FacadeMatrix

GCC WIND LOAD & Ixx CALCULATOR

SAMPLE CALCULATION REPORT

Dubai Office Tower · ASCE 7-16 · Chapter 30

REPORT REFERENCE

SR-GCC-001

26 May 2026

Reference Case

Dubai · h = 60 m · Exposure C · b = 1.5 m · L = 3.5 m

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Input Parameters

City	Dubai
Country	UAE
Design code	ASCE 7-16 · Chapter 30 (C&C)
Applicable figure	Figure 30.4-1 (h > 18.3 m / 60 ft)
Enclosure classification	Enclosed building
Basic wind speed V	45 m/s (3-sec gust · Risk Cat II · 10 m AGL)
Mean roof height h	60.00 m / 196.85 ft
Exposure Category	C — open desert / inland terrain
Least plan dimension B_min	40.00 m
Mullion span L	3.50 m
Bay width b	1.50 m

Material Properties — AA 6063-T6 Aluminium

Material	AA 6063-T6 Extruded Aluminium Alloy
Modulus of elasticity E	69,000 MPa (68.9 GPa — Thomasnet)
Yield strength Fy	214 MPa
Allowable bending stress sigma_allow	128 MPa (ADM ASD · 0.6 x Fy)
Deflection code basis	AAMA TIR-A11 / IBC §2403.3 / CWCT TN 32

Code & Standard References

Wind load procedure	ASCE 7-16 Chapter 30 — C&C envelope procedure
Velocity pressure equation	ASCE 7-16 §26.10 — $q_h = 0.613 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2$
GCp figure (h > 60 ft)	ASCE 7-16 Figure 30.4-1 — Walls, high-rise buildings
Internal pressure GCpi	ASCE 7-16 Table 26.13-1 — ±0.18 (enclosed building)
Minimum design pressure	DM Res. 37/2021 §2.4 — 1.0 kN/m² floor (Dubai)
Deflection — L/175	AAMA TIR-A11 — spans ≤ 4.1 m (13 ft 6 in)
Deflection — L/240 + 6.35 mm	AAMA TIR-A11 — spans 4.1 m to 12 m
Material design standard	ADM Aluminum Design Manual (ASD) — sigma_allow = 0.6 x Fy = 128 MPa

Calculation Steps 1–20

Site Parameters · Velocity Pressure · Zone a · GCp · Design Pressures · Mullion Section Properties

Step 1 — Basic Wind Speed	
FORMULA	V from Dubai Wind Code 2013 §3.1.2 via ASCE 7-16
VALUES	3-sec gust at 10 m AGL · Risk Category II · Exposure C
RESULT	**V = 45 m/s**

Dubai Wind Code 2013 §3.1.2: "30 m/s (10-min mean) ≡ 45 m/s (3-sec gust)"

Step 2 — Building Height Conversion	
FORMULA	h_ft = h_m x 3.28084
VALUES	h_ft = 60.00 x 3.28084 = 196.85 ft
RESULT	**h = 60.00 m / 196.85 ft**

Step 3 — Applicable ASCE 7-16 Figure	
FORMULA	Criterion: h > 18.3 m (60 ft) → Figure 30.4-1 applies GCpi = ±0.18 (ASCE 7-16 Table 26.13-1 — enclosed building)
VALUES	h = 60.00 m > 18.3 m → high-rise wall C&C procedure applies
RESULT	**Applicable figure: ASCE 7-16 Figure 30.4-1**

Step 4 — Velocity Pressure Coefficient Kh	
FORMULA	Kh = 2.01 x (h / zg)^(2/alpha) Exposure C: zg = 274.32 m · alpha = 9.5
VALUES	z_eff = max(60.00, 4.57) = 60.00 m Kh = 2.01 x (60.00/274.32)^(2/9.5) = 2.01 x 0.7265
RESULT	**Kh = 1.460**

Computed from formula per ASCE 7-16 §26.10. Table interpolation not used.

Step 5 — Pressure Modification Factors	
FORMULA	Kzt per §26.8 | Kd per Table 26.6-1 | Ke per §26.9
VALUES	Kzt = 1.00 — flat terrain, no topographic feature Kd = 0.85 — buildings, components & cladding (C&C) Ke = 1.00 — sea-level site
RESULT	**Kzt = 1.00 | Kd = 0.85 | Ke = 1.00**

Step 6 — Velocity Pressure qh	
FORMULA	qh = 0.613 x Kh x Kzt x Kd x Ke x V^2 (N/m^2)
VALUES	qh = 0.613 x 1.460 x 1.00 x 0.85 x 1.00 x 45^2 = 0.613 x 1.460 x 0.85 x 2,025
RESULT	**qh = 1,540 N/m^2 = 1.540 kN/m^2**

Step 7 — Zone 5 Corner Dimension a	
FORMULA	a = min(0.1xB_min, 0.4xh) ≥ max(0.04xB_min, 0.91 m)
VALUES	a = min(0.1x40, 0.4x60) = min(4.00, 24.00) = 4.00 m Min check: max(0.04x40, 0.91) = max(1.60, 0.91) = 1.60 m ✓
RESULT	**Zone 5 a = 4.00 m from each external building corner**

Zone 4 = field zone (beyond a). Zone 5 = corner strip of width a.

