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STATIC CALCULATION REPORT

Project	BEUS Facade – Sample Facade Calculation
Subject	Mullion and Transom (Wind) Calculations
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Approved by	BEUS FACE CONSULTANCY AND ENGINEERING
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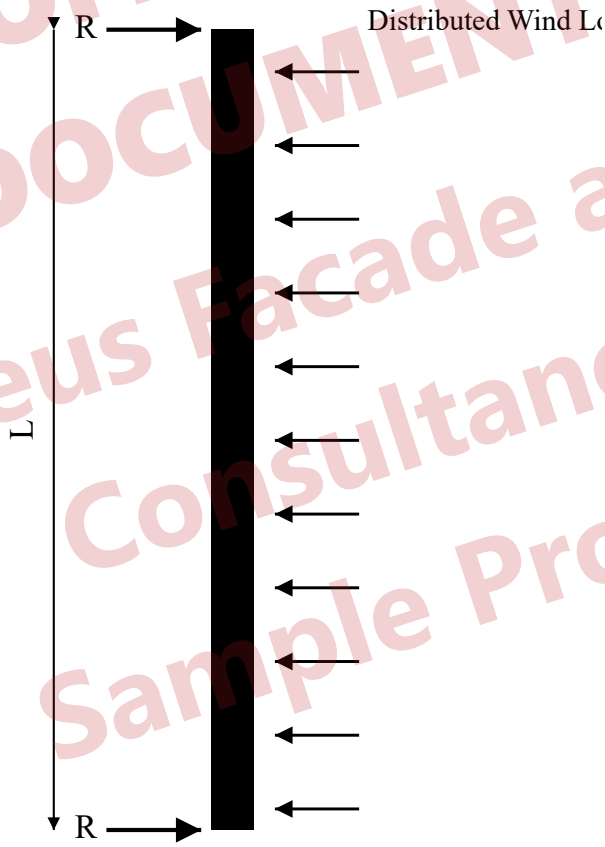
1. Vertical Profile – Wind Load (SLS)



Inputs	
Material note	Aluminum 6060-T66
|q|	1.100 kN/m² (Pressure (positive))
B	120 cm
L	320 cm
E	70 GPa
Yield strength (f_y)	170.00 MPa
$\sigma_{allow,d}$ (ULS)	154.55 MPa (γ_M1 = 1.1)
W (ULS)	20.00 cm³
I (SLS)	200.00 cm⁴
SLS (γ = 1.0)	
w	1.320 kN/m
R, V, M	2.112 kN; 2.112 kN; 1.690 kN·m
f_{limit}	15.67 mm
I_{req}	164.34 cm⁴
Deflection Compliance	12.87 mm (Compliant ✅)
ULS (γ_Q = 1.5)	
R_d, M_d	3.168 kN; 2.534 kN·m
σ_d	126.72 MPa (W = 20 cm³)
Strength Compliance	Compliant ✅ (σd ≤ 154.55 MPa)

1.1 Step-by-Step Calculation – Mullion

UDL (SLS): $w = |q| \cdot B = 1.320$ kN/m

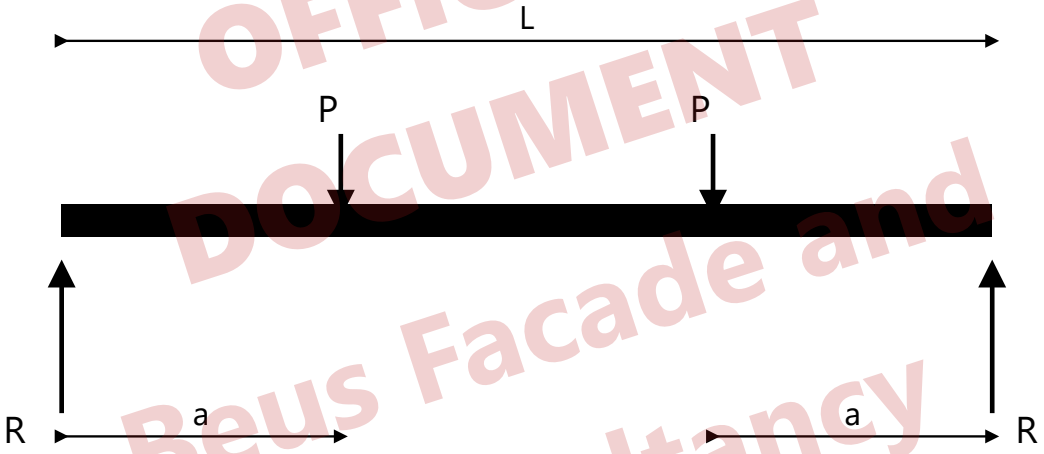
Deflection limit: EN 13830 §5.7–§5.8 → 5 mm + L/300; $f_{limit} = 15.67$ mm

I_{req} (SLS): $5 \cdot w \cdot L^4/(384 \cdot E \cdot f) = 164.34$ cm⁴

ULS moment: $M_d = w_d \cdot L^2/8 = 2.534$ kN·m

ULS stress: $\sigma_d = M_d/W = 126.72$ MPa ≤ $\sigma_{allow,d} = 154.55$ MPa → **Compliant** ✅
Material: Aluminum ($\gamma_{M1} = 1.1$)

