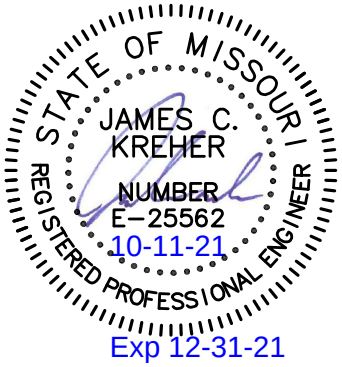
KREHER ENGINEERING, INC.

STRUCTURAL CALCULATIONS

DUTCH BROS COFFEE
500 NW CHIPMAN ROAD
LEE SUMMIT, MO

ARCHITECT:
CORALIC ARCHITECTURE
10/11/2021

The Professional Engineers seal affixed to this sheet indicates that the named engineer has prepared or directed the preparation of the material shown only on the attached sheets pages 1 through 112 Other drawings and documents not exhibiting this seal shall not be considered prepared by or the responsibility of the undersigned



Exp 12-31-21

208 N. Main St., Suite H, Columbia, IL 62236 ph (618)281-8505 fax (618)281-8515

ORDER OF PRESENTATION

LOCAL CODES/LOADS/ATC HAZARDS by Location

SNOW ANALYSIS

WIND ANALYSIS

BUILDING

SITE STRUCTURES

RISA-3D ANALYSIS

- WALLS

-HEADERS

-FOUNDATION

SITE STRUCTURE(S) FOUNDATION DESIGN

LOCALLY ADOPTED CODE:

Building Code - 2018 IBC

LOCAL AUTHORITY HAVING

JURISDICTION:

Lee Summit, Missouri

KREHER ENGINEERING, INC.

Code Review

Job Number: K21-002L Date: 09/21/2021

Job Name: DUTCH BROS - LEE SUMMIT

Job Location: LEE SUMMIT, MO

Building Department: DEVELOPMENT SERVICES

Code Review Contact: — or Website: —

Phone Number: (____)- — Ext. —

Design Parameters:

Adopted Building Code / Year: IBC 2018

Risk Category: II

Recommended Frost Depth of Footings: 36 in

Recommended Min. Allowable Soil Bearing Pressure: 2500 psf

Geotechnical Engineer Report: - GSI ENGINEERING Report Date: JULY 28, 2021

Minimum Ground Snow Load: 20 psf

Minimum Roof Snow Load: 20 psf
Importance Factor: Is: 1.0

Required Rain-on-Snow Surcharge Load: Yes / (No) ____ psf

Ice Load: 1.5 in.
Importance Factor: Ii: 1.0

Minimum Wind Speed Required: 111 mph – Exposure C
Importance Factor Iw: 1.0

Minimum Wind Pressure Required: 16 psf

Seismic Load Factors: Minimum Ss: 0.099 short spectral acceleration
Minimum S1: 0.068 1-sec spectral acceleration
Importance Factor Ie: 1.0

Special Inspections by Third Party Required per IBC Chapter 17 (Yes) / No

Other Considerations: ____

208 N. Main St., Suite H. Columbia, IL 62236 (618)281-8505 (618)281-8515(fax)

Hazards by Location

Search Information

Address: 500 NW Chipman Rd, Lee's Summit, MO 64063, USA

Coordinates: 38.9255856, -94.3914879

Elevation: 1012 ft

Timestamp: 2021-09-21T13:23:47.457Z

Hazard Type: Snow

ASCE 7-16

Ground Snow Load ..... 20 lb/sqft

ASCE 7-10

Ground Snow Load ..... 20 lb/sqft

ASCE 7-05

Ground Snow Load ..... 20 lb/sqft

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 interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer.

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Hazards by Location

Search Information

Address: 500 NW Chipman Rd, Lee's Summit, MO 64063, USA

Coordinates: 38.9255856, -94.3914879

Elevation: 1012 ft

Timestamp: 2021-09-21T13:19:58.178Z

Hazard Type: Wind

ASCE 7-16

MRI 10-Year	76 mph
MRI 25-Year	83 mph
MRI 50-Year	88 mph
MRI 100-Year	94 mph
Risk Category I	103 mph
Risk Category II	109 mph
Risk Category III	117 mph
Risk Category IV	122 mph

ASCE 7-10

MRI 10-Year	76 mph
MRI 25-Year	84 mph
MRI 50-Year	90 mph
MRI 100-Year	96 mph
Risk Category I	105 mph
Risk Category II	115 mph
Risk Category III-IV	120 mph

ASCE 7-05

ASCE 7-05 Wind Speed	90 mph

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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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Hazards by Location

Search Information

Address: 500 NW Chipman Rd, Lee's Summit, MO 64063, USA

Coordinates: 38.9255856, -94.3914879

Elevation: 1012 ft

Timestamp: 2021-09-21T13:24:06.842Z

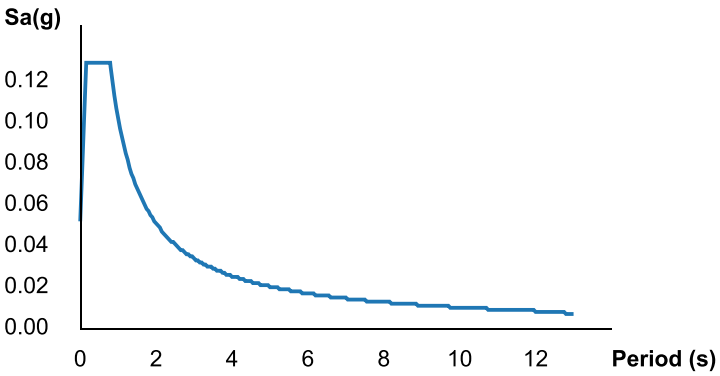
Hazard Type: Seismic

Reference Document: ASCE7-16

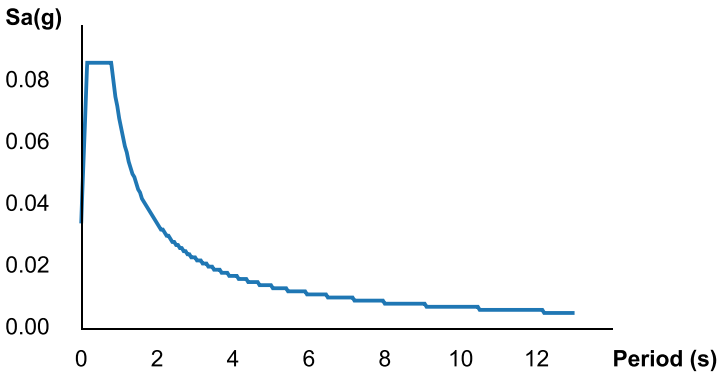
Risk Category: II

Site Class: C

MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.099	MCE_R ground motion (period=0.2s)
S_1	0.068	MCE_R ground motion (period=1.0s)
S_{MS}	0.129	Site-modified spectral acceleration value
S_{M1}	0.102	Site-modified spectral acceleration value
S_{DS}	0.086	Numeric seismic design value at 0.2s SA
S_{D1}	0.068	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	B	Seismic design category
F_a	1.3	Site amplification factor at 0.2s
F_v	1.5	Site amplification factor at 1.0s

CR_S	0.927	Coefficient of risk (0.2s)
CR_1	0.877	Coefficient of risk (1.0s)
PGA	0.047	MCE_G peak ground acceleration
F_{PGA}	1.3	Site amplification factor at PGA
PGA_M	0.061	Site modified peak ground acceleration
T_L	12	Long-period transition period (s)
SsRT	0.099	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.107	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.068	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.077	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

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Disclaimer

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

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SNOW LOAD CALCULATIONS

Tekla Tedds
Kreher Engineering Inc.
208 N Main St., Suite H, Columbia, IL 62236

Project				Job Ref.	
Dutch Bros				K21-002	
Section				Sheet no./rev.	
				1	
Calc. by	Date	Chk'd by	Date	App'd by	Date
NJD	9/20/2021				

SNOW LOADING

In accordance with ASCE7-16

Tedds calculation version 1.0.10

Building details

Roof type	Flat
Width of roof	b = **49.08** ft

Ground snow load

Ground snow load (Figure 7.2-1)	p_g = **20.00** lb/ft^2
Density of snow	$\gamma = \min(0.13 \times p_g / 1ft + 14lb/ft^3, 30lb/ft^3)$ = **16.60** lb/ft^3
Terrain typeSect. 26.7	C
Exposure condition (Table 7.3-1)	Partially exposed
Exposure factor (Table 7.3-1)	C_e = **1.00**
Thermal condition (Table 7.3-2)	All
Thermal factor (Table 7.3-2)	C_t = **1.00**
Importance category (Table 1.5-1)	II
Importance factor (Table 1.5-2)	I_s = **1.00**
Min snow load for low slope roofs (Sect 7.3.4)	$p_{f\_min} = I_s \times p_g$ = **20.00** lb/ft^2
Flat roof snow load (Sect 7.3)	$p_f = 0.7 \times C_e \times C_t \times I_s \times p_g$ = **14.00** lb/ft^2

Left parapet

Balanced snow load height	$h_b = p_f / \gamma$ = **0.84** ft
Height of left parapet	h_{pptL} = **6.00** ft
Height from balance load to top of left parapet	$h_{c\_pptL} = h_{pptL} - h_b$ = **5.16** ft
Length of roof - left parapet	$l_{u\_pptL} = b$ = **49.08** ft
Drift height windward drift - left parpet	$h_{d\_l\_pptL} = \sqrt{(l_s)} \times 0.75 \times (0.43 \times (\max(20\ ft, l_{u\_pptL}) \times 1ft^2)^{1/3} \times (p_g / 1lb/ft^2 + 10)^{1/4} - 1.5ft)$ = **1.64** ft
Drift height - left parapet	$h_{d\_pptL} = \min(h_{d\_l\_pptL}, h_{pptL} - h_b)$ = **1.64** ft
Drift width	$W_{d\_pptL} = \min(4 \times h_{d\_l\_pptL}, 8 \times (h_{pptL} - h_b), b)$ = **6.55** ft
Drift surcharge load - left parapet	$p_{d\_pptL} = h_{d\_pptL} \times \gamma$ = **27.20** lb/ft^2

Right parapet

Height of right parapet	h_{pptR} = **6.00** ft
Height from balance load to top of right parapet	$h_{c\_pptR} = h_{pptR} - h_b$ = **5.16** ft
Length of roof - right parapet	$l_{u\_pptR} = b$ = **49.08** ft
Drift height windward drift - right parpet	$h_{d\_l\_pptR} = \sqrt{(l_s)} \times 0.75 \times (0.43 \times (\max(20\ ft, l_{u\_pptR}) \times 1ft^2)^{1/3} \times (p_g / 1lb/ft^2 + 10)^{1/4} - 1.5ft)$ = **1.64** ft
Drift height - right parapet	$h_{d\_pptR} = \min(h_{d\_l\_pptR}, h_{pptR} - h_b)$ = **1.64** ft
Drift width	$W_{d\_pptR} = \min(4 \times h_{d\_l\_pptR}, 8 \times (h_{pptR} - h_b), b)$ = **6.55** ft
Drift surcharge load - right parapet	$p_{d\_pptR} = h_{d\_pptR} \times \gamma$ = **27.20** lb/ft^2

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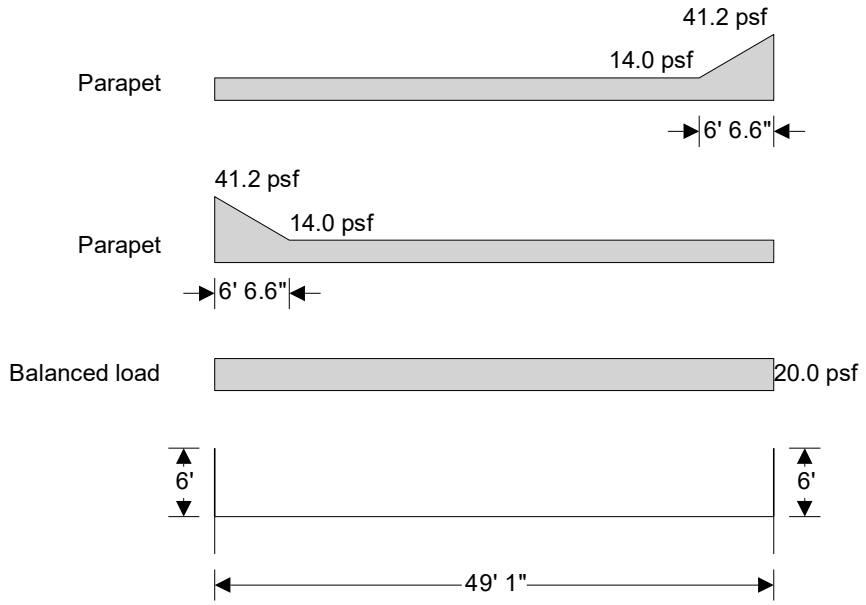

Roof elevation

Drift calculations

Balanced snow load height	$h_b = p_f / \gamma =$ **0.84** ft
Length of upper roof	$l_u =$ **86.00** ft
Length of lower roof	$l_l =$ **4.00** ft
Height diff between uppper and lower roofs	$h_{diff} =$ **12.00** ft
Height from balance load to top of upper roof	$h_c = h_{diff} - h_b =$ **11.16** ft
Drift height leeward drift	$h_{d\_l} = \min(\sqrt{(l_s)} \times (0.43 \times (\max(20\ ft, l_u) \times 1ft^2)^{1/3} \times (p_g / 1lb/ft^2 + 10)^{1/4} - 1.5ft), 0.6 \times l_l) =$ **2.40** ft
Drift height windward drift	$h_{d\_w} = \min(0.75 \times \sqrt{(l_s)} \times (0.43 \times (\max(20\ ft, l_l) \times 1ft^2)^{1/3} \times (p_g / 1lb/ft^2 + 10)^{1/4} - 1.5ft), \sqrt{(l_s \times p_g \times l_l / (4 \times \gamma))}) =$ **0.92** ft
Maximum lw/ww drift height	$h_{d\_max} = \max(h_{d\_w}, h_{d\_l}) =$ **2.40** ft
Drift height	$h_d = \min(h_{d\_max}, h_c) =$ **2.40** ft
Drift width	$W_d = \min(4 \times h_{d\_max}, 8 \times h_c) =$ **9.60** ft
Drift surcharge load	$p_d = h_d \times \gamma =$ **39.84** lb/ft^2

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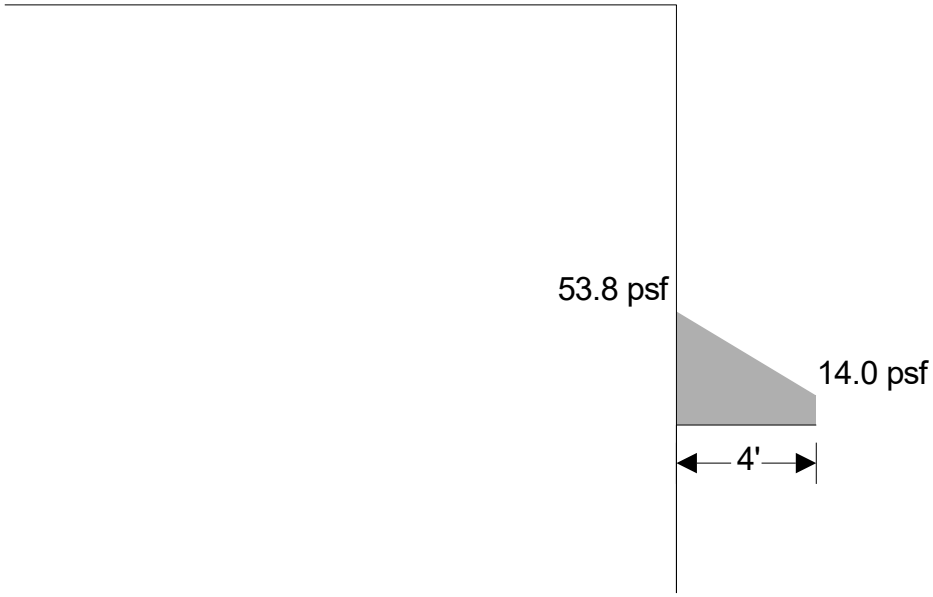

Elevation on snow drift

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Kreher Engineering Inc.
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NJD	9/20/2021				

SNOW LOADING

In accordance with ASCE7-16

Tedds calculation version 1.0.10

Building details

Roof type	Flat
Width of roof	b = **24.58** ft

Ground snow load

Ground snow load (Figure 7.2-1)	p_g = **20.00** lb/ft^2
Density of snow	$\gamma = \min(0.13 \times p_g / 1\text{ft} + 14\text{lb/ft}^3, 30\text{lb/ft}^3)$ = **16.60** lb/ft^3
Terrain typeSect. 26.7	C
Exposure condition (Table 7.3-1)	Partially exposed
Exposure factor (Table 7.3-1)	C_e = **1.00**
Thermal condition (Table 7.3-2)	All
Thermal factor (Table 7.3-2)	C_t = **1.00**
Importance category (Table 1.5-1)	II
Importance factor (Table 1.5-2)	I_s = **1.00**
Min snow load for low slope roofs (Sect 7.3.4)	$p_{f\_min} = I_s \times p_g$ = **20.00** lb/ft^2
Flat roof snow load (Sect 7.3)	$p_f = 0.7 \times C_e \times C_t \times I_s \times p_g$ = **14.00** lb/ft^2

Left parapet

Balanced snow load height	$h_b = p_f / \gamma$ = **0.84** ft
Height of left parapet	h_{pptL} = **6.00** ft
Height from balance load to top of left parapet	$h_{c\_pptL} = h_{pptL} - h_b$ = **5.16** ft
Length of roof - left parapet	$l_{u\_pptL} = b$ = **24.58** ft
Drift height windward drift - left parpet	$h_{d\_l\_pptL} = \sqrt{(I_s)} \times 0.75 \times (0.43 \times (\max(20\text{ ft}, l_{u\_pptL}) \times 1\text{ft}^2)^{1/3} \times (p_g / 1\text{lb/ft}^2 + 10)^{1/4} - 1.5\text{ft})$ = **1.07** ft
Drift height - left parapet	$h_{d\_pptL} = \min(h_{d\_l\_pptL}, h_{pptL} - h_b)$ = **1.07** ft
Drift width	$W_{d\_pptL} = \min(4 \times h_{d\_l\_pptL}, 8 \times (h_{pptL} - h_b), b)$ = **4.28** ft
Drift surcharge load - left parapet	$p_{d\_pptL} = h_{d\_pptL} \times \gamma$ = **17.75** lb/ft^2

Right parapet

Height of right parapet	h_{pptR} = **6.00** ft
Height from balance load to top of right parapet	$h_{c\_pptR} = h_{pptR} - h_b$ = **5.16** ft
Length of roof - right parapet	$l_{u\_pptR} = b$ = **24.58** ft
Drift height windward drift - right parpet	$h_{d\_l\_pptR} = \sqrt{(I_s)} \times 0.75 \times (0.43 \times (\max(20\text{ ft}, l_{u\_pptR}) \times 1\text{ft}^2)^{1/3} \times (p_g / 1\text{lb/ft}^2 + 10)^{1/4} - 1.5\text{ft})$ = **1.07** ft
Drift height - right parapet	$h_{d\_pptR} = \min(h_{d\_l\_pptR}, h_{pptR} - h_b)$ = **1.07** ft
Drift width	$W_{d\_pptR} = \min(4 \times h_{d\_l\_pptR}, 8 \times (h_{pptR} - h_b), b)$ = **4.28** ft
Drift surcharge load - right parapet	$p_{d\_pptR} = h_{d\_pptR} \times \gamma$ = **17.75** lb/ft^2

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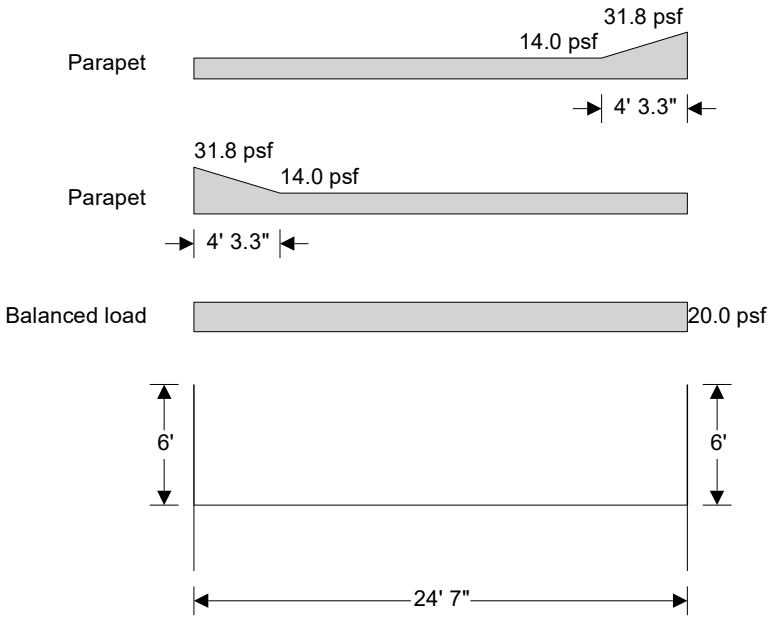

Roof elevation

Drift calculations

Balanced snow load height	$h_b = p_f / \gamma =$ **0.84** ft
Length of upper roof	$l_u =$ **33.00** ft
Length of lower roof	$l_l =$ **4.00** ft
Height diff between uppper and lower roofs	$h_{diff} =$ **12.00** ft
Height from balance load to top of upper roof	$h_c = h_{diff} - h_b =$ **11.16** ft
Drift height leeward drift	$h_{d\_l} = \min(\sqrt{(l_s)} \times (0.43 \times (\max(20\ ft, l_u) \times 1ft^2)^{1/3} \times (p_g / 1lb/ft^2 + 10)^{1/4} - 1.5ft), 0.6 \times l_l) =$ **1.73** ft
Drift height windward drift	$h_{d\_w} = \min(0.75 \times \sqrt{(l_s)} \times (0.43 \times (\max(20\ ft, l_l) \times 1ft^2)^{1/3} \times (p_g / 1lb/ft^2 + 10)^{1/4} - 1.5ft), \sqrt{(l_s \times p_g \times l_l / (4 \times \gamma))}) =$ **0.92** ft
Maximum lw/ww drift height	$h_{d\_max} = \max(h_{d\_w}, h_{d\_l}) =$ **1.73** ft
Drift height	$h_d = \min(h_{d\_max}, h_c) =$ **1.73** ft
Drift width	$W_d = \min(4 \times h_{d\_max}, 8 \times h_c) =$ **6.91** ft
Drift surcharge load	$p_d = h_d \times \gamma =$ **28.68** lb/ft^2

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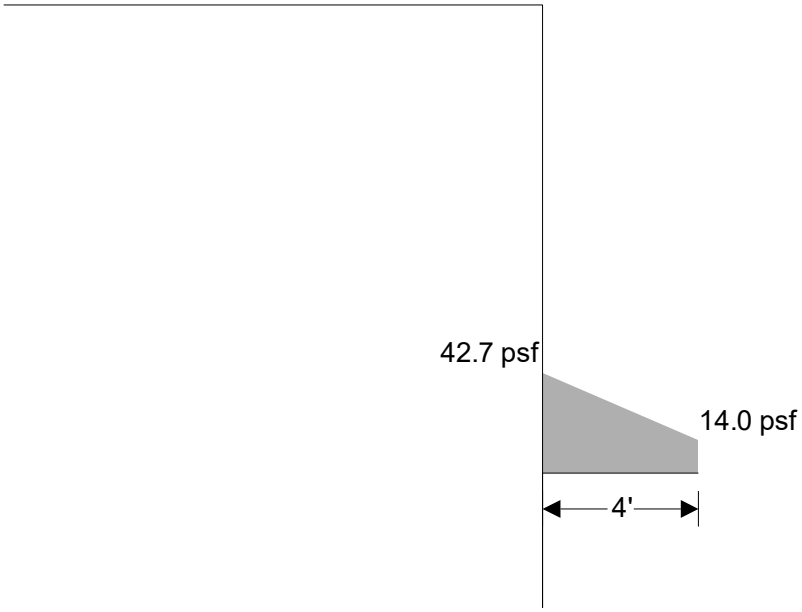

Elevation on snow drift

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Dutch Bros				K21-002	
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Calc. by	Date	Chk'd by	Date	App'd by	Date
NJD	9/20/2021				

SNOW LOADING

In accordance with ASCE7-16

Tedds calculation version 1.0.10

Building details

Roof type	Flat
Width of roof	b = **10.00** ft

Ground snow load

Ground snow load (Figure 7.2-1)	p_g = **20.00** lb/ft^2
Density of snow	$\gamma = \min(0.13 \times p_g / 1ft + 14lb/ft^3, 30lb/ft^3)$ = **16.60** lb/ft^3
Terrain typeSect. 26.7	C
Exposure condition (Table 7.3-1)	Partially exposed
Exposure factor (Table 7.3-1)	C_e = **1.00**
Thermal condition (Table 7.3-2)	All
Thermal factor (Table 7.3-2)	C_t = **1.00**
Importance category (Table 1.5-1)	II
Importance factor (Table 1.5-2)	I_s = **1.00**
Min snow load for low slope roofs (Sect 7.3.4)	$p_{f\_min} = I_s \times p_g$ = **20.00** lb/ft^2
Flat roof snow load (Sect 7.3)	$p_f = 0.7 \times C_e \times C_t \times I_s \times p_g$ = **14.00** lb/ft^2

Left parapet

Balanced snow load height	$h_b = p_f / \gamma$ = **0.84** ft
Height of left parapet	h_{pptL} = **2.00** ft
Height from balance load to top of left parapet	$h_{c\_pptL} = h_{pptL} - h_b$ = **1.16** ft
Length of roof - left parapet	$l_{u\_pptL} = b$ = **10.00** ft
Drift height windward drift - left parpet	$h_{d\_l\_pptL} = \min(\sqrt{(l_s)} \times 0.75 \times (0.43 \times (\max(20\ ft, l_{u\_pptL}) \times 1ft^2)^{1/3} \times (p_g / 1lb/ft^2 + 10)^{1/4} - 1.5ft), \sqrt{(I_s \times p_g \times l_{u\_pptL} / (4 \times \gamma))})$ = **0.92** ft
Drift height - left parapet	$h_{d\_pptL} = \min(h_{d\_l\_pptL}, h_{pptL} - h_b)$ = **0.92** ft
Drift width	$W_{d\_pptL} = \min(4 \times h_{d\_l\_pptL}, 8 \times (h_{pptL} - h_b), b)$ = **3.69** ft
Drift surcharge load - left parapet	$p_{d\_pptL} = h_{d\_pptL} \times \gamma$ = **15.33** lb/ft^2

Right parapet

Height of right parapet	h_{pptR} = **2.00** ft
Height from balance load to top of right parapet	$h_{c\_pptR} = h_{pptR} - h_b$ = **1.16** ft
Length of roof - right parapet	$l_{u\_pptR} = b$ = **10.00** ft
Drift height windward drift - right parpet	$h_{d\_l\_pptR} = \min(\sqrt{(l_s)} \times 0.75 \times (0.43 \times (\max(20\ ft, l_{u\_pptR}) \times 1ft^2)^{1/3} \times (p_g / 1lb/ft^2 + 10)^{1/4} - 1.5ft), \sqrt{(I_s \times p_g \times l_{u\_pptR} / (4 \times \gamma))})$ = **0.92** ft
Drift height - right parapet	$h_{d\_pptR} = \min(h_{d\_l\_pptR}, h_{pptR} - h_b)$ = **0.92** ft
Drift width	$W_{d\_pptR} = \min(4 \times h_{d\_l\_pptR}, 8 \times (h_{pptR} - h_b), b)$ = **3.69** ft
Drift surcharge load - right parapet	$p_{d\_pptR} = h_{d\_pptR} \times \gamma$ = **15.33** lb/ft^2

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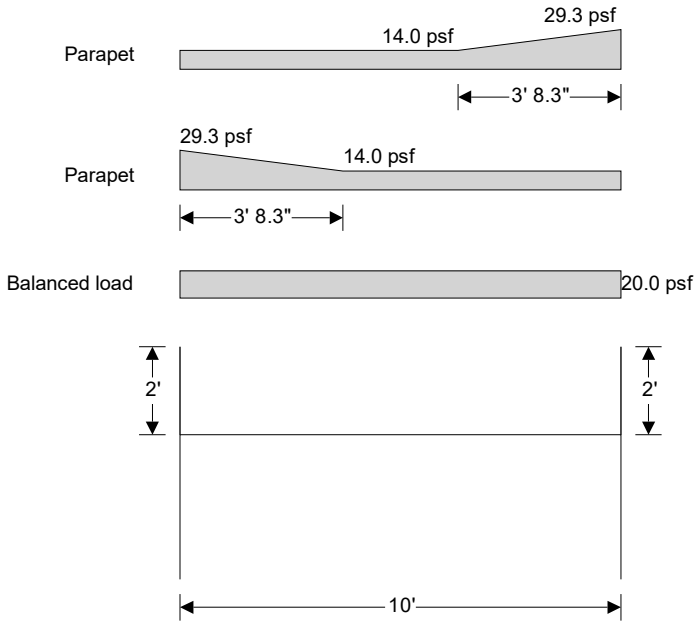

