

MecaWind v2404

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Calculations Prepared by:

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Date: Apr 21, 2022
Designer: 0

Calculations Prepared For:

Client: 0
Project #: 0
Location: 0

File Location : F:\Dropbox\rvproj_example2\models\MecaWind\solar_pavillion.wnd

Basic Wind Parameters

Wind Load Standard	= ASCE 7-16	Exposure Category	= B
Wind Design Speed	= 90.0 mph	Risk Category	= II
Structure Type	= Building	Building Type	= Open

General Wind Settings

Incl_LF	= Include ASD Load Factor of 0.6 in Pressures	= False
DynType	= Dynamic Type of Structure	= Rigid
Zg	= Altitude (Ground Elevation) above Sea Level	= 0.000 ft
Bdist	= Base Elevation of Structure	= 0.000 ft
SDB	= Simple Diaphragm Building	= False
Reacs	= Show the Base Reactions in the output	= True
MWFRSType	= MWFRS Method Selected	= Ch 27 Pt 1

Topographic Factor per Fig 26.8-1

Topo	= Topographic Feature	= None
Kzt	= Topographic Factor	= 1.000

Building Inputs

RoofType: Roof Type	= MonoSlope	h	: Mean Roof Height	= 9.000 ft	
L	: Width Normal to Ridge	= 10.000 ft	D	: Length Along Ridge	= 20.000 ft
WindFlow: Wind Flow Method	= Clear	Slope	: Slope of Roof	= 12.0 Deg	
Frames : Incl Transverse Frames	= True	n	: Number of Frames	= 2	
e	: Solidity Ratio	= 0.050			

Exposure Constants per Table 26.11-1:

Alpha: Table 26.11-1 Const	= 7.000	Zg: Table 26.11-1 Const	= 1200.000 ft
At: Table 26.11-1 Const	= 0.143	Bt: Table 26.11-1 Const	= 0.840
Am: Table 26.11-1 Const	= 0.250	Bm: Table 26.11-1 Const	= 0.450
C: Table 26.11-1 Const	= 0.300	Eps: Table 26.11-1 Const	= 0.333

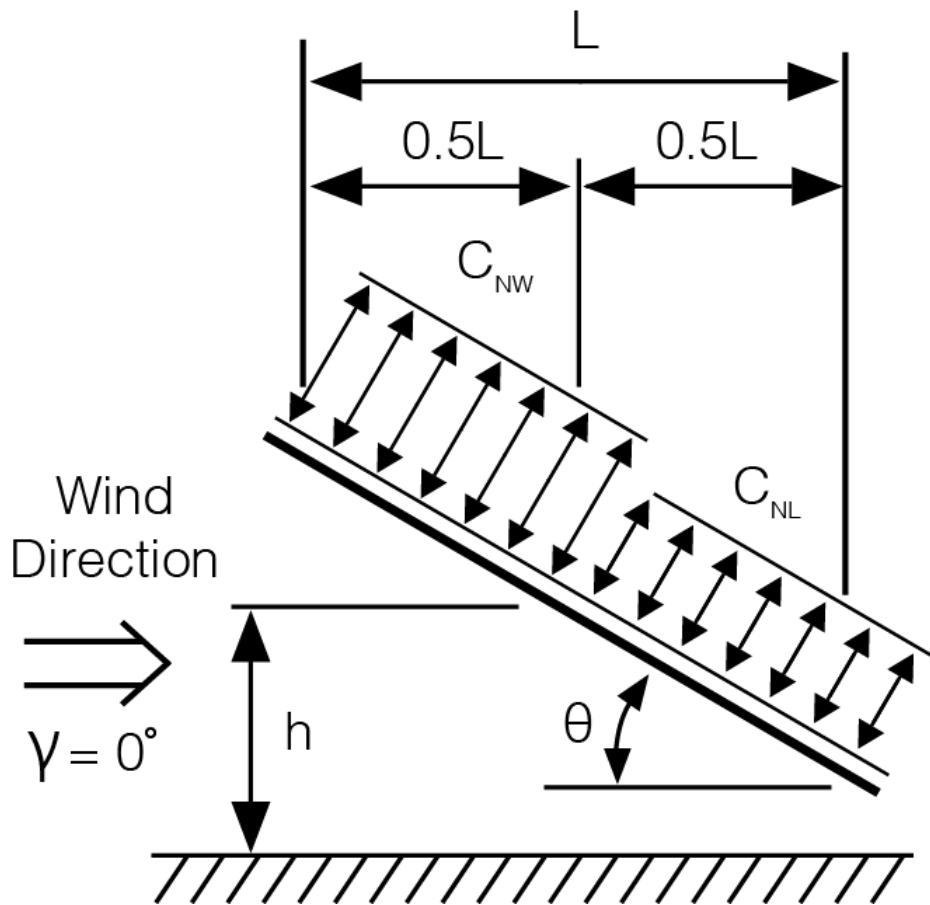
Gust Factor Calculation:

Gust Factor Category I Rigid Structures - Simplified Method		
G1	= For Rigid Structures (Nat. Freq.>1 Hz) use 0.85	= 0.85
Gust Factor Category II Rigid Structures - Complete Analysis		
Zm	= Max(0.6 * Ht, Zmin)	= 30.000 ft
Izm	= Cc * (33 / Zm) ^ 0.167	= 0.305
Lzm	= L * (Zm / 33) ^ Eps	= 309.993
B	= Structure Width Normal to Wind	= 20.000 ft
Q	= (1 / (1 + 0.63 * ((B + Ht) / Lzm)^0.63))^0.5	= 0.936
G2	= 0.925 * ((1 + 0.7 * Izm * 3.4 * Q) / (1 + 0.7 * 3.4 * Izm))	= 0.887
Gust Factor Used in Analysis		
G	= Lessor Of G1 Or G2	= 0.850

Main Wind Force Resisting System (MWFRS) Calculations per Ch 27 Part 1:

LF	= Load Factor based upon STRENGTH Design	= 1.00
h	= Mean Roof Height above grade	= 9.000 ft
Kh	= Z < 15 ft [4.572 m]--> (2.01 * (15/zg)^(2/Alpha) {Table 26.10-1})	= 0.575
Kzt	= Topographic Factor is 1 since no Topographic feature specified	= 1.000
Kd	= Wind Directionality Factor per Table 26.6-1	= 0.85
qh	= (0.00256 * Kh * Kzt * Kd * Ke * V^2) * LF	= 10.13 psf

Wind Pressures on Open Building Monoslope Free Roof per Fig 27.4.4 - Wind Dir 0 Deg:



MWFRS Pressures per Fig 27.3-4 on Monoslope Free Roof - Wind Dir 0 Deg
All wind pressures include a load factor of 1.0

Load Case	Cnw	Cnl	Pnw psf	Pnl psf
-----	-----	-----	-----	-----
Load Case A	-0.780	-1.180	-6.72	-10.16
Load Case B	-1.700	0.000	-14.64	0.00

Notes:

Pnw = Pressure on windward portion of roof: $qh \cdot G \cdot C_{nw} \cdot LF$ {Eqn 27.3-4}

Pnl = Pressure On Leeward portion Of roof: $qh \cdot G \cdot C_{nl} \cdot LF$ [Eqn 27.3-4]