Step 8 — Effective Wind Area Aeff	
FORMULA	A_trib = bxL | A_1/3 = Lx(L/3) | Aeff = max(A_trib, A_1/3)

VALUES	A_trib = 1.50x3.50 = 5.25 m² | A_1/3 = 3.50x1.167 = 4.08 m²
	Aeff = max(5.25, 4.08) = 5.25 m² = 56.53 sq ft
RESULT	**Aeff = 5.25 m² (56.53 sq ft)**

ASCE 7-16 §C26.6: effective wind area need not be less than LxL/3 for slender members.

Step 9 — GCp — Zone 4 (Figure 30.4-1, log-linear interpolation)

FORMULA	GCp(A) = GCp_20 + (GCp_500 - GCp_20) x [ln(A)-ln(20)] / [ln(500)-ln(20)]
	Anchors: A=20 sq ft → ±0.90 | A=500 sq ft → ±0.60
VALUES	A=56.53 sq ft: GCp = 0.90 + (0.60-0.90)x[ln(56.53)-ln(20)]/[ln(500)-ln(20)]
	= 0.90 - 0.30 x [4.034-2.996]/[6.215-2.996] = 0.90 - 0.097
RESULT	**+GCp Zone 4 = +0.803 | -GCp Zone 4 = -0.803**

Step 10 — GCp — Zone 5 (Figure 30.4-1)

FORMULA	+GCp5 = +GCp4 (same positive curve)
	-GCp: anchors A=20 sq ft → -1.80 | A=500 sq ft → -1.00
VALUES	-GCp5 = -1.80 + (-1.00-(-1.80)) x [ln(56.53)-ln(20)] / [ln(500)-ln(20)]
	= -1.80 + 0.80 x 0.3225 = -1.80 + 0.258
RESULT	**+GCp Zone 5 = +0.803 | -GCp Zone 5 = -1.542**

Zone 5 suction (-1.542) is 92% higher than Zone 4 (-0.803) — corner suction governs.

Step 11 — Design Pressure Equation [ASCE 7-16 Eq. 30.4-1]

FORMULA	p = qh x (GCp - GCpi)
VALUES	qh = 1.540 kN/m² | GCpi = ±0.18 (enclosed building)
	Four combinations evaluated for Zone 4 and Zone 5.
RESULT	**See Steps 12 and 13 for full combination tabulation.**

Step 12 — Zone 4 Pressure Combinations (field zone)

Combination	Formula	Calculation	p (kN/m²)
1 — Inward	q x (+GCp-(-GCpi))	1.540x(0.803+0.18)	+1.514
2 — Suction	q x (-GCp-(+GCpi))	1.540x(0.803+0.18)	-1.514
3	q x (+GCp-(+GCpi))	1.540x(0.803-0.18)	+0.960
4	q x (-GCp-(-GCpi))	1.540x(0.803-0.18)	-0.959
Governing Zone 4			**±1.514 kN/m²**

Step 13 — Zone 5 Pressure Combinations (corner zone — governs)

Combination	Formula	Calculation	p (kN/m²)
1 — Inward	q x (+GCp-(-GCpi))	1.540x(0.803+0.18)	+1.514
2 — Suction ★	q x (-GCp-(+GCpi))	1.540x(1.542+0.18)	-2.652
3	q x (+GCp-(+GCpi))	1.540x(0.803-0.18)	+0.960
4	q x (-GCp-(-GCpi))	1.540x(1.542-0.18)	-2.097
Governing Zone 5		**SUCTION GOVERNS**	**-2.652 kN/m²**

Pressure Envelope Summary

Zone	+GCp	-GCp	p_pos (kN/m²)	p_neg (kN/m²)
Zone 4 (field)	0.803	0.803	+1.514	-1.514
Zone 5 (corner)	0.803	1.542	+1.514	-2.652

Governing design pressure: p_design = 2.652 kN/m² (Zone 5 suction · Combination 2)

