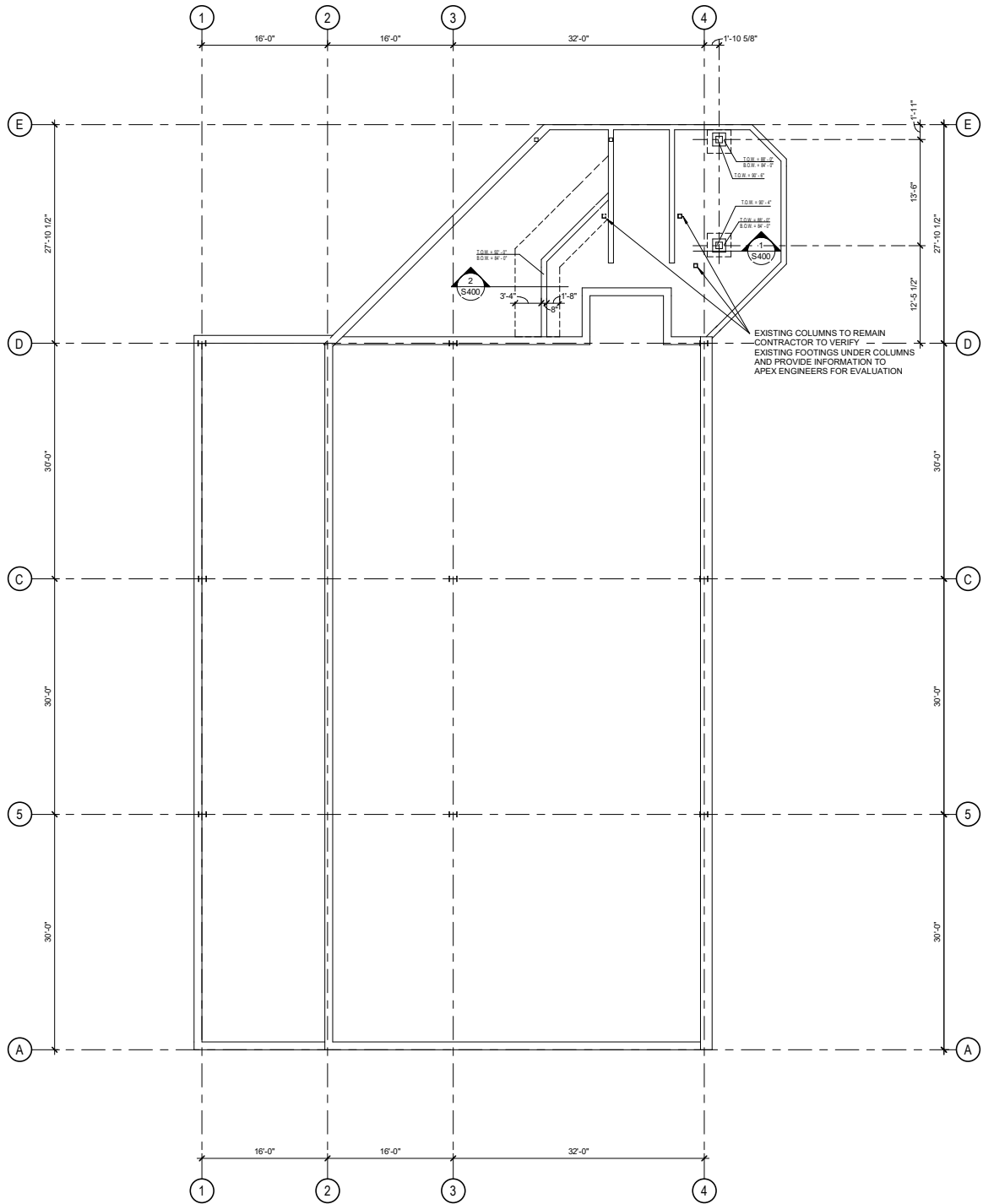
Load Combination		Max Stress Ratios		Summary of Moment Values						Summary of Shear Values			
Segment Length	Span #	M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
+0.60D+0.70E+0.60H													
Dsgn. L = 6.50 ft	1	0.018	0.008	0.48		0.48	44.47	26.63	1.00	1.00	0.29	62.93	37.68

