HINGED WINDOW STRUCTURAL CALCULATION

The following structural calculation is based on strict compliance to **ALUMEG** fabrication manual instruction, the good practise of curtain wall fabrication & installation, and CWCT relevant technical notes.

DESIGN PROCEDURE FOR HINGED WINDOW STRUCTURAL CALCULATION:
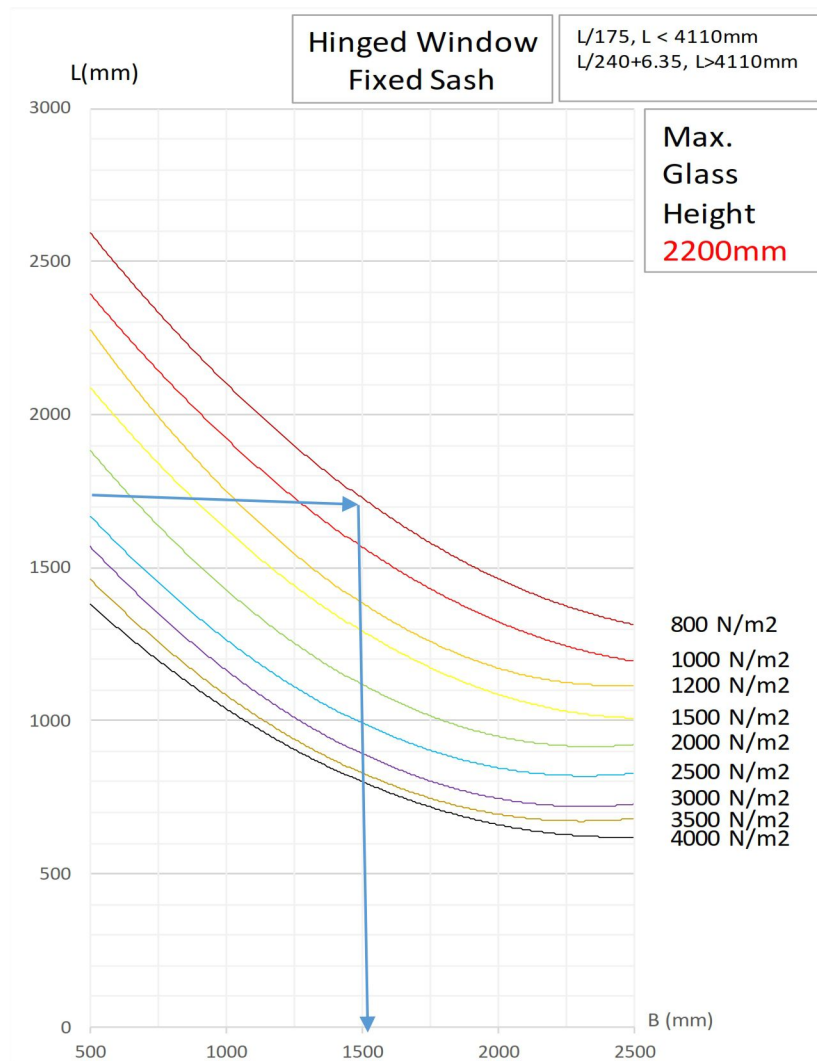
a) LOAD COMPUTATIONS:

Hinged Doors and windows design criteria will be as follow:

- Stress computation formula = $F = C_f \times K \times q$ (Kg/m^2)
- Wind loads will be obtained from Egyptian code for loads (ECP-201/2015)
- Choosing C_f as per opening of hinged window or door
    - $C_f = 1.30$, the hinged door or window is opened. Critical case when sash is closed and fixed from top and bottom to the wall
    - $C_f = 0.80$, the hinged door or window is closed. Critical case when sash is closed and fixed from top and bottom to the wall and the other hinged panel is hinged to the fixed panel in the middle.
    - $C_f = 0.80$, the hinged door or window is closed. Critical case when sash is closed and fixed from top and bottom to the wall and the hinged panel is hinged to the fixed panel in the top, middle and bottom.
    - All the above cases were taking into consideration and only ONE curve only is used in calculations; Sash is fixed from top and bottom and hinged panel is hinged from middle only.
- Choosing K according to the hinged door or window height from land level and gust factor (A, B, C), according to table (7-3)
- $q = 0.50 \times 10^{-3} \times \rho \times V^2 \times C_t \times C_s$ (kN/m^2), refer to page 85 in ECP
    - V = Basic wind speed (m/sec) from project specifications, or refer to table (7-1)
    - ρ = air density (1.25 Kg/m^3)
    - C_t = Topographic factor (unitless), refer to table (7-2)
    - C_s = Building factor (unitless), refer to appendix (7-A)

b) CHOOSING THE CURVE:

- Curves were created by governing the section type and maximum allowable deflection
    - $L / 175$ for L < 4110mm
    - $L / 240 + 6.35$mm for L > 4110mm

      *L is the hinged door or window height in mm

- The design curves were created according to:
  - o Assuming that one panel of the system is fixed from top and bottom and the other panel is opened (C=1.30)
  - o Assuming that one panel of the system is fixed from top and bottom and the other panel is closed and hinged to the fixed panel from middle (C=0.80)
  - o Finally, critical one curve is used which the fixed sash is fixed from top and bottom and the hinged one is opened with (C=1.30)
- By using the stress value (F, illustrated in curves from 800 N/m2 to 4000 N/m2), the height of the window and door in architecture drawings are given. So, breadth of the window or door panel will be achieved and hence, the total breadth of the window or door system and numbers of panels will be achieved.

Hinged Window Fixed Sash

L/175, L < 4110mm
L/240+6.35, L>4110mm

Max. Glass Height **2200mm**

L(mm)

800 N/m2
1000 N/m2
1200 N/m2
1500 N/m2
2000 N/m2
2500 N/m2
3000 N/m2
3500 N/m2
4000 N/m2

B (mm)

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EXAMPLE FOR HINGED DOOR OR WINDOW STRUCTURAL CALCULATION

ASSUME:

Hinged window will be used in Cairo zone, at height 40m.

The project in flat area, exposure (A).

Hinged window height according to architecture drawings is 1.50m.

Deflection limitation is L / 175 (taking into consideration in curves) as per project specifications.

LOAD COMPUTATIONS:

Hinged window design criteria will be as follow:

- Stress computation formula = $F = C_f \times K \times q$ (Kg/m^2)
- Wind loads will be obtained from Egyptian code for loads (ECP-201/2015)
- Choosing K = 1.60, according to table (7-3)
- $q = 0.50 \times 10^{-3} \times \rho \times V^2 \times C_t \times C_s$ (Kg/m^2), refer to page 85 in ECP
  - V = 33 m/sec, Cairo zone
  - ρ = air density (1.25 Kg/m^3)
  - C_t =1, refer to table (7-2)
  - C_s = 1, building is less than 60m, refer to appendix (7-A)
- $q = 0.50 \times 10^3 \times 1.25 \times (33)^2 \times 1 \times 1 = 0.68$ kN/m^2
- $F = 1.30 \times 1.60 \times 0.68 = 1.414$ kN/m^2 = 1414 N/m^2

CHOOSING THE CURVE:

- Choosing the curve will be used as per:
  - Hinged window height = 1.50m, deflection limitation is 8.57mm, considered in curves
  - Start the choosing by hinged window panel breadth from using the optimum panel breadth and hence the total opening breadth.
  - The wind stress = 1414 N/m^2
  - Choosing the curve between 1200 N/m^2 to 1500 N/m^2, which equal 1414 N/m^2
  - Start from vertical axis by 1.50m, draw horizontal line until intersecting the curve 1414 (N/m^2), then draw vertical line until intersect the horizontal axis, which leads to maximum breadth of hinged window panel. Finally, maximum opening breadth will be achieved

Curve	H (mm)	Maximum B (mm)	Maximum Opening (mm)
Hinged Window	1500	1200	2400

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Hinged Window Fixed Sash

L/175, L < 4110mm
L/240+6.35, L>4110mm

Max. Glass Height
2200mm

L(mm)

3000

2500

2000

1500

1000

500

0

500   1000   1500   2000   2500

B (mm)

800 N/m2
1000 N/m2
1200 N/m2
1500 N/m2
2000 N/m2
2500 N/m2
3000 N/m2
3500 N/m2
4000 N/m2

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