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		Rev	

Wind Load Calculation as per ASCE 7-16

Site Conditions

Wind Parameters:

Basic wind speed (3sec-gust)	=	45.00	m/s	
Exposure Category	=	B		(CL. 26.7.3), ASCE 7 -16
Risk Category	=	II		(Table 1.5-1), ASCE 7 -16

Velocity Pressure q_z :

$$q_z, (N/m^2) = 0.613 K_z K_{zt} K_d K_e V^2 \quad (\text{CL. 26.10.2), ASCE 7 -16}$$

K_z , Velocity pressure exposure coefficient

K_{zt} , Topographic factor

K_d , Wind directionality factor

K_e , Ground elevation factor

V, Basic wind speed (3 sec - Gust) , m/s

K_z , Velocity pressure exposure coefficient

(CL 26.10.1), ASCE 7-16

$$K_z = "2.01*(z/z_g)^{2/\alpha}" \quad \text{For } 15 \text{ ft (4.6 m)} \leq z \leq z_g$$

$$K_z = "2.01*(15/z_g)^{2/\alpha}" \quad \text{For } z < 15 \text{ ft (4.6 m)}$$

$$15 \text{ ft.} = 4.57 \text{ m}$$

Exposure	α	$z_g(\text{ft})$	$z_g(\text{m})$	$z_{\min}(\text{ft})^\alpha$	$z_{\min}(\text{m})^\alpha$
B	7.0	1200	365.76	30	9.14
C	9.5	900	274.32	15	4.57
D	11.5	700	213.36	7	2.13

(Table 26.11-1), ASCE 7-16

K_{zt} , Topographic factor	=	1	(CL 26.8.2), ASCE 7-16
K_d , Wind directionality factor	=	0.85	(Table 26.6-1), ASCE 7-16
K_e , Grond elevation factor	=	1.00	(CL 26.9), ASCE 7-16
G - Gust effect factor	=	0.85	(CL 26.11.1), ASCE 7-16
Based on rigid or flexible structure classification			
I - Importance factor	=	1	(Table 1.5-2), ASCE 7 -16

Level	Height above ground "m"		K_z	K_{zt}	K_d	K_e	$q_p(z)$ (kN/m ²)	$G*q_p(z)$ (kN/m ²)
Level-1	0.00 -	4.60	0.58	1.00	0.85	1.00	0.61	0.52
Level-2	4.60 -	6.10	0.62	1.00	0.85	1.00	0.66	0.56
Level-3	6.10 -	7.60	0.66	1.00	0.85	1.00	0.70	0.60
Level-4	7.60 -	9.10	0.70	1.00	0.85	1.00	0.74	0.63
Level-5	9.10 -	12.20	0.76	1.00	0.85	1.00	0.80	0.68
Level-6	12.20 -	15.20	0.81	1.00	0.85	1.00	0.86	0.73
Level-7	15.20 -	18.00	0.85	1.00	0.85	1.00	0.90	0.76
Level-8	18.00 -	21.30	0.89	1.00	0.85	1.00	0.94	0.80
Level-9	21.30 -	24.40	0.93	1.00	0.85	1.00	0.98	0.83
Level-10	24.40 -	27.40	0.96	1.00	0.85	1.00	1.01	0.86
Level-11	27.40 -	30.50	0.99	1.00	0.85	1.00	1.04	0.89
Level-12	30.50 -	36.60	1.04	1.00	0.85	1.00	1.10	0.93
Level-13	36.60 -	42.70	1.09	1.00	0.85	1.00	1.15	0.98

Level-14	42.70	-	48.80	1.13	1.00	0.85	1.00	1.19	1.01
Level-15	48.80	-	54.90	1.17	1.00	0.85	1.00	1.23	1.05
Level-16	54.90	-	61.00	1.20	1.00	0.85	1.00	1.27	1.08
Level-17	61.00	-	76.20	1.28	1.00	0.85	1.00	1.36	1.15
Level-18	76.20	-	91.40	1.35	1.00	0.85	1.00	1.43	1.21
Level-19	91.40	-	106.70	1.41	1.00	0.85	1.00	1.49	1.27
Level-20	106.70	-	121.90	1.47	1.00	0.85	1.00	1.55	1.32
Level-21	121.90	-	137.20	1.52	1.00	0.85	1.00	1.60	1.36
Level-22	137.20	-	152.40	1.57	1.00	0.85	1.00	1.65	1.40

****USE KZ=0.7 for Exposure B, when z < 30 ft (9.1 m)****

Transverse Wind Force due to Cable Tray:

Ref: Sec. 4.1, ASCE-Report - Wind Loads and Anchor Bolt Design for Petrochemical Facilities

Tributary Area: $A_e = (D + 10\%W) \times \text{Bent Spacing(m)}$

where, D is maximum pipe diameter at respective level & W is Width of Pipe Rack

$$q_z(\text{N/m}^2) = 0.613 K_z K_{zt} K_d V^2$$

$$\text{Force on Pipe: } F = q_z \times G \times C_f \times A_f$$

z, (m)	Dia. of Pipe - D, (Incl. Insulation thk.) (m)	No of Trays	Width of PR,(m)	Length, (m)	Af, (m2)	F=qz x G x CfxAe, (kN) (Per frame)	Direction "X" or "Z"	Elevations in 'm'
8.40	0.150	3.000	9.0	6.0	6.300	1.47	Z	108.400

Above calculated forces are applied in STAAD as joint loads at respective locations.