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.0101	3.269		0.0000	0.000

Vertical Reactions

Load Combination	Support 1	Support 2
Overall MAXimum	1.300	1.300
Overall MINimum	0.293	0.293
+D+H	0.488	0.488
+D+L+H	1.300	1.300
+D+Lr+H	0.488	0.488
+D+S+H	0.488	0.488
+D+0.750Lr+0.750L+H	1.097	1.097
+D+0.750L+0.750S+H	1.097	1.097
+D+0.60W+H	0.488	0.488
+D+0.70E+H	0.488	0.488
+D+0.750Lr+0.750L+0.450W+H	1.097	1.097
+D+0.750L+0.750S+0.450W+H	1.097	1.097
+D+0.750L+0.750S+0.5250E+H	1.097	1.097
+0.60D+0.60W+0.60H	0.293	0.293
+0.60D+0.70E+0.60H	0.293	0.293
D Only	0.488	0.488
L Only	0.813	0.813
H Only		



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

Project Name/Number : retaining wal

Title :
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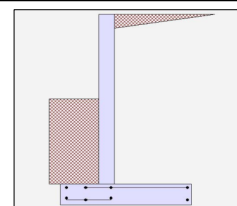
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Cantilevered Retaining Wall

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

Criteria

Retained Height	=	8.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	48.00 in
Water height over heel	=	0.0 ft



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

Soil Data and Lateral Earth Pressure

Allow Soil Bearing	=	1,500.0 psf	Soil Density, Heel	=	110.00 pcf
Equivalent Fluid Pressure Method			Soil Density, Toe	=	110.00 pcf
Active Heel Pressure	=	35.0 psf/ft	Footing Soil Friction	=	0.400
	=		Soil height to ignore for passive pressure	=	12.00 in
Passive Pressure	=	250.0 psf/ft			

Surcharge Loads

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

Axial Load Applied to Stem

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

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

Wind on Exposed Stem (Service Level)	=	0.0 psf
---	---	---------

Adjacent Footing Load

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

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Cantilevered Retaining Wall

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

Wall Design Summary

Stability Ratios

Overturning	=	3.85 OK
Sliding	=	3.62 OK

Soil Bearing

Total Bearing Load	=	5,317 lbs
...resultant ecc.	=	6.69 in
Soil Pressure @ Toe	=	1,492 psf OK
Soil Pressure @ Heel	=	385 psf OK
Allowable	=	1,500 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	2,089 psf
ACI Factored @ Heel	=	538 psf
Footing Shear @ Toe	=	10.1 psi OK
Footing Shear @ Heel	=	7.1 psi OK
Allowable	=	82.2 psi

Sliding

Resisting Forces

Sliding Forces

Vertical Forces

Force

Lateral Forces

Force

Soil Over Heel (above water table, if any)	2,933.3 lbs	Heel Active Pressure (above water table, if any)	1,417.5 lbs
Soil Over Heel (below water table, if any)	0.0	Heel Active Pressure (below water table, if any)	0.0
Water Over Heel	0.0	Hydrostatic Force	0.0
Buoyant Force	0.0	* Heel Active Pressure	1,417.5
Sloped Soil Over Heel	0.0	Surcharge over Heel	0.0
Surcharge Over Heel	0.0	Adjacent Footing	0.0
Adjacent Footing Load	0.0	Surcharge Over Toe	0.0
Axial Dead Load on Stem	0.0	Load @ Stem Above Soil	0.0
Axial Live Load on Stem *	Omit	Added Lateral Load	0.0
Soil Over Toe	733.5	Seismic Load	0.0
Surcharge Over Toe	0.0	Seismic-Self-weight	0.0
Stem Weight(s)	800.0	Lateral on Key	0.0
Earth @ Stem Transitions	0.0		
Footing Weight	850.1		
Key Weight	0.0		
Vert. Component **	0.0		

Totals =

1,417.5 lbs

*Includes water table effect

Total Vertical Loads

5,316.9 lbs

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

Sliding Calcs

Lateral Sliding Force	=	1,417.5 lbs
less 100% Passive Force	=	- 3,000.0 lbs
less 100% Friction Force	=	- 2,126.7 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 pressures.