2. Horizontal Profile – Glass Load (SLS)



Inputs	
t_{total}	10 mm
B	320 cm
L	120 cm
a	15 cm
E	70 GPa
Yield strength (f_y)	170.00 MPa
$\sigma_{allow,d}$ (ULS)	154.55 MPa (γ_M1 = 1.1)
Section modulus (W)	4.00 cm^3
Moment of inertia (I)	20.00 cm^4
SLS (γ = 1.0)	
W_{glass}, P	0.960 kN; 0.480 kN
R, M	0.480 kN; 0.072 kN·m
f_{limit}	min(L/500 = 2.40 mm, 3 mm) = **2.40 mm**
I_{req}	7.55 cm^4
Deflection Compliance	0.91 mm (Compliant ✅)
ULS (γ_G = 1.35)	
R_d, M_d	0.648 kN; 0.097 kN·m
σ_d	24.30 MPa (W = 4 cm^3)
Strength Compliance	Compliant ✅ (σd ≤ 154.55 MPa)

2.1 Step-by-Step Calculation – Transom

Glass load (SLS): $W = 0.025 \cdot t_{total} \cdot L \cdot B \rightarrow P = W/2$

Deflection limit (SLS): EN 13830 §5.6 → L/500; and also ≤ 3 mm.
Used limit: $f_{limit,proj} = \min(L/500 = 2.40\ mm,\ 3\ mm) = 2.40\ mm$
Deflection check: $\Delta_{max} = 0.91\ mm \leq 2.40\ mm \rightarrow$ **Compliant** ✅

I_{req} (SLS): $P \cdot a \cdot (3L^2 - 4a^2) / (24 \cdot E \cdot f) = 7.55\ cm^4$

ULS moment: $M_d = (\gamma_G \cdot P) \cdot a = 0.097\ kN \cdot m$

ULS stress: $\sigma_d = M_d/W = 24.30\ MPa \leq \sigma_{allow,d} = 154.55\ MPa \rightarrow$ **Compliant** ✅
Material: Aluminum ($\gamma_{M1} = 1.1$)

3. Deflection Limits (EN 13830 – Information)

Mullion SLS deflection limits (EN 13830 §5.7–§5.8): 5 mm + L/300.

Transom SLS deflection limit (EN 13830 §5.6): L/500; **Project note:** additionally limited to **≤ 3 mm**; deflection must not contact glass and must not obstruct drainage/ventilation.

Load definitions and combinations: D: dead load, W: wind; SLS = D + W, ULS = 1.35·D + 1.5·W.

Section class (information): Steel/aluminum section class (1–4) affects moment capacity; this tool does not determine section class.

4. Assumptions and Methodology

Structural Model: Simple beam (two pinned supports), in-plane bending; second-order effects, buckling, connection deformation, and panel/frame interaction are neglected.

Loads and Combinations: SLS = D + W (γ = 1.0); ULS = 1.35·D + 1.5·W.

Vertical (Mullion): $w = |q| \cdot B = 1.320$ kN/m; $f_{limit} = 15.67$ mm (EN 13830 §5.7–§5.8). $\Delta = 5wL^4/(384EI)$, $I_{req} = 5wL^4/(384Ef)$. ULS: $M_d = w_d L^2/8$.

Horizontal (Transom): $W = 0.025 \cdot t_{total} \cdot L \cdot B$; $P = W/2$; $f_{limit} = \min(L/500, 3\text{ mm})$ (EN 13830 §5.6). $\Delta = P \cdot a \cdot (3L^2 - 4a^2)/(24EI)$, $I_{req} = P \cdot a \cdot (3L^2 - 4a^2)/(24Ef)$. ULS: $M_d = (\gamma_G \cdot P) \cdot a$.

Material Strength: User-entered f_o/f_y (MPa). Aluminum: γ_M1 = 1.1 → σ_allow,d = $f_o/1.1$; Steel: γ_M0 = 1.0 → σ_allow,d = $f_y/1.0$.

birims/Sign: kN, m, mm, kN/m, kN·m, MPa. Wind pressure can be entered as pressure (+) or suction (−); calculations use |q|.

5. Standard References

EN 1990 — Structural Design Basis: SLS/ULS principles and load combinations.

EN 1991-1-1 — Dead Loads: Densities and dead load calculation.

EN 1991-1-4 — Wind Loads: Velocity pressure and facade pressure coefficients.

EN 13830 — Facade Systems: §5.6 (Transom SLS deflection: L/500, no glass contact; protect drainage/ventilation), §5.7–§5.8 (Mullion SLS deflection).

EN 1993-1-1 — Steel: γ_M0 ≈ 1.0 (verify per national annexes).

EN 1999-1-1 — Aluminum: γ_M1 ≈ 1.1 (verify per national annexes).

6. Authority and Responsibility

Authority and Responsibility:
This report is for preliminary sizing and informational purposes. Interpretation and use of the report in official design/implementation/approval processes are solely the responsibility of civil engineers. Final design must be conducted by competent engineers in accordance with relevant Eurocodes, national annexes, and project specifications; anchorage, connections, section class, buckling, and all safety checks must be separately verified.