Roof elevation

Drift calculations

Balanced snow load height	$h_b = p_f / \gamma =$ **0.84** ft
Length of upper roof	$l_u =$ **33.00** ft
Length of lower roof	$l_l =$ **4.00** ft
Height diff between uppper and lower roofs	$h_{diff} =$ **12.00** ft
Height from balance load to top of upper roof	$h_c = h_{diff} - h_b =$ **11.16** ft
Drift height leeward drift	$h_{d\_l} = \min(\sqrt{(l_s)} \times (0.43 \times (\max(20\ ft, l_u) \times 1ft^2)^{1/3} \times (p_g / 1lb/ft^2 + 10)^{1/4} - 1.5ft), 0.6 \times l_l) =$ **1.73** ft
Drift height windward drift	$h_{d\_w} = \min(0.75 \times \sqrt{(l_s)} \times (0.43 \times (\max(20\ ft, l_l) \times 1ft^2)^{1/3} \times (p_g / 1lb/ft^2 + 10)^{1/4} - 1.5ft), \sqrt{(l_s \times p_g \times l_l / (4 \times \gamma))}) =$ **0.92** ft
Maximum lw/ww drift height	$h_{d\_max} = \max(h_{d\_w}, h_{d\_l}) =$ **1.73** ft
Drift height	$h_d = \min(h_{d\_max}, h_c) =$ **1.73** ft
Drift width	$W_d = \min(4 \times h_{d\_max}, 8 \times h_c) =$ **6.91** ft
Drift surcharge load	$p_d = h_d \times \gamma =$ **28.68** lb/ft^2

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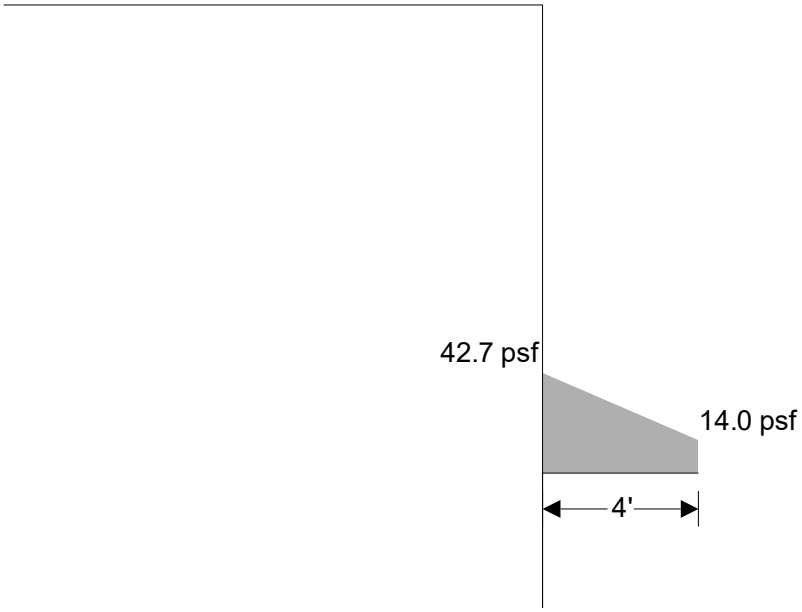

Elevation on snow drift

WIND ANALYSIS

BUILDING

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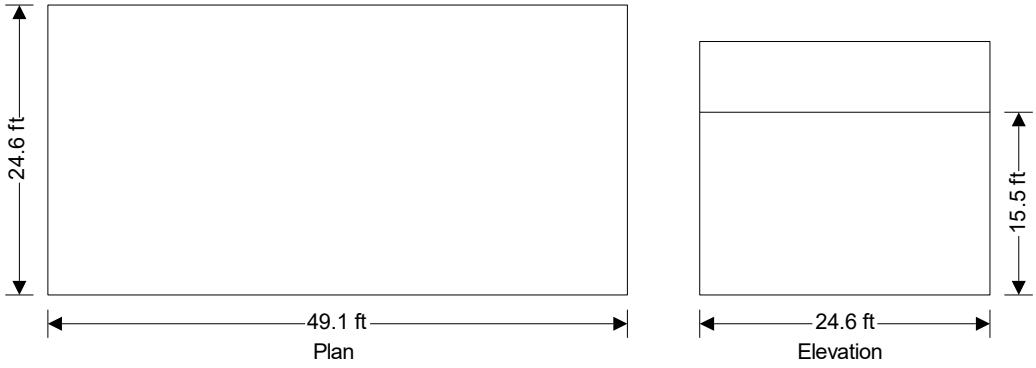
WIND LOADING

In accordance with ASCE7-16

Using the directional design method

Tedds calculation version 2.1.09



Building data

Type of roof	Flat
Length of building	b = **49.08** ft
Width of building	d = **24.58** ft
Height to eaves	H = **15.50** ft
Height of parapet	h_p = **6.00** ft
Mean height	h = **15.50** ft

General wind load requirements

Basic wind speed	V = **111.0** mph
Risk category	II
Velocity pressure exponent coef (Table 26.6-1)	K_d = **0.85**
Ground elevation above sea level	z_{gl} = **0** ft
Ground elevation factor	$K_e = \exp(-0.0000362 \times z_{gl}/1ft)$ = **1.00**
Exposure category (cl 26.7.3)	C
Enclosure classification (cl.26.12)	Enclosed buildings
Internal pressure coef +ve (Table 26.13-1)	GC_{pi_p} = **0.18**
Internal pressure coef –ve (Table 26.13-1)	GC_{pi_n} = **-0.18**
Gust effect factor	G_f = **0.85**
Minimum design wind loading (cl.27.4.7)	p_{min_r} = **8** lb/ft^2

Topography

Topography factor not significant	K_{zt} = 1.0
Velocity pressure equation	$q = 0.00256 \times K_z \times K_{zt} \times K_d \times V^2 \times 1psf/mph^2$

Velocity pressures table

z (ft)	K_z (Table 26.10-1)	q_z (psf)
15.00	0.85	22.79
15.50	0.86	22.92
21.50	0.91	24.45

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Peak velocity pressure for internal pressure

Peak velocity pressure – internal (as roof press.) q_i = **22.92** psf

Parapet pressures and forces

Velocity pressure at top of parapet q_p = **24.45** psf

Combined net pressure coefficient, leeward GC_{pnl} = **-1.0**

Combined net parapet pressure, leeward $p_{pl} = q_p \times GC_{pnl}$ = **-24.45** psf

Combined net pressure coefficient, windward GC_{pnw} = **1.5**

Combined net parapet pressure, windward $p_{pw} = q_p \times GC_{pnw}$ = **36.68** psf

Wind direction 0 deg:

Leeward parapet force $F_{w,wpl\_0} = p_{pl} \times h_p \times b$ = **-7.2** kips

Windward parapet force $F_{w,wpw\_0} = p_{pw} \times h_p \times b$ = **10.8** kips

Wind direction 90 deg:

Leeward parapet force $F_{w,wpl\_90} = p_{pl} \times h_p \times d$ = **-3.6** kips

Windward parapet force $F_{w,wpw\_90} = p_{pw} \times h_p \times d$ = **5.4** kips

Pressures and forces

Net pressure $p = q \times G_f \times C_{pe} - q_i \times GC_{pi}$

Net force $F_w = p \times A_{ref}$

Roof load case 1 - Wind 0, GC_{pi} 0.18, $-c_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A (-ve)	15.50	-0.96	22.92	-22.92	380.39	-8.72
B (-ve)	15.50	-0.85	22.92	-20.64	380.39	-7.85
C (-ve)	15.50	-0.55	22.92	-14.89	445.82	-6.64

Total vertical net force $F_{w,v}$ = **-23.21** kips

Total horizontal net force $F_{w,h}$ = **0.00** kips

Walls load case 1 - Wind 0, GC_{pi} 0.18, $-c_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A_1	15.00	0.80	22.79	11.37	736.25	8.37
A_2	15.50	0.80	22.92	11.46	24.54	0.28
B	15.50	-0.50	22.92	-13.87	760.79	-10.55
C	15.50	-0.70	22.92	-17.77	381.04	-6.77
D	15.50	-0.70	22.92	-17.77	381.04	-6.77

Overall loading

Projected vertical plan area of wall $A_{vert\_w\_0} = b \times (H + h_p)$ = **1055.28** ft^2

Projected vertical area of roof $A_{vert\_r\_0}$ = **0.00** ft^2

Minimum overall horizontal loading $F_{w,total\_min} = p_{min\_w} \times A_{vert\_w\_0} + p_{min\_r} \times A_{vert\_r\_0}$ = **16.88** kips

Leeward net force $F_l = F_{w,wB} + F_{w,wpl\_0}$ = **-17.8** kips

Windward net force $F_w = F_{w,wA\_1} + F_{w,wA\_2} + F_{w,wpw\_0}$ = **19.5** kips

Overall horizontal loading $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total\_min})$ = **37.2** kips

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Roof load case 2 - Wind 0, GC_{pi} -0.18, -0c_{pe}

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A (+ve)	15.50	-0.18	22.92	0.62	380.39	0.24
B (+ve)	15.50	-0.18	22.92	0.62	380.39	0.24
C (+ve)	15.50	-0.18	22.92	0.62	445.82	0.28

Total vertical net force $F_{w,v}$ = **0.75** kips

Total horizontal net force $F_{w,h}$ = **0.00** kips

Walls load case 2 - Wind 0, GC_{pi} -0.18, -0c_{pe}

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A_1	15.00	0.80	22.79	19.62	736.25	14.45
A_2	15.50	0.80	22.92	19.71	24.54	0.48
B	15.50	-0.50	22.92	-5.62	760.79	-4.27
C	15.50	-0.70	22.92	-9.51	381.04	-3.62
D	15.50	-0.70	22.92	-9.51	381.04	-3.62

Overall loading

Projected vertical plan area of wall $A_{vert\_w\_0} = b \times (H + h_p)$ = **1055.28** ft^2

Projected vertical area of roof $A_{vert\_r\_0}$ = **0.00** ft^2

Minimum overall horizontal loading $F_{w,total\_min} = p_{min\_w} \times A_{vert\_w\_0} + p_{min\_r} \times A_{vert\_r\_0}$ = **16.88** kips

Leeward net force $F_l = F_{w,wB} + F_{w,wpl\_0}$ = **-11.5** kips

Windward net force $F_w = F_{w,wA\_1} + F_{w,wA\_2} + F_{w,wpw\_0}$ = **25.7** kips

Overall horizontal loading $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total\_min})$ = **37.2** kips

Roof load case 3 - Wind 90, GC_{pi} 0.18, -c_{pe}

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A (-ve)	15.50	-0.90	22.92	-21.66	190.52	-4.13
B (-ve)	15.50	-0.90	22.92	-21.66	190.52	-4.13
C (-ve)	15.50	-0.50	22.92	-13.87	381.04	-5.28
D (-ve)	15.50	-0.30	22.92	-9.97	444.53	-4.43

Total vertical net force $F_{w,v}$ = **-17.97** kips

Total horizontal net force $F_{w,h}$ = **0.00** kips

Walls load case 3 - Wind 90, GC_{pi} 0.18, -c_{pe}

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A_1	15.00	0.80	22.79	11.37	368.74	4.19
A_2	15.50	0.80	22.92	11.46	12.29	0.14

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Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
B	15.50	-0.30	22.92	-9.98	381.04	-3.80
C	15.50	-0.70	22.92	-17.77	760.79	-13.52
D	15.50	-0.70	22.92	-17.77	760.79	-13.52

Overall loading

Projected vertical plan area of wall $A_{vert\_w\_90} = d \times (H + h_p) =$ **528.53** ft^2

Projected vertical area of roof $A_{vert\_r\_90} =$ **0.00** ft^2

Minimum overall horizontal loading $F_{w,total\_min} = p_{min\_w} \times A_{vert\_w\_90} + p_{min\_r} \times A_{vert\_r\_90} =$ **8.46** kips

Leeward net force $F_l = F_{w,wB} + F_{w,wpl\_90} =$ **-7.4** kips

Windward net force $F_w = F_{w,wA\_1} + F_{w,wA\_2} + F_{w,wpw\_90} =$ **9.7** kips

Overall horizontal loading $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total\_min}) =$ **17.2** kips

Roof load case 4 - Wind 90, GC_{pi} -0.18, $+c_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A (+ve)	15.50	-0.18	22.92	0.62	190.52	0.12
B (+ve)	15.50	-0.18	22.92	0.62	190.52	0.12
C (+ve)	15.50	-0.18	22.92	0.62	381.04	0.24
D (+ve)	15.50	-0.18	22.92	0.62	444.53	0.28

Total vertical net force $F_{w,v} =$ **0.75** kips

Total horizontal net force $F_{w,h} =$ **0.00** kips

Walls load case 4 - Wind 90, GC_{pi} -0.18, $+c_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A_1	15.00	0.80	22.79	19.62	368.74	7.24
A_2	15.50	0.80	22.92	19.71	12.29	0.24
B	15.50	-0.30	22.92	-1.73	381.04	-0.66
C	15.50	-0.70	22.92	-9.51	760.79	-7.24
D	15.50	-0.70	22.92	-9.51	760.79	-7.24

Overall loading

Projected vertical plan area of wall $A_{vert\_w\_90} = d \times (H + h_p) =$ **528.53** ft^2

Projected vertical area of roof $A_{vert\_r\_90} =$ **0.00** ft^2

Minimum overall horizontal loading $F_{w,total\_min} = p_{min\_w} \times A_{vert\_w\_90} + p_{min\_r} \times A_{vert\_r\_90} =$ **8.46** kips

Leeward net force $F_l = F_{w,wB} + F_{w,wpl\_90} =$ **-4.3** kips

Windward net force $F_w = F_{w,wA\_1} + F_{w,wA\_2} + F_{w,wpw\_90} =$ **12.9** kips

Overall horizontal loading $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total\_min}) =$ **17.2** kips

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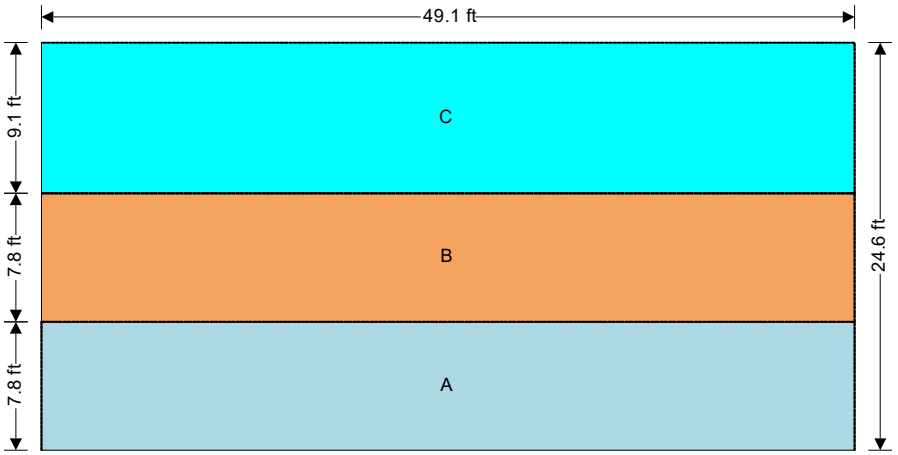
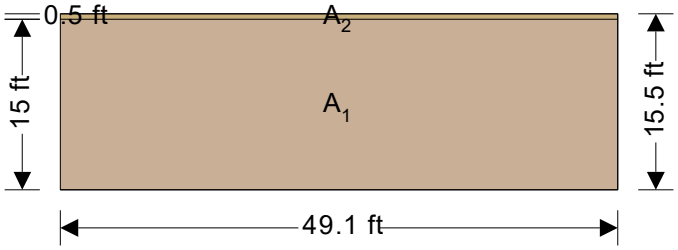
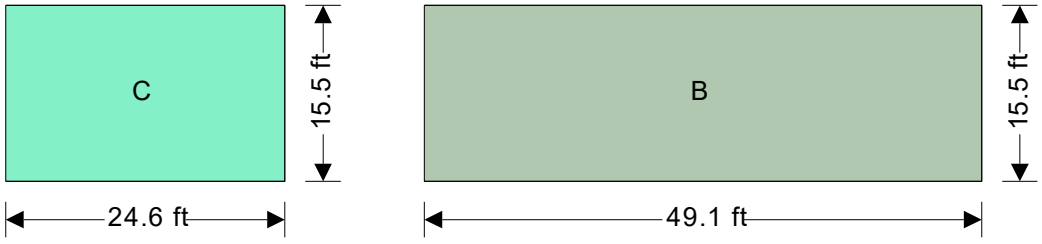


Plan view - Flat roof



Windward face



Side face

Leeward face

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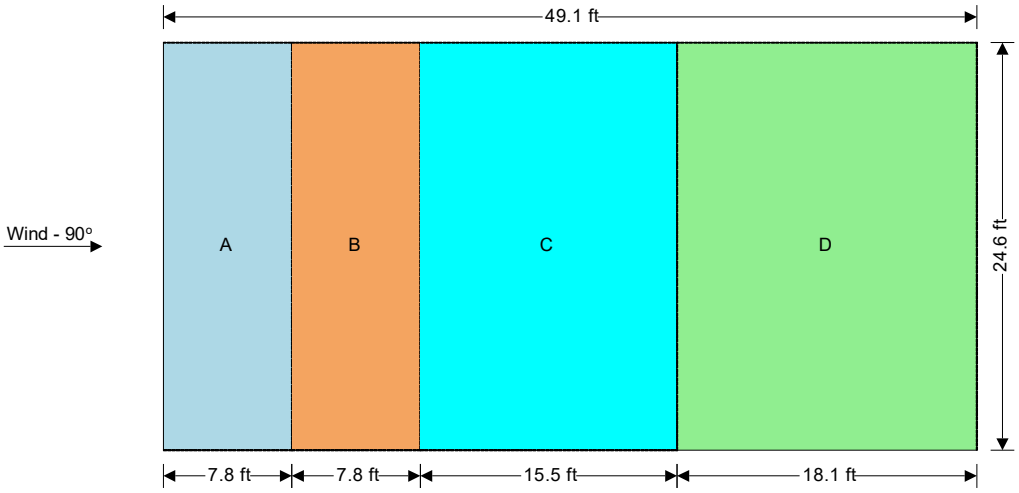
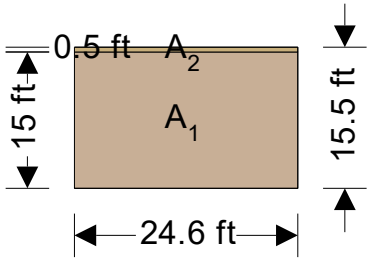
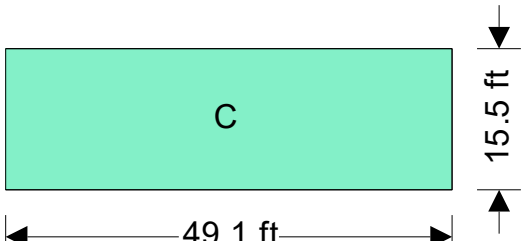


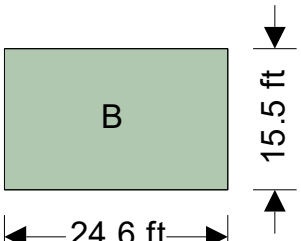
Plan view - Flat roof



Windward face



Side face



Leeward face

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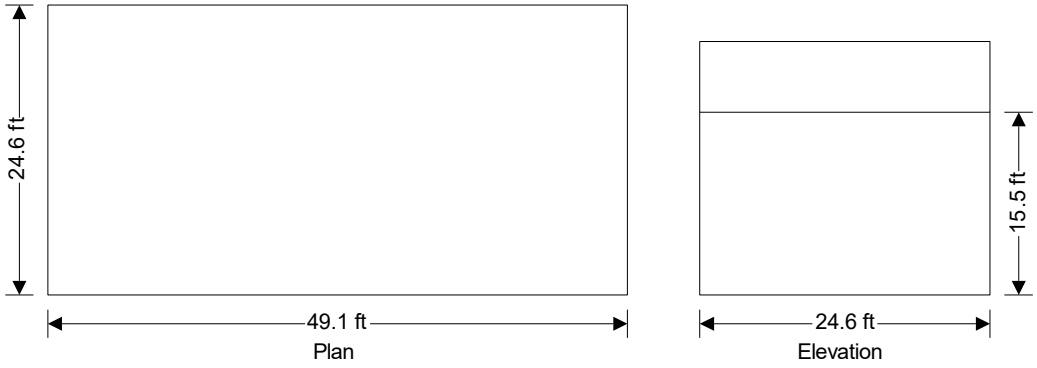
WIND LOADING

In accordance with ASCE7-16

Using the components and cladding design method

Tedds calculation version 2.1.09



Building data

Type of roof	Flat
Length of building	b = **49.08** ft
Width of building	d = **24.58** ft
Height to eaves	H = **15.50** ft
Height of parapet	h_p = **6.00** ft
Mean height	h = **15.50** ft

General wind load requirements

Basic wind speed	V = **111.0** mph
Risk category	II
Velocity pressure exponent coef (Table 26.6-1)	K_d = **0.85**
Ground elevation above sea level	z_{gl} = **0** ft
Ground elevation factor	$K_e = \exp(-0.0000362 \times z_{gl}/1ft)$ = **1.00**
Exposure category (cl 26.7.3)	C
Enclosure classification (cl.26.12)	Enclosed buildings
Internal pressure coef +ve (Table 26.13-1)	GC_{pi_p} = **0.18**
Internal pressure coef –ve (Table 26.13-1)	GC_{pi_n} = **-0.18**
Parapet internal pressure coef +ve (Table 26.11-1)	GC_{pi_pp} = **0.18**
Parapet internal pressure coef –ve (Table 26.11-1)	GC_{pi_np} = **-0.18**
Gust effect factor	G_f = **0.85**

Topography

Topography factor not significant	K_{zt} = 1.0

Velocity pressure

Velocity pressure coefficient (Table 26.10-1)	K_z = **0.86**
Velocity pressure	$q_h = 0.00256 \times K_z \times K_{zt} \times K_d \times K_e \times V^2 \times 1psf/mph^2$ = **22.9** psf

Velocity pressure at parapet

Velocity pressure coefficient (Table 26.10-1)	K_z = **0.91**
Velocity pressure	$q_p = 0.00256 \times K_z \times K_{zt} \times K_d \times K_e \times V^2 \times 1psf/mph^2$ = **24.5** psf

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Peak velocity pressure for internal pressure

Peak velocity pressure – internal (as roof press.) q_i = **22.92** psf

Equations used in tables

Net pressure $p = q_h \times [GC_p - GC_{pi}]$

Parapet net pressure $p = q_p \times [GC_p - GC_{pi\_p}]$

Components and cladding pressures - Wall (Table 30.3-1 and (Figure 30.3-2A))

Component	Zone	Length (ft)	Width (ft)	Eff. area (ft^2)	$+GC_p$	$-GC_p$	Pres (+ve) (psf)	Pres (-ve) (psf)
<=10 sf	4	-	-	10.0	0.90	-0.99	24.8	-26.8
50 sf	4	-	-	50.0	0.79	-0.88	22.2	-24.3
200 sf	4	-	-	200.0	0.69	-0.78	20.0	-22.1
<=10 sf	5	-	-	10.0	0.90	-1.26	24.8	-33.0
50 sf	5	-	-	50.0	0.79	-1.04	22.2	-27.9
200 sf	5	-	-	200.0	0.69	-0.85	20.0	-23.5
10 sf (W)	4p	-	-	10.0	0.90	-2.30	26.4	-60.6
50 sf (W)	4p	-	-	50.0	0.79	-1.93	23.7	-51.6
200 sf (W)	4p	-	-	200.0	0.69	-1.61	21.4	-43.8
10 sf (W)	5p	-	-	10.0	0.90	-2.30	26.4	-60.6
50 sf (W)	5p	-	-	50.0	0.79	-1.93	23.7	-51.6
200 sf (W)	5p	-	-	200.0	0.69	-1.61	21.4	-43.8
10 sf (L)	4p	-	-	10.0	0.90	-0.99	26.4	-28.6
50 sf (L)	4p	-	-	50.0	0.79	-0.88	23.7	-25.9
200 sf (L)	4p	-	-	200.0	0.69	-0.78	21.4	-23.6
10 sf (L)	5p	-	-	10.0	0.90	-1.26	26.4	-35.2
50 sf (L)	5p	-	-	50.0	0.79	-1.04	23.7	-29.8
200 sf (L)	5p	-	-	200.0	0.69	-0.85	21.4	-25.1

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Calc. by	Date	Chk'd by	Date	App'd by	Date
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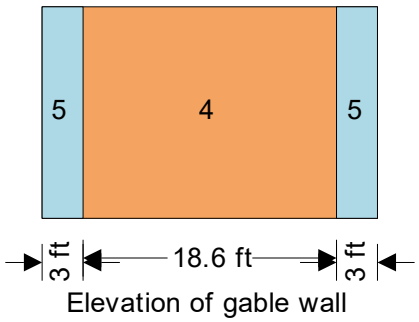
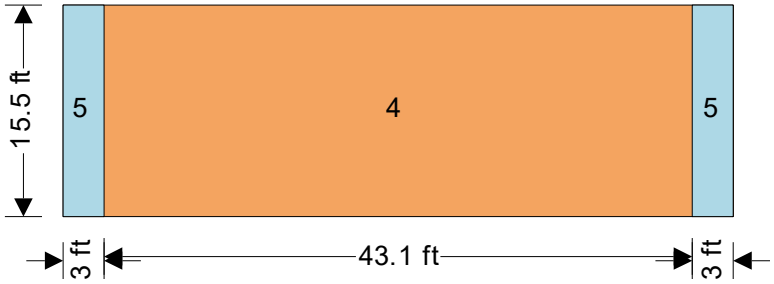


Elevation of gable wall



Elevation of side wall

Components and cladding pressures - Roof (Figure 30.3-2A)

Component	Zone	Length (ft)	Width (ft)	Eff. area (ft^2)	+GC_p	-GC_p	Pres (+ve) (psf)	Pres (-ve) (psf)
<=10 sf	1	-	-	10.0	0.30	-1.70	11.0 #	-43.1
50 sf	1	-	-	50.0	0.23	-1.41	9.4 #	-36.5
100 sf	1	-	-	100.0	0.20	-1.29	8.7 #	-33.7
<=10 sf	2	-	-	10.0	0.90	-2.30	24.8	-56.8
50 sf	2	-	-	50.0	0.79	-1.93	22.2	-48.4
100 sf	2	-	-	100.0	0.74	-1.77	21.1	-44.7
<=10 sf	3	-	-	10.0	0.90	-2.30	24.8	-56.8
50 sf	3	-	-	50.0	0.79	-1.93	22.2	-48.4
100 sf	3	-	-	100.0	0.74	-1.77	21.1	-44.7

The final net design wind pressure, including all permitted reductions, used in the design shall not be less than 16psf acting in either direction

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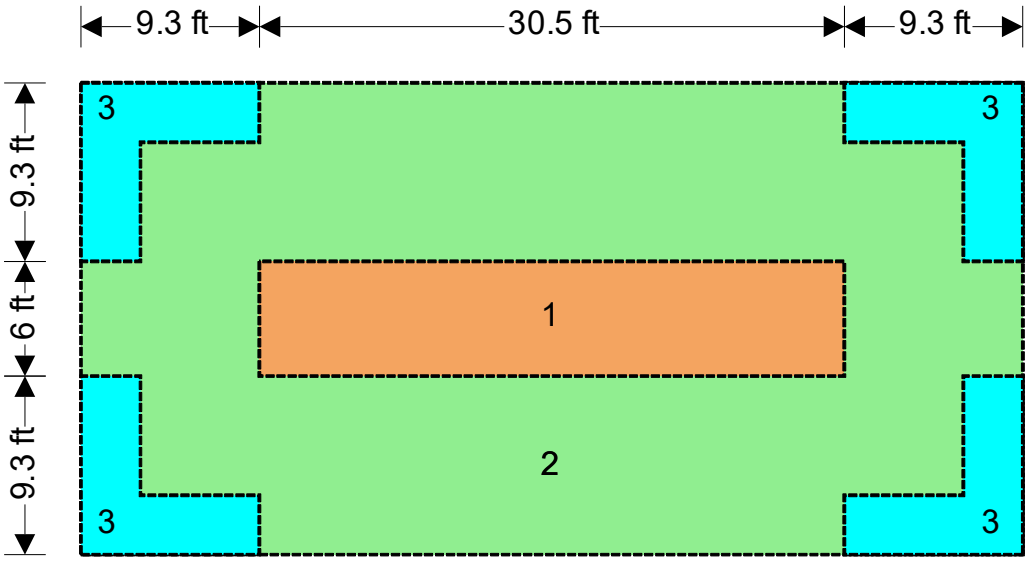
	Calc. by	Date	Chk'd by	Date	App'd by	Date
	NJD	9/20/2021				



Plan on roof

WIND ANALYSIS

SITE STRUCTURES

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Tekla Tedds	Project				Job Ref.	
Kreher Engineering Inc. 208 N Main St., Suite H, Columbia, IL 62236	Dutch Bros				K21-002	
	Section				Sheet no./rev.	
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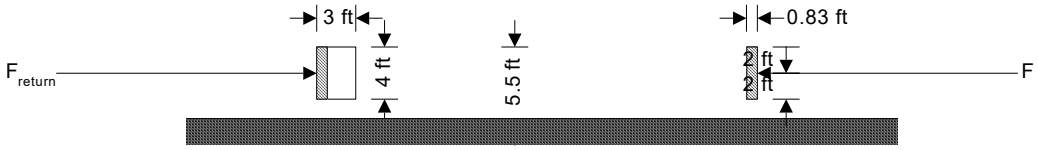
	NJD	9/20/2021				

WIND LOADING

In accordance with ASCE7-16

Using the directional design method

Tedds calculation version 2.1.09



Wall/sign data

Length of wall/sign	B = **3.00** ft
Height of wall/sign	s = **4.00** ft
Height to top of sign	h = **5.50** ft

General wind load requirements

Basic wind speed	V = **111.0** mph
Risk category	II
Velocity pressure exponent coef (Table 26.6-1)	K_d = **0.85**
Ground elevation above sea level	z_{gl} = **0** m
Ground elevation factor	$K_e = \exp(-0.0000362 \times z_{gl}/1ft) =$ **1.00**
Exposure category (cl 26.7.3)	C
Gust effect factor	G_f = **0.85**
Minimum design wind loading (cl.27.4.7)	p_{min_r} = **8** lb/ft^2

