



Project: Angle Design	Contract: 1472-2
Subject: DESIGN C – 1500x1000mm	Sheet No. 0
Date: 19/10/2021	By: A.N

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Angle Design
1472-2
DESIGN C – 1500x1000mm
6mm Angle

Analysis By	Checked By
A.N	T.S.

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Actions/Result Summary:

Introduction:

T. Singleton & Associates Consulting Engineers (TSA) have been commissioned by Concorde Glass Ltd to carry out an Angle Design to support 1500×1000 Glass Floor.

Actions:

Load = 4kN/m²

(As per client instruction)

Assumption:

Steel Grade S235

Result Summary:

Angle: 75x50x6mm Grade S235 Mild Steel Angle.

Weld: Full penetration Butt weld at four corners.

Note: To be fabricated in accordance with BS EN 1090 Execution Class 2

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Sketch of System:

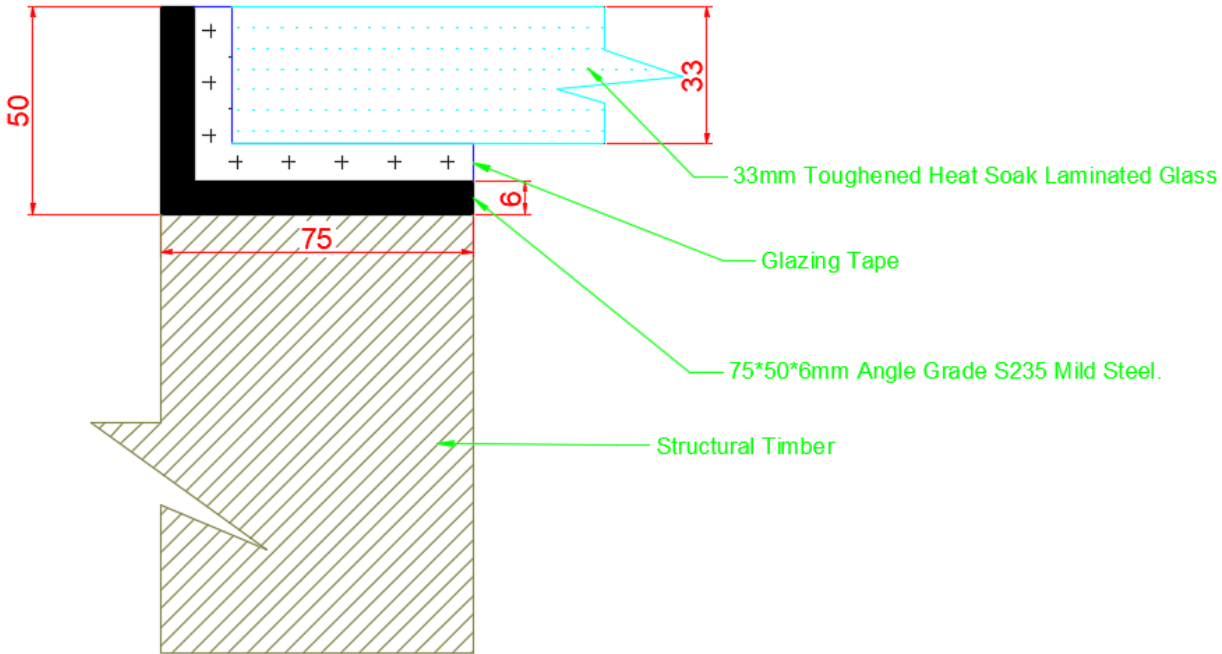


FIGURE 1 - SHOWS AN ELEVATION SKETCH

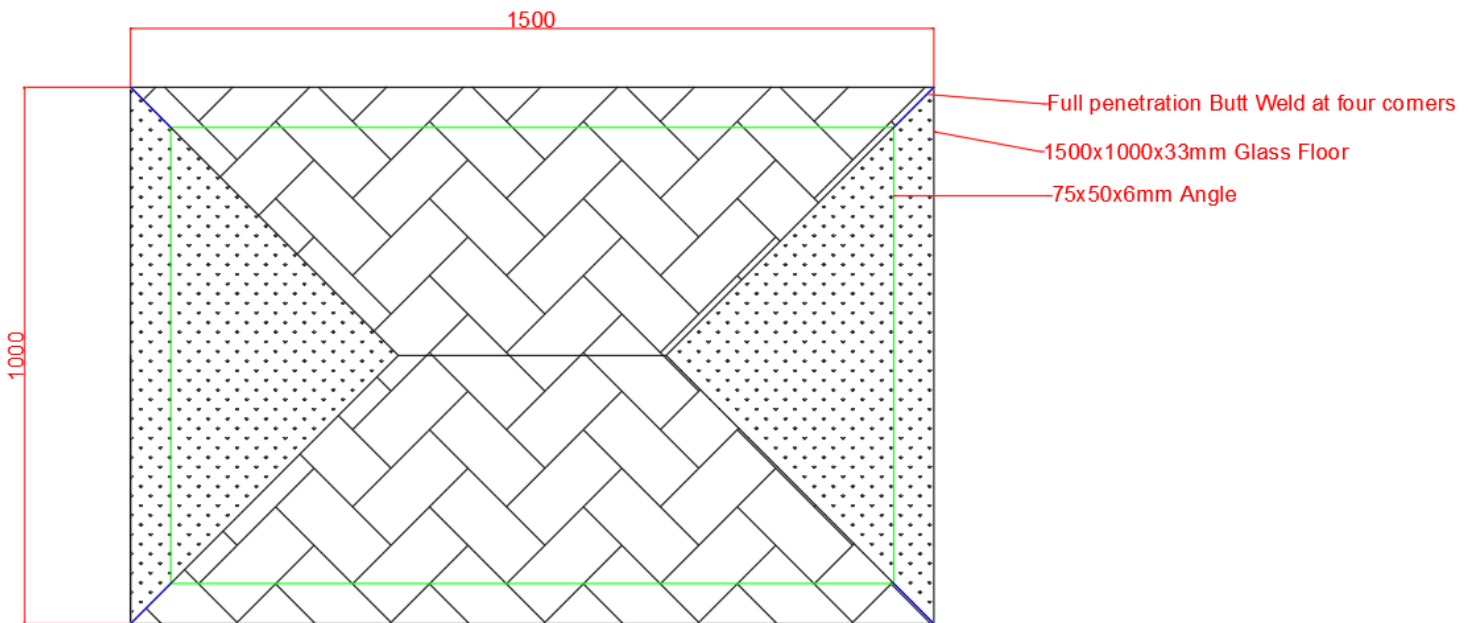


FIGURE 2 - SHOWS THE PATTERN OF THE LOAD DISTRIBUTED ON THE GLASS FLOOR PANEL

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Loading:

Live load = 4kN/m^2 (SLS)

Dead load (Self weight of glass) = $0.033\text{m} \times 25\text{kN/m}^3 = 0.825\text{kN/m}^2$ (SLS)

Total load = $(4\text{kN/m}^2 \times 1.5) + (0.825\text{kN/m}^2 \times 1.35) = 7.11\text{kN/m}^2$ (ULS)