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Cantilevered Retaining Wall

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

Overturning

Resisting Moments

<u>Resisting Moments</u>	<u>Force</u>	<u>Distance</u>	<u>Moment</u>
Soil Over Heel (above water table, if any)	2,933.3 lbs	4.00 ft	11,734.3ft-#
Soil Over Heel (below water table, if any)	0.0		
Water Table	0.0		
Soil Over Heel	2,933.3	4.00	11,734.3
Sloped Soil Over Heel	0.0		
Surcharge Over Heel	0.0		
Adjacent Footing Load	0.0		
Axial Dead Load on Stem	0.0		
Axial Live Load on Stem *	0.0		
Soil Over Toe	733.5	0.83	611.4
Surcharge Over Toe	0.0		
Stem Weight(s)	800.0	2.00	1,600.3
Earth @ Stem Transitions	0.0		
Footing Weight	850.1	2.83	2,408.6
Key Weight	0.0		
Vert. Component	0.0		
Total Vertical Loads	5,316.9 lbs		

Resisting Moment

16,354.6 ft-#

Eccentricity

-6.7 in

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

Overturning

Overturning Moments

<u>Overturning Moments</u>	<u>Force</u>	<u>Distance</u>	<u>Moment</u>
Heel Active Pressure (above water table, if any)	1,417.5 lbs	3.00 ft	4,252.5 ft-#
Heel Active Pressure (below water table, if any)	0.0		
Hydrostatic Force	0.0		
Buoyant Force	0.0		
Surcharge over Heel	0.0		
Adjacent Footing	0.0		
Surcharge Over Toe	0.0		
Load @ Stem Above Soil	0.0		
Added Lateral Load	0.0		
Seismic Load	0.0		
Seismic-Self-weight	0.0		
Totals =	1,417.5 lbs		
Overturning Moment			4,252.5 ft-#

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Cantilevered Retaining Wall

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

Stem Design Summary

Bottom		
		Stem OK
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	=	0.582
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	1,792.0
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	4,778.7
Moment.....Allowable	=	8,206.3
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	24.1
Shear.....Allowable	psi =	82.2
Anet	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 =	3,000.0
Fy	psi =	60,000.0

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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) :	0.1809 in2/ft		
(4/3) * As :	0.2413 in2/ft	Min Stem T&S Reinf Area 1.536 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 :	0.2413 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 :	1.0059 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.67 ft	f _c	=	3,000 psi
Heel Width	=	4.00	F _y	=	60,000 psi
Total Footing Width	=	5.67 ft	Footing Concrete Density	=	150.00 pcf
Footing Thickness	=	12.00 in	Min. As %	=	0.0018
Key Width	=	0.00 in	Rebar Cover @ Top	=	2.00 in
Key Depth	=	0.00 in	@ Bottom	=	3.00 in
Key Distance from Toe	=	0.00 ft			

Footing Design Results

		<u>Toe</u>	<u>Heel</u>
Factored Pressure	=	2,089	538 psf
Mu' : Upward	=	32,289	4,680 ft-#
Mu' : Downward	=	11,805	6,867 ft-#
Mu: Design	=	1,707	431 ft-#
Actual 1-Way Shear	=	10.09	7.07 psi
Allow 1-Way Shear	=	82.16	82.16 psi
Toe Reinforcing	=	# 5 @ 14.35 in	
Heel Reinforcing	=	# 5 @ 14.35 in	
Key Reinforcing	=	None Spec'd	

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46

Key: No key defined

Min footing T&S reinf Area	1.47 in2
Min footing T&S reinf Area per fo	0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

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.

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Cantilevered Retaining Wall

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

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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) 0.059 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.

General Footing

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APEX ENGINEERS INC

DESCRIPTION: new canopy pad

Code References

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

Load Combinations Used : IBC 2015

General Information

Material Properties

f'_c : Concrete 28 day strength	=	3.0	ksi
f_y : Rebar Yield	=	60.0	ksi
E_c : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
ϕ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=		
Min Allow % Temp Reinf.	=	0.00180	
Min. Overturning Safety Factor	=	1.0	:
Min. Sliding Safety Factor	=	1.0	:
Add Ftg Wt for Soil Pressure	:	Yes	
Use ftg wt for stability, moments & shears	:	Yes	
Add Pedestal Wt for Soil Pressure	:	Yes	
Use Pedestal wt for stability, mom & shear	:	Yes	

Soil Design Values

Allowable Soil Bearing	=	1.50	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