Topography

Topography factor not significant	K_{zt} = 1.0

Velocity pressure

Velocity pressure coefficient (Table 26.10-1)	K_z = **0.85**
Velocity pressure	$q_h = 0.00256 \times K_z \times K_{zt} \times K_d \times K_e \times V^2 \times 1psf/mph^2 =$ **22.8** psf
Area of sign	$A_f = B \times s =$ **12** ft^2
Ratio of solid area to gross area	ε = **1.00**

Wall/sign forces – Case A and B

Force coefficient (Figure 29.3-1)	C_{f_A} = **1.66**
Resultant force	$F_A = \max(16psf, q_h \times G_f \times C_{f\_A}) \times A_f =$ **0.4** kips

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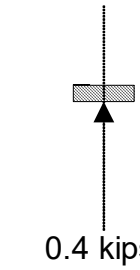
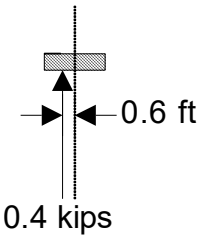


Plan - Case A



Plan - Case B

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Project				Job Ref.	
Dutch Bros				K21-002	
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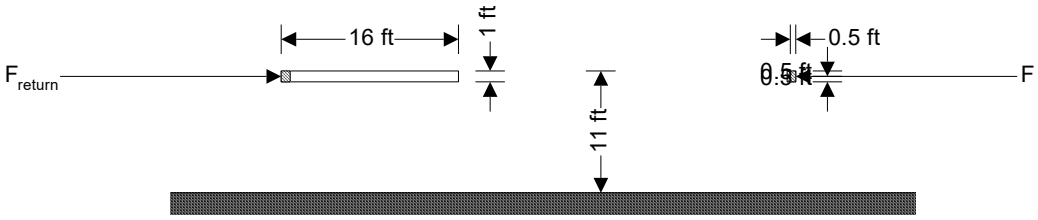
NJD	9/20/2021				

WIND LOADING

In accordance with ASCE7-16

Using the directional design method

Tedds calculation version 2.1.09



Wall/sign data

Length of wall/sign	B = **16.00** ft
Height of wall/sign	s = **1.00** ft
Height to top of sign	h = **11.00** ft

General wind load requirements

Basic wind speed	V = **111.0** mph
Risk category	II
Velocity pressure exponent coef (Table 26.6-1)	K_d = **0.85**
Ground elevation above sea level	z_{gl} = **0** m
Ground elevation factor	$K_e = \exp(-0.0000362 \times z_{gl}/1ft) =$ **1.00**
Exposure category (cl 26.7.3)	C
Gust effect factor	G_f = **0.85**
Minimum design wind loading (cl.27.4.7)	p_{min_r} = **8** lb/ft^2

Topography

Topography factor not significant	K_{zt} = 1.0

Velocity pressure

Velocity pressure coefficient (Table 26.10-1)	K_z = **0.85**
Velocity pressure	$q_h = 0.00256 \times K_z \times K_{zt} \times K_d \times K_e \times V^2 \times 1psf/mph^2 =$ **22.8** psf
Area of sign	$A_f = B \times s =$ **16** ft^2
Ratio of solid area to gross area	ε = **1.00**

Wall/sign forces – Case A and B

Force coefficient (Figure 29.3-1)	C_{f_A} = **1.88**
Resultant force	$F_A = \max(16psf, q_h \times G_f \times C_{f\_A}) \times A_f =$ **0.6** kips

Wall sign forces - Case C

Number of whole regions - main wall	$N_s = Int(B/s) =$ **16**
Length of balance - main wall	$L_{balance} = B - 10 \times s =$ **6.0** ft

Region 1 - 0.0 ft to 1.0 ft

Force coefficient (Figure 29.3-1)	$C_{f\_C\_0\ to\ s}$ = **3.45**
Effective area	$A_{f\_C\_1} = s \times s =$ **1.0** ft^2
Resultant force	$F_{A\_c\_1} = \max(16psf, q_h \times G_f \times C_{f\_C\_0\ to\ s}) \times A_{f\_C\_1} =$ **0.1** kips

Region 2 - 1.0 ft to 2.0 ft

Force coefficient (Figure 29.3-1) $C_{f\_C\_s\ to\ 2s}$ = **2.60**

Effective area $A_{f\_C\_2} = s \times s$ = **1.0** ft^2

Resultant force $F_{A\_c\_2} = \max(16psf, q_h \times G_f \times C_{f\_C\_s\ to\ 2s}) \times A_{f\_C\_2}$ = **0.1** kips

Region 3 - 2.0 ft to 3.0 ft

Force coefficient (Figure 29.3-1) $C_{f\_C\_2s\ to\ 3s}$ = **2.00**

Effective area $A_{f\_C\_3} = s \times s$ = **1.0** ft^2

Resultant force $F_{A\_c\_3} = \max(16psf, q_h \times G_f \times C_{f\_C\_2s\ to\ 3s}) \times A_{f\_C\_3}$ = **0.0** kips

Region 4 - 3.0 ft to 4.0 ft

Force coefficient (Figure 29.3-1) $C_{f\_C\_3s\ to\ 4s}$ = **1.53**

Effective area $A_{f\_C\_4} = s \times s$ = **1.0** ft^2

Resultant force $F_{A\_c\_4} = \max(16psf, q_h \times G_f \times C_{f\_C\_3s\ to\ 4s}) \times A_{f\_C\_4}$ = **0.0** kips

Region 5 - 4.0 ft to 5.0 ft

Force coefficient (Figure 29.3-1) $C_{f\_C\_4s\ to\ 5s}$ = **1.40**

Effective area $A_{f\_C\_5} = s \times s$ = **1.0** ft^2

Resultant force $F_{A\_c\_5} = \max(16psf, q_h \times G_f \times C_{f\_C\_4s\ to\ 5s}) \times A_{f\_C\_5}$ = **0.0** kips

Region 6 - 5.0 ft to 10.0 ft

Force coefficient (Figure 29.3-1) $C_{f\_C\_5s\ to\ 10s}$ = **0.92**

Effective area $A_{f\_C\_6} = 5 \times s \times s$ = **5.0** ft^2

Resultant force $F_{A\_c\_6} = \max(16psf, q_h \times G_f \times C_{f\_C\_5s\ to\ 10s}) \times A_{f\_C\_6}$ = **0.1** kips

Region 7 - 10.0 ft to 16.0 ft

Force coefficient (Figure 29.3-1) $C_{f\_C\_10s}$ = **0.55**

Effective area $A_{f\_C\_7} = L_{balance} \times s$ = **6.0** ft^2

Resultant force $F_{A\_c\_7} = \max(16psf, q_h \times G_f \times C_{f\_C\_10s}) \times A_{f\_C\_7}$ = **0.1** kips

Wall sign forces - Case C return

Number of whole regions - return $N_{s,r} = \text{Int}(L_r/s)$ = **0**

Length of balance - return $L_{balance,r} = L_r - N_{s,r} \times s$ = **0.5** ft

Region 1 return - 0.0 ft to 0.5 ft

Force coefficient (Figure 29.3-1) $C_{f\_C\_0\ to\ s}$ = **3.45**

Effective area $A_{f\_C\_1,r} = L_{balance,r} \times s$ = **0.5** ft^2

Resultant force $F_{A\_c\_1,r} = \max(16psf, q_h \times G_f \times C_{f\_C\_0\ to\ s}) \times A_{f\_C\_1,r}$ = **0.0** kips

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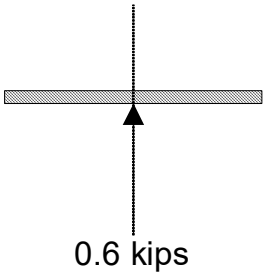
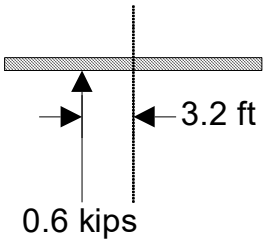
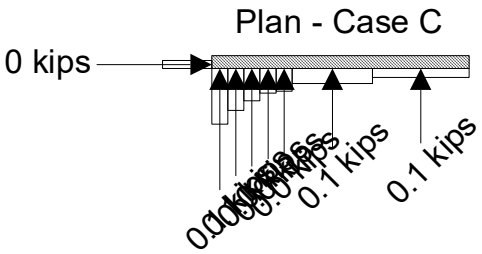
NJD	9/20/2021				



Plan - Case A



Plan - Case B



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NJD	9/21/2021				

WIND LOADING

In accordance with ASCE7-16

Using the directional design method

Tedds calculation version 2.1.09

Wall/sign data

Length of wall/sign	B = **13.00** ft
Height of wall/sign	s = **12.00** ft
Height to top of sign	h = **12.00** ft

General wind load requirements

Basic wind speed	V = **111.0** mph
Risk category	II
Velocity pressure exponent coef (Table 26.6-1)	K_d = **0.85**
Ground elevation above sea level	z_{gl} = **0** m
Ground elevation factor	$K_e = \exp(-0.0000362 \times z_{gl}/1ft) =$ **1.00**
Exposure category (cl 26.7.3)	C
Gust effect factor	G_f = **0.85**
Minimum design wind loading (cl.27.4.7)	p_{min_r} = **8** lb/ft^2

Topography

Topography factor not significant	K_{zt} = 1.0

Velocity pressure

Velocity pressure coefficient (Table 26.10-1)	K_z = **0.85**
Velocity pressure	$q_h = 0.00256 \times K_z \times K_{zt} \times K_d \times K_e \times V^2 \times 1psf/mph^2 =$ **22.8** psf
Area of sign	$A_f = B \times s =$ **156** ft^2
Ratio of solid area to gross area	ε = **1.00**

Wall/sign forces – Case A and B

Force coefficient (Figure 29.3-1)	C_{f_A} = **1.45**
Resultant force	$F_A = \max(16psf, q_h \times G_f \times C_{f\_A}) \times A_f =$ **4.4** kips

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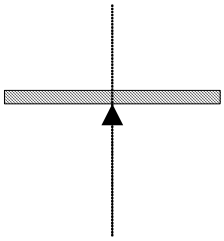
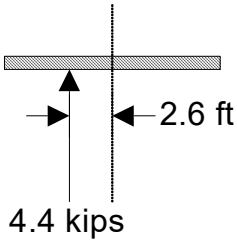
Calc. by	Date	Chk'd by	Date	App'd by	Date
NJD	9/21/2021				



Plan - Case A



Plan - Case B

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Project				Job Ref.	
Dutch Bros				K21-002	
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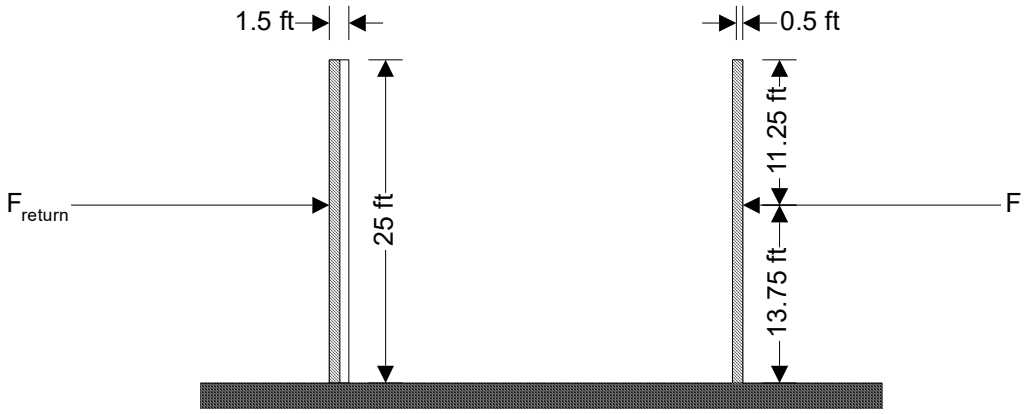
ASCE 7-16 Wind - Light Pole				1	
Calc. by	Date	Chk'd by	Date	App'd by	Date
NJD	9/20/2021				

WIND LOADING

In accordance with ASCE7-16

Using the directional design method

Tedds calculation version 2.1.09



Wall/sign data

Length of wall/sign	B = **1.50** ft
Height of wall/sign	s = **25.00** ft
Height to top of sign	h = **25.00** ft

General wind load requirements

Basic wind speed	V = **111.0** mph
Risk category	II
Velocity pressure exponent coef (Table 26.6-1)	K_d = **0.85**
Ground elevation above sea level	z_{gl} = **0** m
Ground elevation factor	$K_e = \exp(-0.0000362 \times z_{gl}/1ft) =$ **1.00**
Exposure category (cl 26.7.3)	C
Gust effect factor	G_f = **0.85**
Minimum design wind loading (cl.27.4.7)	p_{min_r} = **8** lb/ft^2

Topography

Topography factor not significant	K_{zt} = 1.0

Velocity pressure

Velocity pressure coefficient (Table 26.10-1)	K_z = **0.94**
Velocity pressure	$q_h = 0.00256 \times K_z \times K_{zt} \times K_d \times K_e \times V^2 \times 1psf/mph^2 =$ **25.2** psf
Area of sign	$A_f = B \times s =$ **37.5** ft^2
Ratio of solid area to gross area	ε = **1.00**

Wall/sign forces – Case A and B

Force coefficient (Figure 29.3-1)	C_{f_A} = **1.78**
Resultant force	$F_A = \max(16psf, q_h \times G_f \times C_{f\_A}) \times A_f =$ **1.4** kips

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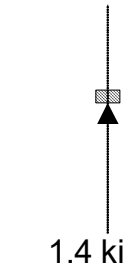
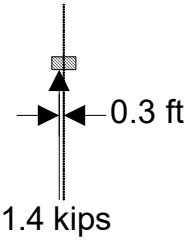
Calc. by	Date	Chk'd by	Date	App'd by	Date
NJD	9/20/2021				



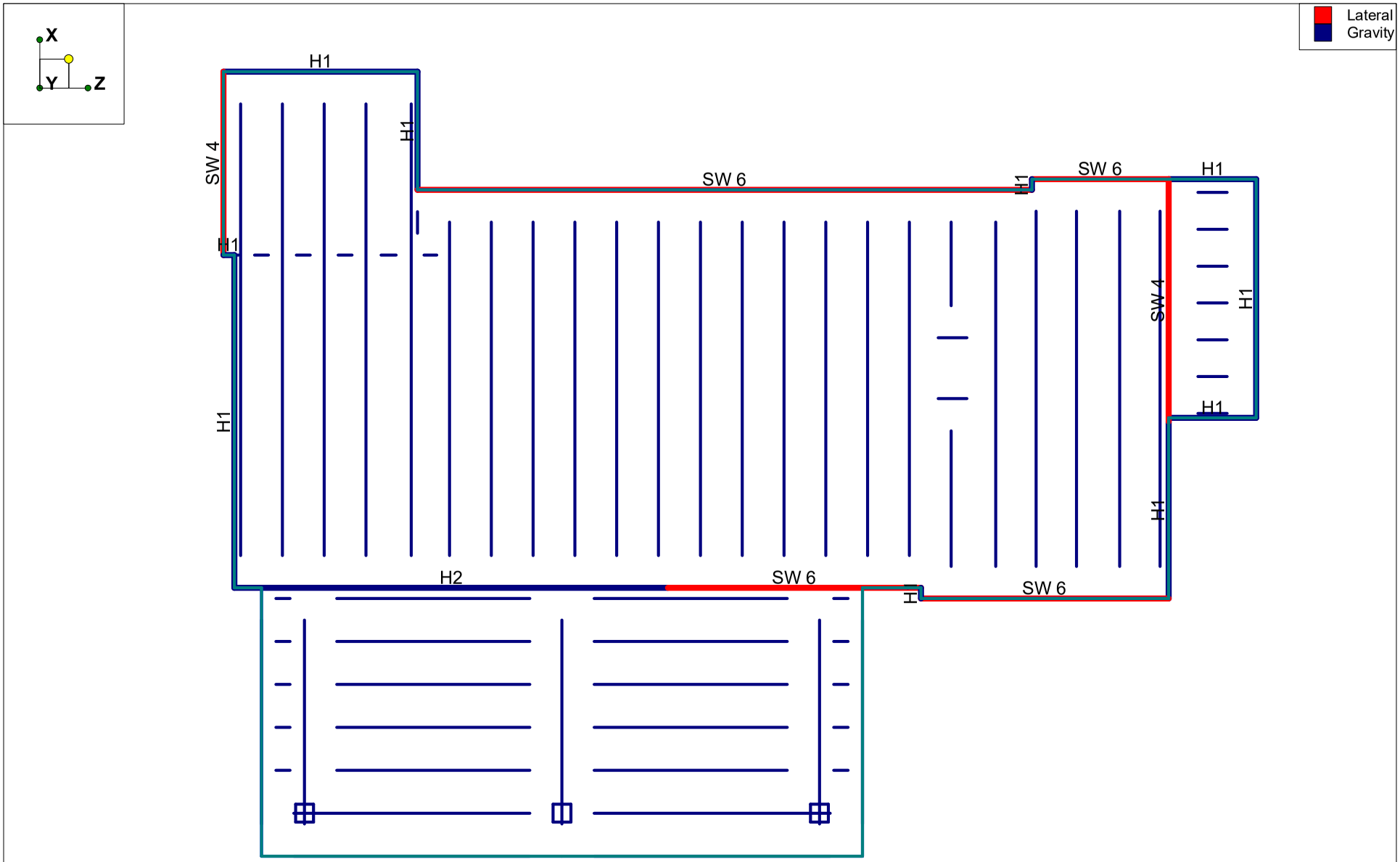
Plan - Case A



Plan - Case B

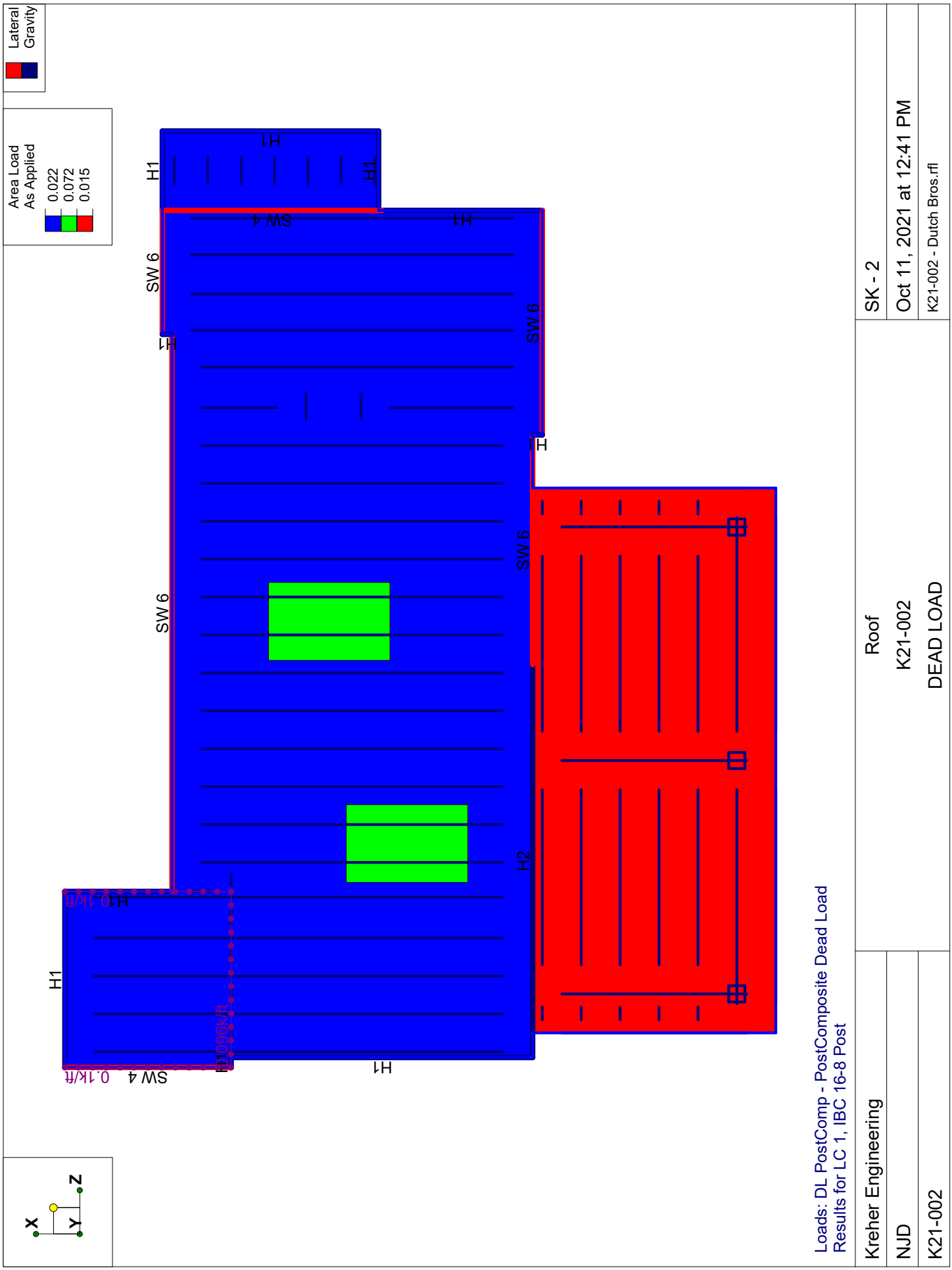
RISA 3D ANALYSIS

GRAVITY AND SHEAR WALLS



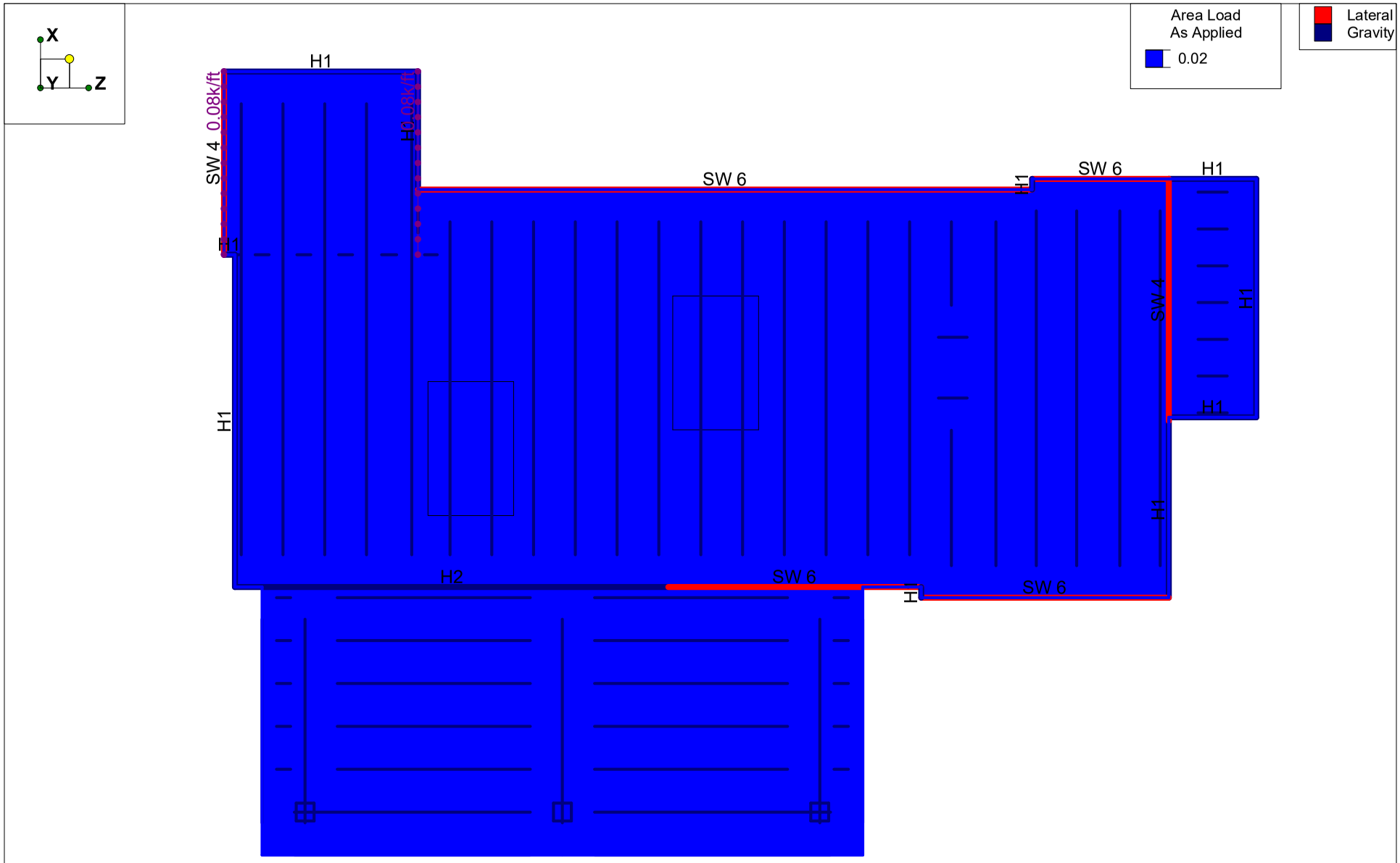
Loads: DL PreComp - PreComposite Dead Load
Results for LC 1, IBC 16-8 Post

Kreher Engineering	Roof	SK - 1
NJD	K21-002	Oct 11, 2021 at 12:40 PM
K21-002	SW = SHEAR WALL, H = HEADER	K21-002 - Dutch Bros.rfl



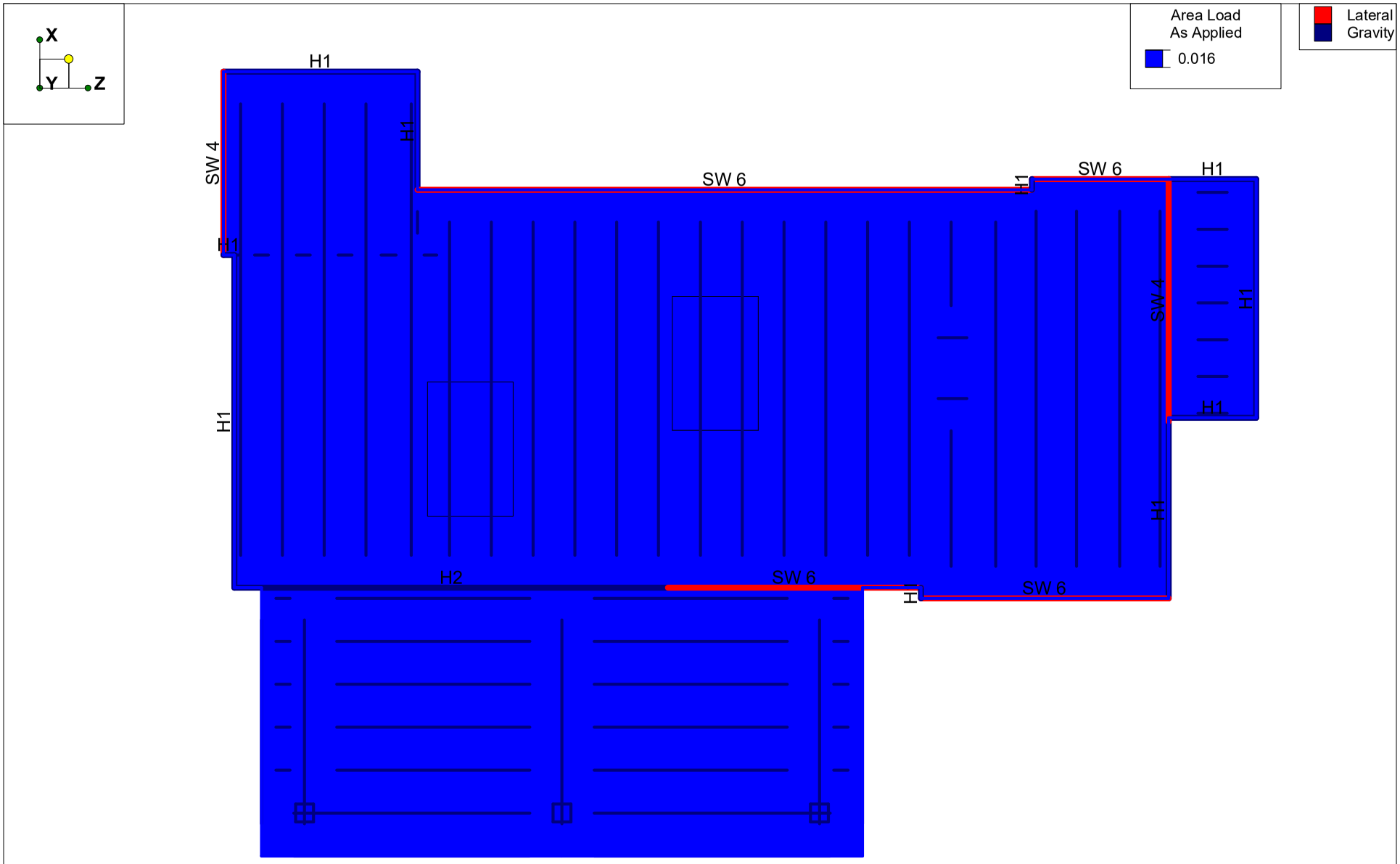
Loads: DL PostComp - PostComposite Dead Load
Results for LC 1, IBC 16-8 Post

Kreher Engineering	Roof	SK - 2
NJD	K21-002	Oct 11, 2021 at 12:41 PM
K21-002	DEAD LOAD	K21-002 - Dutch Bros.rfl