Transverse Wind Force due to Cable Tray:

Ref: Sec. 4.1, ASCE-Report - Wind Loads and Anchor Bolt Design for Petrochemical Facilities

Tributary Area: $A_e = (D + 10\%W) \times \text{Bent Spacing(m)}$

where, D is Depth of Cable Tray at respective level & W is Width of Cable Tray supports

Vertical spacing between tray = 0.5 m

Assumed width of Cable Tray support = 1.1 m

$$\text{Force on Pipe: } F = q_z \times G \times C_f \times A_e$$

Legend: PR-Pipe Rack

CT Frame supporting level, z (m)	z, (m)	Kz	Depth. of Cable Tray - D, (m)	No. of vertical column of trays	Sum of width of Cable tray support,(m)	Length, (m)	Ae, (m2)	F, (kN) (Per frame)	Remarks
4	4.00	0.58	0.15	2	2.20	6.00	2.22		
21	21.00	0.81	0.15	6	6.60	6.00	4.86		

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Wind Load Calculation as per ASCE 7-16

Site Conditions

Wind Parameters:

Basic wind speed (3sec-gust)	=	100.00	mph	
Exposure Category	=	B		(CL. 26.7.3), ASCE 7 -16
Risk Category	=	II		(Table 1.5-1), ASCE 7 -16

Velocity Pressure q_z :

$$q_z, (N/m^2) = 0.00256 K_z K_{zt} K_d K_e V^2 \quad (\text{CL. 26.10.2), ASCE 7 -16}$$

K_z , Velocity pressure exposure coefficient

K_{zt} , Topographic factor

K_d , Wind directionality factor

K_e , Ground elevation factor

V, Basic wind speed (3 sec - Gust) , m/s

K_z , Velocity pressure exposure coefficient (CL 26.10.1), ASCE 7-16

$$K_z = "2.01*(z/z_g)^{2/\alpha}" \quad \text{For } 15 \text{ ft (4.6 m)} \leq z \leq z_g$$

$$K_z = "2.01*(15/z_g)^{2/\alpha}" \quad \text{For } z < 15 \text{ ft (4.6 m)}$$

$$15 \text{ ft} = 4.57 \text{ m}$$

Exposure	α	$z_g(\text{ft})$	$z_g(\text{m})$	$z_{\min}(\text{ft})^\alpha$	$z_{\min}(\text{m})^\alpha$
B	7.0	1200	365.76	30	9.14
C	9.5	900	274.32	15	4.57
D	11.5	700	213.36	7	2.13

(Table 26.11-1), ASCE 7-16

K_{zt} , Topographic factor	=	1	(CL 26.8.2), ASCE 7-16
K_d , Wind directionality factor	=	0.85	(Table 26.6-1), ASCE 7-16
K_e , Grond elevation factor	=	1.00	(CL 26.9), ASCE 7-16
G - Gust effect factor	=	0.85	(CL 26.11.1), ASCE 7-16
I - Importance factor	=	1	(Table 1.5-2), ASCE 7 -16

Level	Height above ground "ft"	K_z	K_{zt}	K_d	K_e	$q_p(z)$ (lb/ft ²)	$G*q_p(z)$ (lb/ft ²)
Level-1	0.00 - 15.00	0.57	1.00	0.85	1.00	12.51	10.63
Level-2	15.00 - 20.00	0.62	1.00	0.85	1.00	13.58	11.54
Level-3	20.00 - 25.00	0.67	1.00	0.85	1.00	14.47	12.30
Level-4	25.00 - 30.00	0.70	1.00	0.85	1.00	15.25	12.96
Level-5	30.00 - 40.00	0.76	1.00	0.85	1.00	16.55	14.07
Level-6	40.00 - 50.00	0.81	1.00	0.85	1.00	17.64	14.99
Level-7	50.00 - 60.00	0.85	1.00	0.85	1.00	18.58	15.80
Level-8	60.00 - 70.00	0.89	1.00	0.85	1.00	19.42	16.51
Level-9	70.00 - 80.00	0.93	1.00	0.85	1.00	20.18	17.15
Level-10	80.00 - 90.00	0.96	1.00	0.85	1.00	20.87	17.74
Level-11	90.00 - 100.00	0.99	1.00	0.85	1.00	21.50	18.28
Level-12	100.00 - 120.00	1.04	1.00	0.85	1.00	22.65	19.26
Level-13	120.00 - 140.00	1.09	1.00	0.85	1.00	23.67	20.12