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

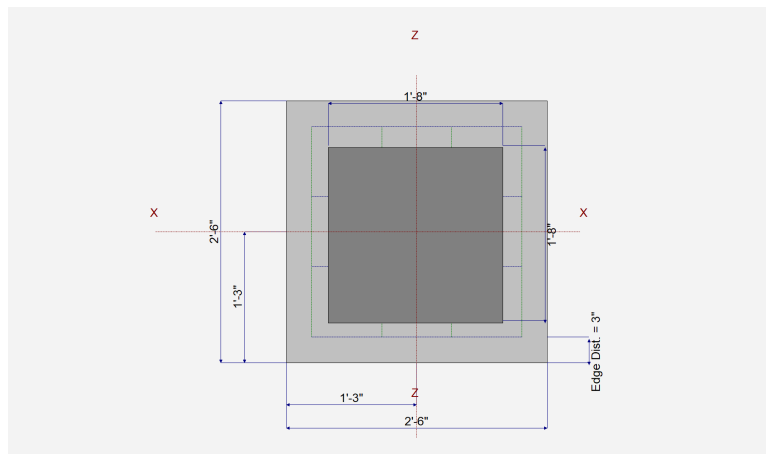
Increases based on footing plan dimension

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

Dimensions

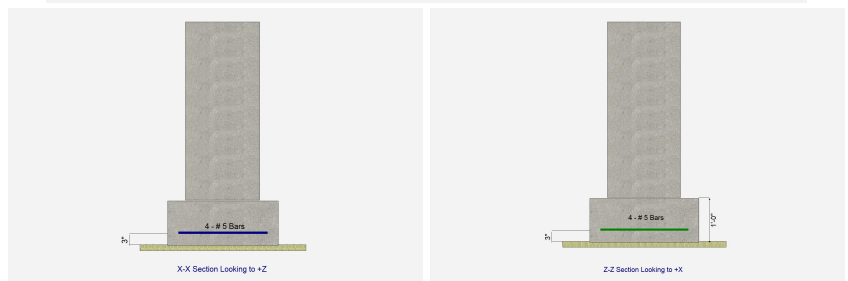
Width parallel to X-X Axis	=	2.5	ft
Length parallel to Z-Z Axis	=	2.50	ft
Footing Thickness	=	12.0	in

Pedestal dimensions...	=		
px : parallel to X-X Axis	=	20.0	in
pz : parallel to Z-Z Axis	=	20.0	in
Height	=	48.0	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0	in



Reinforcing

Bars parallel to X-X Axis	=		
Number of Bars	=	4.0	
Reinforcing Bar Size	=	#	5
Bars parallel to Z-Z Axis	=		
Number of Bars	=	4	
Reinforcing Bar Size	=	#	5
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	=	1.0			2.0				k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=								k-ft
V-x	=								k
V-z	=								k

General Footing

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APEX ENGINEERS INC

DESCRIPTION: **new canopy pad**

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.5885	Soil Bearing	0.8828 ksf	1.50 ksf	+D+S+H 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	0.004627	Z Flexure (+X)	0.08793 k-ft/ft	19.003 k-ft/ft	+1.20D+0.50L+1.60S+1.60H
PASS	0.004627	Z Flexure (-X)	0.08793 k-ft/ft	19.003 k-ft/ft	+1.20D+0.50L+1.60S+1.60H
PASS	0.004627	X Flexure (+Z)	0.08793 k-ft/ft	19.003 k-ft/ft	+1.20D+0.50L+1.60S+1.60H
PASS	0.004627	X Flexure (-Z)	0.08793 k-ft/ft	19.003 k-ft/ft	+1.20D+0.50L+1.60S+1.60H
PASS	n/a	1-way Shear (+X)	0.0 psi	82.158 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a
PASS	n/a	1-way Shear (+Z)	0.0 psi	82.158 psi	n/a
PASS	n/a	1-way Shear (-Z)	0.0 psi	82.158 psi	n/a
PASS	n/a	2-way Punching	0.4756 psi	82.158 psi	+1.20D+0.50L+1.60S+1.60H