All wind pressures include a load factor of 1.0

+ Pressures Acting TOWARD Surface - Pressures Acting AWAY from Surface

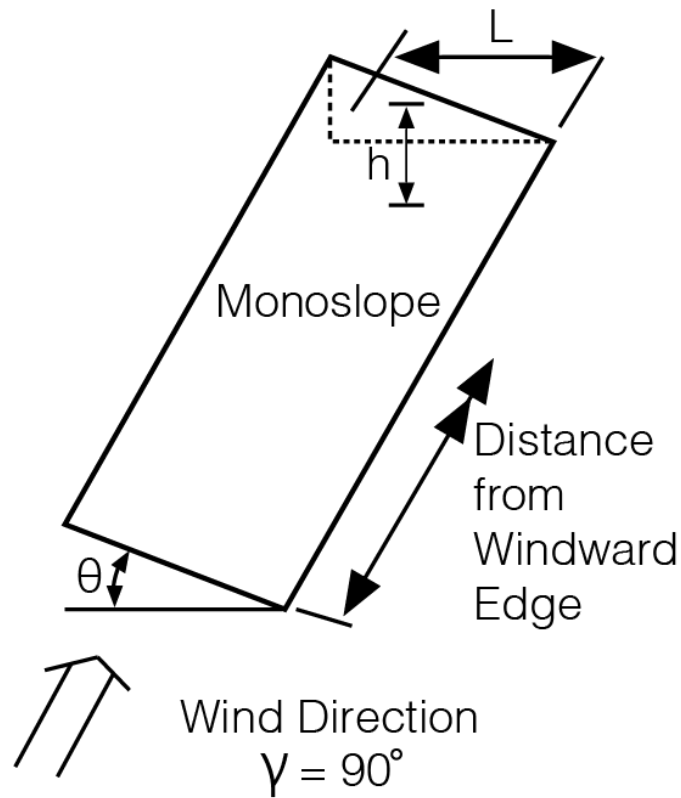
Reactions Roof +GCPi Wind Dir 0 Deg

Description	Pressure psf	Area ft	Fx Kip	Fy Kip	Fz Kip	Mx k-ft	My k-ft	Mz k-ft
-----	-----	-----	-----	-----	-----	-----	-----	-----
Leeward Roof	-10.16	102.23	0.00	-0.22	-1.02	-0.71	0.00	0.00
Windward Roof	-6.72	102.23	0.00	-0.14	-0.67	3.04	0.00	0.00
-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	0.00	204.47	0.00	-0.36	-1.69	2.33	0.00	0.00

Reactions Roof -GCPi Wind Dir 0 Deg

Description	Pressure psf	Area ft	Fx Kip	Fy Kip	Fz Kip	Mx k-ft	My k-ft	Mz k-ft
-----	-----	-----	-----	-----	-----	-----	-----	-----
Windward Roof	-14.64	102.23	0.00	-0.31	-1.46	6.62	0.00	0.00
-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	0.00	102.23	0.00	-0.31	-1.46	6.62	0.00	0.00

Wind Pressures on Open Building Monoslope Free Roof per Fig 27.4.7 - Wind Dir 90 Deg:



Open Building Along Ridge Pressures per Fig 27.3-7 - Wind 90 Deg
All wind pressures include a load factor of 1.0

Roof Var	Start Dist ft	End Dist ft	CnA	CnB	Pressure PnA psf	Pressure PnB psf
-----	-----	-----	-----	-----	-----	-----
Roof_1	0.000	9.000	-0.800	0.800	-6.89	6.89
Roof_2	9.000	18.000	-0.600	0.500	-5.17	4.31
Roof_3	18.000	20.000	-0.300	0.300	-2.58	2.58

Notes Roof Pressures:

Start Dist = Start Dist from Windward Edge End Dist = End Dist from Windward Edge

CnA = Cn for Load Case A

CnB = Cn for Load Case B

PnA = $qh \cdot G \cdot CnA$ {Eqn 27.4-3}

PnB = $qh \cdot g \cdot CnB$ {Eqn 27.4-3}

+ Pressures Acting TOWARD Surface

- Pressures Acting AWAY from Surface

Reactions Roof +GCPi Wind Dir 90 Deg

Description	Pressure psf	Area ft	Fx Kip	Fy Kip	Fz Kip	Mx k-ft	My k-ft	Mz k-ft
-----	-----	-----	-----	-----	-----	-----	-----	-----
Roof (Roof)	-2.58	10.22	0.00	-0.01	-0.03	-0.02	0.23	-0.05
Roof (Roof)	-2.58	10.22	0.00	-0.01	-0.03	0.12	0.23	-0.05
Roof (Roof)	-5.17	46.01	0.00	-0.05	-0.23	1.05	0.81	-0.17
Roof (Roof)	-5.17	46.01	0.00	-0.05	-0.23	-0.16	0.81	-0.17
Roof (Roof)	-6.89	46.01	0.00	-0.07	-0.31	1.40	-1.70	0.36
Roof (Roof)	-6.89	46.01	0.00	-0.07	-0.31	-0.22	-1.70	0.36
-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	0.00	204.47	0.00	-0.24	-1.14	2.17	-1.32	0.28