Level-14	140.00 -	160.00	1.13	1.00	0.85	1.00	24.60	20.91
Level-15	160.00 -	180.00	1.17	1.00	0.85	1.00	25.44	21.62
Level-16	180.00 -	200.00	1.20	1.00	0.85	1.00	26.21	22.28
Level-17	200.00 -	250.00	1.28	1.00	0.85	1.00	27.94	23.75
Level-18	250.00 -	300.00	1.35	1.00	0.85	1.00	29.43	25.02
Level-19	300.00 -	350.00	1.41	1.00	0.85	1.00	30.76	26.15
Level-20	350.00 -	400.00	1.47	1.00	0.85	1.00	31.96	27.16
Level-21	400.00 -	450.00	1.52	1.00	0.85	1.00	33.05	28.09
Level-22	450.00 -	500.00	1.57	1.00	0.85	1.00	34.06	28.95

****USE KZ=0.7 for Exposure B, when z < 30 ft (9.1 m)****

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Wind Load Calculation as per ASCE 7-16 for Shelter H>18m

Shelter & Site Data:

Length of the building:	=	60	m	
Width of the building:	=	40	m	
Eave height of the building:	=	25	m	Eave height should be considered for $\theta \leq 10^\circ$, $\theta > 10^\circ$ mean height should be considered
Ridge height of the building:	=	27	m	
Mean height of the building:	=	26	m	
Roof slope	=	1:10		
Roof slope degree	=	5.71	deg	
Basic wind speed (3sec-gust)	=	45.00	m/s	
Exposure Category	=	B		(CL. 26.7.3), ASCE 7 -16
Risk Category	=	II		(Table 1.5-1), ASCE 7 -16

Velocity Pressure q_z :

$$q_z, (N/m^2) = 0.613 K_z K_{zt} K_d K_e V^2 \quad (\text{CL. 26.10.2), ASCE 7 -16}$$

K_z , Velocity pressure exposure coefficient

K_{zt} , Topographic factor

K_d , Wind directionality factor

K_e , Ground elevation factor

V, Basic wind speed (3 sec - Gust) , m/s

K_z , Velocity pressure exposure coefficient

(CL 26.10.1), ASCE 7-16

$$K_z = "2.01*(z/z_g)^{2/\alpha}" \quad \text{For } 15 \text{ ft (4.6 m)} \leq z \leq z_g$$

$$K_z = "2.01*(15/z_g)^{2/\alpha}" \quad \text{For } z < 15 \text{ ft (4.6 m)}$$

$$15 \text{ ft.} = 4.57 \text{ m}$$

Exposure	α	$z_g(\text{ft})$	$z_g(\text{m})$	$z_{min}(\text{ft})^\alpha$	$z_{min}(\text{m})^\alpha$
B	7.0	1200	365.76	30	9.14
C	9.5	900	274.32	15	4.57
D	11.5	700	213.36	7	2.13

(Table 26.11-1), ASCE 7-16

K_{zt} , Topographic factor	=	1	(CL 26.8.2), ASCE 7-16
K_d , Wind directionality factor	=	0.85	(Table 26.6-1), ASCE 7-16
K_e , Ground elevation factor	=	1.00	(CL 26.9), ASCE 7-16
G - Gust effect factor	=	0.85	(CL 26.11.1), ASCE 7-16
I - Importance factor	=	1	(Table 1.5-2), ASCE 7 -16

Level	Height above ground "m"		K_z	K_{zt}	K_d	K_e	$q_p(z)$ (kN/m ²)	$q_p(z)$ (kN/m ²)
Level-1	0.00 -	5.00	0.59	1.00	0.85	1.00	0.62	0.62
Level-2	5.00 -	10.00	0.72	1.00	0.85	1.00	0.76	0.76
Level-3	10.00 -	15.00	0.81	1.00	0.85	1.00	0.85	0.85
Level-4	15.00 -	20.00	0.88	1.00	0.85	1.00	0.93	0.93
Level-5	20.00 -	25.00	0.93	1.00	0.85	1.00	0.99	0.99
Level-6	25.00 -	30.00	0.98	1.00	0.85	1.00	1.04	1.04
Level-7	30.00 -	35.00	1.03	1.00	0.85	1.00	1.09	1.09
Level-8	35.00 -	40.00	1.07	1.00	0.85	1.00	1.13	1.13
Level-9	40.00 -	45.00	1.10	1.00	0.85	1.00	1.17	1.17