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+H	1.50	n/a	0.0	0.5628	0.5628	n/a	n/a	0.375
X-X, +D+L+H	1.50	n/a	0.0	0.5628	0.5628	n/a	n/a	0.375
X-X, +D+Lr+H	1.50	n/a	0.0	0.5628	0.5628	n/a	n/a	0.375
X-X, +D+S+H	1.50	n/a	0.0	0.8828	0.8828	n/a	n/a	0.589
X-X, +D+0.750Lr+0.750L+H	1.50	n/a	0.0	0.5628	0.5628	n/a	n/a	0.375
X-X, +D+0.750L+0.750S+H	1.50	n/a	0.0	0.8028	0.8028	n/a	n/a	0.535
X-X, +D+0.60W+H	1.50	n/a	0.0	0.5628	0.5628	n/a	n/a	0.375
X-X, +D+0.70E+H	1.50	n/a	0.0	0.5628	0.5628	n/a	n/a	0.375
X-X, +D+0.750Lr+0.750L+0.450W+H	1.50	n/a	0.0	0.5628	0.5628	n/a	n/a	0.375
X-X, +D+0.750L+0.750S+0.450W+H	1.50	n/a	0.0	0.8028	0.8028	n/a	n/a	0.535
X-X, +D+0.750L+0.750S+0.5250E+H	1.50	n/a	0.0	0.8028	0.8028	n/a	n/a	0.535
X-X, +0.60D+0.60W+0.60H	1.50	n/a	0.0	0.3377	0.3377	n/a	n/a	0.225
X-X, +0.60D+0.70E+0.60H	1.50	n/a	0.0	0.3377	0.3377	n/a	n/a	0.225
Z-Z, +D+H	1.50	0.0	n/a	n/a	n/a	0.5628	0.5628	0.375
Z-Z, +D+L+H	1.50	0.0	n/a	n/a	n/a	0.5628	0.5628	0.375
Z-Z, +D+Lr+H	1.50	0.0	n/a	n/a	n/a	0.5628	0.5628	0.375
Z-Z, +D+S+H	1.50	0.0	n/a	n/a	n/a	0.8828	0.8828	0.589
Z-Z, +D+0.750Lr+0.750L+H	1.50	0.0	n/a	n/a	n/a	0.5628	0.5628	0.375
Z-Z, +D+0.750L+0.750S+H	1.50	0.0	n/a	n/a	n/a	0.8028	0.8028	0.535
Z-Z, +D+0.60W+H	1.50	0.0	n/a	n/a	n/a	0.5628	0.5628	0.375
Z-Z, +D+0.70E+H	1.50	0.0	n/a	n/a	n/a	0.5628	0.5628	0.375
Z-Z, +D+0.750Lr+0.750L+0.450W+H	1.50	0.0	n/a	n/a	n/a	0.5628	0.5628	0.375
Z-Z, +D+0.750L+0.750S+0.450W+H	1.50	0.0	n/a	n/a	n/a	0.8028	0.8028	0.535
Z-Z, +D+0.750L+0.750S+0.5250E+H	1.50	0.0	n/a	n/a	n/a	0.8028	0.8028	0.535
Z-Z, +0.60D+0.60W+0.60H	1.50	0.0	n/a	n/a	n/a	0.3377	0.3377	0.225
Z-Z, +0.60D+0.70E+0.60H	1.50	0.0	n/a	n/a	n/a	0.3377	0.3377	0.225