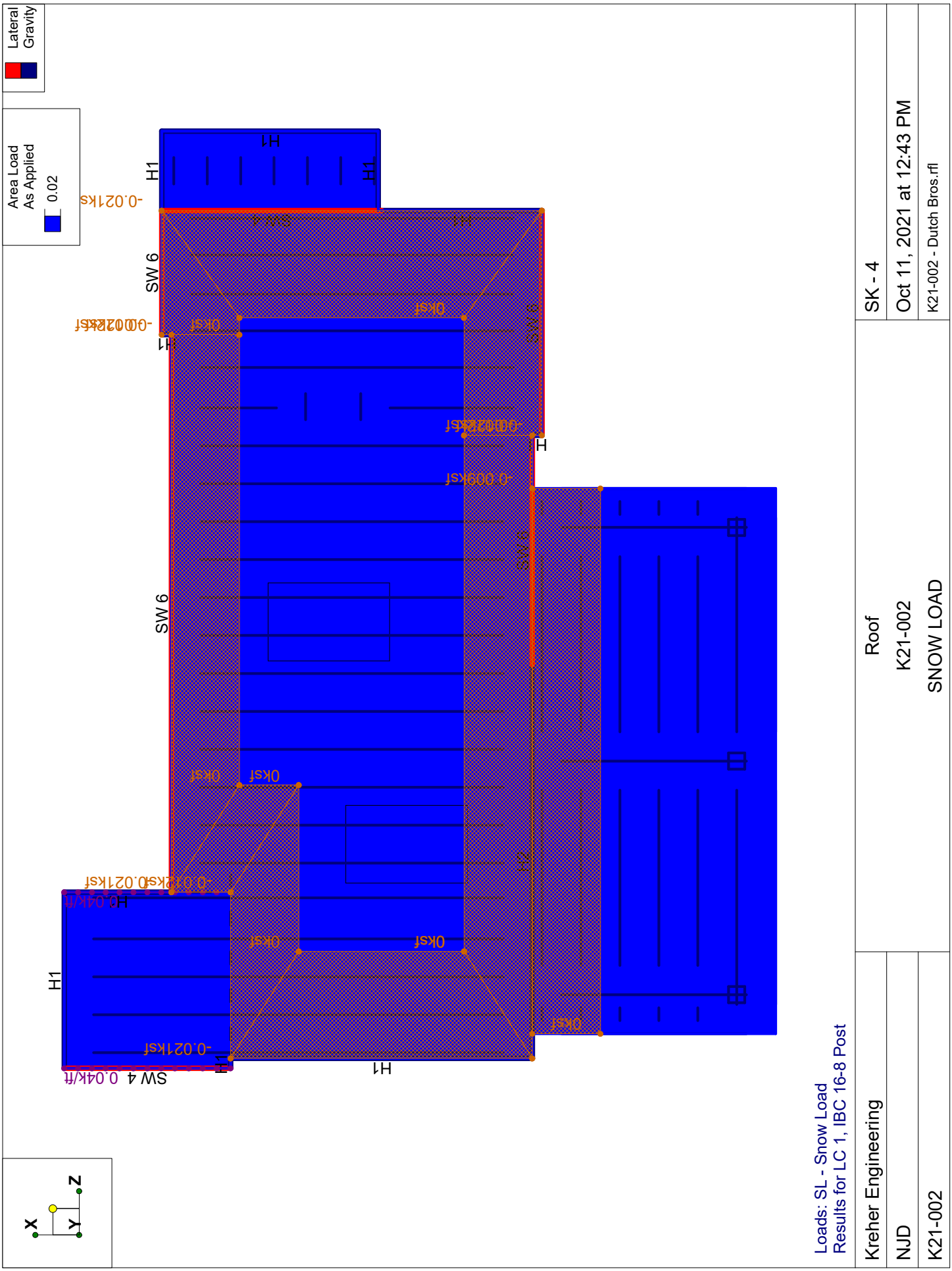
Loads: RLL-Non - Roof Live Load
Results for LC 1, IBC 16-8 Post

Kreher Engineering	Roof	SK - 3
NJD	K21-002	Oct 11, 2021 at 12:43 PM
K21-002	ROOF LIVE LOAD	K21-002 - Dutch Bros.rfl



Loads: RL - Rain Load
Results for LC 1, IBC 16-8 Post

Kreher Engineering	Roof	SK - 5
NJD	K21-002	Oct 11, 2021 at 12:44 PM
K21-002	RAIN LOAD	K21-002 - Dutch Bros.rfl



Kreher Engineering

NJD

K21-002

Roof

K21-002

SNOW LOAD

SK - 4

Oct 11, 2021 at 12:43 PM

K21-002 - Dutch Bros.rfl

Wind Generation Input

Wind Code:	**ASCE 7-16**	Topographic Factor K1:	**0**
Wind Speed, V(mph):	**111**	Topographic Factor K2:	**0**
		Topographic Factor K3:	**0**
Exposure Category:	**C**	Directionality Factor Kd:	**0.85**
Base Elevation(ft):	**0**	Parapet Height(ft):	**0**

Wind Generation Detail Results

		Kzt:	**1**
Exposure Constant Alpha:	**9.5**	h (ft):	**13**
Exposure Constant zg:	**900**	Kh:	**0.849**
Gust Effect Factor, G:	**0.85**	Windward Cp:	**0.8**
		qh (ksf):	**0.019**
		GCpn (windward):	**+1.5**
		GCpn (leeward):	**-1.0**

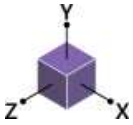
Wind Generation Floor Geometry Results

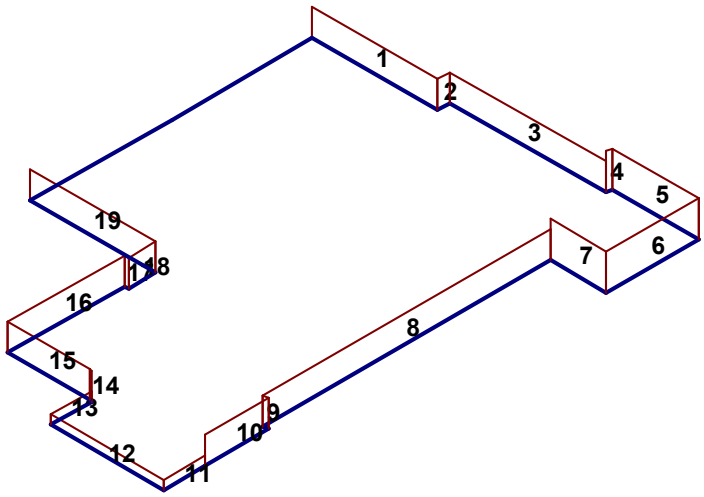
Floor Level	Height (ft)	Kz	Width (X) (ft)	Length (Z) (ft)	Leeward Cp(X)	Leeward Cp(Z)
Roof	**13**	**0.849**	**36.542**	**48.125**	**0.5**	**0.437**

Wind Generation Floor Force Results

Floor Level	qz (ksf)	Windward Pres. (ksf)	Leeward Pres. X (ksf)	Leeward Pres. Z (ksf)	Force X (k)	Force Z (k)
Roof	**0.019**	**0.013**	**0.008**	**0.007**	**6.687**	**4.83**
Add'l Parapet					**12.1**	**13.279**
Total					**18.787**	**18.109**

Parapet Summary (heights are base parapet height unless noted below)





Parapet	Height Above	X Length	Z Length	qp (ksf)	Force X (k)	Force Z (k)
1	**6**	**12.5**	**0**	**0.02**	**0**	**2.287**
2	**6**	**0**	**1.271**	**0.02**	**0.233**	**0**

3	6	15.5	0	0.02	0	2.836
4	**8**	**0**	**0.5**	**0.021**	**0.125**	**0**
5	**8**	**8.542**	**0**	**0.021**	**0**	**2.129**
6	**8**	**0**	**9.042**	**0.021**	**2.253**	**0**
7	**8**	**5.5**	**0**	**0.021**	**0**	**1.371**
8	**6**	**0**	**28.625**	**0.02**	**5.238**	**0**
9	**6**	**0.5**	**0**	**0.02**	**0**	**0.091**
10	**6**	**0**	**6.375**	**0.02**	**1.167**	**0**
11	**2**	**0**	**4.083**	**0.019**	**0.237**	**0**
12	**2**	**11.125**	**0**	**0.019**	**0**	**0.646**
13	**2**	**0**	**4.083**	**0.019**	**0.237**	**0**
14	**6**	**0.167**	**0**	**0.02**	**0**	**0.031**
15	**6**	**8.25**	**0**	**0.02**	**0**	**1.51**
16	**6**	**0**	**11.542**	**0.02**	**2.112**	**0**
17	**6**	**0.5**	**0**	**0.02**	**0**	**0.091**
18	**6**	**0**	**2.729**	**0.02**	**0.499**	**0**
19	**6**	**12.5**	**0**	**0.02**	**0**	**2.287**

Note: GCpn = 1.5 for these portions of the parapet in both horizontal directions.

Seismic Generation Input

Seismic Code:	**ASCE 7-16**				
Ct_X:	**0.02**	T_X (sec):	**0.155**	R_X:	**6.5**
Ct_Z:	**0.02**	T_Z (sec):	**0.155**	R_Z:	**6.5**
Ct Exp. X:	**0.75**	Ct Exp. Z:	**0.75**		
Risk Cat	**I or II**	TL (sec):	**12**		
SD1 (g):	**0.068**	SDS (g):	**0.086**	S1 (g):	**0.068**
Base Elev (ft):	**0**	Parapet Ht (ft):	**0**		

Seismic Generation Detail Results

T_X Used (sec):	**0.155**	T_X Method A:	**0.137**	T_X Upper Limit:	**0.233**
T_Z Used (sec):	**0.155**	T_Z Method A:	**0.137**	T_Z Upper Limit:	**0.233**
Importance Fac.:	**1**	Design Cat.:	**B**		
V_X (k):	**0.487**	Gov. Eqn.	**ASCE Eqn 12.8-2**	Cs_X:	**0.013**
V_Z (k):	**0.487**	Gov. Eqn.	**ASCE Eqn 12.8-2**	Cs_Z:	**0.013**

Seismic Generation Force Results

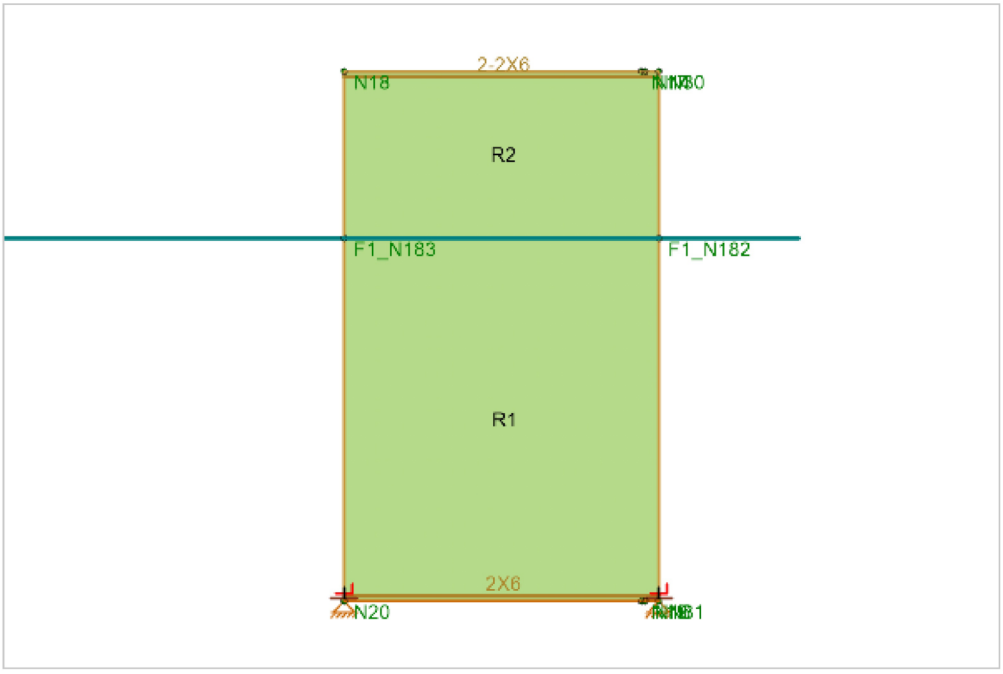
Floor Level	Height (ft)	Weight (k)	Force X (k)	Force Z (k)	CG X (ft)	CG Z (ft)
Roof	**13**	**32.651**	**0.487**	**0.487**	**6.739**	**20.562**
Base		**4.146**				
Totals		**36.797**	**0.487**	**0.487**		

Seismic Generation Diaphragm Results

Floor Level	Width (X) (ft)	Length (Z) (ft)	X Plus (ft)	X Minus (ft)	Z Plus (ft)	Z Minus (ft)
Roof	**36.542**	**48.125**	**1.827**	**1.827**	**2.406**	**2.406**

Detail Report: WP12A

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Segmented
Height (ft):	19
Length (ft):	11.292
Wall Material:	Southern Pine No.2
Panel Schedule:	AWC 2015 PLY
Sel. Shear Panel:	RS_15/32_10d@4

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	N/A
K:	1

Material Properties:

Top Plate:	Southern Pine No.2	Fb (ksi):	1	Ft (ksi):	0.6
Sill:	Southern Pine No.2	Fv (ksi):	0.175	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Southern Pine No.2	Fc (ksi):	1.4		
Chord:	Southern Pine No.2	Specific Gravity:	0.55		
E:	1400	Density (k/ft^3):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Controlling region					**PASS**
Controlling region R1					
ShearPanel					
RS_15/32_10d@4	12 (W)	0.569 k/ft	0.644 k/ft	0.884	PASS
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer : Simpson HoldDowns					
HDU8-SDS2.5_4.5_DF-SP	28 (W)	6.94 k	7.87 k	0.882	PASS
Chords					
2-2X6 (Tension)	28 (W)	6.94 k	15.84 k	0.438	PASS
2-2X6 (Compression)	12 (W)	5.217 k	8.618 k	0.605	PASS
Studs					
2X6	6 (W)	0.237 k	4.222 k	0.056	PASS

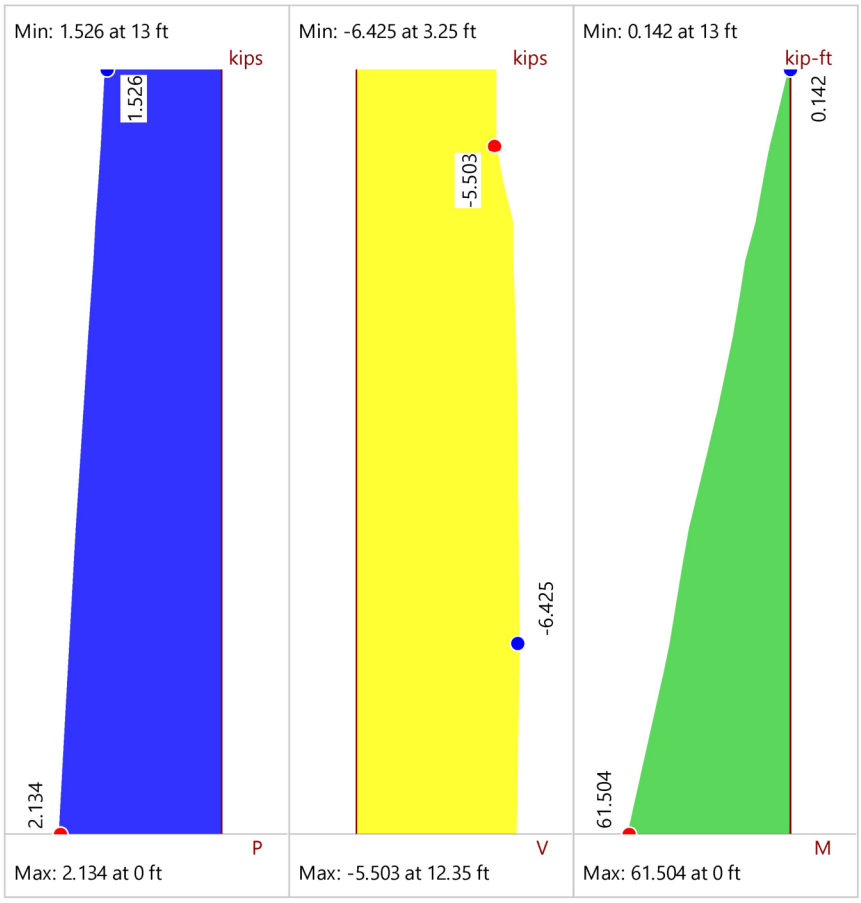
Deflection Results

Maximum Region Deflection (in)	Gov. LC	Finite element Deflection (in)	Shear Stiffness Adjustment Factor (SSAF)
0.584(R1)	12 (W)	0.54	1

Region Design

	Shear UC	Strap / Hold-Down UC	Chord UC	Stud UC	Result
R1 (In-Plane)	**0.884**	**0.882**	**0.605**	**0.056**	**PASS**

Envelope Diagrams



Axial Diagram **Shear Diagram** **Moment Diagram**

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SP
Panel Schedule:	AWC 2015 PLY
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

Wall Studs:	SP
Stud Size:	2X6
Chord Material:	SP
Chord Size:	2-2X6
Top Plate & Sill:	SP
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

Total Heigth (ft):	13
Total Length (ft):	11.292
Region H/W:	1.15
Wind ASIF:	1.4
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.40
Stud Spacing (in):	16
K:	1.0

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.569 k/ft**	**0.644 k/ft**	**0.884**	**PASS**

Shear Panel: RS_15/32_10d@4

Panel Grade	RS
Panel Thickness	0.469in
Number Sides	One
Over Gyp. Board	No
Nail Size	10d

NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box

Required Penetration	1.5 in
Required Spacing	4 in
Specific Gravity Adjustment Factor = 1.0	1
Shear Capacity	0.46 k/ft
Reduced Shear Capacity (SGAF)	0.46 k/ft
Adjusted Capacity	0.644 k/ft

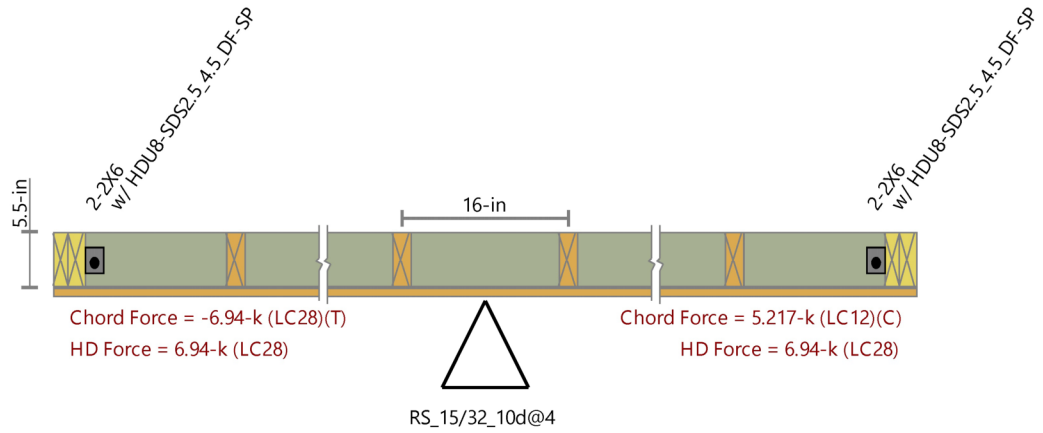
Chord Design	**5.217 k**	**8.618 k**	**0.605**	**PASS**
Gov Compression LC = 12				
Compression Analysis	5.217 k	8.618 k	0.605	PASS
Gov Tension LC = 28				
Tension Analysis	6.94 k	15.84 k	0.438	PASS

Stud Design	**0.237 k**	**4.222 k**	**0.056**	**PASS**
Gov. LC = 6				
Gov. Region = R1				
Spacing = 16 in				

Hold Down Design	**6.94 k**	**7.87 k**	**0.882**	**PASS**
Selected Chord Strap / Hold Down:	HDU8-SDS2.5_4.5_DF-SP			
Governing Load Combination = 28				
Clear Span				4.5
Fastener Size				0
Required chord Mat				Douglas Fir
Base Cap (C_D=1)				4.919 k
C_D Factor				1.6
Adjusted Capacity				7.87 k

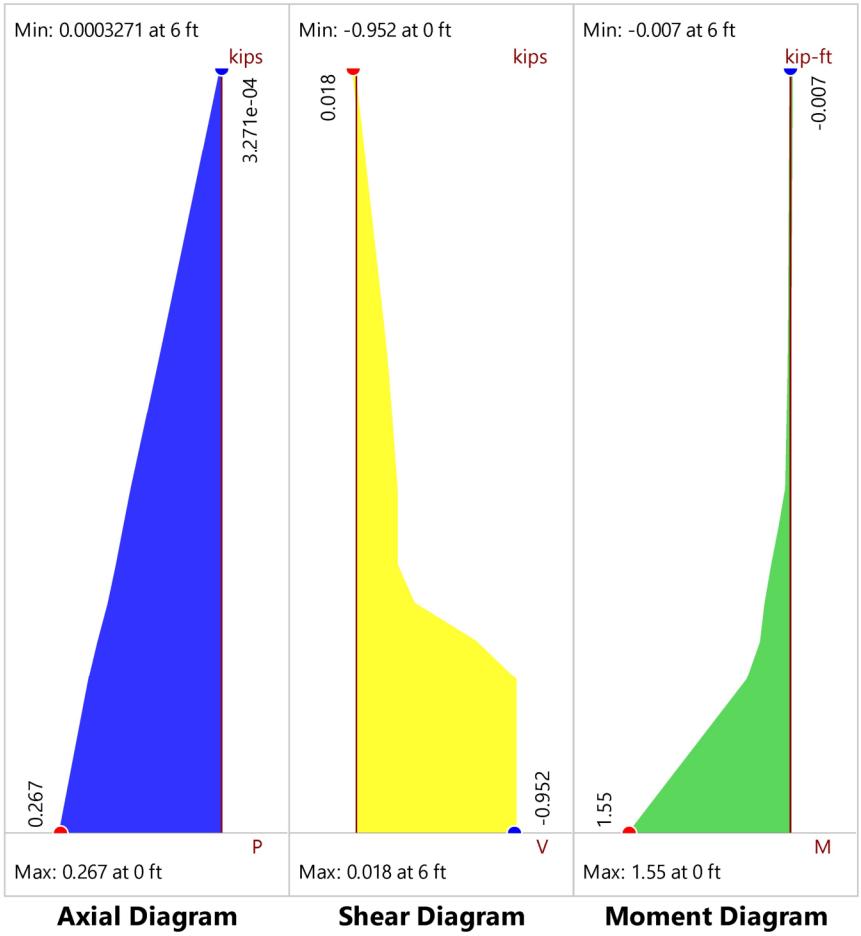
Deflection	
Flexure Compression	0.038 in
Shear Compression	0.435 in
HD Elongation	0.11 in
Total Deflection	0.584 in

Cross Section Detailing



R2 (In-Plane)	**0.131**	**0.014**	**0.007**	**0.003**	**PASS**

Envelope Diagrams



Axial Diagram **Shear Diagram** **Moment Diagram**

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SP
Panel Schedule:	AWC 2015 PLY
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

Wall Studs:	SP
Stud Size:	2X6
Chord Material:	SP
Chord Size:	2-2X6
Top Plate & Sill:	SP
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

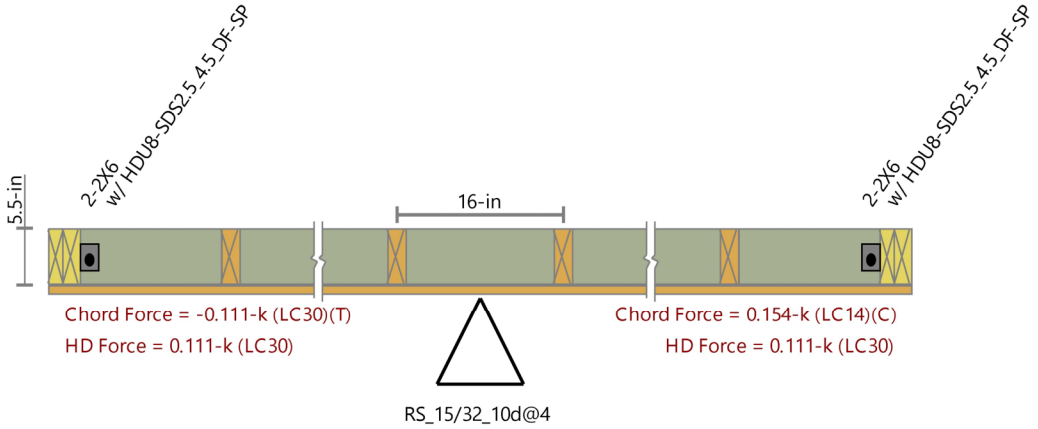
Total Heigth (ft):	6
Total Length (ft):	11.292
Region H/W:	0.53
Wind ASIF:	1.4
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.40
Stud Spacing (in):	16
K:	1.0

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.084 k/ft**	**0.644 k/ft**	**0.131**	**PASS**
Shear Panel: RS_15/32_10d@4				
Panel Grade				RS
Panel Thickness				0.469in
Number Sides				One
Over Gyp. Board				No
Nail Size				10d
NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box				
Required Penetration				1.5 in
Required Spacing				4 in
Specific Gravity Adjustment Factor = 1.0				1
Shear Capacity				0.46 k/ft
Reduced Shear Capacity (SGAF)				0.46 k/ft
Adjusted Capacity				0.644 k/ft
Chord Design	**0.111 k**	**15.84 k**	**0.007**	**PASS**
Gov Compression LC = 14				
Compression Analysis	0.154 k	22.176 k	0.007	PASS
Gov Tension LC = 30				
Tension Analysis	0.111 k	15.84 k	0.007	PASS
Stud Design	**0.03 k**	**10.01 k**	**0.003**	**PASS**
Gov. LC = 5				
Gov. Region = R1				
Spacing = 16 in				
Hold Down Design	**0.111 k**	**7.87 k**	**0.014**	**PASS**
Selected Chord Strap / Hold Down:	HDU8-SDS2.5_4.5_DF-SP			
Governing Load Combination = 30				
Clear Span				4.5
Fastener Size				0
Required chord Mat				Douglas Fir
Base Cap (C_D=1)				4.919 k
C_D Factor				1.6
Adjusted Capacity				7.87 k
Deflection				
Flexure Compression				0.0005583 in
Shear Compression				0.03 in

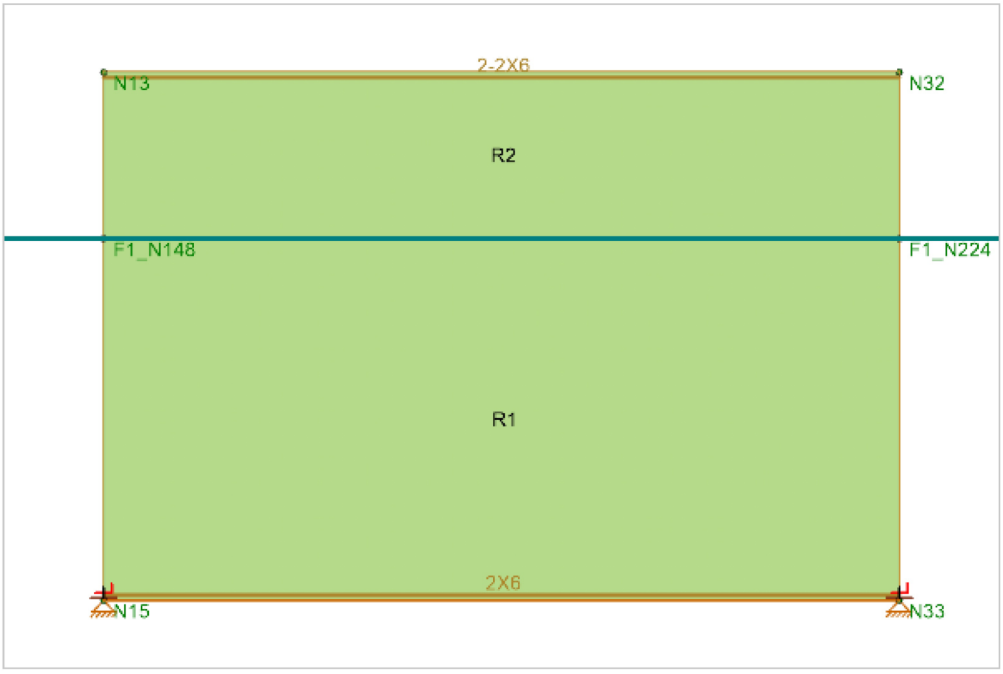
HD Elongation	0.0004738 in
Total Deflection	0.031 in

Cross Section Detailing



Detail Report: WP12B

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Segmented
Height (ft):	19
Length (ft):	28.625
Wall Material:	Southern Pine No.2
Panel Schedule:	AWC 2015 PLY
Sel. Shear Panel:	RS_15/32_10d@6

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	N/A
K:	1

Material Properties:

Top Plate:	Southern Pine No.2	Fb (ksi):	1	Ft (ksi):	0.6
Sill:	Southern Pine No.2	Fv (ksi):	0.175	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Southern Pine No.2	Fc (ksi):	1.4		
Chord:	Southern Pine No.2	Specific Gravity:	0.55		
E:	1400	Density (k/ft^3):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Controlling region					**PASS**
Controlling region R1					
ShearPanel					
RS_15/32_10d@6	29 (W)	0.161 k/ft	0.434 k/ft	0.372	PASS
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer :					
Not Req'd	NC			NC	
Chords					
2-2X6 (Compression)	6 (W)	2.214 k	8.618 k	0.123	PASS
2-2X6 (Compression)	13 (W)	2.214 k	8.618 k	0.257	PASS
Studs					
2X6	6 (W)	0.674 k	4.222 k	0.160	PASS