Level-10	45.00 -	50.00	1.14	1.00	0.85	1.00	1.20	1.20
Level-11	50.00 -	55.00	1.17	1.00	0.85	1.00	1.24	1.24
Level-12	55.00 -	60.00	1.20	1.00	0.85	1.00	1.27	1.27
Level-13	60.00 -	65.00	1.23	1.00	0.85	1.00	1.30	1.30
Level-14	65.00 -	70.00	1.25	1.00	0.85	1.00	1.32	1.32
Level-15	70.00 -	75.00	1.28	1.00	0.85	1.00	1.35	1.35
Level-16	75.00 -	80.00	1.30	1.00	0.85	1.00	1.37	1.37
Level-17	80.00 -	85.00	1.32	1.00	0.85	1.00	1.40	1.40
Level-18	85.00 -	90.00	1.35	1.00	0.85	1.00	1.42	1.42
Level-19	90.00 -	95.00	1.37	1.00	0.85	1.00	1.44	1.44
Level-20	95.00 -	100.00	1.39	1.00	0.85	1.00	1.47	1.47
Level-21	100.00 -	105.00	1.41	1.00	0.85	1.00	1.49	1.49
Level-22	105.00 -	110.00	1.43	1.00	0.85	1.00	1.51	1.51

****USE KZ=0.7 for Exposure B, when z < 30 ft (9.1 m)****

Type of Structure:

Height of opening @ near side wall	=	3.0	m
Wide of opening @ near side wall	=	60.0	m
No of opening @ near side wall	=	1	nos
Height of opening @ far side wall	=	3.0	m
Wide of opening @ far side wall	=	60.0	m
No of opening @ far side wall	=	1	nos
Height of opening @ left end wall	=	3.0	m
Wide of opening @ left end wall	=	30.0	m
No of opening @ left end wall	=	1	nos
Height of opening @ right end wall	=	3.0	m
Wide of opening @ right end wall	=	30.0	m
No of opening @ right end wall	=	1	nos
Length of opening @ roof	=	0.0	m
Wide of opening @ roof	=	0.0	m
No of opening @ roof	=	1	nos
Area of Opening, A_o @ near side wall	=	180	m ²
Area of Opening, A_o @ far side wall	=	180	m ²
Area of Opening, A_o @ left end wall	=	90	m ²
Area of Opening, A_o @ right end wall	=	90	m ²
Area of Opening, A_o @ roof	=	0	m ²
Area of Wall, A_g @ near side wall	=	1500	m ²
Area of Wall, A_g @ far side wall	=	1500	m ²
Area of Wall, A_g @ left end wall	=	1020	m ²
Area of Wall, A_g @ right end wall	=	1020	m ²
Area of surface, A_g @ roof	=	2411.97	m ²
Total Gross Area of opening, A_{oi}	=	540	m ²
Total Gross Area of Wall & Roof, A_{gi}	=	7451.97	m ²

Condition for Shelter Type (As per Clause 26.2 of ASCE-7-16):

Condition	NSW	FSW	LEW	REW
Open condition $A_o \geq 0.8A_g$	not ok	not ok	not ok	not ok
Enclosed condition, $A_o < \min(0.01A_g, 0.37m^2)$	not ok	not ok	not ok	not ok
Partially enclosed, $A_o > 1.10A_{oi}$	not ok	not ok	not ok	not ok
Partially enclosed, $A_o > \min(0.01A_g, 0.37m^2)$	ok	ok	ok	ok
Partially enclosed, $A_{oi} / A_{gi} \leq 0.2$	ok			

Based on the above table the building condition will be chosen as

Partially Enclosed Building

**Design Wind Pressure for the Main Wind Force Resisting System
for buildings of all heights in (kN/m²)**

$$p = q G C_p - q_i (GC_{pi})$$

(CL 27.3.1), ASCE 7-16

Internal Pressure Coefficient, GC_{pi}

(Table 26.13-1), ASCE 7-16

CASE A	0.55
CASE B	-0.55

External Pressure Co-efficient for Pitched Free Roofs, C_p

Refer Figure 27.3-1, ASCE 7-16 (reduction Factor = 1.0)

X direction (0°) h/L	=	0.43
Z direction (90°) h/B	=	0.65
Walls L/B	=	1.50
Walls B/L	=	0.67
θ	=	5.71°

ROOF PRESSURE CO-EFFICIENT, C_p							
X direction (Normal to Ridge)				Z direction (Parallel to Ridge)			
upto h/2	h/2 to h	h to 2h	>2h	upto h/2	h/2 to h	h to 2h	>2h
-0.90	-0.90	-0.50		-0.90	-0.90	-0.5	-0.3

WALL PRESSURE CO-EFFICIENT, C_p for X direction	
Windward	0.80
Leeward	-0.40
Side Wall	-0.70

WALL PRESSURE CO-EFFICIENT, C_p for Z direction	
Windward	0.80
Leeward	-0.50
Side Wall	-0.70

Side wall bay spacing	=	6	m
End wall bay spacing	=	6	m

WIND LOAD ACTING IN X DIRECTION

For Wall:

	Height	.+ve internal PRESSURE	.-ve internal PRESSURE
	(m)	$p=qGC_p-q_i(GC_{pi})$ (kN/m ²)	$p=qGC_p-q_i(GC_{pi})$ (kN/m ²)
Windward	5	0.08	0.76
	10	0.10	0.93
	15	0.11	1.05
	20	0.12	1.14
	25	0.13	1.22
	26	0.14	1.28
	0		
	5	-0.55	0.13
	10	-0.68	0.16
	15	-0.76	0.18

Leeward	20	-0.83	0.20
	25	-0.88	0.21
	26	-0.93	0.22
	0		
Sidewall	5	-0.71	-0.03
	10	-0.87	-0.03
	15	-0.97	-0.04
	20	-1.06	-0.04
	25	-1.13	-0.04
	26	-1.19	-0.05
	0		

Wind pressure acting on wall

	Height	.+ve internal PRESSURE	.-ve internal PRESSURE
	(m)	$p=qGCp-q_i(GCp_i)$ (kN/m)	$p=qGCp-q_i(GCp_i)$ (kN/m)
Windward	5	0.48	4.58
	10	0.59	5.61
	15	0.66	6.27
	20	0.73	6.86
	25	0.77	7.31
	26	0.81	7.68
	0		
Leeward	5	-3.31	0.78
	10	-4.06	0.96
	15	-4.54	1.07
	20	-4.97	1.17
	25	-5.29	1.25
	26	-5.55	1.31
	0		
Sidewall	5	-4.26	-0.17
	10	-5.22	-0.21
	15	-5.84	-0.23
	20	-6.39	-0.25
	25	-6.80	-0.27
	26	-7.14	-0.28
	0		

For Roof:

TRIB (m)	X direction (Normal to Ridge)			
	$p=qGCp-q_i(GCp_i)$ (kN/m)			
	.+ve internal PRESSURE			
	upto h/2	h/2 to h	h to 2h	>2h
	-1.37	-1.37	-1.01	-0.57
6	-8.206	-8.206	-6.084	
3	-4.103	-4.103	-3.042	

TRIB (m)	X direction (Normal to Ridge)			
	$p=qGCp-q_i(GCp_i)$ (kN/m)			
	.-ve internal PRESSURE			
	upto h/2	h/2 to h	h to 2h	>2h
	-0.22	-0.22	0.13	0.57
6	-1.342	-1.342	0.780	
3	-0.671	-0.671	0.390	

WIND LOAD ACTING IN Z DIRECTION

For Wall:

	Height	.+ve internal PRESSURE	.-ve internal PRESSURE
	(m)	$p=qGC_p-q_i(GC_{pi})$ (kN/m ²)	$p=qGC_p-q_i(GC_{pi})$ (kN/m ²)
Windward	5	0.08	0.76
	10	0.10	0.93
	15	0.11	1.05
	20	0.12	1.14
	25	0.13	1.22
	26	0.14	1.28
	0		
Leeward	5	-0.60	0.08
	10	-0.74	0.10
	15	-0.83	0.11
	20	-0.91	0.12
	25	-0.97	0.12
	26	-1.01	0.13
	0		
Sidewall	5	-0.71	-0.03
	10	-0.87	-0.03
	15	-0.97	-0.04
	20	-1.06	-0.04
	25	-1.13	-0.04
	26	-1.19	-0.05
	0		

Wind pressure acting on wall

	Height	.+ve internal PRESSURE	.-ve internal PRESSURE
	(m)	$p=qGC_p-q_i(GC_{pi})$ (kN/m)	$p=qGC_p-q_i(GC_{pi})$ (kN/m)
Windward	5	0.48	4.58
	10	0.59	5.61
	15	0.66	6.27
	20	0.73	6.86
	25	0.77	7.31
	26	0.81	7.68
	0		
Leeward	5	-3.63	0.47
	10	-4.45	0.57
	15	-4.97	0.64
	20	-5.44	0.70
	25	-5.79	0.74
	26	-6.08	0.78
	0		
Sidewall	5	-4.26	-0.17
	10	-5.22	-0.21
	15	-5.84	-0.23
	20	-6.39	-0.25
	25	-6.80	-0.27
	26	-7.14	-0.28
	0		

For Roof:

TRIB (m)	Z direction (Parallel to Ridge)			
	$p=qGCp-q_i(GCp_i)$ (kN/m)			
	. +ve internal PRESSURE			
	upto h/2	h/2 to h	h to 2h	>2h
	-1.37	-1.37	-1.01	-0.84
6	-8.206	-8.206	-6.084	-5.023
3	-4.103	-4.103	-3.042	-2.512

TRIB (m)	Z direction (Parallel to Ridge)			
	$p=qGCp-q_i(GCp_i)$ (kN/m)			
	. -ve internal PRESSURE			
	upto h/2	h/2 to h	h to 2h	>2h
	-0.22	-0.22	0.13	0.31
6	-1.342	-1.342	0.780	1.841
3	-0.671	-0.671	0.390	0.920

www.rcneggstudios.com		Date	
	Wind Load Calculation for Shelter as per ASCE 7-16 (Metric)	Rev	