Reactions Roof -GCPi Wind Dir 90 Deg

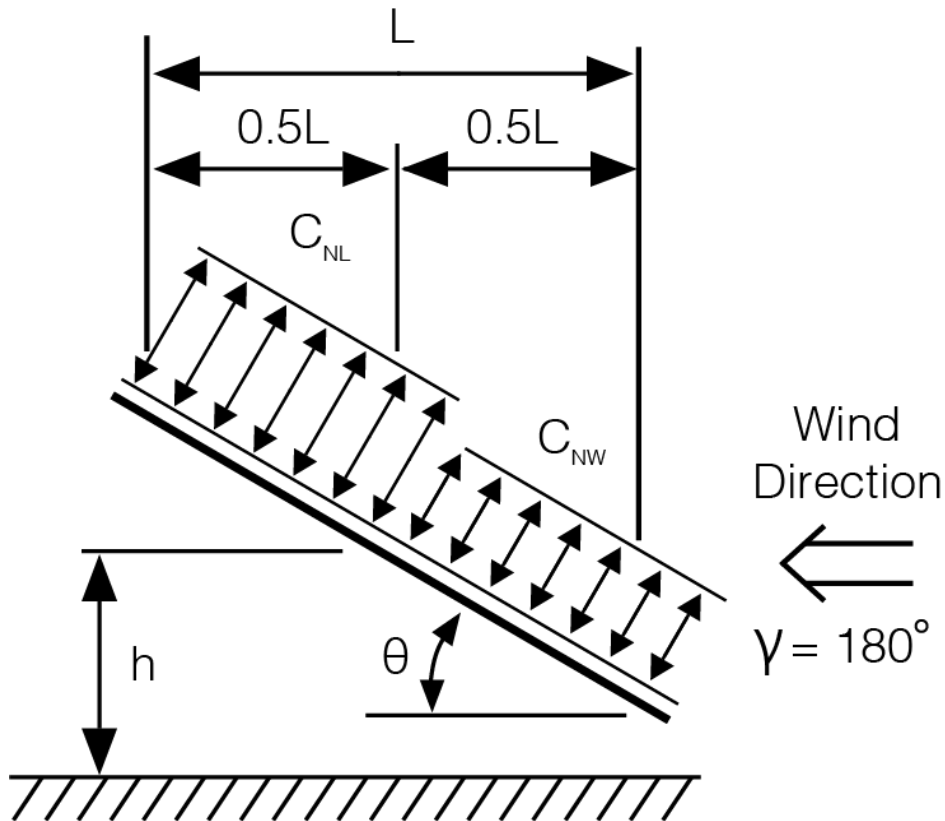
Description	Pressure psf	Area ft	Fx Kip	Fy Kip	Fz Kip	Mx k-ft	My k-ft	Mz k-ft
-----	-----	-----	-----	-----	-----	-----	-----	-----
Roof (Roof)	6.89	46.01	0.00	0.07	0.31	-1.40	1.70	-0.36
Roof (Roof)	6.89	46.01	0.00	0.07	0.31	0.22	1.70	-0.36
Roof (Roof)	4.31	46.01	0.00	0.04	0.19	-0.88	-0.68	0.14
Roof (Roof)	4.31	46.01	0.00	0.04	0.19	0.14	-0.68	0.14
Roof (Roof)	2.58	10.22	0.00	0.01	0.03	0.02	-0.23	0.05
Roof (Roof)	2.58	10.22	0.00	0.01	0.03	-0.12	-0.23	0.05
-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	0.00	204.47	0.00	0.23	1.06	-2.03	1.59	-0.34

Horizontal Wind End Loads on Transverse Frames per Sec 28.3.5: Wind Dir 90 Deg

Frames	= Incl Transverse Frames	= True
n	= Number of Frames	= 2
e	= Solidity Ratio	= 0.050
qh	= $(0.00256 * K_h * K_{zt} * K_d * K_e * V^2) * LF$	= 12.35 psf
B	= Width of Buiding Perpendicular to Ridge	= 10.000 ft
GCpf5	= GCpf for Zone 5 and Load Case B per Fig 28.3-1	= 0.400
GCpf5E	= GCpf for Zone 5E and Load Case B per Fig 28.3-1	= 0.610
GCpf_W	= Windward GCpf: $(GCpf5 + GCpf5E)*0.5$	= 0.51
GCpf6	= GCpf for Zone 6 and Load Case B per Fig 28.3-1	= -0.290
GCpf6E	= GCpf for Zone 6E and Load Case B per Fig 28.3-1	= -0.430
GCpf_L	= Leeward GCpf: $(GCpf5 + GCpf5E)*0.5$	= -0.36
Kb	= Frame Width Factor: $B < 100 \text{ ft } [30.5 \text{ m}] \quad 1.8-0.01*B$	= 1.700
Ks	= Shielding Factor: $0.6 + 0.073*(n-3) + 1.25*E^{1.8}$	= 0.533
Ae	= Total End Wall Area	= 90.00 sq ft
p	= Horizontal Wind: $qh * (GCpf_W - GCpf_L) * Kb * Ks \quad \{28.3-3\}$	= 9.67 psf
F	= Total longitudinal force to be resisted by MWFRS: $p*Ae$	= 871 lb

Applicable to building with open end walls and with end walls fully or partially enclosed with Cladding. The force 'F' is the total force for which the MWFRS longitudinal bracing shall be designed. The distribution to each sidewall shall be based upon the force 'F' applied at the centroid of the end wall area. Fascia load only needs to be considered separately if the fascia was not considered in the solidity ratio entered.