*Dubai Municipality minimum pressure floor: 1.0 kN/m² (DM Res. 37/2021 §2.4) — **not triggered**. Calculated 2.652 kN/m² governs.*

Step 14 — Mullion Line Load w	
FORMULA	w [N/mm] = p_design [kN/m²] x b [m] (1 kN/m = 1 N/mm exactly)
VALUES	w = 2.652 x 1.50
RESULT	**w = 3.978 kN/m = 3.978 N/mm**

Step 15 — Maximum Bending Moment M	
FORMULA	M = w x L² / 8 (simply supported · uniformly distributed load)
VALUES	M = 3.978 [N/mm] x 3,500² [mm²] / 8 = 3.978 x 12,250,000 / 8
RESULT	**M = 6,092,625 N·mm = 6.093 kN·m**

Step 16 — Maximum Shear Force V	
FORMULA	V = w x L / 2
VALUES	V = 3.978 x 3,500 / 2 = 6,962 N
RESULT	**V = 6,962 N = 6.962 kN**

Step 17 — Required Section Modulus Z_req	
FORMULA	Z_req = M / sigma_allow [sigma_allow = 128 MPa · ADM ASD · 0.6 x Fy]
VALUES	Z_req = 6,092,625 N·mm / 128 N/mm²
RESULT	**Z_req = 47,598 mm³ = 47.6 cm³**

Select extrusion with section modulus Z ≥ 47,598 mm³ about the strong axis.

Required Moment of Inertia Ixx — Three Deflection Limits

Common formula: Ixx_req = 5 x w x L^4 / (384 x E x delta_allow) where E = 69,000 N/mm² (AA 6063-T6 · Thomasnet) · all in N and mm.

Step 18 — Ixx at L/175 — Recommended (L ≤ 4.1 m · AAMA TIR-A11)	
FORMULA	delta_allow = L/175 = 3,500/175 = 20.00 mm
VALUES	Ixx = 5x3.978x3,500^4 / (384x69,000x20.00) = 5x3.978x1.5006x10^13 / 530,496,000
RESULT	**Ixx = 5,633,500 mm^4 = 563.35 cm^4 ← RECOMMENDED**

Step 19 — Ixx at L/240 + 6.35 mm — Long-span limit (AAMA TIR-A11)	
FORMULA	delta_allow = 3,500/240 + 6.35 = 14.583 + 6.35 = 20.933 mm
VALUES	Ixx = 5x3.978x3,500^4 / (384x69,000x20.933)
RESULT	**Ixx = 5,382,300 mm^4 = 538.23 cm^4**

L/240+6.35 governs for spans 4.1 m to 12 m. At L=3.5 m, L/175 governs.

Step 20 — Ixx at L/360 — Project-specific (SSG / brittle finishes)	
FORMULA	delta_allow = 3,500/360 = 9.722 mm
VALUES	Ixx = 5x3.978x3,500^4 / (384x69,000x9.722)
RESULT	**Ixx = 11,588,800 mm^4 = 1,158.88 cm^4**

Use L/360 only when project specification explicitly requires it (ETAG 002 / EN 13022).

Deflection Limit Summary — AA 6063-T6 Mullion

Deflection Limit	delta_allow (mm)	Ixx required (cm^4)	Note
L / 175	20.00	**563.35**	RECOMMENDED
L / 240 + 6.35 mm	20.93	**538.23**	
L / 360	9.72	**1,158.88**	PROJECT-SPECIFIC

Results Summary

Velocity pressure qh	**1.540 kN/m²**
Zone 5 corner dimension a	**4.00 m**
Effective wind area Aeff	**5.25 m² (56.53 sq ft)**
Governing design pressure p_design	**2.652 kN/m² — Zone 5 suction governs**
Mullion line load w	**3.978 kN/m = 3.978 N/mm**
Maximum bending moment M	**6.093 kN·m**
Maximum shear force V	**6.962 kN**
Required section modulus Z_req	**47,598 mm³ (47.6 cm³)**
Ixx at L/175 (RECOMMENDED)	**563.35 cm^4**
Ixx at L/240 + 6.35 mm	**538.23 cm^4**
Ixx at L/360 (project-specific)	**1,158.88 cm^4**

Design Recommendation

Select an AA 6063-T6 extruded aluminium mullion with Ixx ≥ 563.35 cm^4 (L/175 · AAMA TIR-A11 · recommended for spans ≤ 4.1 m per IBC §2403.3) and section modulus Z ≥ 47,598 mm³. Apply 2.652 kN/m² for corner zones within 4.00 m of each external corner (Zone 5). Apply 1.514 kN/m² for field zones (Zone 4).