Wind Load Calculation as per ASCE 7-16 for Shelter H<18m

Shelter & Site Data:

Length of the building:	=	60	m	
Width of the building:	=	30	m	
Eave height of the building:	=	10	m	
Ridge height of the building	=	11.5	m	
Mean height of the building:		10.75	m	
Roof slope	=	1	:10	
Roof slope degree	=	5.71	deg	
Basic wind speed (3sec-gust)	=	45.00	m/s	
Exposure Category	=	B		(CL. 26.7.3), ASCE 7 -16
Risk Category	=	II		(Table 1.5-1), ASCE 7 -16

Eave height should be considered for $\theta \leq 10^\circ$, $\theta > 10^\circ$ mean height should be considered

Velocity Pressure q_z :

$$q_z, (N/m^2) = 0.613 K_z K_{zt} K_d K_e V^2 \quad (\text{CL. 26.10.2), ASCE 7 -16}$$

K_z , Velocity pressure exposure coefficient

K_{zt} , Topographic factor

K_d , Wind directionality factor

K_e , Ground elevation factor

V, Basic wind speed (3 sec - Gust) , m/s

K_z , Velocity pressure exposure coefficient

(CL 26.10.1), ASCE 7-16

$$K_z = 2.01 \cdot (z/z_g)^{2/\alpha} \quad \text{For } 15 \text{ ft (4.6 m)} \leq z \leq z_g$$

$$K_z = 2.01 \cdot (15/z_g)^{2/\alpha} \quad \text{For } z < 15 \text{ ft (4.6 m)}$$

$$15 \text{ ft.} = 4.57 \text{ m}$$

Exposure	α	$z_g(\text{ft})$	$z_g(\text{m})$	$z_{\min}(\text{ft})^\alpha$	$z_{\min}(\text{m})^\alpha$
B	7.0	1200	365.76	30	9.14
C	9.5	900	274.32	15	4.57
D	11.5	700	213.36	7	2.13

(Table 26.11-1), ASCE 7-16

K_{zt} , Topographic factor	=	1	(CL 26.8.2), ASCE 7-16
K_d , Wind directionality factor	=	0.85	(Table 26.6-1), ASCE 7-16
K_e , Ground elevation factor	=	1.00	(CL 26.9), ASCE 7-16
G - Gust effect factor	=	0.85	(CL 26.11.1), ASCE 7-16
I - Importance factor	=	1	(Table 1.5-2), ASCE 7 -16

Level	Height above ground "m"		K_z	K_{zt}	K_d	K_e	$q_p(z)$ (kN/m ²)	$G \cdot q_p(z)$ (kN/m ²)
Level-1	0.00	- 5.00	0.59	1.00	0.85	1.00	0.62	0.53

Level-2	5.00	-	10.00	0.72	1.00	0.85	1.00	0.76	0.65
Level-3	10.00	-	15.00	0.81	1.00	0.85	1.00	0.85	0.72
Level-4	15.00	-	18.30	0.85	1.00	0.85	1.00	0.90	0.77

****USE KZ=0.7 for Exposure B, when z < 30 ft (9.1 m)****

Type of Structure:

Height of opening @ near side wall	=	3.0	m
Wide of opening @ near side wall	=	60.0	m
No of opening @ near side wall	=	1	nos
Height of opening @ far side wall	=	3.0	m
Wide of opening @ far side wall	=	60.0	m
No of opening @ far side wall	=	1	nos
Height of opening @ left end wall	=	3.0	m
Wide of opening @ left end wall	=	30.0	m
No of opening @ left end wall	=	1	nos
Height of opening @ right end wall	=	3.0	m
Wide of opening @ right end wall	=	30.0	m
No of opening @ right end wall	=	1	nos
Length of opening @ roof	=	0.0	m
Wide of opening @ roof	=	0.0	m
No of opening @ roof	=	1	nos
Area of Opening, A_o @ near side wall	=	180	m ²
Area of Opening, A_o @ far side wall	=	180	m ²
Area of Opening, A_o @ left end wall	=	90	m ²
Area of Opening, A_o @ right end wall	=	90	m ²
Area of Opening, A_o @ roof	=	0	m ²
Area of Wall, A_g @ near side wall	=	600	m ²
Area of Wall, A_g @ far side wall	=	600	m ²
Area of Wall, A_g @ left end wall	=	311.25	m ²
Area of Wall, A_g @ right end wall	=	311.25	m ²
Area of surface, A_g @ roof	=	1808.98	m ²
Total Gross Area of opening, A_{oi}	=	540	m ²
Total Gross Area of Wall & Roof, A_{gi}	=	3631.48	m ²

Condition for Shelter Type (As per Clause 26.2 of ASCE-7-16):