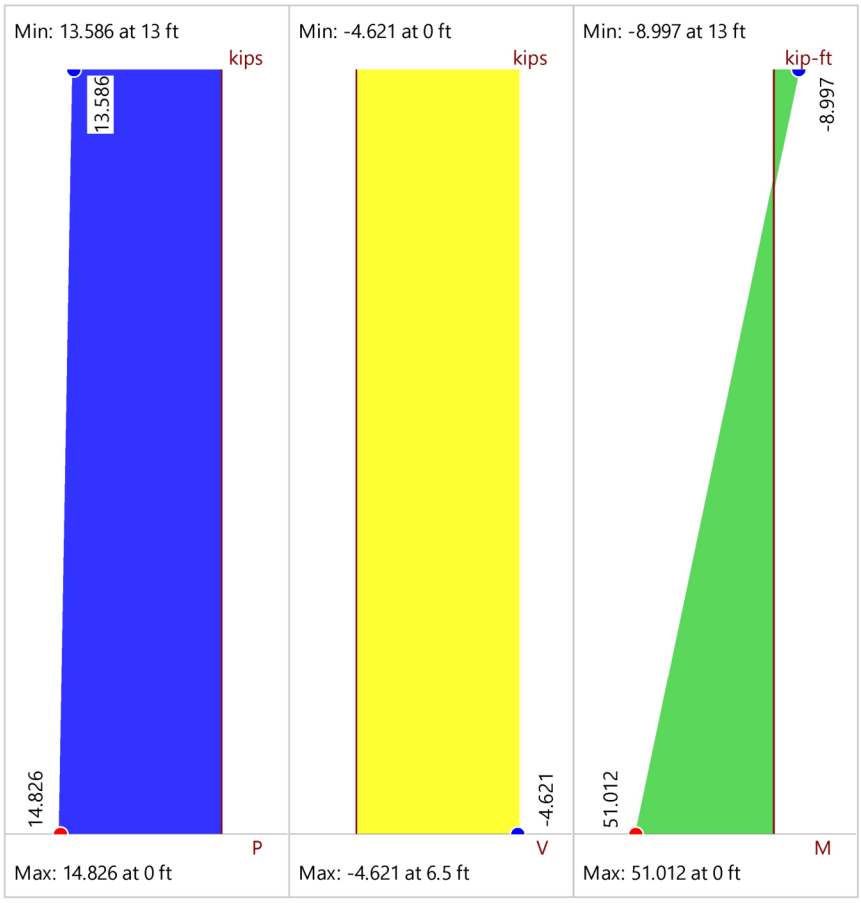
Deflection Results

Maximum Region Deflection (in)	Gov. LC	Finite element Deflection (in)	Shear Stiffness Adjustment Factor (SSAF)
0.154(R1)	29 (W)	0.163	1

Region Design

	Shear UC	Strap / Hold-Down UC	Chord UC	Stud UC	Result
R1 (In-Plane)	**0.372**	**NC**	**0.257**	**0.16**	**PASS**

Envelope Diagrams



Axial Diagram **Shear Diagram** **Moment Diagram**

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SP
Panel Schedule:	AWC 2015 PLY
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

Wall Studs:	SP
Stud Size:	2X6
Chord Material:	SP
Chord Size:	2-2X6
Top Plate & Sill:	SP
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

Total Heigth (ft):	13
Total Length (ft):	28.625
Region H/W:	0.45
Wind ASIF:	1.4
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.40
Stud Spacing (in):	16
K:	1.0

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.161 k/ft**	**0.434 k/ft**	**0.372**	**PASS**

Shear Panel: RS_15/32_10d@6

Panel Grade	RS
Panel Thickness	0.469in
Number Sides	One
Over Gyp. Board	No
Nail Size	10d

NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box

Required Penetration	1.5 in
Required Spacing	6 in
Specific Gravity Adjustment Factor = 1.0	1
Shear Capacity	0.31 k/ft
Reduced Shear Capacity (SGAF)	0.31 k/ft
Adjusted Capacity	0.434 k/ft

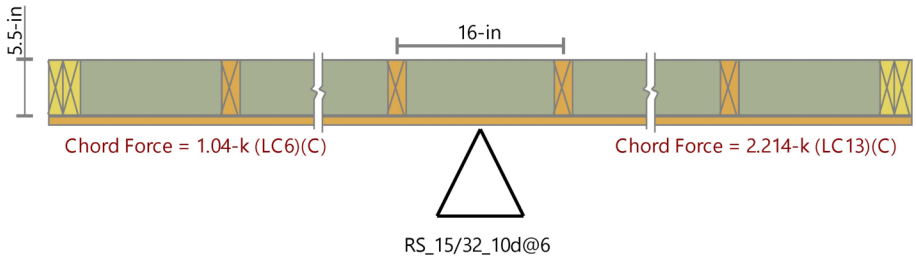
Chord Design	**2.214 k**	**8.618 k**	**0.257**	**PASS**
Gov Compression LC = 13				
Compression Analysis	2.214 k	8.618 k	0.257	PASS
Gov Tension LC = N/A				
Tension Analysis	0 k	15.84 k	0	PASS

Stud Design	**0.674 k**	**4.222 k**	**0.16**	**PASS**
Gov. LC = 6				
Gov. Region = R1				
Spacing = 16 in				

Hold Down Design	**None required**

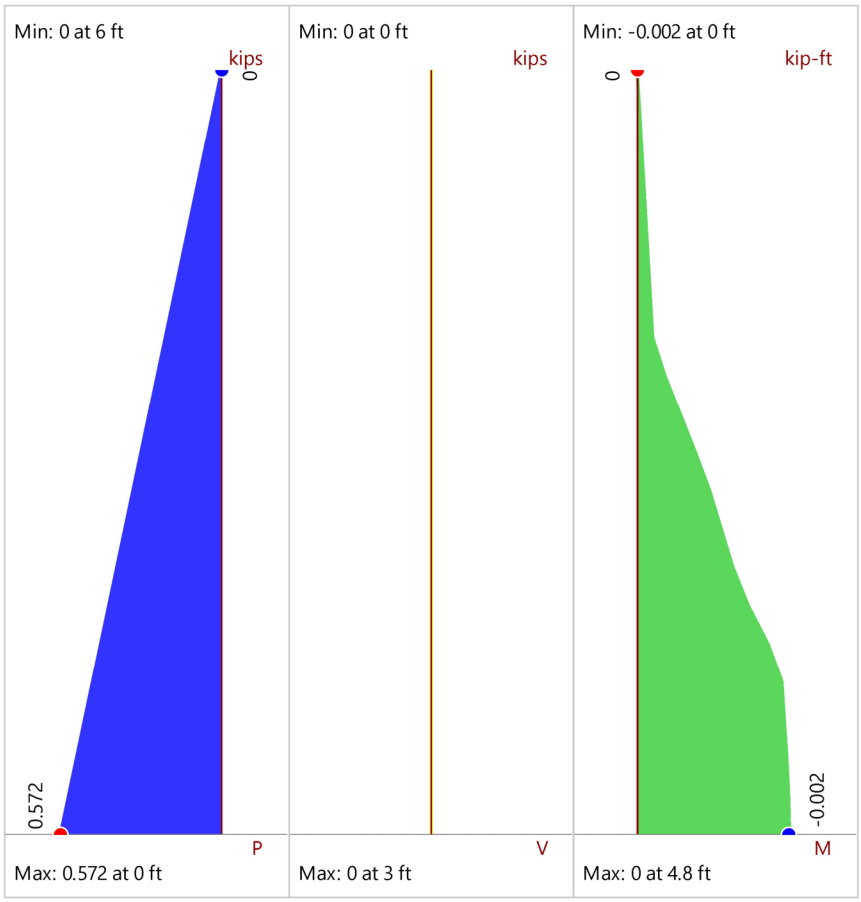
Deflection	
Flexure Compression	0.004 in
Shear Compression	0.15 in
HD Elongation	0 in
Total Deflection	0.154 in

Cross Section Detailing



R2 (In-Plane)	**0**	**NC**	**0.002**	**0.003**	**PASS**

Envelope Diagrams



Axial Diagram **Shear Diagram** **Moment Diagram**

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SP
Panel Schedule:	AWC 2015 PLY
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

Wall Studs:	SP
Stud Size:	2X6
Chord Material:	SP
Chord Size:	2-2X6
Top Plate & Sill:	SP
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

Total Heigth (ft):	6
Total Length (ft):	28.625
Region H/W:	0.21
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.00
Stud Spacing (in):	16
K:	1.0

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0 k/ft**	**0.31 k/ft**	**0**	**PASS**

Shear Panel: RS_15/32_10d@6	
Panel Grade	RS
Panel Thickness	0.469in
Number Sides	One
Over Gyp. Board	No
Nail Size	10d
NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box	
Required Penetration	1.5 in
Required Spacing	6 in
Specific Gravity Adjustment Factor = 1.0	1
Shear Capacity	0.31 k/ft
Reduced Shear Capacity (SGAF)	0.31 k/ft
Adjusted Capacity	0.31 k/ft

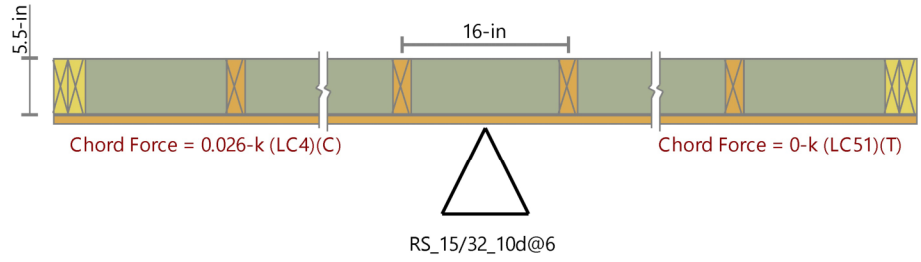
Chord Design	0.026 k	12.474 k	0.002	PASS
Gov Compression LC = 4				
Compression Analysis	0.026 k	12.474 k	0.002	PASS
Gov Tension LC = N/A				
Tension Analysis	0 k	15.84 k	0	PASS

Stud Design	0.026 k	10.01 k	0.003	PASS
Gov. LC = 1				
Gov. Region = R1				
Spacing = 16 in				

Hold Down Design	None required

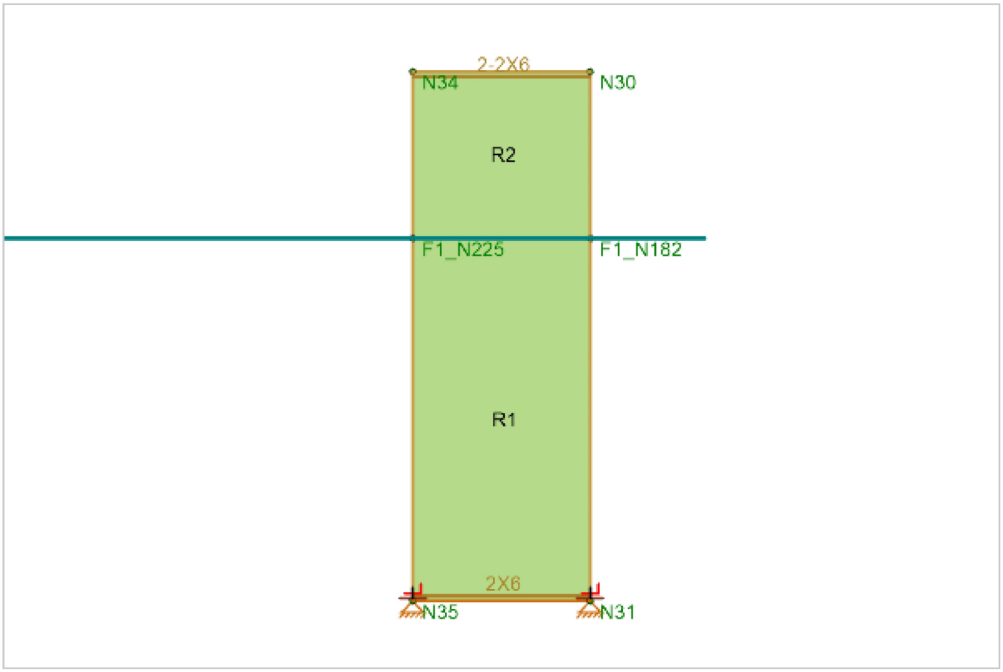
Deflection	
Flexure Compression	0 in
Shear Compression	0 in
HD Elongation	0 in
Total Deflection	0 in

Cross Section Detailing



Detail Report: WP13

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Segmented
Height (ft):	19
Length (ft):	6.375
Wall Material:	Southern Pine No.2
Panel Schedule:	AWC 2015 PLY
Sel. Shear Panel:	RS_15/32_10d@6

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	N/A
K:	1

Material Properties:

Top Plate:	Southern Pine No.2	Fb (ksi):	1	Ft (ksi):	0.6
Sill:	Southern Pine No.2	Fv (ksi):	0.175	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Southern Pine No.2	Fc (ksi):	1.4		
Chord:	Southern Pine No.2	Specific Gravity:	0.55		
E:	1400	Density (k/ft^3):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Controlling region					**PASS**
Controlling region R1					
ShearPanel					
RS_15/32_10d@6	15 (W)	0.144 k/ft	0.432 k/ft	0.332	PASS
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer : Simpson HoldDowns					
HTT5KT_DF-SP	31 (W)	0.977 k	5.445 k	0.179	PASS
Chords					
2-2X6 (Compression)	6 (W)	2.737 k	8.618 k	0.088	PASS
2-2X6 (Compression)	14 (W)	2.737 k	8.618 k	0.318	PASS
Studs					
2X6	6 (W)	0.549 k	4.222 k	0.130	PASS

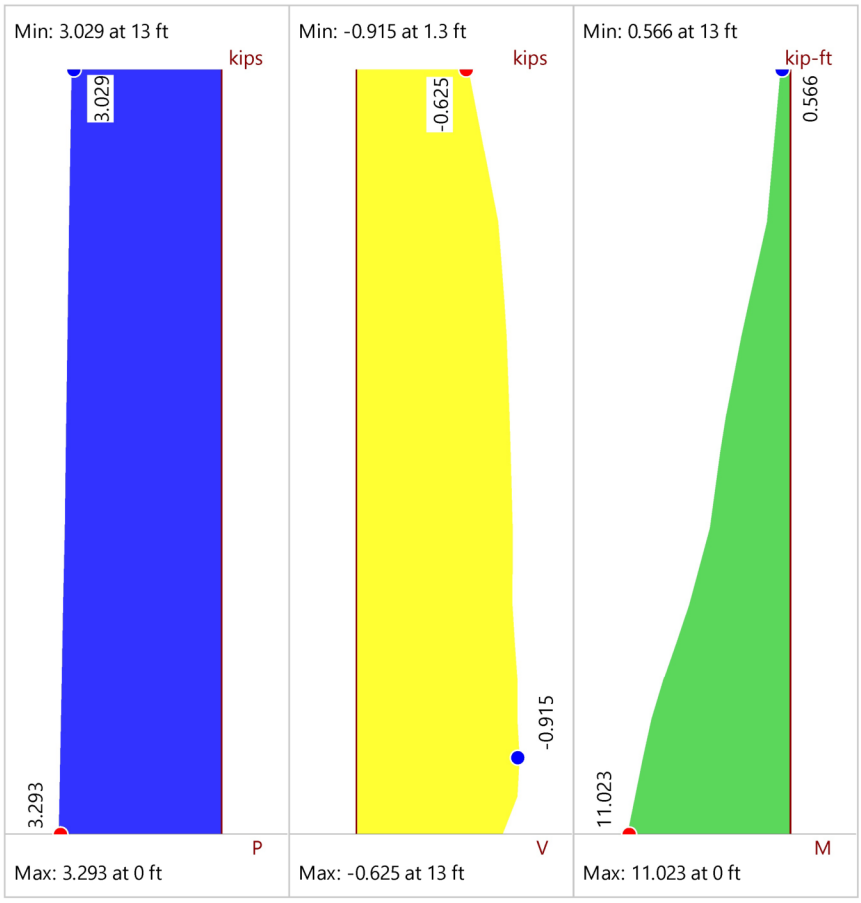
Deflection Results

Maximum Region Deflection (in)	Gov. LC	Finite element Deflection (in)	Shear Stiffness Adjustment Factor (SSAF)
0.17(R1)	15 (W)	0.181	1

Region Design

	Shear UC	Strap / Hold-Down UC	Chord UC	Stud UC	Result
R1 (In-Plane)	**0.332**	**0.179**	**0.318**	**0.13**	**PASS**

Envelope Diagrams



Axial Diagram **Shear Diagram** **Moment Diagram**

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SP
Panel Schedule:	AWC 2015 PLY
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

Wall Studs:	SP
Stud Size:	2X6
Chord Material:	SP
Chord Size:	2-2X6
Top Plate & Sill:	SP
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

Total Heigth (ft):	13
Total Length (ft):	6.375
Region H/W:	2.04
Wind ASIF:	1.4
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.39
Stud Spacing (in):	16
K:	1.0

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.144 k/ft**	**0.432 k/ft**	**0.332**	**PASS**

Shear Panel: RS_15/32_10d@6

Panel Grade	RS
Panel Thickness	0.469in
Number Sides	One
Over Gyp. Board	No
Nail Size	10d

NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box

Required Penetration	1.5 in
Required Spacing	6 in
Specific Gravity Adjustment Factor = 1.0	1
Shear Capacity	0.31 k/ft
Reduced Shear Capacity (SGAF)	0.31 k/ft
Adjusted Capacity	0.432 k/ft

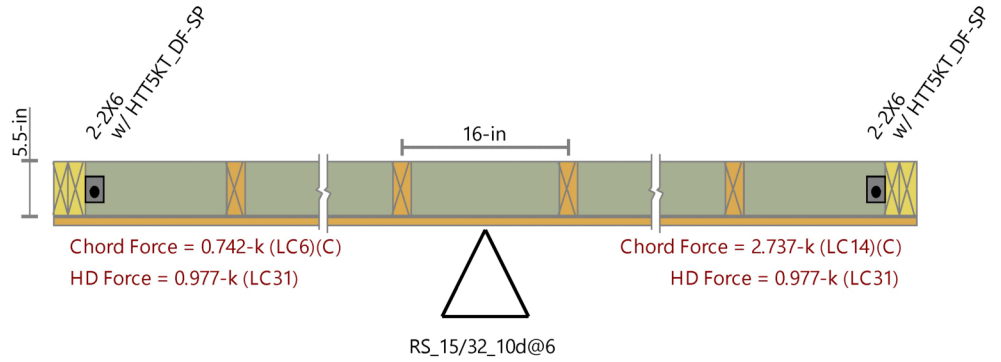
Chord Design	**2.737 k**	**8.618 k**	**0.318**	**PASS**
Gov Compression LC = 14				
Compression Analysis	2.737 k	8.618 k	0.318	PASS
Gov Tension LC = 31				
Tension Analysis	0.977 k	15.84 k	0.062	PASS

Stud Design	**0.549 k**	**4.222 k**	**0.13**	**PASS**
Gov. LC = 6				
Gov. Region = R1				
Spacing = 16 in				

Hold Down Design	**0.977 k**	**5.445 k**	**0.179**	**PASS**
Selected Chord Strap / Hold Down:	HTT5KT_DF-SP			
Governing Load Combination = 31				
Clear Span				3
Fastener Size				0
Required chord Mat				Douglas Fir
Base Cap (C_D=1)				3.403 k
C_D Factor				1.6
Adjusted Capacity				5.445 k

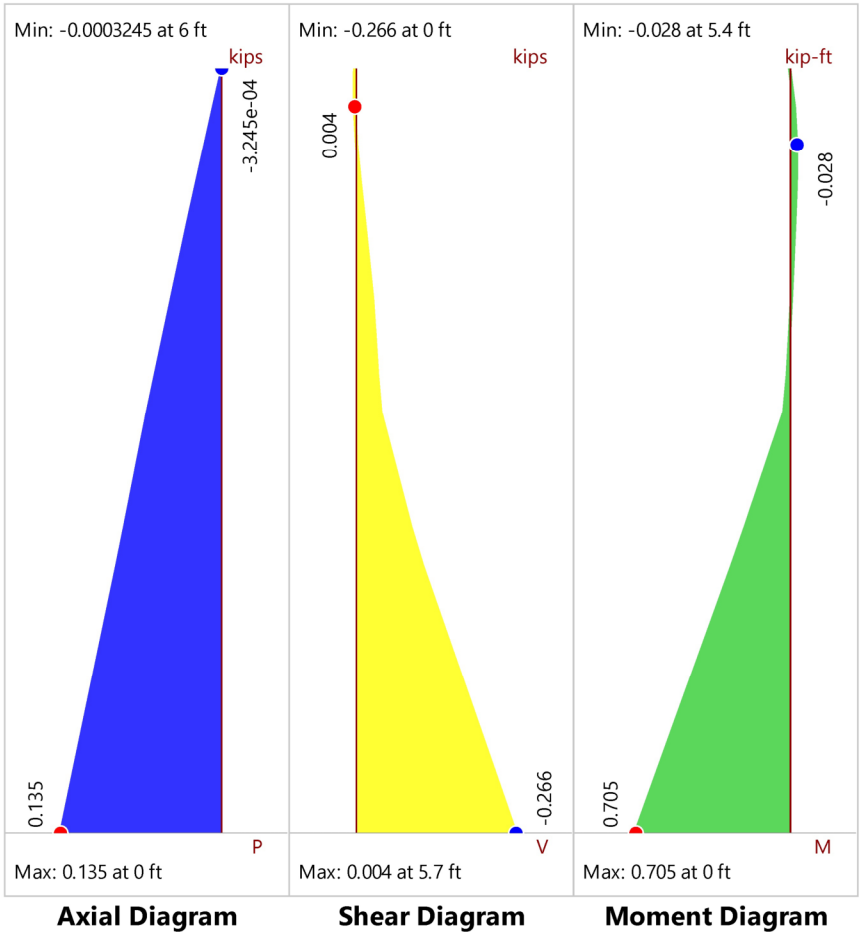
Deflection	
Flexure Compression	0.017 in
Shear Compression	0.133 in
HD Elongation	0.02 in
Total Deflection	0.17 in

Cross Section Detailing



R2 (In-Plane)	**0.096**	**0.009**	**0.007**	**0.002**	**PASS**

Envelope Diagrams



Axial Diagram **Shear Diagram** **Moment Diagram**

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SP
Panel Schedule:	AWC 2015 PLY
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

Wall Studs:	SP
Stud Size:	2X6
Chord Material:	SP
Chord Size:	2-2X6
Top Plate & Sill:	SP
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

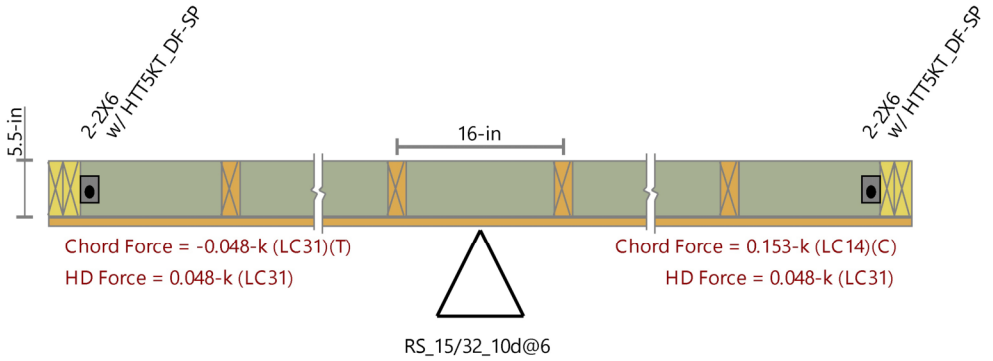
Total Heigth (ft):	6
Total Length (ft):	6.375
Region H/W:	0.94
Wind ASIF:	1.4
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.40
Stud Spacing (in):	16
K:	1.0

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.042 k/ft**	**0.434 k/ft**	**0.096**	**PASS**
Shear Panel: RS_15/32_10d@6				
Panel Grade				RS
Panel Thickness				0.469in
Number Sides				One
Over Gyp. Board				No
Nail Size				10d
NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box				
Required Penetration				1.5 in
Required Spacing				6 in
Specific Gravity Adjustment Factor = 1.0				1
Shear Capacity				0.31 k/ft
Reduced Shear Capacity (SGAF)				0.31 k/ft
Adjusted Capacity				0.434 k/ft
Chord Design	**0.153 k**	**22.176 k**	**0.007**	**PASS**
Gov Compression LC = 14				
Compression Analysis	0.153 k	22.176 k	0.007	PASS
Gov Tension LC = 31				
Tension Analysis	0.048 k	15.84 k	0.003	PASS
Stud Design	**0.023 k**	**10.01 k**	**0.002**	**PASS**
Gov. LC = 1				
Gov. Region = R1				
Spacing = 16 in				
Hold Down Design	**0.048 k**	**5.445 k**	**0.009**	**PASS**
Selected Chord Strap / Hold Down:	HTT5KT_DF-SP			
Governing Load Combination = 31				
Clear Span				3
Fastener Size				0
Required chord Mat				Douglas Fir
Base Cap (C_D=1)				3.403 k
C_D Factor				1.6
Adjusted Capacity				5.445 k
Deflection				
Flexure Compression				0.0004905 in
Shear Compression				0.018 in

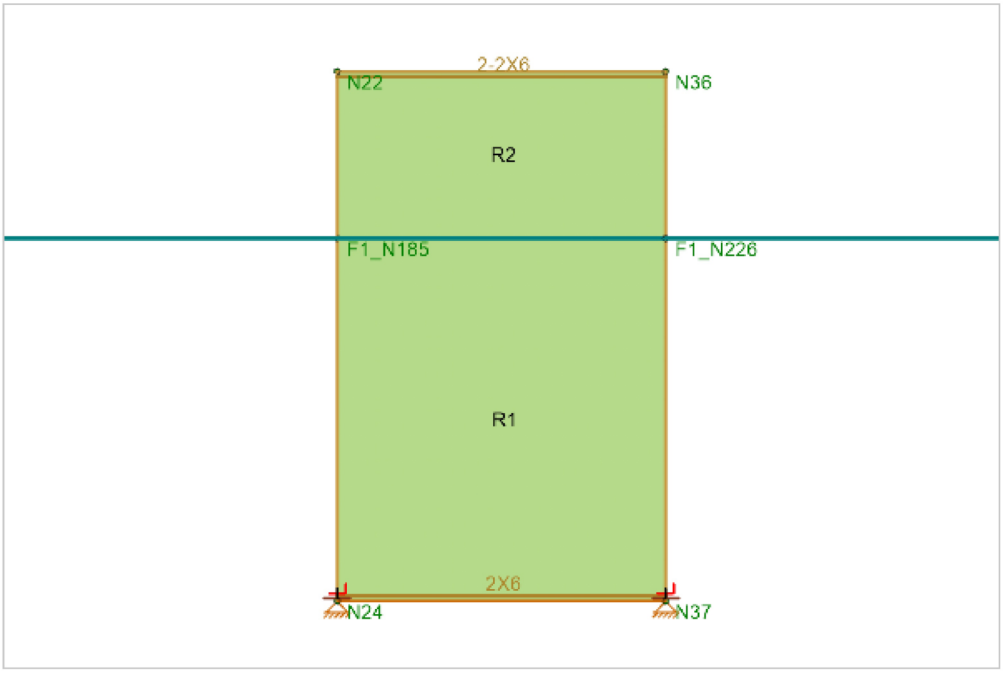
HD Elongation	0.0003149 in
Total Deflection	0.019 in

Cross Section Detailing



Detail Report: WP14A

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Segmented
Height (ft):	19
Length (ft):	11.787
Wall Material:	Southern Pine No.2
Panel Schedule:	AWC 2015 PLY
Sel. Shear Panel:	RS_15/32_10d@6

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	N/A
K:	1

Material Properties:

Top Plate:	Southern Pine No.2	Fb (ksi):	1	Ft (ksi):	0.6
Sill:	Southern Pine No.2	Fv (ksi):	0.175	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Southern Pine No.2	Fc (ksi):	1.4		
Chord:	Southern Pine No.2	Specific Gravity:	0.55		
E:	1400	Density (k/ft^3):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Controlling region					**PASS**
Controlling region R1					
ShearPanel					
RS_15/32_10d@6	31 (W)	0.238 k/ft	0.434 k/ft	0.549	PASS
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer : Simpson HoldDowns					
HTT5KT_DF-SP	31 (W)	1.567 k	5.445 k	0.288	PASS
Chords					
2-2X6 (Compression)	6 (W)	3.46 k	8.618 k	0.101	PASS
2-2X6 (Compression)	15 (W)	3.46 k	8.618 k	0.402	PASS
Studs					
2X6	6 (W)	0.81 k	4.222 k	0.192	PASS

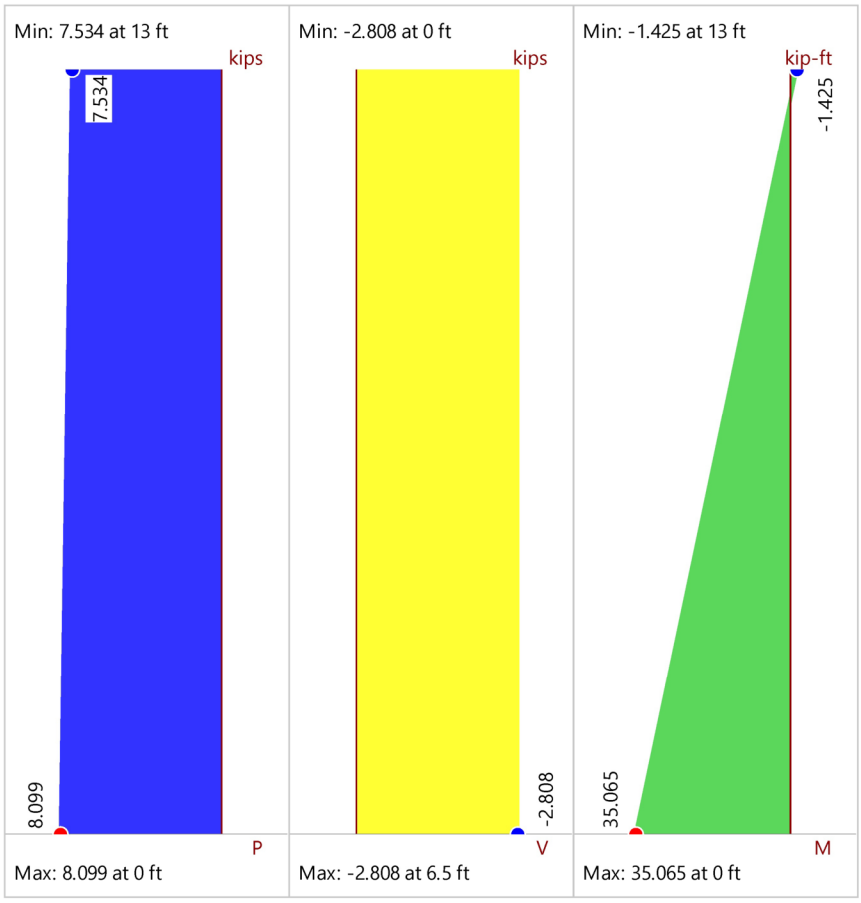
Deflection Results

Maximum Region Deflection (in)	Gov. LC	Finite element Deflection (in)	Shear Stiffness Adjustment Factor (SSAF)
0.269(R1)	31 (W)	0.277	1