Wind Pressures on Open Building Monoslope Free Roof per Fig 27.4.4 - Wind Dir 180 Deg:



MWFRS Pressures per Fig 27.3-4 on Monoslope Free Roof - Wind Dir 180 Deg
All wind pressures include a load factor of 1.0

Load Case	Cnw	Cnl	Pnw psf	Pnl psf
-----	-----	-----	-----	-----
Load Case A	1.140	1.560	9.82	13.43
Load Case B	1.720	0.480	14.81	4.13

Notes:

Pnw = Pressure on windward portion of roof: $qh*G*Cnw*LF \quad \{Eqn \ 27.3-4\}$

Pnl = Pressure On Leeward portion Of roof: $qh*G*Cnl*LF \quad [Eqn \ 27.3-4]$

All wind pressures include a load factor of 1.0

+ Pressures Acting TOWARD Surface

- Pressures Acting AWAY from Surface

Reactions Roof +GCPI Wind Dir 180 Deg

Description	Pressure psf	Area ft	Fx Kip	Fy Kip	Fz Kip	Mx k-ft	My k-ft	Mz k-ft
-----	-----	-----	-----	-----	-----	-----	-----	-----
Leeward Roof	13.43	102.23	0.00	0.29	1.34	-6.08	0.00	0.00
Windward Roof	9.82	102.23	0.00	0.21	0.98	0.69	0.00	0.00
-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	0.00	204.47	0.00	0.49	2.32	-5.39	0.00	0.00

Reactions Roof -GCPI Wind Dir 180 Deg

Description	Pressure psf	Area ft	Fx Kip	Fy Kip	Fz Kip	Mx k-ft	My k-ft	Mz k-ft
-----	-----	-----	-----	-----	-----	-----	-----	-----
Leeward Roof	4.13	102.23	0.00	0.09	0.41	-1.87	0.00	0.00
Windward Roof	14.81	102.23	0.00	0.31	1.48	1.04	0.00	0.00
-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	0.00	204.47	0.00	0.40	1.89	-0.83	0.00	0.00

Reactions Roof Minimum Pressure Wind Dir 180 Deg

Description	Pressure psf	Area* ft	Fx Kip	Fy Kip	Fz Kip	Mx k-ft	My k-ft	Mz k-ft
-----	-----	-----	-----	-----	-----	-----	-----	-----
Leeward Roof	16.00	21.26	0.00	0.34	0.00	-3.24	0.00	0.00
Windward Roof	16.00	21.26	0.00	0.34	0.00	-2.88	0.00	0.00
-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	0.00	42.51	0.00	0.68	0.00	-6.12	0.00	0.00

Reaction Summary (MWFRS)

Description	Fx Kip	Fy Kip	Fz Kip	Mx k-ft	My k-ft	Mz k-ft
-----	-----	-----	-----	-----	-----	-----
Wind Dir 0 Deg Roof Load Case A	0.00	-0.36	-1.69	2.33	0.00	0.00
Wind Dir 0 Deg Roof Load Case B	0.00	-0.31	-1.46	6.62	0.00	0.00
Wind Dir 90 Deg Roof Load Case A	0.00	-0.24	-1.14	2.17	-1.32	0.28
Wind Dir 90 Deg Roof Load Case B	0.00	0.23	1.06	-2.03	1.59	-0.34
Wind Dir 180 Deg Roof Load Case A	0.00	0.49	2.32	-5.39	0.00	0.00
Wind Dir 180 Deg Roof Load Case B	0.00	0.40	1.89	-0.83	0.00	0.00
Wind Dir 180 Deg Roof Minimum Pressure	0.00	0.68	0.00	-6.12	0.00	0.00