Condition	NSW	FSW	LEW	REW
Open condition $A_o \geq 0.8A_g$	not ok	not ok	not ok	not ok
Enclosed condition, $A_o < \min(0.01A_g, 0.37m^2)$	not ok	not ok	not ok	not ok
Partially enclosed, $A_o > 1.10A_{oi}$	not ok	not ok	not ok	not ok
Partially enclosed, $A_o > \min(0.01A_g, 0.37m^2)$	ok	ok	ok	ok
Partially enclosed, $A_{oi} / A_{gi} \leq 0.2$	ok			

Partially Enclosed Building

(Table 26.13-1), ASCE 7-16

CASE A	0.55
CASE B	-0.55

End zone Condition, a = 10 % of least horizontal dimnsion or 0.4h, whichever is smaller
But not less than 4 % of least horizontal dimnsion or 0.9m
= 3 > 1.2

End zone distance, $2a$ = 6 m (Fig 28.3-1), ASCE 7-16

Load Case A (X Direction) (Fig 28.3-1), ASCE 7-16

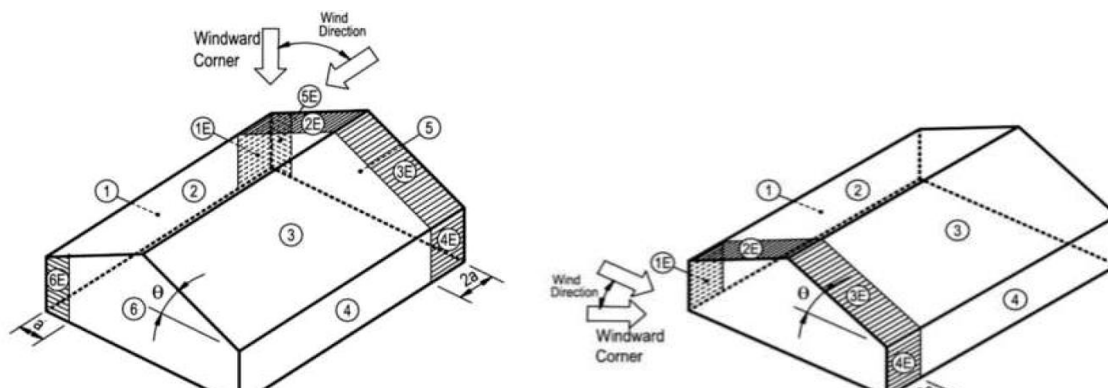
	Building Surface							
Slope	1	2	3	4	1E	2E	3E	4E
5	0.40	-0.69	-0.37	-0.29	0.61	-1.07	-0.53	-0.43
20	0.53	-0.69	-0.48	-0.43	0.80	-1.07	-0.69	-0.64
5.71	0.41	-0.69	-0.38	-0.30	0.62	-1.07	-0.54	-0.44

Load Case B (Z Direction) (Fig 28.3-1), ASCE 7-16

	Building Interior Surface					
Slope	1	2	3	4	5	6
5.71	-0.45	-0.69	-0.37	-0.45	0.40	-0.29

Load Case B (Z Direction) (Fig 28.3-1), ASCE 7-16

	Building End Surface					
Slope	1E	2E	3E	4E	5E	6E
5.71	-0.48	-1.07	-0.53	-0.48	0.61	-0.43





	Building Interior Surface					
	1	2	3	4	5	6
X DIR	0.41	-0.69	-0.38	-0.30	-0.29	-0.29
Z DIR	-0.45	-0.69	-0.37	-0.45	0.40	-0.29

	Building End Surface					
Load Case	1E	2E	3E	4E	5E	6E
X DIR	0.62	-1.07	-0.54	-0.44	-0.43	-0.43
Z DIR	-0.48	-1.07	-0.53	-0.48	0.61	-0.43

(-) sign indicates wind pressure acting away from wall / roof.

(+) sign indicates wind pressure acting towards wall / roof.

DESIGN WIND PRESSURE

Design Wind Pressure for the Main Wind Force Resisting System
for buildings of all heights in (kN/m²)

$$p = qh [(GC_{pf}) - (GC_{pi})]$$

(CL 28.3.1), ASCE 7-16

	Building Interior Surface (kN/m ²)					
	1	2	3	4	5	6
X DIR (PRESSURE)	-0.09	-0.81	-0.60	-0.55	-0.55	-0.55
X DIR (SUCTION)	0.62	-0.09	0.11	0.16	0.17	0.17
Z DIR (PRESSURE)	-0.65	-0.81	-0.60	-0.65	-0.10	-0.55
Z DIR (SUCTION)	0.07	-0.09	0.12	0.07	0.62	0.17

EH reference is
considered for
calculation

	Building End Surface (kN/m ²)					
Load Case	1E	2E	3E	4E	5E	6E
X DIR (PRESSURE)	0.04	-1.05	-0.71	-0.64	-0.64	-0.64

EH reference is
considered for
calculation

X DIR (SUCTION)	0.76	-0.34	0.01	0.07	0.08	0.08
Z DIR (PRESSURE)	-0.67	-1.05	-0.70	-0.67	0.04	-0.64
Z DIR (SUCTION)	0.05	-0.34	0.01	0.05	0.75	0.08