Region Design

	Shear UC	Strap / Hold-Down UC	Chord UC	Stud UC	Result
R1 (In-Plane)	**0.549**	**0.288**	**0.402**	**0.192**	**PASS**

Envelope Diagrams



Axial Diagram **Shear Diagram** **Moment Diagram**

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SP
Panel Schedule:	AWC 2015 PLY
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

Wall Studs:	SP
Stud Size:	2X6
Chord Material:	SP
Chord Size:	2-2X6
Top Plate & Sill:	SP
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

Total Heigth (ft):	13
Total Length (ft):	11.787
Region H/W:	1.10
Wind ASIF:	1.4
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.40
Stud Spacing (in):	16
K:	1.0

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.238 k/ft**	**0.434 k/ft**	**0.549**	**PASS**

Shear Panel: RS_15/32_10d@6

Panel Grade	RS
Panel Thickness	0.469in
Number Sides	One
Over Gyp. Board	No
Nail Size	10d

NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box

Required Penetration	1.5 in
Required Spacing	6 in
Specific Gravity Adjustment Factor = 1.0	1
Shear Capacity	0.31 k/ft
Reduced Shear Capacity (SGAF)	0.31 k/ft
Adjusted Capacity	0.434 k/ft

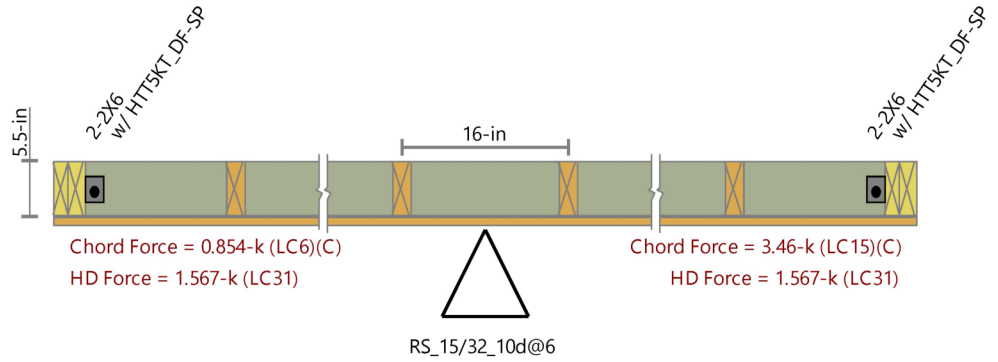
Chord Design	**3.46 k**	**8.618 k**	**0.402**	**PASS**
Gov Compression LC = 15				
Compression Analysis	3.46 k	8.618 k	0.402	PASS
Gov Tension LC = 31				
Tension Analysis	1.567 k	15.84 k	0.099	PASS

Stud Design	**0.81 k**	**4.222 k**	**0.192**	**PASS**
Gov. LC = 6				
Gov. Region = R1				
Spacing = 16 in				

Hold Down Design	**1.567 k**	**5.445 k**	**0.288**	**PASS**
Selected Chord Strap / Hold Down:	HTT5KT_DF-SP			
Governing Load Combination = 31				
Clear Span				3
Fastener Size				0
Required chord Mat				Douglas Fir
Base Cap (C_D=1)				3.403 k
C_D Factor				1.6
Adjusted Capacity				5.445 k

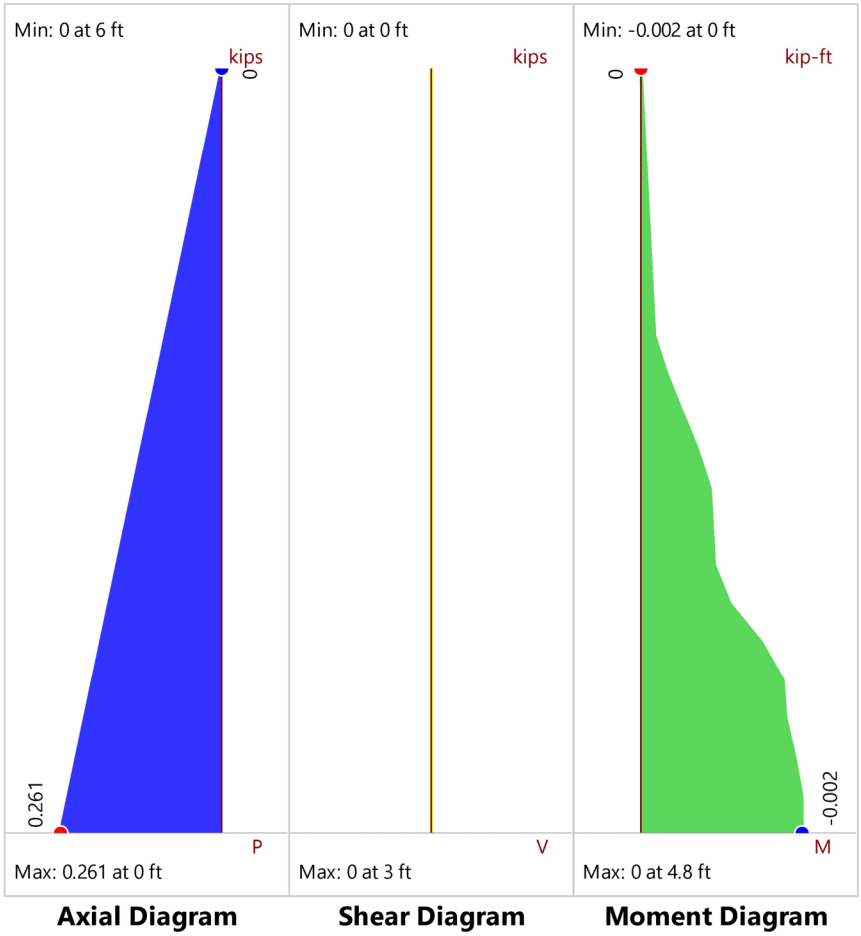
Deflection	
Flexure Compression	0.015 in
Shear Compression	0.221 in
HD Elongation	0.033 in
Total Deflection	0.269 in

Cross Section Detailing



R2 (In-Plane)	**0**	**NC**	**0.002**	**0.003**	**PASS**

Envelope Diagrams



Axial Diagram **Shear Diagram** **Moment Diagram**

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SP
Panel Schedule:	AWC 2015 PLY
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

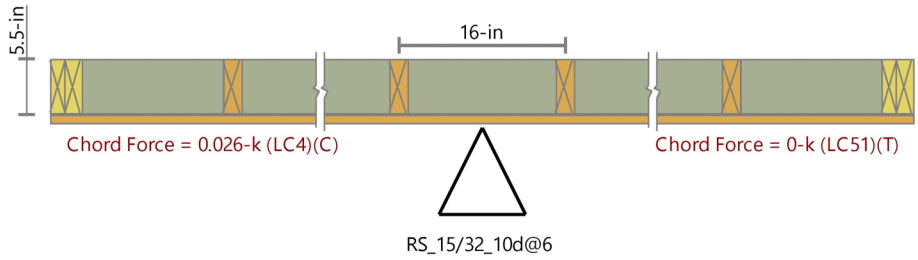
Wall Studs:	SP
Stud Size:	2X6
Chord Material:	SP
Chord Size:	2-2X6
Top Plate & Sill:	SP
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

Total Heigth (ft):	6
Total Length (ft):	11.787
Region H/W:	0.51
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.00
Stud Spacing (in):	16
K:	1.0

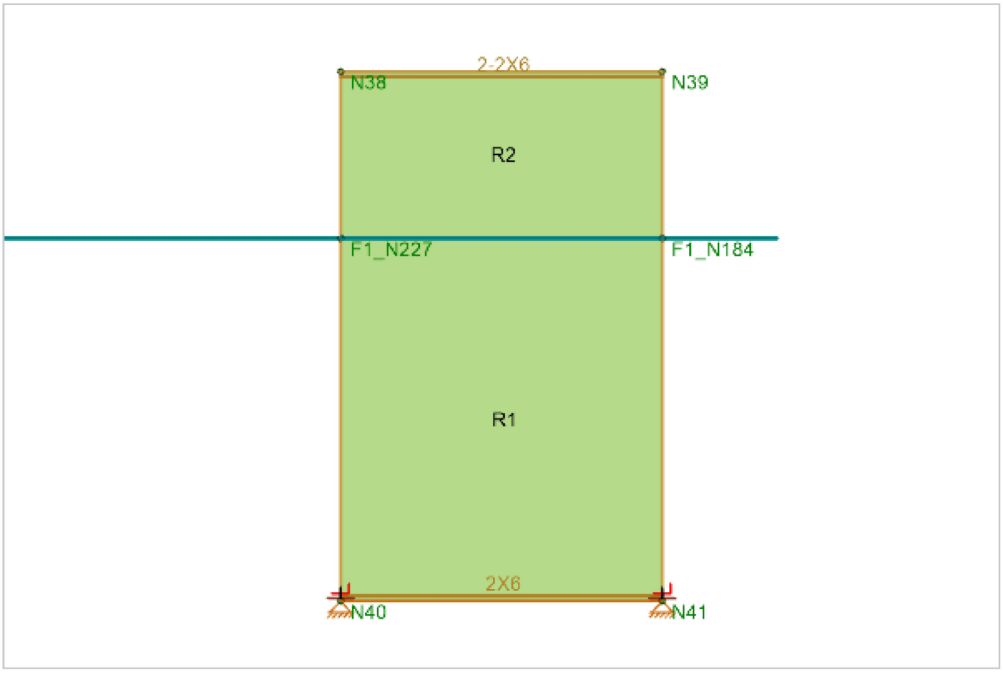
Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0 k/ft**	**0.31 k/ft**	**0**	**PASS**
Shear Panel: RS_15/32_10d@6				
Panel Grade				RS
Panel Thickness				0.469in
Number Sides				One
Over Gyp. Board				No
Nail Size				10d
NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box				
Required Penetration				1.5 in
Required Spacing				6 in
Specific Gravity Adjustment Factor = 1.0				1
Shear Capacity				0.31 k/ft
Reduced Shear Capacity (SGAF)				0.31 k/ft
Adjusted Capacity				0.31 k/ft
Chord Design	**0.026 k**	**12.474 k**	**0.002**	**PASS**
Gov Compression LC = 4				
Compression Analysis	0.026 k	12.474 k	0.002	PASS
Gov Tension LC = N/A				
Tension Analysis	0 k	15.84 k	0	PASS
Stud Design	**0.026 k**	**10.01 k**	**0.003**	**PASS**
Gov. LC = 1				
Gov. Region = R1				
Spacing = 16 in				
Hold Down Design				**None required**
Deflection				
Flexure Compression				0 in
Shear Compression				0 in
HD Elongation				0 in
Total Deflection				0 in
Cross Section Detailing				


5.5-in
16-in
Chord Force = 0.026-k (LC4)(C)
Chord Force = 0-k (LC51)(T)
RS_15/32_10d@6

Detail Report: WP15

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Segmented
Height (ft):	19
Length (ft):	11.542
Wall Material:	Southern Pine No.2
Panel Schedule:	AWC 2015 PLY
Sel. Shear Panel:	RS_15/32_10d@6

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	N/A
K:	1

Material Properties:

Top Plate:	Southern Pine No.2	Fb (ksi):	1	Ft (ksi):	0.6
Sill:	Southern Pine No.2	Fv (ksi):	0.175	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Southern Pine No.2	Fc (ksi):	1.4		
Chord:	Southern Pine No.2	Specific Gravity:	0.55		
E:	1400	Density (k/ft^3):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Controlling region					**PASS**
Controlling region R1					
ShearPanel					
RS_15/32_10d@6	31 (W)	0.224 k/ft	0.434 k/ft	0.515	PASS
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer : Simpson HoldDowns					
HTT5KT_DF-SP	31 (W)	1.849 k	5.445 k	0.340	PASS
Chords					
2-2X6 (Tension)	31 (W)	1.849 k	15.84 k	0.117	PASS
2-2X6 (Compression)	15 (W)	3.311 k	8.618 k	0.384	PASS
Studs					
2X6	6 (W)	0.541 k	4.222 k	0.128	PASS

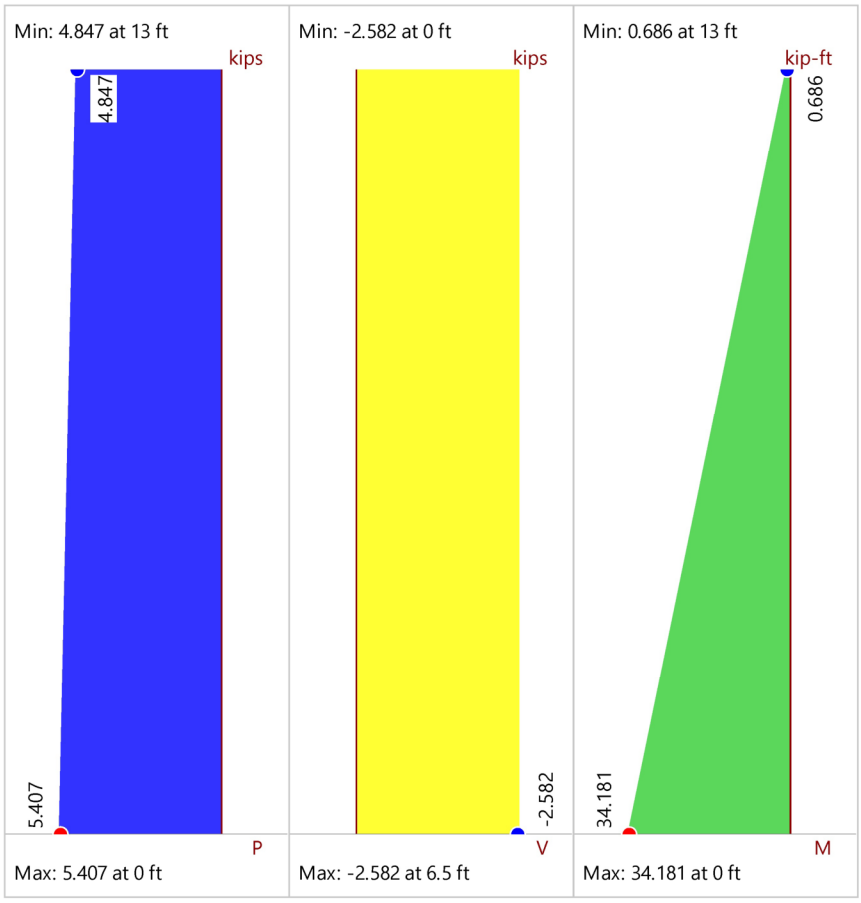
Deflection Results

Maximum Region Deflection (in)	Gov. LC	Finite element Deflection (in)	Shear Stiffness Adjustment Factor (SSAF)
0.262(R1)	31 (W)	0.263	1

Region Design

	Shear UC	Strap / Hold-Down UC	Chord UC	Stud UC	Result
R1 (In-Plane)	**0.515**	**0.34**	**0.384**	**0.128**	**PASS**

Envelope Diagrams



Axial Diagram **Shear Diagram** **Moment Diagram**

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SP
Panel Schedule:	AWC 2015 PLY
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

Wall Studs:	SP
Stud Size:	2X6
Chord Material:	SP
Chord Size:	2-2X6
Top Plate & Sill:	SP
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

Total Heigth (ft):	13
Total Length (ft):	11.542
Region H/W:	1.13
Wind ASIF:	1.4
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.40
Stud Spacing (in):	16
K:	1.0

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.224 k/ft**	**0.434 k/ft**	**0.515**	**PASS**

Shear Panel: RS_15/32_10d@6	
Panel Grade	RS
Panel Thickness	0.469in
Number Sides	One
Over Gyp. Board	No
Nail Size	10d

NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box

Required Penetration	1.5 in
Required Spacing	6 in
Specific Gravity Adjustment Factor = 1.0	1
Shear Capacity	0.31 k/ft
Reduced Shear Capacity (SGAF)	0.31 k/ft
Adjusted Capacity	0.434 k/ft

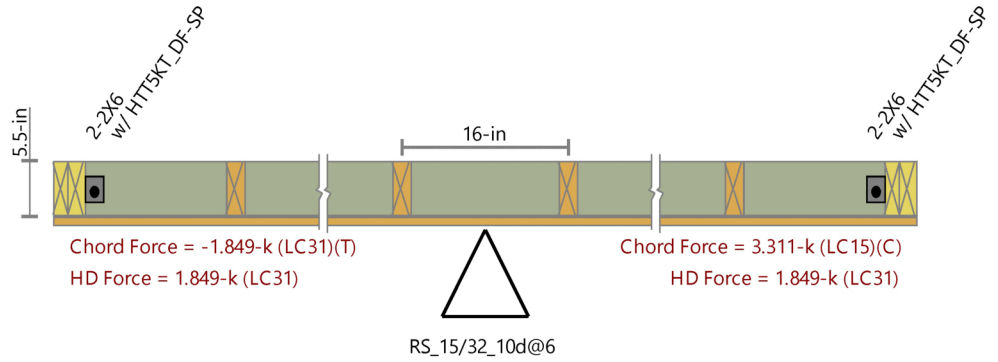
Chord Design	**3.311 k**	**8.618 k**	**0.384**	**PASS**
Gov Compression LC = 15				
Compression Analysis	3.311 k	8.618 k	0.384	PASS
Gov Tension LC = 31				
Tension Analysis	1.849 k	15.84 k	0.117	PASS

Stud Design	**0.541 k**	**4.222 k**	**0.128**	**PASS**
Gov. LC = 6				
Gov. Region = R1				
Spacing = 16 in				

Hold Down Design	**1.849 k**	**5.445 k**	**0.34**	**PASS**
Selected Chord Strap / Hold Down:	HTT5KT_DF-SP			
Governing Load Combination = 31				
Clear Span				3
Fastener Size				0
Required chord Mat				Douglas Fir
Base Cap (C_D=1)				3.403 k
C_D Factor				1.6
Adjusted Capacity				5.445 k

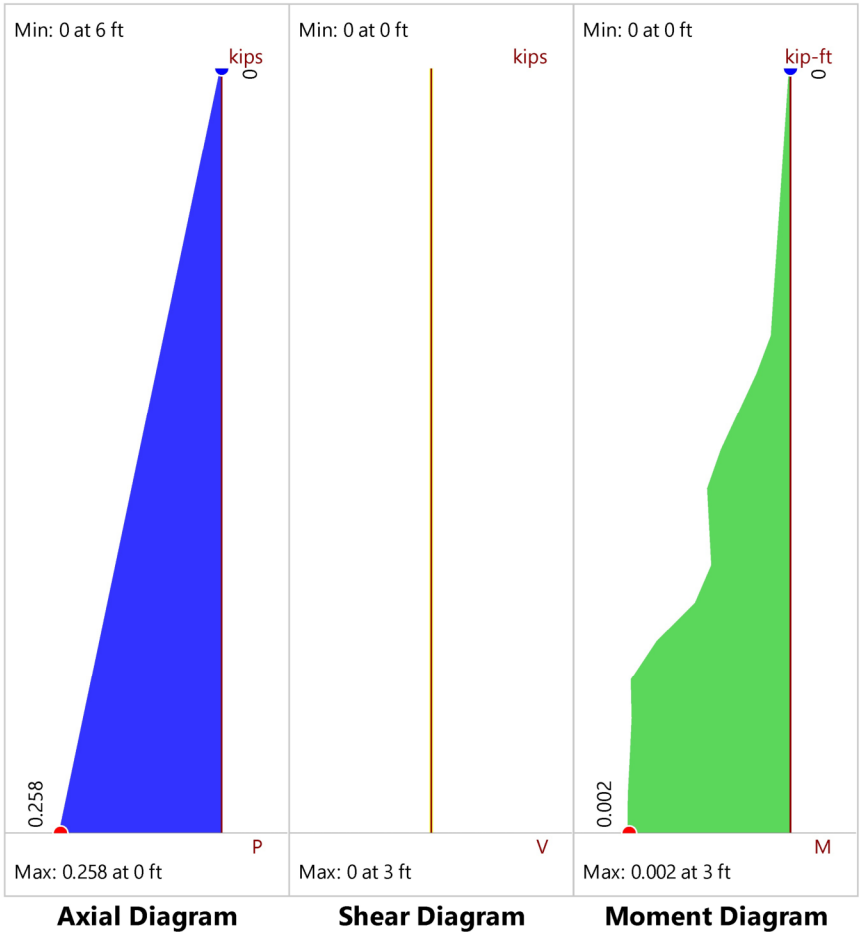
Deflection	
Flexure Compression	0.015 in
Shear Compression	0.208 in
HD Elongation	0.039 in
Total Deflection	0.262 in

Cross Section Detailing



R2 (In-Plane)	**0**	**NC**	**0.002**	**0.003**	**PASS**

Envelope Diagrams



Axial Diagram **Shear Diagram** **Moment Diagram**

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SP
Panel Schedule:	AWC 2015 PLY
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

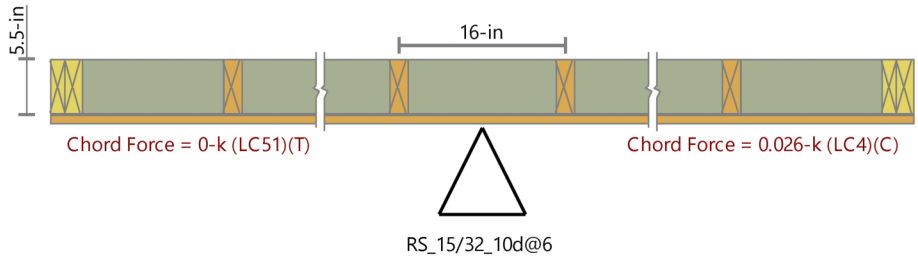
Wall Studs:	SP
Stud Size:	2X6
Chord Material:	SP
Chord Size:	2-2X6
Top Plate & Sill:	SP
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

Total Heigth (ft):	6
Total Length (ft):	11.542
Region H/W:	0.52
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.00
Stud Spacing (in):	16
K:	1.0

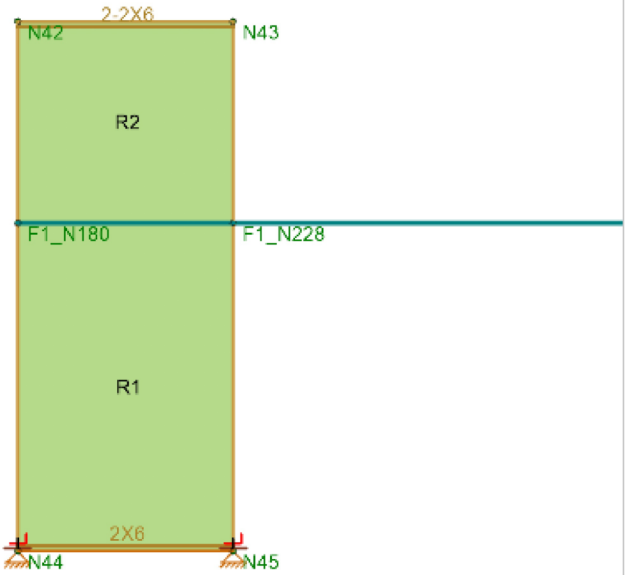
Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0 k/ft**	**0.31 k/ft**	**0**	**PASS**
Shear Panel: RS_15/32_10d@6				
Panel Grade				RS
Panel Thickness				0.469in
Number Sides				One
Over Gyp. Board				No
Nail Size				10d
NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box				
Required Penetration				1.5 in
Required Spacing				6 in
Specific Gravity Adjustment Factor = 1.0				1
Shear Capacity				0.31 k/ft
Reduced Shear Capacity (SGAF)				0.31 k/ft
Adjusted Capacity				0.31 k/ft
Chord Design	**0.026 k**	**12.474 k**	**0.002**	**PASS**
Gov Compression LC = 4				
Compression Analysis	0.026 k	12.474 k	0.002	PASS
Gov Tension LC = N/A				
Tension Analysis	0 k	15.84 k	0	PASS
Stud Design	**0.026 k**	**10.01 k**	**0.003**	**PASS**
Gov. LC = 1				
Gov. Region = R1				
Spacing = 16 in				
Hold Down Design				**None required**
Deflection				
Flexure Compression				0 in
Shear Compression				0 in
HD Elongation				0 in
Total Deflection				0 in
Cross Section Detailing				


5.5-in
16-in
Chord Force = 0-k (LC51)(T)
Chord Force = 0.026-k (LC4)(C)
RS_15/32_10d@6

Detail Report: WP16A

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Segmented
Height (ft):	21
Length (ft):	8.542
Wall Material:	Southern Pine No.2
Panel Schedule:	AWC 2015 PLY
Sel. Shear Panel:	RS_15/32_10d@4

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	N/A
K:	1

Material Properties:

Top Plate:	Southern Pine No.2	Fb (ksi):	1	Ft (ksi):	0.6
Sill:	Southern Pine No.2	Fv (ksi):	0.175	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Southern Pine No.2	Fc (ksi):	1.4		
Chord:	Southern Pine No.2	Specific Gravity:	0.55		
E:	1400	Density (k/ft^3):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Controlling region					**PASS**
Controlling region R1					
ShearPanel					
RS_15/32_10d@4	30 (W)	0.57 k/ft	0.644 k/ft	0.885	PASS
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer : Simpson HoldDowns					
HDU8-SDS2.5_4.5_DF-SP	30 (W)	6.929 k	7.87 k	0.880	PASS
Chords					
2-2X6 (Compression)	14 (W)	7.635 k	8.618 k	0.886	PASS
2-2X6 (Tension)	30 (W)	6.929 k	15.84 k	0.437	PASS
Studs					
2X6	6 (W)	0.336 k	4.222 k	0.080	PASS

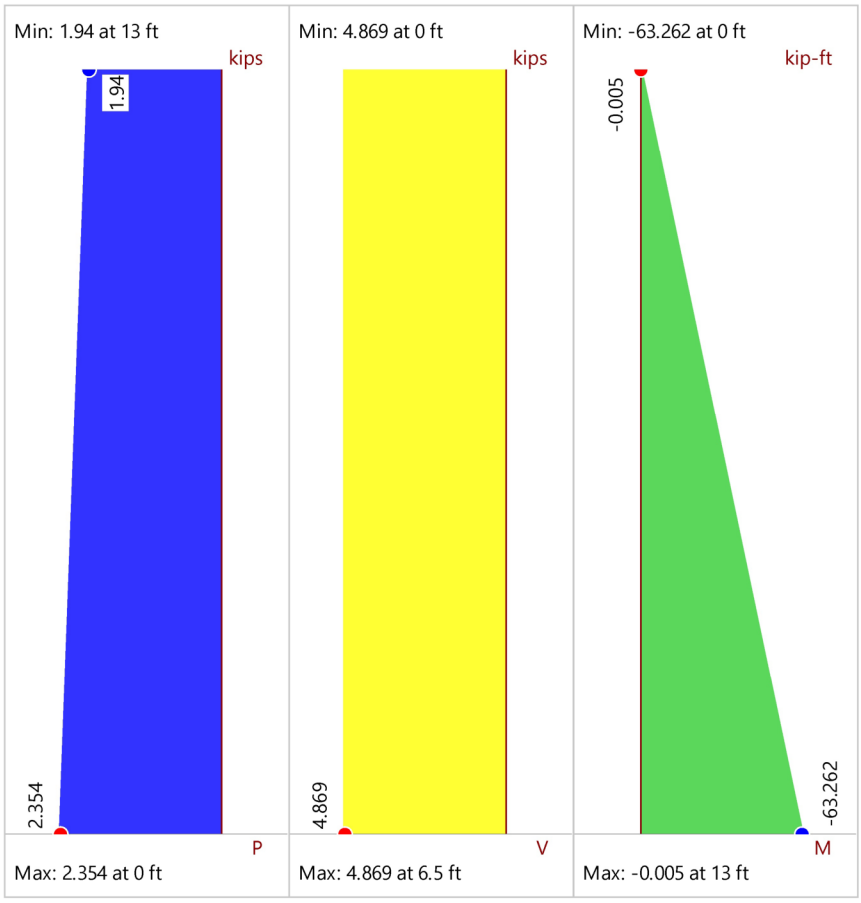
Deflection Results

Maximum Region Deflection (in)	Gov. LC	Finite element Deflection (in)	Shear Stiffness Adjustment Factor (SSAF)
0.638(R1)	30 (W)	0.668	1

Region Design

	Shear UC	Strap / Hold-Down UC	Chord UC	Stud UC	Result
R1 (In-Plane)	**0.885**	**0.88**	**0.886**	**0.08**	**PASS**

Envelope Diagrams



Axial Diagram **Shear Diagram** **Moment Diagram**

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SP
Panel Schedule:	AWC 2015 PLY
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

Wall Studs:	SP
Stud Size:	2X6
Chord Material:	SP
Chord Size:	2-2X6
Top Plate & Sill:	SP
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

Total Heigth (ft):	13
Total Length (ft):	8.542
Region H/W:	1.52
Wind ASIF:	1.4
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.40
Stud Spacing (in):	16
K:	1.0