Notes applyig to MWFRS Reactions

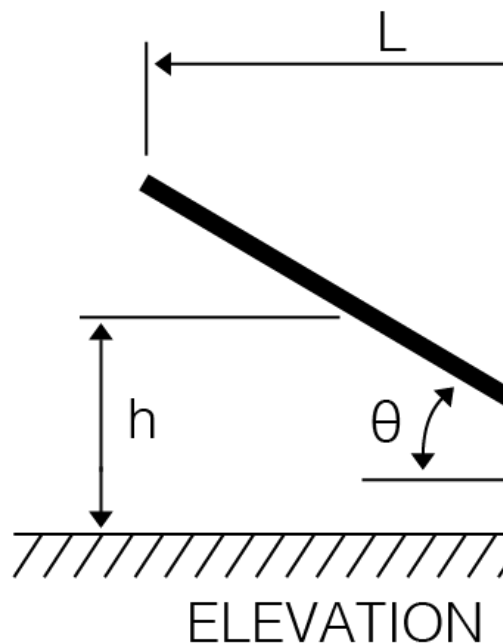
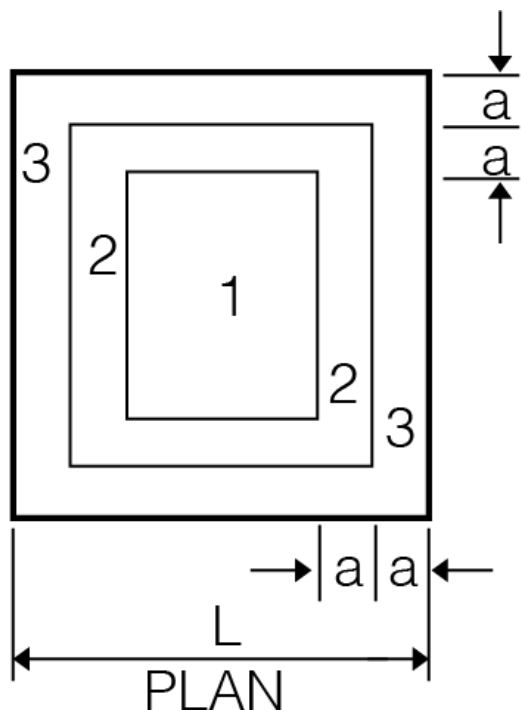
* Per Figure 27.4-1 Note 9, Use greater of Shear calculated with or without roof.

* X= Along Building ridge, Y = Normal to Building Ridge, Z = Vertical

* Minimum Pressures applied to a vertical plane normal to wind.

* Reactions calculated about the geometric center of the footprint

Components and Cladding (C&C) Zone Summary per Ch 30 Pt 5:



h = Mean Roof Height above grade = 9.000 ft
 Kh = $Z < 15 \text{ ft [4.572 m]} \rightarrow (2.01 * (15/zg)^{(2/\text{Alpha})}) \text{ \{Table 26.10-1\}} = 0.575$
 Kzt = Topographic Factor is 1 since no Topographic feature specified = 1.000
 LF = Load Factor based upon STRENGTH Design = 1.00
 qh = $(0.00256 * Kh * Kzt * Kd * Ke * V^2) * LF = 10.13 \text{ psf}$
 Theta = Roof Slope = 12.0 Deg
 LHD = Least Horizontal Dimension: $\text{Min}(B, L) = 10.000 \text{ ft}$
 a1 = $\text{Min}(0.1 * LHD, 0.4 * h) = 1.000 \text{ ft}$
 a = $\text{Max}(a1, 0.04 * LHD, 3 \text{ ft [0.9 m]}) = 3.000 \text{ ft}$

Wind Pressure Summary for C&C Zones based Upon Areas Ch 30 Pt 5
All wind pressures include a load factor of 1.0

Zone	Figure	A ≤ 9.00 sq ft psf	9.00 > A ≥ 36.00 sq ft psf	A ≥ 36.00 sq ft psf
1	Figure 30.7-1	14.81 -14.64	14.81 -14.64	14.81 -14.64
2	Figure 30.7-1	22.21 -22.21	22.21 -22.21	14.81 -14.64
3	Figure 30.7-1	29.62 -34.10	22.21 -22.21	14.81 -14.64

* A is effective wind area for C&C: Span Length * Effective Width
 * Effective width need not be less than 1/3 of the span length
 * Maximum and minimum values of pressure shown.
 * + Pressures acting toward surface, - Pressures acting away from surface
 * Per Para 30.2.2 the Minimum Pressure for C&C is 16.00 psf [0.766 kPa] {Includes LF}