Side wall bay spacing = 6 m
End wall bay spacing = 6 m

Total Wind load on Column & Rafter

	Building Interior Surface (kN/m)					
	1	2	3	4	5	6
X DIR (PRESSURE)	-0.56	-4.84	-3.61	-3.30	-3.28	-3.28
X DIR (SUCTION)	3.73	-0.55	0.68	0.99	1.01	1.01
Z DIR (PRESSURE)	-3.90	-4.84	-3.59	-3.90	-0.59	-3.28
Z DIR (SUCTION)	0.39	-0.55	0.70	0.39	3.71	1.01

	Building End Surface (kN/m)					
Load Case	1E	2E	3E	4E	5E	6E
X DIR (PRESSURE)	0.27	-6.32	-4.24	-3.86	-3.82	-3.82
X DIR (SUCTION)	4.56	-2.03	0.05	0.43	0.47	0.47
Z DIR (PRESSURE)	-4.02	-6.32	-4.21	-4.02	0.23	-3.82
Z DIR (SUCTION)	0.27	-2.03	0.08	0.27	4.52	0.47

STAAD INPUT

NEAR SIDE WALL COLUMN NO = 1 2 3 4 5
LEFT SLOPE BEAM NO = 15 16 17
RIGHT SLOPE BEAM NO = 18 19 20
FAR SIDE WALL COLUMN NO = 6 7 8 9 10
LEFT END WALL COLUMN NO = 11 12
RIGHT END WALL COLUMN NO = 13 14

Wind Load case start no : 11

	Building Interior Surface					
	1	2	3	4	5	6
X DIR (PRESSURE)	SUCTION	SUCTION	SUCTION	SUCTION	SUCTION	SUCTION
X DIR (SUCTION)	PRESSURE	SUCTION	PRESSURE	PRESSURE	PRESSURE	PRESSURE
Z DIR (PRESSURE)	SUCTION	SUCTION	SUCTION	SUCTION	SUCTION	SUCTION
Z DIR (SUCTION)	PRESSURE	SUCTION	PRESSURE	PRESSURE	PRESSURE	PRESSURE

*Need to check wind direction manually after coping to staad

*Shelter orientation shall be the ridge line parallel to staad gobal Z axis

*For End zone should be calculated manually for staad

***Format method for reference**

* LOAD XX LOAD TYPE Wind TITLE WLXX

*MEMBER LOAD

*NEAR SIDE WALL COLUMN NO

*LEFT SLOPE BEAM NO

*RIGHT SLOPE BEAM NO

*FAR SIDE WALL COLUMN NO

*LEFT END WALL COLUMN NO

*RIGHT END WALL COLUMN NO

LOAD 11 LOADTYPE Wind TITLE WL1

MEMBER LOAD

1 2 3 4 5 UNI GX -0.560983225974462

15 16 17 UNI Y -4.836

18 19 20 UNI Y -3.60832188571392

6 7 8 9 10 UNI GX -3.30186421818135

11 12 UNI GZ -3.276

13 14 UNI GZ -3.276

LOAD 12 LOADTYPE Wind TITLE WL2

MEMBER LOAD

1 2 3 4 5 UNI GX 3.72901677402554

15 16 17 UNI Y -0.546

18 19 20 UNI Y 0.681678114286083

6 7 8 9 10 UNI GX 0.988135781818652

11 12 UNI GZ 1.014

13 14 UNI GZ 1.014

LOAD 13 LOADTYPE Wind TITLE WL3

MEMBER LOAD

1 2 3 4 5 UNI GX -3.30186421818135

15 16 17 UNI Y -3.60832188571392

18 19 20 UNI Y -4.836

6 7 8 9 10 UNI GX -0.560983225974462

11 12 UNI GZ -3.276

13 14 UNI GZ -3.276

LOAD 14 LOADTYPE Wind TITLE WL4

MEMBER LOAD

1 2 3 4 5 UNI GX 0.988135781818652

15 16 17 UNI Y 0.681678114286083

18 19 20 UNI Y -0.546

6 7 8 9 10 UNI GX 3.72901677402554

11 12 UNI GZ 1.014

13 14 UNI GZ 1.014

LOAD 15 LOADTYPE Wind TITLE WL5

MEMBER LOAD

1 2 3 4 5 UNI GX -3.9

15 16 17 UNI Y -4.836

18 19 20 UNI Y -3.588

6 7 8 9 10 UNI GX -3.9

11 12 UNI GZ -0.585

13 14 UNI GZ -3.276

LOAD 16 LOADTYPE Wind TITLE WL6

MEMBER LOAD

1 2 3 4 5 UNI GX 0.39

15 16 17 UNI Y -0.546

18 19 20 UNI Y 0.702

6 7 8 9 10 UNI GX 0.39

11 12 UNI GZ 3.705

13 14 UNI GZ 1.014