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.57 k/ft**	**0.644 k/ft**	**0.885**	**PASS**

Shear Panel: RS_15/32_10d@4

Panel Grade	RS
Panel Thickness	0.469in
Number Sides	One
Over Gyp. Board	No
Nail Size	10d

NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box

Required Penetration	1.5 in
Required Spacing	4 in
Specific Gravity Adjustment Factor = 1.0	1
Shear Capacity	0.46 k/ft
Reduced Shear Capacity (SGAF)	0.46 k/ft
Adjusted Capacity	0.644 k/ft

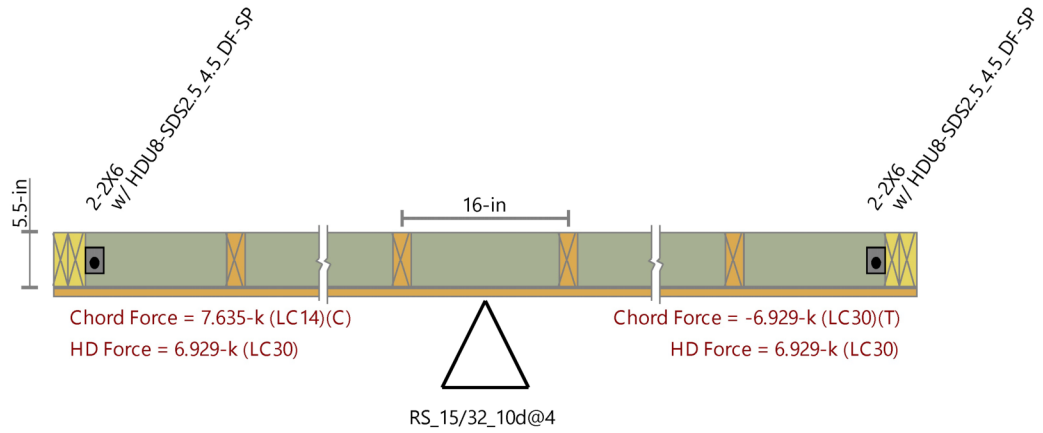
Chord Design	**7.635 k**	**8.618 k**	**0.886**	**PASS**
Gov Compression LC = 14				
Compression Analysis	7.635 k	8.618 k	0.886	PASS
Gov Tension LC = 30				
Tension Analysis	6.929 k	15.84 k	0.437	PASS

Stud Design	**0.336 k**	**4.222 k**	**0.08**	**PASS**
Gov. LC = 6				
Gov. Region = R1				
Spacing = 16 in				

Hold Down Design	**6.929 k**	**7.87 k**	**0.88**	**PASS**
Selected Chord Strap / Hold Down:	HDU8-SDS2.5_4.5_DF-SP			
Governing Load Combination = 30				
Clear Span				4.5
Fastener Size				0
Required chord Mat				Douglas Fir
Base Cap (C_D=1)				4.919 k
C_D Factor				1.6
Adjusted Capacity				7.87 k

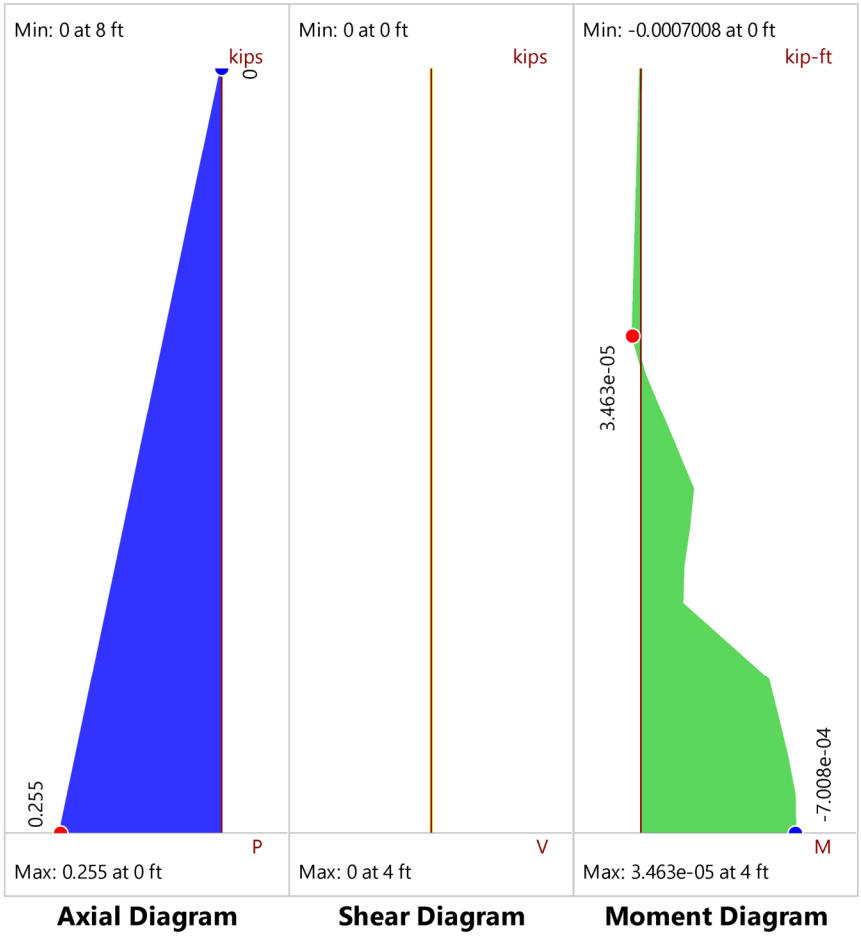
Deflection	
Flexure Compression	0.051 in
Shear Compression	0.436 in
HD Elongation	0.151 in
Total Deflection	0.638 in

Cross Section Detailing



R2 (In-Plane)	**0**	**NC**	**0.003**	**0.004**	**PASS**

Envelope Diagrams



Axial Diagram **Shear Diagram** **Moment Diagram**

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SP
Panel Schedule:	AWC 2015 PLY
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

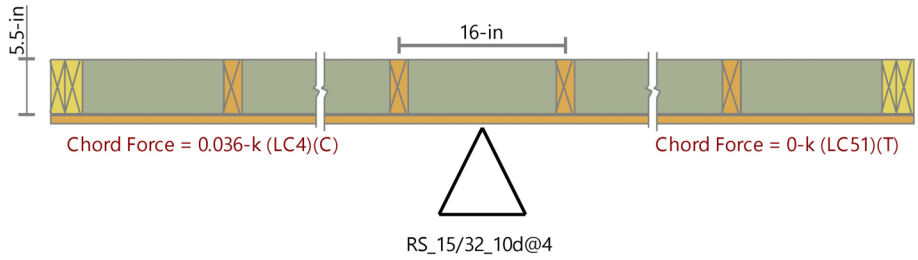
Wall Studs:	SP
Stud Size:	2X6
Chord Material:	SP
Chord Size:	2-2X6
Top Plate & Sill:	SP
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

Total Heigth (ft):	8
Total Length (ft):	8.542
Region H/W:	0.94
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.00
Stud Spacing (in):	16
K:	1.0

Code Check:

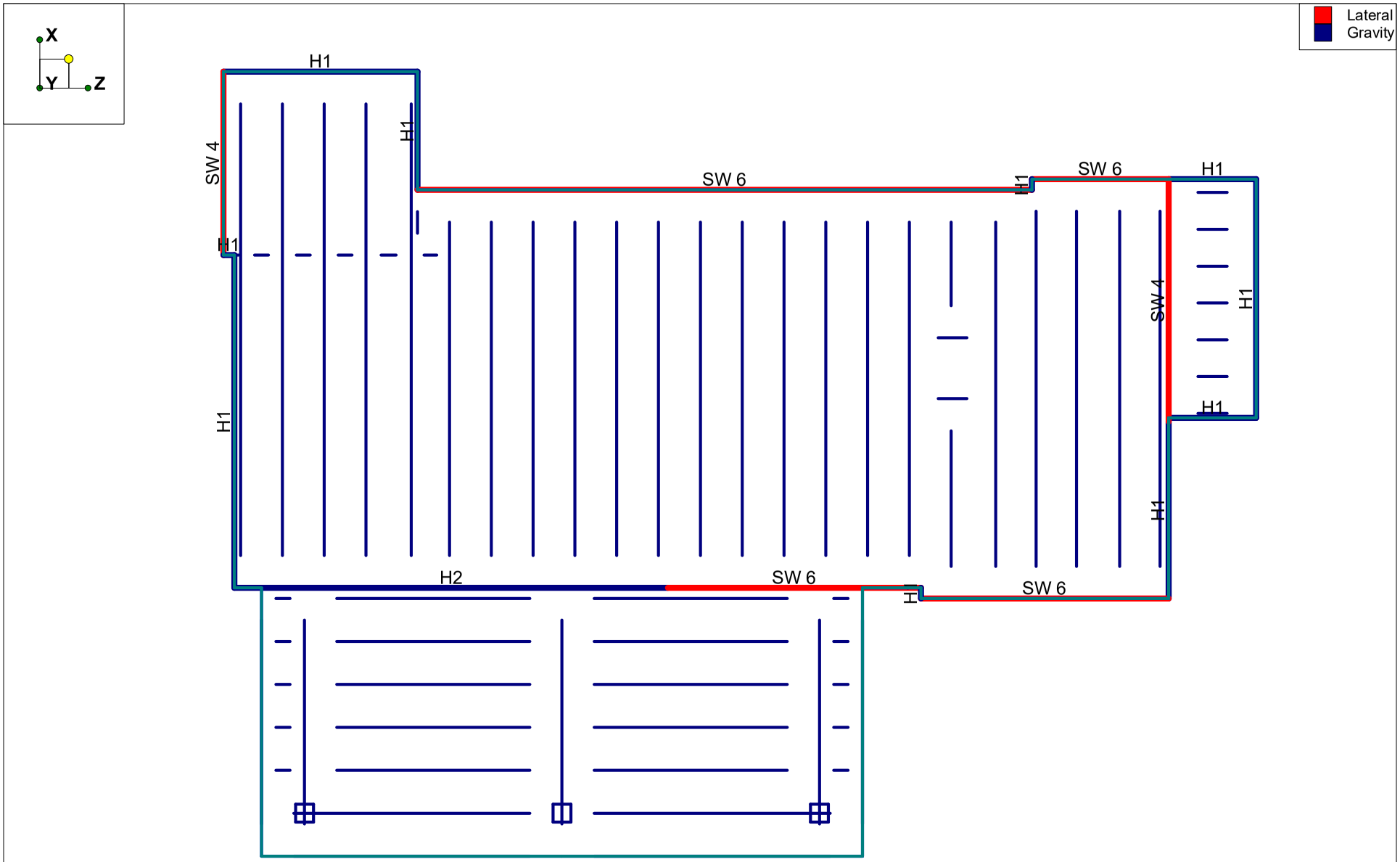
Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0 k/ft**	**0.46 k/ft**	**0**	**PASS**
Shear Panel: RS_15/32_10d@4				
Panel Grade				RS
Panel Thickness				0.469in
Number Sides				One
Over Gyp. Board				No
Nail Size				10d
NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box				
Required Penetration				1.5 in
Required Spacing				4 in
Specific Gravity Adjustment Factor = 1.0				1
Shear Capacity				0.46 k/ft
Reduced Shear Capacity (SGAF)				0.46 k/ft
Adjusted Capacity				0.46 k/ft
Chord Design	**0.036 k**	**12.474 k**	**0.003**	**PASS**
Gov Compression LC = 4				
Compression Analysis	0.036 k	12.474 k	0.003	PASS
Gov Tension LC = N/A				
Tension Analysis	0 k	15.84 k	0	PASS
Stud Design	**0.036 k**	**8.298 k**	**0.004**	**PASS**
Gov. LC = 1				
Gov. Region = R1				
Spacing = 16 in				
Hold Down Design				**None required**
Deflection				
Flexure Compression				0 in
Shear Compression				0 in
HD Elongation				0 in
Total Deflection				0 in
Cross Section Detailing				


5.5-in
16-in
Chord Force = 0.036-k (LC4)(C)
Chord Force = 0-k (LC51)(T)
RS_15/32_10d@4

RISA 3D ANALYSIS

HEADERS

208 N. Main St., Suite H, Columbia, IL 62236 ph (618)281-8505 fax (618)281-8515



Loads: DL PreComp - PreComposite Dead Load
Results for LC 1, IBC 16-8 Post

Kreher Engineering	Roof	SK - 1
NJD	K21-002	Oct 11, 2021 at 12:40 PM
K21-002	SW = SHEAR WALL, H = HEADER	K21-002 - Dutch Bros.rfl

Company : Kreher Engineering
Designer : NJD
Job Number : K21-002
Model Name : K21-002

WP5 (In-Plane)

Sept 21, 2021
9:05 AM
Checked By:_____

GENERAL

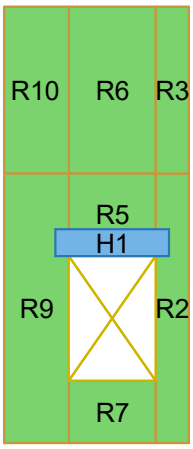
Code	:	**AWC NDS-18:ASD**
Design Method	:	**Segmented**
Wall Material	:	**SP**
Function	:	**Gravity**

GEOMETRY

Total Height	:	**21**	**ft**
Total Length	:	**9.042**	**ft**
Parapet Height	:	**8**	**ft**
Wall H/W Ratio	:	**2.32**	
K	:	**1.00**	

MATERIALS

Description	Material	Size
Top Pl	**SP**	**2-2X6**
Sill	**SP**	**2X6**
Wall Stud	**SP**	**2X6**
Chord	**SP**	**2-2X6**



DESIGN DETAILS

REGION INFORMATION

Full-Height Region Label	Stud Required Cap	Stud Provided Cap	Stud UC	Stud LC
R2	**1.394**	**4.222**	**0.33**	**3**
R3	**0.057**	**7.811**	**0.007**	**1**
R6	**0.032**	**7.811**	**0.004**	**1**
R10	**0.054**	**7.811**	**0.007**	**1**
R9	**1.1**	**4.222**	**0.261**	**3**

OPENING INFORMATION

Header Label	Header Size	Shear UC	Bending UC	Governing LC
H1	**2-2X10**	**0.373**	**0.454**	**3**

Company : Kreher Engineering
Designer : NJD
Job Number : K21-002
Model Name : K21-002

WP6 (In-Plane)

Sept 21, 2021
9:05 AM
Checked By:_____

GENERAL

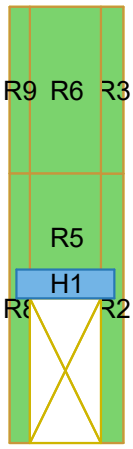
Code	:	**AWC NDS-18:ASD**
Design Method	:	**Segmented**
Wall Material	:	**SP**
Function	:	**Gravity**

GEOMETRY

Total Height	:	**21**	**ft**
Total Length	:	**5.5**	**ft**
Parapet Height	:	**8**	**ft**
Wall H/W Ratio	:	**3.82**	
K	:	**1.00**	

MATERIALS

Description	Material	Size
Top Pl	**SP**	**2-2X6**
Sill	**SP**	**2X6**
Wall Stud	**SP**	**2X6**
Chord	**SP**	**2-2X6**



DESIGN DETAILS

REGION INFORMATION

Full-Height Region Label	Stud Required Cap	Stud Provided Cap	Stud UC	Stud LC
R2	**0.351**	**4.222**	**0.083**	**3**
R3	**0.046**	**7.811**	**0.006**	**1**
R6	**0.029**	**7.811**	**0.004**	**1**
R9	**0.046**	**7.811**	**0.006**	**1**
R8	**0.351**	**4.222**	**0.083**	**3**

OPENING INFORMATION

Header Label	Header Size	Shear UC	Bending UC	Governing LC
H1	**2-2X10**	**0.104**	**0.108**	**3**

Company : Kreher Engineering
Designer : NJD
Job Number : K21-002
Model Name : K21-002

WP8 (In-Plane)

Sept 21, 2021
9:06 AM
Checked By:_____

GENERAL

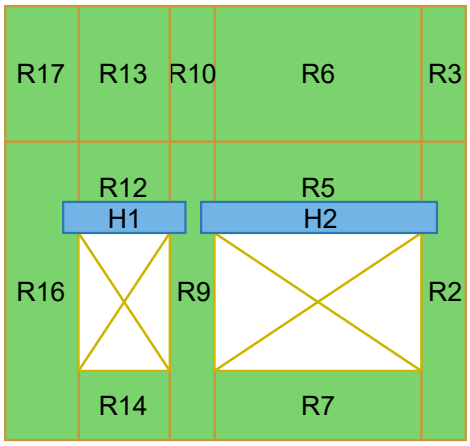
Code	:	**AWC NDS-18:ASD**
Design Method	:	**Segmented**
Wall Material	:	**SP**
Function	:	**Gravity**

GEOMETRY

Total Height	:	**19**	**ft**
Total Length	:	**20.213**	**ft**
Parapet Height	:	**6**	**ft**
Wall H/W Ratio	:	**0.94**	
K	:	**1.00**	

MATERIALS

Description	Material	Size
Top Pl	**SP**	**2-2X6**
Sill	**SP**	**2X6**
Wall Stud	**SP**	**2X6**
Chord	**SP**	**2-2X6**



DESIGN DETAILS

REGION INFORMATION

Full-Height Region Label	Stud Required Cap	Stud Provided Cap	Stud UC	Stud LC
R2	**2.322**	**4.222**	**0.55**	**3**
R3	**0.067**	**9.178**	**0.007**	**1**
R6	**0.023**	**9.178**	**0.003**	**1**
R10	**0.088**	**9.178**	**0.01**	**1**
R9	**3.425**	**4.222**	**0.811**	**3**
R13	**0.021**	**9.178**	**0.002**	**1**
R17	**0.036**	**9.178**	**0.004**	**1**
R16	**1.328**	**4.222**	**0.314**	**3**

OPENING INFORMATION

Header Label	Header Size	Shear UC	Bending UC	Governing LC
H1	**2-1.75X11.875...**	**0.149**	**0.078**	**3**
H2	**2-1.75X11.875...**	**0.342**	**0.337**	**3**

Company : Kreher Engineering
Designer : NJD
Job Number : K21-002
Model Name : K21-002

WP9 (In-Plane)

Sept 21, 2021
9:06 AM
Checked By:_____

GENERAL

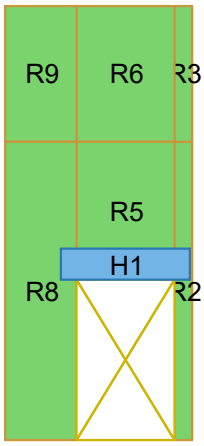
Code	:	**AWC NDS-18:ASD**
Design Method	:	**Segmented**
Wall Material	:	**SP**
Function	:	**Gravity**

GEOMETRY

Total Height	:	**19**	**ft**
Total Length	:	**8.25**	**ft**
Parapet Height	:	**6**	**ft**
Wall H/W Ratio	:	**2.30**	
K	:	**1.00**	

MATERIALS

Description	Material	Size
Top Pl	**SP**	**2-2X6**
Sill	**SP**	**2X6**
Wall Stud	**SP**	**2X6**
Chord	**SP**	**2-2X6**



DESIGN DETAILS

REGION INFORMATION

Full-Height Region Label	Stud Required Cap	Stud Provided Cap	Stud UC	Stud LC
R2	**0.091**	**4.222**	**0.021**	**3**
R3	**0.034**	**9.178**	**0.004**	**1**
R6	**0.024**	**9.178**	**0.003**	**1**
R9	**0.041**	**9.178**	**0.004**	**1**
R8	**0.125**	**4.222**	**0.03**	**3**

OPENING INFORMATION

Header Label	Header Size	Shear UC	Bending UC	Governing LC
H1	**2-2X10**	**0.031**	**0.04**	**3**

Company : Kreher Engineering
Designer : NJD
Job Number : K21-002
Model Name : K21-002

WP12 (In-Plane)

Sept 21, 2021
9:05 AM
Checked By:_____

GENERAL

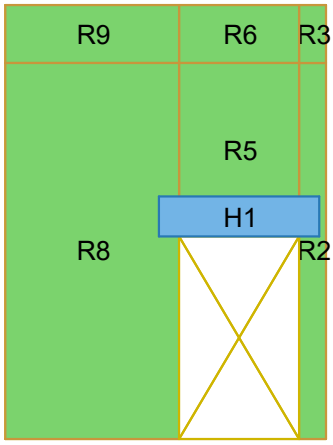
Code	:	**AWC NDS-18:ASD**
Design Method	:	**Segmented**
Wall Material	:	**SP**
Function	:	**Gravity**

GEOMETRY

Total Height	:	**15 ft**
Total Length	:	**11.125 ft**
Parapet Height	:	**2 ft**
Wall H/W Ratio	:	**1.35**
K	:	**1.00**

MATERIALS

Description	Material	Size
Top Pl	**SP**	**2-2X6**
Sill	**SP**	**2X6**
Wall Stud	**SP**	**2X6**
Chord	**SP**	**2-2X6**



DESIGN DETAILS

REGION INFORMATION

Full-Height Region Label	Stud Required Cap	Stud Provided Cap	Stud UC	Stud LC
R2	**0.197**	**4.222**	**0.047**	**3**
R3	**0.011**	**10.315**	**0.001**	**1**
R6	**0.008**	**10.315**	**0**	**1**
R9	**0.01**	**10.315**	**0**	**1**
R8	**0.189**	**4.222**	**0.045**	**3**

OPENING INFORMATION

Header Label	Header Size	Shear UC	Bending UC	Governing LC
H1	**2-2X10**	**0.061**	**0.08**	**3**

Company : Kreher Engineering
Designer : NJD
Job Number : K21-002
Model Name : K21-002

WP17A (In-Plane)

Sept 21, 2021
9:06 AM
Checked By:_____

GENERAL

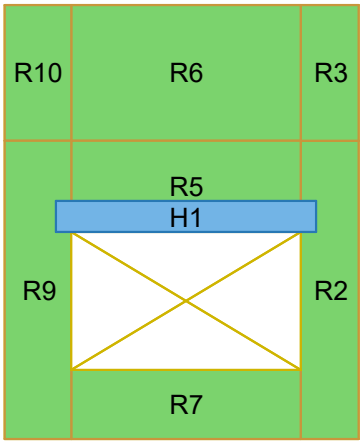
Code	:	**AWC NDS-18:ASD**
Design Method	:	**Segmented**
Wall Material	:	**SP**
Function	:	**Gravity**

GEOMETRY

Total Height	:	**19**	**ft**
Total Length	:	**15.5**	**ft**
Parapet Height	:	**6**	**ft**
Wall H/W Ratio	:	**1.23**	
K	:	**1.00**	

MATERIALS

Description	Material	Size
Top Pl	**SP**	**2-2X6**
Sill	**SP**	**2X6**
Wall Stud	**SP**	**2X6**
Chord	**SP**	**2-2X6**



DESIGN DETAILS

REGION INFORMATION

Full-Height Region Label	Stud Required Cap	Stud Provided Cap	Stud UC	Stud LC
R2	**0.133**	**4.222**	**0.031**	**3**
R3	**0.054**	**9.178**	**0.006**	**1**
R6	**0.027**	**9.178**	**0.003**	**1**
R10	**0.057**	**9.178**	**0.006**	**1**
R9	**0.147**	**4.222**	**0.035**	**3**

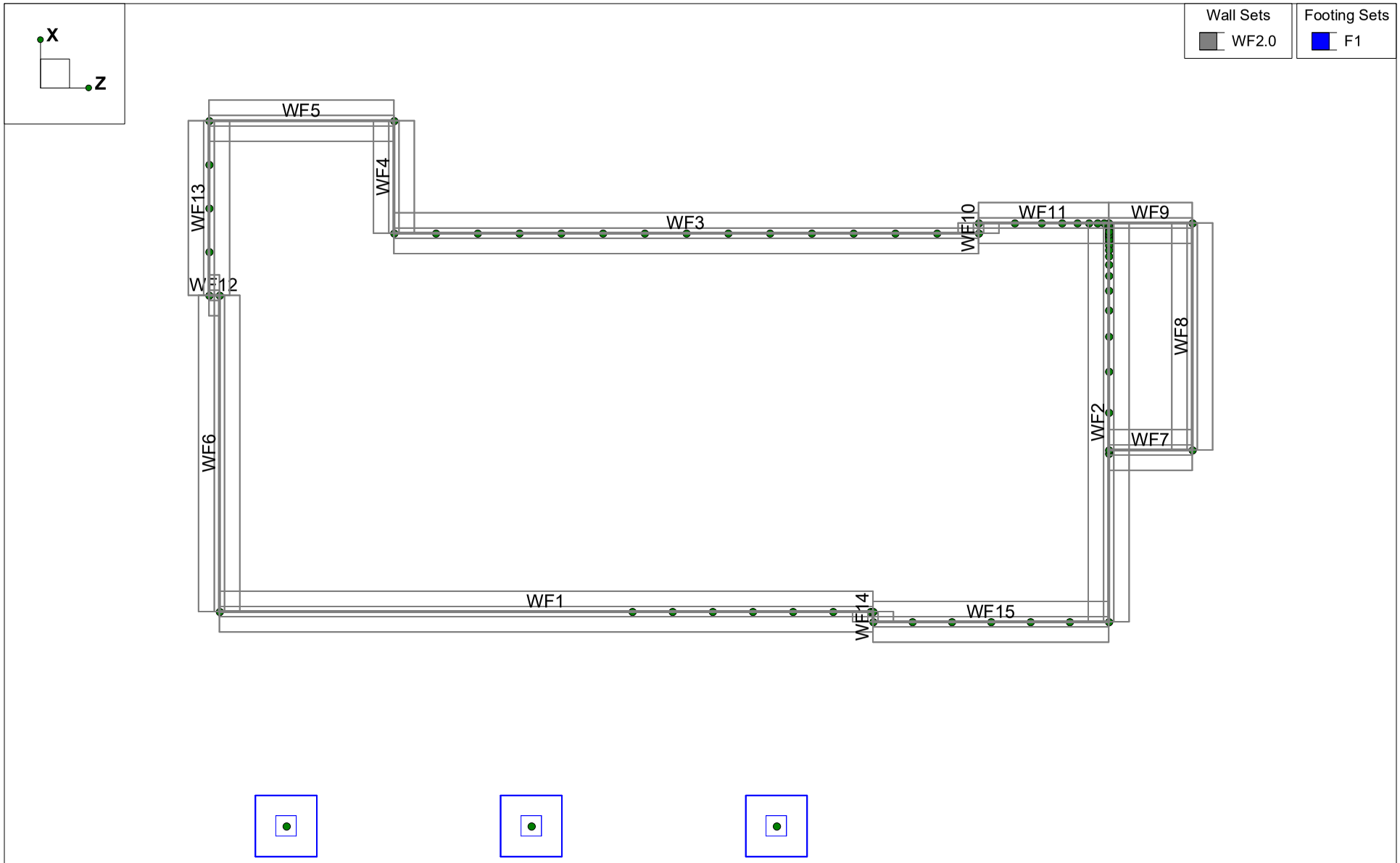
OPENING INFORMATION

Header Label	Header Size	Shear UC	Bending UC	Governing LC
H1	**2-2X10**	**0.059**	**0.178**	**3**

RISA 3D ANALYSIS

BUILDING FOUNDATION

208 N. Main St., Suite H, Columbia, IL 62236 ph (618)281-8505 fax (618)281-8515



Results for LC 1, IBC 16-1

Kreher Engineering	K21-002	SK - 1
NJD		Sept 21, 2021 at 9:17 AM
K21-002		K21-002 - Dutch Bros.rfl

Footing Geometry Results

	Joint	Footing	Length[ft]	Width[ft]	Thickness[in]	ex[in]	ez[in]	Pedestal Ht[in]	Ped Xdim[in]	Ped Zdim[in]
1	FLR_1_N1...	F1	3	3	24	0	0	0	12	12
2	FLR_1_N1...	F1	3	3	24	0	0	0	12	12
3	FLR_1_N1...	F1	3	3	24	0	0	0	12	12

Wall Footing Stability

	Label	Bearing UC	Bearing LC	Max Bearing[ksf]	OT UC	OT UC LC	MOT[k-ft/ft]	Sliding UC	Sliding LC	Sliding Force[k/ft]
1	WF1	0.479	36	1.199	0.132	35	0.187	0	66	0
2	WF2	0.245	43	0.612	0.361	66	0.215	0.085	43	0.018
3	WF3	0.434	36	1.085	0.002	66	0.003	0	66	0
4	WF4	0.261	36	0.652	0.676	67	0.455	0.161	67	0.026
5	WF5	0.466	42	1.166	0.356	42	0.465	0.237	42	0.078
6	WF6	0.353	44	0.882	NC	NC	NC	NC	NC	NC
7	WF7	0.192	44	0.481	NC	NC	NC	NC	NC	NC
8	WF8	0.202	54	0.506	NC	NC	NC	NC	NC	NC
9	WF9	0.236	42	0.591	0.177	42	0.145	0.08	66	0.016
10	WF10	0.489	36	1.223	NC	NC	NC	NC	NC	NC
11	WF11	0.395	42	0.987	0.136	67	0.098	0.061	42	0.022
12	WF12	Not Design...								
13	WF13	0.222	36	0.555	0	67	0	0	66	0
14	WF14	0.559	36	1.399	NC	NC	NC	NC	NC	NC
15	WF15	0.261	36	0.651	0.011	66	0.008	0.001	66	0

SITE STRUCTURE(s)

FOUNDATION DESIGN

Tekla Tedds	Project				Job Ref.	
Kreher Engineering Inc. 208 N Main St., Suite H, Columbia, IL 62236	Dutch Bros				K21-002	
	Section				Sheet no./rev.	
	Menu Board Foundation				1	
	Calc. by	Date	Chk'd by	Date	App'd by	Date
	NJD	9/20/2021				