Overturning Stability

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

Sliding Stability

All units k

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

General Footing

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APEX ENGINEERS INC

Lic. #: KW-06005244

DESCRIPTION: new canopy pad

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+1.60H	0.05075	+Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.40D+1.60H	0.05075	-Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+0.50Lr+1.60L+1.60H	0.04350	+Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+0.50Lr+1.60L+1.60H	0.04350	-Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+1.60L+0.50S+1.60H	0.05738	+Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+1.60L+0.50S+1.60H	0.05738	-Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+1.60Lr+0.50L+1.60H	0.04350	+Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+1.60Lr+0.50L+1.60H	0.04350	-Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+1.60Lr+0.50W+1.60H	0.04350	+Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+1.60Lr+0.50W+1.60H	0.04350	-Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+0.50L+1.60S+1.60H	0.08793	+Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+0.50L+1.60S+1.60H	0.08793	-Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+1.60S+0.50W+1.60H	0.08793	+Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+1.60S+0.50W+1.60H	0.08793	-Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+0.50Lr+0.50L+W+1.60H	0.04350	+Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+0.50Lr+0.50L+W+1.60H	0.04350	-Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+0.50L+0.50S+W+1.60H	0.05738	+Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+0.50L+0.50S+W+1.60H	0.05738	-Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+0.50L+0.70S+E+1.60H	0.06294	+Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +1.20D+0.50L+0.70S+E+1.60H	0.06294	-Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +0.90D+W+0.90H	0.03263	+Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +0.90D+W+0.90H	0.03263	-Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +0.90D+E+0.90H	0.03263	+Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
X-X, +0.90D+E+0.90H	0.03263	-Z	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.40D+1.60H	0.05075	-X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.40D+1.60H	0.05075	+X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+0.50Lr+1.60L+1.60H	0.04350	-X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+0.50Lr+1.60L+1.60H	0.04350	+X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+1.60L+0.50S+1.60H	0.05738	-X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+1.60L+0.50S+1.60H	0.05738	+X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+1.60Lr+0.50L+1.60H	0.04350	-X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+1.60Lr+0.50L+1.60H	0.04350	+X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+1.60Lr+0.50W+1.60H	0.04350	-X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+1.60Lr+0.50W+1.60H	0.04350	+X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+0.50L+1.60S+1.60H	0.08793	-X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+0.50L+1.60S+1.60H	0.08793	+X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+1.60S+0.50W+1.60H	0.08793	-X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+1.60S+0.50W+1.60H	0.08793	+X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+0.50Lr+0.50L+W+1.60H	0.04350	-X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+0.50Lr+0.50L+W+1.60H	0.04350	+X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+0.50L+0.50S+W+1.60H	0.05738	-X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+0.50L+0.50S+W+1.60H	0.05738	+X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+0.50L+0.70S+E+1.60H	0.06294	-X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +1.20D+0.50L+0.70S+E+1.60H	0.06294	+X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +0.90D+W+0.90H	0.03263	-X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +0.90D+W+0.90H	0.03263	+X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +0.90D+E+0.90H	0.03263	-X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK
Z-Z, +0.90D+E+0.90H	0.03263	+X	Bottom	0.2592	Min Temp %	0.4960	19.003	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	82.16 psi	0.00	OK
+1.20D+0.50Lr+1.60L+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	82.16 psi	0.00	OK
+1.20D+1.60L+0.50S+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	82.16 psi	0.00	OK
+1.20D+1.60Lr+0.50L+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	82.16 psi	0.00	OK
+1.20D+1.60Lr+0.50W+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	82.16 psi	0.00	OK
+1.20D+0.50L+1.60S+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	82.16 psi	0.00	OK
+1.20D+1.60S+0.50W+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	82.16 psi	0.00	OK
+1.20D+0.50Lr+0.50L+W+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	82.16 psi	0.00	OK
+1.20D+0.50L+0.50S+W+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	82.16 psi	0.00	OK
+1.20D+0.50L+0.70S+E+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	82.16 psi	0.00	OK
+0.90D+W+0.90H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	82.16 psi	0.00	OK

General Footing

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APEX ENGINEERS INC

DESCRIPTION: new canopy pad

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+0.90D+E+0.90H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	82.16 psi	0.00	OK
Two-Way "Punching" Shear								All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D+1.60H	0.27 psi	164.32psi	0.001671	OK
+1.20D+0.50Lr+1.60L+1.60H	0.24 psi	164.32psi	0.001432	OK
+1.20D+1.60L+0.50S+1.60H	0.31 psi	164.32psi	0.001889	OK
+1.20D+1.60Lr+0.50L+1.60H	0.24 psi	164.32psi	0.001432	OK
+1.20D+1.60Lr+0.50W+1.60H	0.24 psi	164.32psi	0.001432	OK
+1.20D+0.50L+1.60S+1.60H	0.48 psi	164.32psi	0.002894	OK
+1.20D+1.60S+0.50W+1.60H	0.48 psi	164.32psi	0.002894	OK
+1.20D+0.50Lr+0.50L+W+1.60H	0.24 psi	164.32psi	0.001432	OK
+1.20D+0.50L+0.50S+W+1.60H	0.31 psi	164.32psi	0.001889	OK
+1.20D+0.50L+0.70S+E+1.60H	0.34 psi	164.32psi	0.002072	OK
+0.90D+W+0.90H	0.18 psi	164.32psi	0.001074	OK
+0.90D+E+0.90H	0.18 psi	164.32psi	0.001074	OK