OMAR SHEMY PORTFOLIO

SUBJECT: Wind Load Calculation

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2024 JAN 19	**202401**	**DEMO PORTFOLIO**	**O.S.**	**1**

WIND LOAD CALCULATION

References(from NBCC 2015):
Table 4.1.7.3.
1.1.3 Appendix C
4.1.7.3 sentence b)

$I_w := 1.0$

$q := 0.6$ for 1/50 year exceedence

$h := 19 \le 20$ and $h < 66.5$ (smaller planar dimension)

$h := \frac{19}{2} = 9.5$ $9.5 > 6$ ∴ OK

$C_e := \left(\frac{9.5}{10}\right)^{0.2} = 0.99$ $C_e \ge 0.9$ ∴ OK

$C_t := 1.0$ For no hills and escarpments — 4.1.7.4

Load case a

Main Wall — 4.1.7.6

$C_p C_{g1} := 0.75$

$C_p C_{g2} := -0.55$

$P_{windward\_mainwall} := 1.0 \cdot 0.6 \cdot 0.99 \cdot 1.0 \cdot 0.75 = 0.446$

$P_{leeward\_mainwall} := 1.0 \cdot 0.6 \cdot 0.99 \cdot 1.0 \cdot 0.55 = 0.327$

Edge(High zone)

$C_p C_{g3} := 1.15$

$C_p C_{g4} := -0.8$

$P_{windward\_edge} := 1.0 \cdot 0.6 \cdot 0.99 \cdot 1.0 \cdot 1.15 = 0.683$

$P_{leeward\_edge} := 1.0 \cdot 0.6 \cdot 0.99 \cdot 1.0 \cdot 0.8 = 0.475$

Load case b

Main wall parallel to wind

Notes checking: — 4.1.7.6-A

(3) Positive coefficients denote forces toward the surface, negative coefficient denote forces away from the surface

(5) The eave height, H=19m for roof slope<7 deg

(6) End zone:

$y := 2 \cdot 6.65 = 13.3$ $y > 6$ ∴ OK

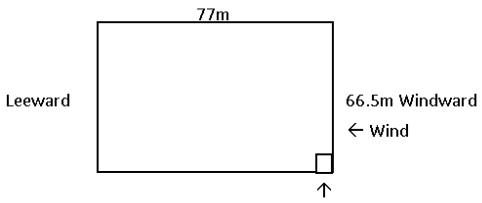
(7) $x := min(0.1 \cdot 66.5, 0.4 \cdot 19) = 6.65$

$0.04 \cdot 66.5 = 2.66$

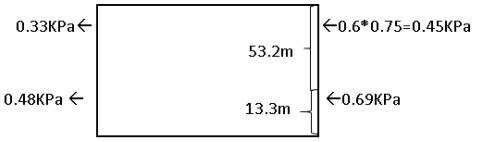
6.65>2.66 ∴ OK

(8) B/H<5 checked

Corner Orientation 1:
Main wall parallel to wind:



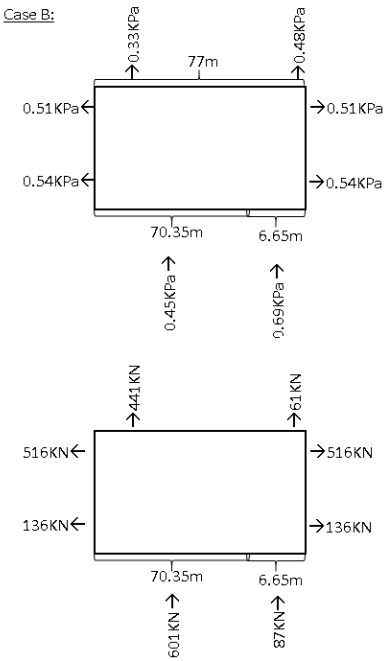
Case A:



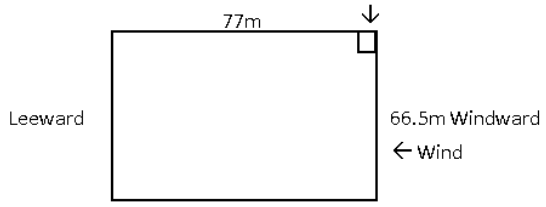
$B/H=\frac{77}{19}=4.05$

H=19

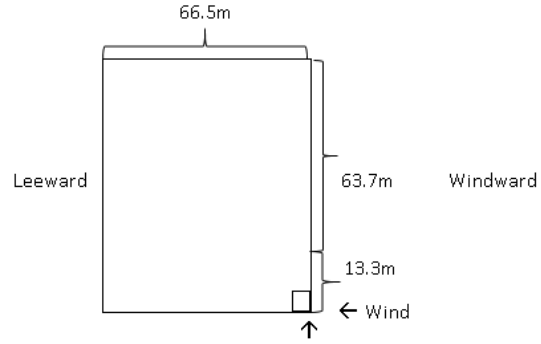
Case B:



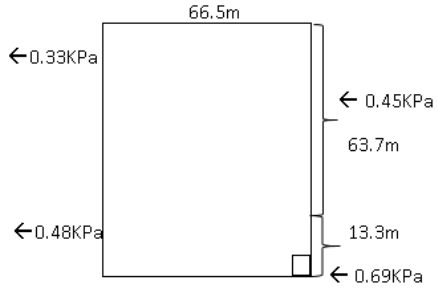
Corner orientation 2 (mirror to orientation 1):

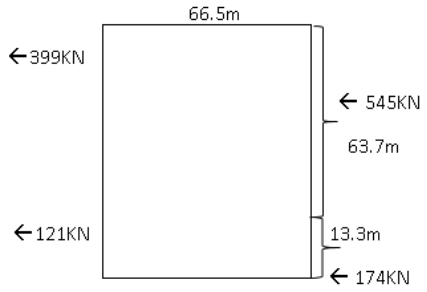


Corner orientation 3:

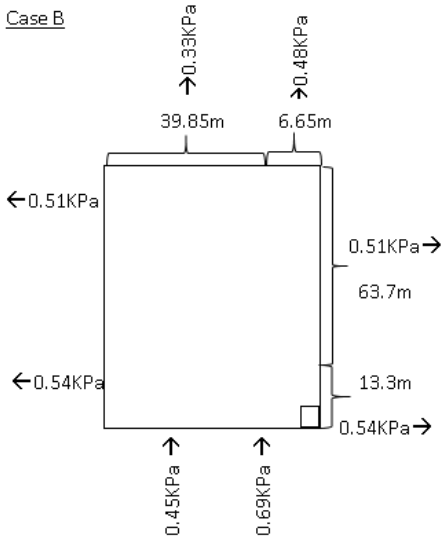


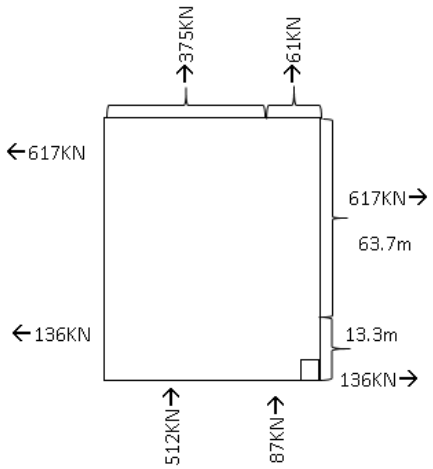
Case A



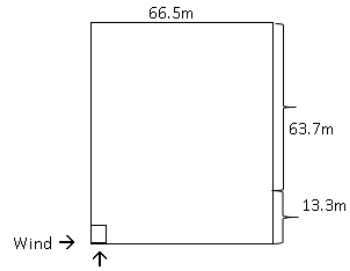


Case B





Corner orientation 4:



Mirror to orientation 3

Most critical:
Orientation 3,4: load case A dominates:

$399\ kN + 545\ kN = 944\ kN$

$121\ kN + 174\ kN = 295\ kN$

Comparing to:

$512\ kN + 375\ kN = 887\ kN$

$87\ kN + 61\ kN = 148\ kN$

Load case 1,2: load case B dominates:

$441\ kN + 601\ kN = \left(1.042 \cdot 10^3\right)\ kN$

$87\ kN + 61\ kN = 148\ kN$

Comparing to :

$445\ kN + 334\ kN = 779\ kN$

$121\ kN + 174\ kN = 295\ kN$

References
(NBCC 2015)
4.1.7.6-B

Hangar walls:

$Z := min\left(0.1 \cdot 54, 0.4 \cdot 19\right) = 5.4$

$5.4 > 1 \quad \therefore OK$

e: $Area := 5.4 \cdot 19 = 102.6$

w: $Area\_w1 := \left(54 - Z \cdot 2\right) \cdot 19 = 820.8$

$Area\_w2 := \left(77 - Z \cdot 2\right) \cdot 19 = 1.258 \cdot 10^3$

$C_p C_g coefficients$:

e: +1.3 -1.5

w: +1.3 -1.5

Hangar roof:

C: $Z^2 = 29.16$

S: $Area\_S1 := \left(54 - Z \cdot 2\right) \cdot Z = 233.28$

$Area\_S2 := \left(77 - Z \cdot 2\right) \cdot Z = 357.48$

r: $Area\_r := \left(54 - Z \cdot 2\right) \cdot \left(77 - Z \cdot 2\right) = 2.86 \cdot 10^3$

	$C_p C_g$ coefficient	
C:	0.3	-2.0
S:	0.3	-2.0
r:	0.3	-1.5

$1 \cdot \left(0.6\right)\ 1 \cdot 1 \cdot 0.3 = 0.18$

$1 \cdot 0.6 \cdot 1 \cdot 1 \cdot -2 = -1.2$

$1 \cdot 0.6 \cdot 1 \cdot 1 \cdot -1.5 = -0.9$

Interior pressure: 4.1.7.3-7

$h = 9.5$

$9.5 < 20$ ∴ case b)

$C_{ei} := \left(\frac{9.5}{10}\right)^{0.2} = 0.99 \qquad 0.99 > 0.9 \ \therefore OK$ 4.1.7.3-5

$C_t := 1.0$ 4.1.7.4-1

$C_{gi} := 2.0$ 4.1.7.3-10

4.1.7.7-1 Table 4.1.7.7

C_{pi} ranges from -0.45 to 0.3

$P_{int\_positive} := 1.0 \cdot 0.6 \cdot 1.0 \cdot 2.0 \cdot 0.99 \cdot 0.3 = 0.356$

$P_{int\_negative} := -0.54$

Summary	P_{ext}		P_{int}		$Netpressure$	
Surface	+	-	+	-	+	-
e	0.78	-0.9	0.36	-0.54	1.14	-1.44
w	0.78	-0.9	0.36	-0.54	1.14	-1.44
c	0.18	-1.2	0.36	-0.54	0.54	-1.74
s	0.18	-1.2	0.36	-0.54	0.54	-1.74
r	0.18	-0.9	0.36	-0.54	0.54	-1.44

References
(NBCC 2015)
4.1.7.6-B

Office walls:

$Z := min(0.1 \cdot 12.5, 0.4 \cdot 9.91) = 1.25$

$1.25 > 1 \qquad \therefore OK$

e: $Area := 1.25 \cdot 9.91 = 12.388$

w: $Area\_w1 := (54 - Z \cdot 2) \cdot 9.91 = 510.365$

$Area\_w2 := (12.5 - Z \cdot 2) \cdot 9.91 = 99.1$

$C_pC_g coefficients$:

e: +1.4 -1.7

w: +1.3 -1.5

C_pC_g coefficient 4.1.7.6 C

Area = 12.5*55=687.5

r: $0.3 \qquad -1.5$

Interior pressure: 4.1.7.3-7

$h := 6$

$6 < 20$ ∴ case b)

$C_{ei} := \left(\frac{6}{10}\right)^{0.2} = 0.903$ $\quad 0.903 > 0.9 \ \therefore OK$ 4.1.7.3-5

$C_t := 1.0$ 4.1.7.4-1

$C_{gi} := 2.0$ 4.1.7.3-10

C_{pi}ranges from -0.45 to 0.3 4.1.7.7-1 Table 4.1.7.7

$P_{int\_positive} := 1.0 \cdot 0.6 \cdot 1.0 \cdot 2.0 \cdot 0.903 \cdot 0.3 = 0.325$

$P_{int\_negative} := -0.49$

Summary	P_{ext}		P_{int}		$Netpressure$	
Surface	+	-	+	-	+	-
e	0.76	-0.92	0.33	-0.49	1.25	-1.24
w	0.70	-0.81	0.33	-0.49	1.19	-1.13
r	0.16	-0.81	0.33	-0.49	0.65	-1.13