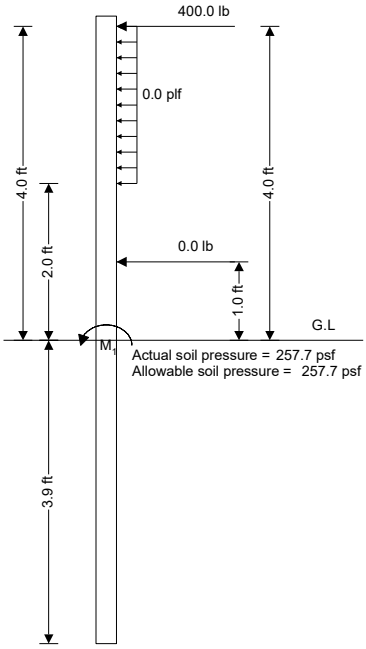
FLAGPOLE EMBEDMENT (IBC)

In accordance with IBC 2018

Tedds calculation version 1.2.02

Design summary

Embedment depth required is 3.87 ft



Soil capacity data

Allowable passive pressure	L_{sbc} = **100** pcf
Maximum allowable passive pressure	P_{max} = **3000** psf
Load factor 1 (1806.1)	LDF_1 = **1.00**
Load factor 2 (1806.3.4)	LDF_2 = **2.0**

Pole geometry

Shape of the pole	**Round**
Diameter of the pole	Dia = **24** in
Laterally restrained	**No**

Load data

First point load	P_1 = **400** lbs
Distance of P_1 from ground surface	H_1 = **4** ft
Second point load	P_2 = **0** lbs
Distance of P_2 from ground surface	H_2 = **1** ft
Uniformly distributed load	W = **0** plf
Start distance of W from ground surface	a = **2** ft
End distance of W from ground surface	a_1 = **4** ft
Applied moment	M_1 = **0** lb_ft

Tekla Tedds
Kreher Engineering Inc.
208 N Main St., Suite H, Columbia, IL 62236

Project				Job Ref.	
Dutch Bros				K21-002	
Section				Sheet no./rev.	
Menu Board Foundation				2	
Calc. by	Date	Chk'd by	Date	App'd by	Date
NJD	9/20/2021				

Distance of M_1 from ground surface — H_3 = **0** ft

Shear force and bending moment

Total shear force — $F = P_1 + P_2 + W \times (a_1 - a)$ = **400** lbs

Total bending moment at grade — $M_g = P_1 \times H_1 + P_2 \times H_2 + W \times (a_1 - a) \times (a + a_1) / 2 + M_1$ = **1600** lb_ft

Distance of resultant lateral force — $h = abs(M_g / F)$ = **4** ft

Embedment depth (1807.3.2.1)

Embedment depth provided — D = **3.87** ft

Allowable lateral passive pressure — $S_1 = min(P_{max}, L_{sbc} \times min(D, 12\ ft) / 3) \times LDF_1 \times LDF_2$ = **257.7** psf

Factor A — $A = 2.34 \times abs(F) / (S_1 \times Dia)$ = **1.8** ft

Embedment depth required — $D_1 = 0.5 \times A \times (1 + (1 + ((4.36 \times h) / A))^{0.5})$ = **3.87** ft

Actual lateral passive pressure — $S_2 = (2.34 \times abs(F) \times ((4.36 \times h) + (4 \times D))) / (4 \times D^2 \times Dia)$ = **257.7** psf

Tekla Tedds	Project				Job Ref.	
Kreher Engineering Inc. 208 N Main St., Suite H, Columbia, IL 62236	Dutch Bros				K21-002	
	Section				Sheet no./rev.	
	DT Canopy Foundation				1	
	Calc. by	Date	Chk'd by	Date	App'd by	Date
	NJD	9/20/2021				

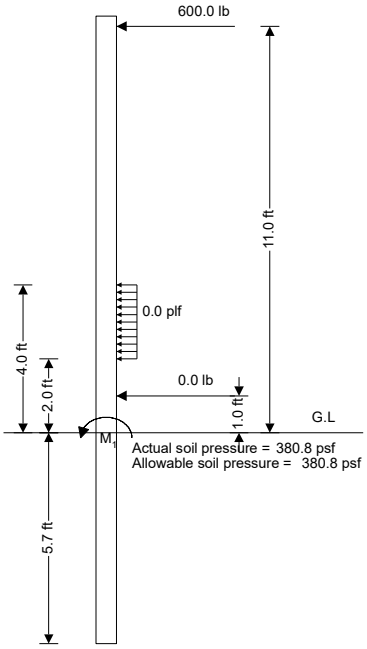
FLAGPOLE EMBEDMENT (IBC)

In accordance with IBC 2018

Tedds calculation version 1.2.02

Design summary

Embedment depth required is 5.71 ft



Soil capacity data

Allowable passive pressure	L_{sbc} = **100** pcf
Maximum allowable passive pressure	P_{max} = **3000** psf
Load factor 1 (1806.1)	LDF_1 = **1.00**
Load factor 2 (1806.3.4)	LDF_2 = **2.0**

Pole geometry

Shape of the pole	**Round**
Diameter of the pole	Dia = **24** in
Laterally restrained	**No**

Load data

First point load	P_1 = **600** lbs
Distance of P_1 from ground surface	H_1 = **11** ft
Second point load	P_2 = **0** lbs
Distance of P_2 from ground surface	H_2 = **1** ft
Uniformly distributed load	W = **0** plf
Start distance of W from ground surface	a = **2** ft
End distance of W from ground surface	a_1 = **4** ft
Applied moment	M_1 = **0** lb_ft

Tekla Tedds
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208 N Main St., Suite H, Columbia, IL 62236

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Calc. by	Date	Chk'd by	Date	App'd by	Date
NJD	9/20/2021				

Distance of M_1 from ground surface	H_3 = **0** ft
Shear force and bending moment	
Total shear force	$F = P_1 + P_2 + W \times (a_1 - a)$ = **600** lbs
Total bending moment at grade	$M_g = P_1 \times H_1 + P_2 \times H_2 + W \times (a_1 - a) \times (a + a_1) / 2 + M_1$ = **6600** lb_ft
Distance of resultant lateral force	$h = abs(M_g / F)$ = **11** ft
Embedment depth (1807.3.2.1)	
Embedment depth provided	D = **5.71** ft
Allowable lateral passive pressure	$S_1 = min(P_{max}, L_{sbc} \times min(D, 12\ ft) / 3) \times LDF_1 \times LDF_2$ = **380.8** psf
Factor A	$A = 2.34 \times abs(F) / (S_1 \times Dia)$ = **1.8** ft
Embedment depth required	$D_1 = 0.5 \times A \times (1 + (1 + ((4.36 \times h) / A))^{0.5})$ = **5.71** ft
Actual lateral passive pressure	$S_2 = (2.34 \times abs(F) \times ((4.36 \times h) + (4 \times D))) / (4 \times D^2 \times Dia)$ = **380.8** psf

Tekla Tedds
Kreher Engineering Inc.
208 N Main St., Suite H, Columbia, IL 62236

Project				Job Ref.	
Dutch Bros				K21-002	
Section				Sheet no./rev.	
Pylon Foundation				1	
Calc. by	Date	Chk'd by	Date	App'd by	Date
NJD	9/21/2021				

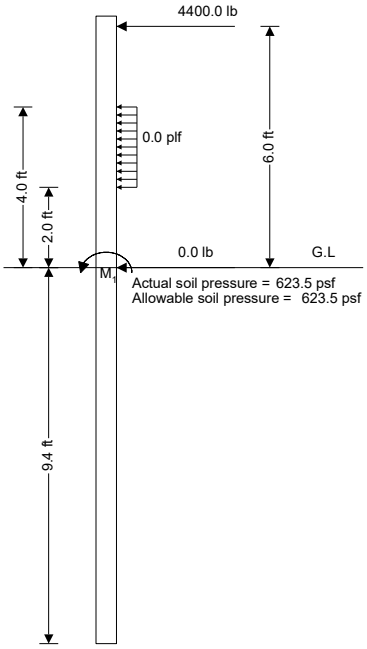
FLAGPOLE EMBEDMENT (IBC)

In accordance with IBC 2018

Tedds calculation version 1.2.02

Design summary

Embedment depth required is 9.35 ft



Soil capacity data

Allowable passive pressure	L_{sbc} = **100** pcf
Maximum allowable passive pressure	P_{max} = **3000** psf
Load factor 1 (1806.1)	LDF_1 = **1.00**
Load factor 2 (1806.3.4)	LDF_2 = **2.0**

Pole geometry

Shape of the pole	**Round**
Diameter of the pole	Dia = **36** in
Laterally restrained	**No**

Load data

First point load	P_1 = **4400** lbs
Distance of P_1 from ground surface	H_1 = **6** ft
Second point load	P_2 = **0** lbs
Distance of P_2 from ground surface	H_2 = **0** ft
Uniformly distributed load	W = **0** plf
Start distance of W from ground surface	a = **2** ft
End distance of W from ground surface	a_1 = **4** ft
Applied moment	M_1 = **0** lb_ft

Tekla Tedds
Kreher Engineering Inc.
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Project				Job Ref.	
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Section				Sheet no./rev.	
Pylon Foundation				2	
Calc. by	Date	Chk'd by	Date	App'd by	Date
NJD	9/21/2021				

Distance of M_1 from ground surface — H_3 = **0** ft

Shear force and bending moment

Total shear force — $F = P_1 + P_2 + W \times (a_1 - a)$ = **4400** lbs

Total bending moment at grade — $M_g = P_1 \times H_1 + P_2 \times H_2 + W \times (a_1 - a) \times (a + a_1) / 2 + M_1$ = **26400** lb_ft

Distance of resultant lateral force — $h = abs(M_g / F)$ = **6** ft

Embedment depth (1807.3.2.1)

Embedment depth provided — D = **9.35** ft

Allowable lateral passive pressure — $S_1 = min(P_{max}, L_{sbc} \times min(D, 12\ ft) / 3) \times LDF_1 \times LDF_2$ = **623.5** psf

Factor A — $A = 2.34 \times abs(F) / (S_1 \times Dia)$ = **5.5** ft

Embedment depth required — $D_1 = 0.5 \times A \times (1 + (1 + ((4.36 \times h) / A))^{0.5})$ = **9.35** ft

Actual lateral passive pressure — $S_2 = (2.34 \times abs(F) \times ((4.36 \times h) + (4 \times D))) / (4 \times D^2 \times Dia)$ = **623.5** psf

Tekla Tedds	Project				Job Ref.	
Kreher Engineering Inc. 208 N Main St., Suite H, Columbia, IL 62236	Dutch Bros				K21-002	
	Section				Sheet no./rev.	
	Light Pole Foundation				1	
	Calc. by	Date	Chk'd by	Date	App'd by	Date
	NJD	9/20/2021				

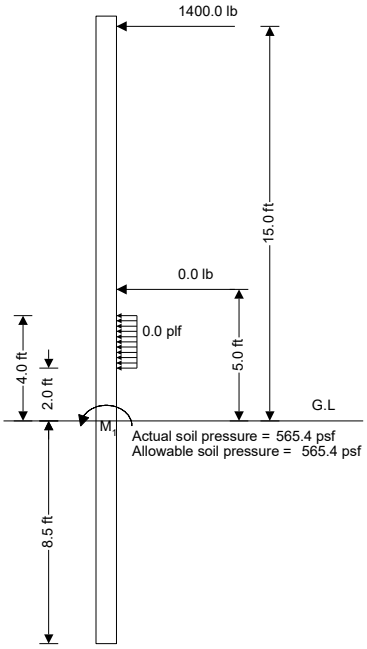
FLAGPOLE EMBEDMENT (IBC)

In accordance with IBC 2018

Tedds calculation version 1.2.02

Design summary

Embedment depth required is 8.48 ft



Soil capacity data

Allowable passive pressure	L_{sbc} = **100** pcf
Maximum allowable passive pressure	P_{max} = **3000** psf
Load factor 1 (1806.1)	LDF_1 = **1.00**
Load factor 2 (1806.3.4)	LDF_2 = **2.0**

Pole geometry

Shape of the pole	**Round**
Diameter of the pole	Dia = **24** in
Laterally restrained	**No**

Load data

First point load	P_1 = **1400** lbs
Distance of P_1 from ground surface	H_1 = **15** ft
Second point load	P_2 = **0** lbs
Distance of P_2 from ground surface	H_2 = **5** ft
Uniformly distributed load	W = **0** plf
Start distance of W from ground surface	a = **2** ft
End distance of W from ground surface	a_1 = **4** ft
Applied moment	M_1 = **0** lb_ft

Tekla Tedds
Kreher Engineering Inc.
208 N Main St., Suite H, Columbia, IL 62236

Project				Job Ref.	
Dutch Bros				K21-002	
Section				Sheet no./rev.	
Light Pole Foundation				2	
Calc. by	Date	Chk'd by	Date	App'd by	Date
NJD	9/20/2021				

Distance of M_1 from ground surface — H_3 = **0** ft

Shear force and bending moment

Total shear force — $F = P_1 + P_2 + W \times (a_1 - a)$ = **1400** lbs

Total bending moment at grade — $M_g = P_1 \times H_1 + P_2 \times H_2 + W \times (a_1 - a) \times (a + a_1) / 2 + M_1$ = **21000** lb_ft

Distance of resultant lateral force — $h = abs(M_g / F)$ = **15** ft

Embedment depth (1807.3.2.1)

Embedment depth provided — D = **8.48** ft

Allowable lateral passive pressure — $S_1 = min(P_{max}, L_{sbc} \times min(D, 12\ ft) / 3) \times LDF_1 \times LDF_2$ = **565.4** psf

Factor A — $A = 2.34 \times abs(F) / (S_1 \times Dia)$ = **2.9** ft

Embedment depth required — $D_1 = 0.5 \times A \times (1 + (1 + ((4.36 \times h) / A))^{0.5})$ = **8.48** ft

Actual lateral passive pressure — $S_2 = (2.34 \times abs(F) \times ((4.36 \times h) + (4 \times D))) / (4 \times D^2 \times Dia)$ = **565.4** psf

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Project Name/Number : Dutch Bros
Title **Trash Enclosure Wall & Ftg**
Dsgnr: **NJD**
Description....

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Cantilevered Retaining Wall

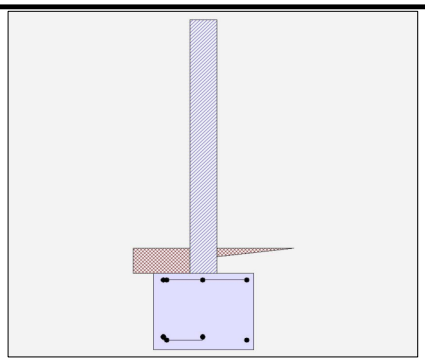
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	0.67 ft
Wall height above soil	=	6.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	8.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	39.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.300
Soil height to ignore for passive pressure	=	28.00 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 (Strength Level)	=	33.0 psf

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

Design Summary

Wall Stability Ratios

Overturning	=	2.23	OK
Sliding	=	2.41	OK
Total Bearing Load	=	1,378 lbs	
...resultant ecc.	=	6.48 in	
Soil Pressure @ Toe	=	1,294 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,811 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	3.3 psi	OK
Footing Shear @ Heel	=	1.6 psi	OK
Allowable	=	94.9 psi	

Sliding Calcs

Lateral Sliding Force	=	257.8 lbs	
less 100% Passive Force	= -	208.3 lbs	
less 100% Friction Force	= -	413.3 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	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Masonry
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 5
Rebar Spacing =	48.00
Rebar Placed at =	Center
Design Data	
fb/FB + fa/Fa =	**0.574**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	212.0
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	729.8
Moment.....Allowable =	1,270.3
Shear.....Actual	
Service Level psi =	
Strength Level psi =	2.3
Shear.....Allowable psi =	90.0
Anet (Masonry) in2 =	91.50
Rebar Depth 'd' in =	3.75
Masonry Data	
f'm psi =	2,500
Fy psi =	60,000
Solid Grouting =	Yes
Modular Ratio 'n' =	12.89
Wall Weight psf =	84.0
Equiv. Solid Thick. in =	7.60
Masonry Block Type =	Normal Weight
Masonry Design Method =	LRFD
Concrete Data	
f'c psi =	
Fy psi =	

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Project Name/Number : Dutch Bros
Title **Trash Enclosure Wall & Ftg**
Dsgnr: **NJD**
Description....

This Wall in File: K:\Acad\Jobs\K21-002 Dutch Bros\K21-002M Shawnee KS\Final Calculations\NJD\05 - R

Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Footing Data

Toe Width	=	0.92 ft
Heel Width	=	1.58
Total Footing Width	=	2.50
Footing Thickness	=	24.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 4,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,811	0 psf
Mu' : Upward	=	7,819	0 ft-#
Mu' : Downward	=	3,079	3,082 ft-#
Mu: Design	=	67	257 ft-#
Actual 1-Way Shear	=	3.28	1.56 psi
Allow 1-Way Shear	=	50.60	50.60 psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = # 5 @ 12.00 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: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 1.30 in2
Min footing T&S reinf Area per foot 0.52 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 4.63 in	#4@ 9.26 in
#5@ 7.18 in	#5@ 14.35 in
#6@ 10.19 in	#6@ 20.37 in

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		139.0	0.89	123.7	Soil Over HL (ab. water tbl)	67.5	2.04	137.9
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.04	137.9
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	=	118.8	5.67	673.6	Soil Over Toe	=	0.46	
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	560.3	1.25	700.3
					Earth @ Stem Transitions	=			
					Footing Weight	=	749.9	1.25	937.3
					Key Weight	=			
					Vert. Component	=			
Total	=	257.8	**O.T.M.** =	797.3	**Total =**	1,377.7 lbs	**R.M.=**	1,775.4

Resisting/Overturning Ratio = **2.23**
Vertical Loads used for Soil Pressure = 1,377.7 lbs

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

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)	0.000	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.

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 =	40.63 in
Development length for #5 bar specified in this stem design segment =	40.63 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	8.30 in
As Provided =	0.0775 in2/ft
As Required =	0.0456 in2/ft

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Project Name/Number : Dutch Bros
Title **Trash Enclosure Wall & Ftg**
Dsgnr: **NJD**
Description....

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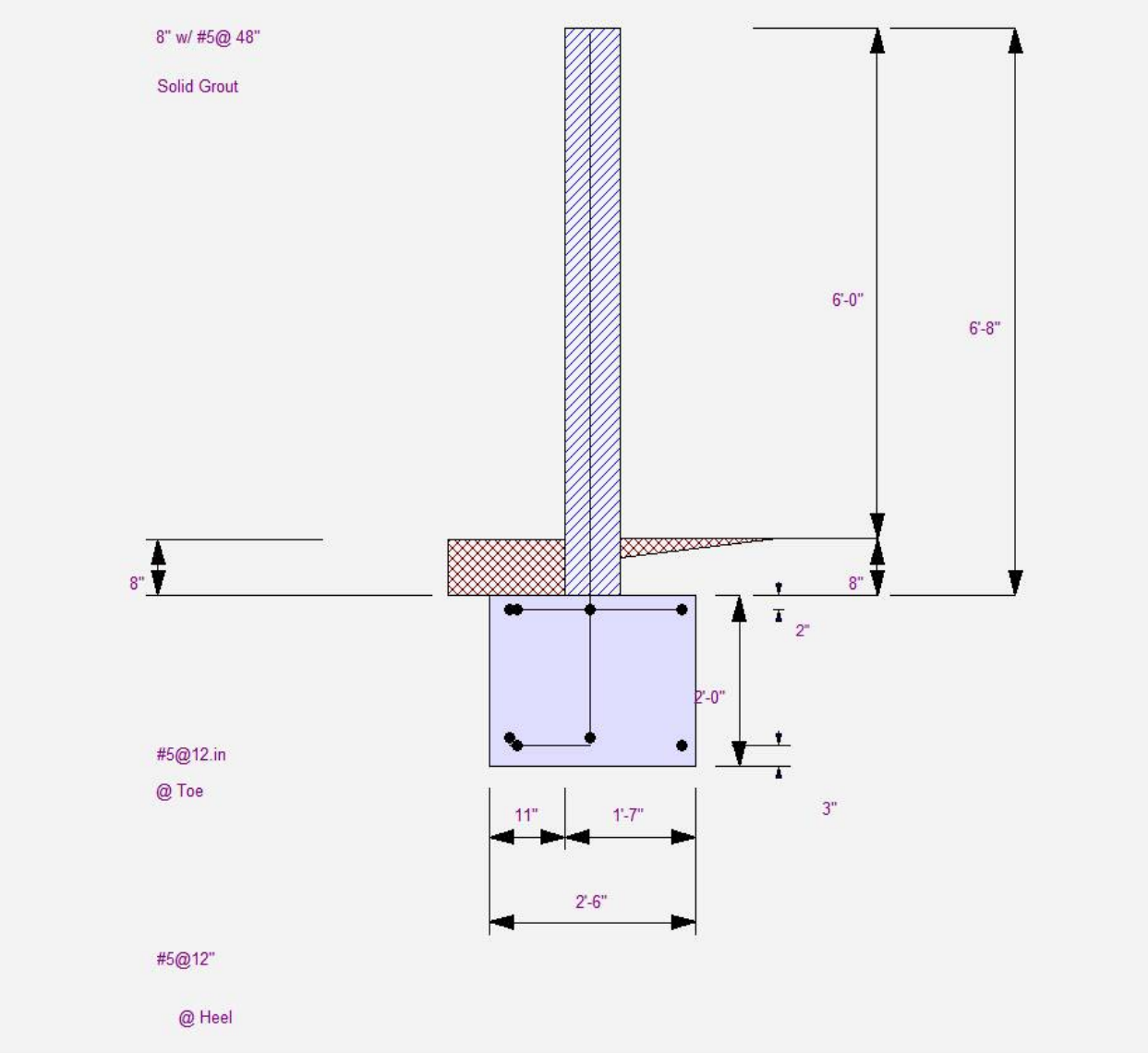
Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13



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Project Name/Number : Dutch Bros
Title **Trash Enclosure Wall & Ftg**
Dsgnr: **NJD**
Description....

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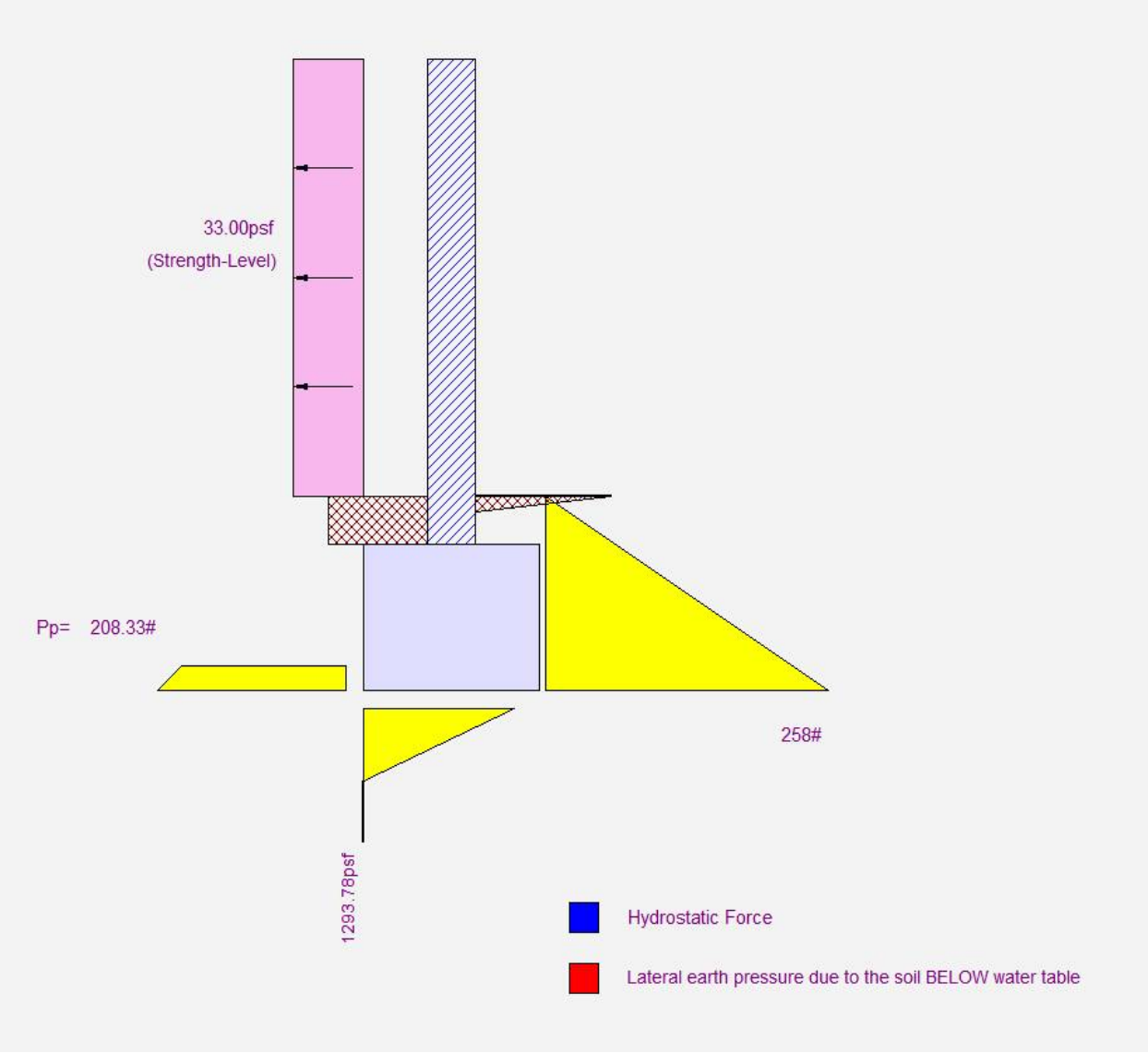
Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13



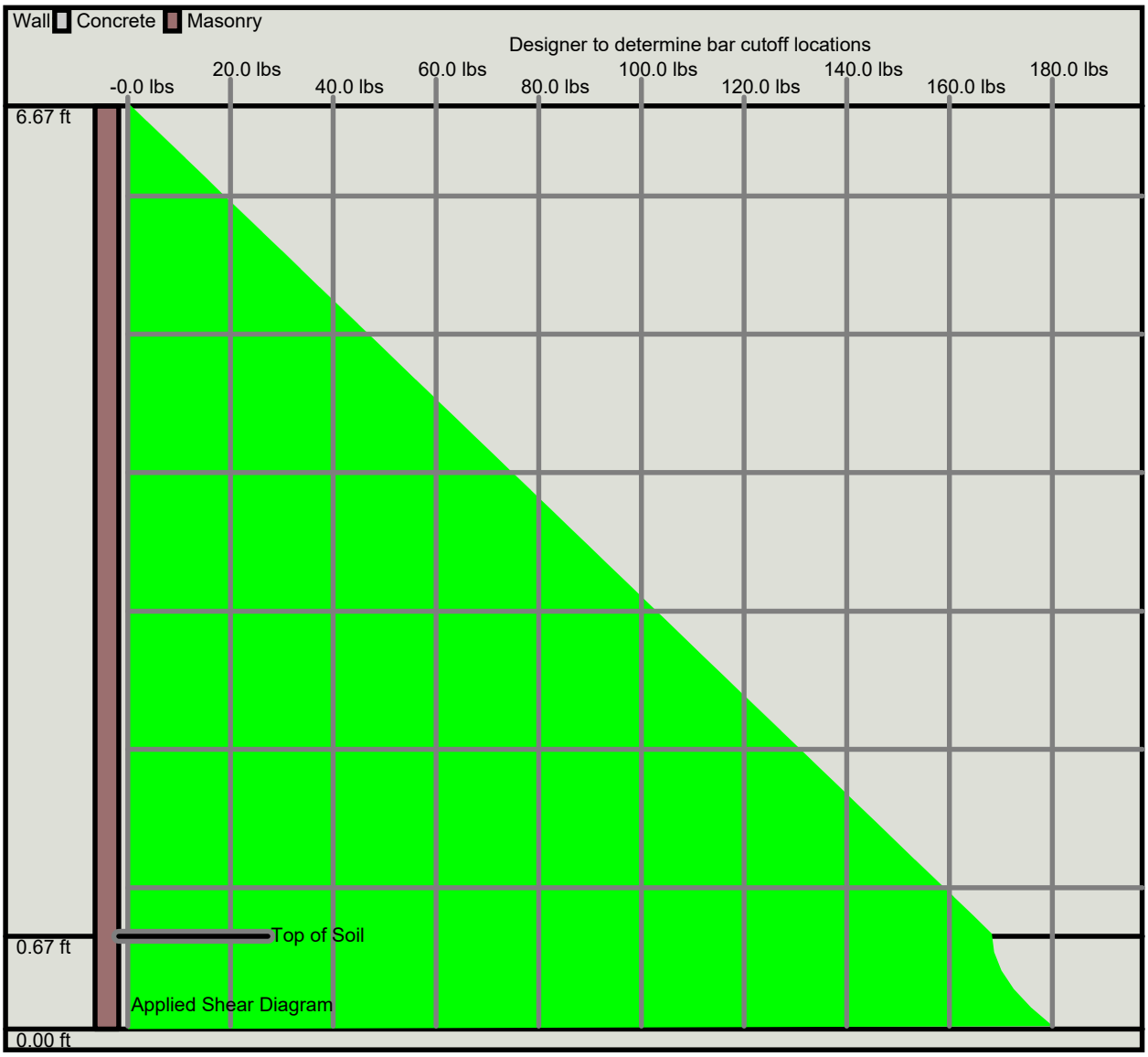
Use menu item Settings > Printing & Title Block to set these five lines of information for your program.

Project Name/Number : Dutch Bros
Title **Trash Enclosure Wall & Ftg**
Dsgnr: **NJD**
Description....

This Wall in File: K:\Acad\Jobs\K21-002 Dutch Bros\K21-002M Shawnee KS\Final Calculations\NJD\05 - R

Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13



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Project Name/Number : Dutch Bros
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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13