Capacity of 75x50x6mm Angle:

Capacity of angle Based on 1500mmx1000mm Glass floor:

Check 1 – 1500mm Long leg:

$f_y = 235\text{ MPa}$ (Grade S235 Mild Steel, Table 3.1 EN 1993-1-1:2005)

$E = 210,000\text{ MPa}$ (Grade S235 Mild Steel, Table 3.1 EN 1993-1-1:2005)

$I = 405000\text{ mm}^4$ (75x50x6mm Angle)

$Z = 8010\text{ mm}^3$ (75x50x6mm Angle)

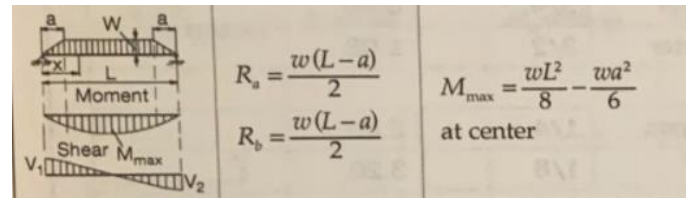
$\gamma_Q = 1.5$ (Table 6.10 EN 1991-1-1:2002)

Maximum Moment = $\left(\frac{7.11\text{kN}}{\text{m}^2} \times 0.5\text{m} \times 1.5^2\text{m}\right) - \left(\frac{7.11\text{kN}}{\text{m}^2} \times 0.5\text{m} \times 0.5^2\text{m}\right) = 0.85\text{kNm}$

Maximum Stress:

$$\sigma_{\max} = \frac{M}{Z}$$

$$\sigma_{\max} = \frac{0.85 \times 10^6}{8010} = 107 \frac{\text{N}}{\text{mm}^2} < 235 \frac{\text{N}}{\text{mm}^2} \quad \text{Okay}$$



Maximum Deflection:

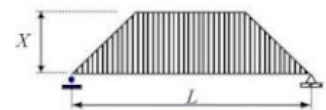
$$\alpha_{\max} = \frac{5w_e^{\Delta} l^4}{384EI}$$

$$\sigma = \left(1 - 1.6 \left(\frac{x}{L}\right)^2 + 0.64 \left(\frac{x}{L}\right)^4\right)$$

$$\sigma = \left(1 - 1.6 \left(\frac{0.5}{1.5}\right)^2 + 0.64 \left(\frac{0.5}{1.5}\right)^4\right) = 0.83$$

$$w_e^{\Delta} = 0.83 \times 4.825\text{kN/m}^2 \times 0.5\text{m} = 2\text{kN/m}$$

$$\alpha_{\max} = \frac{5 \times 2\text{N/mm} \times 1500^4\text{mm}}{384 \times 210000\text{N/mm}^2 \times 405000\text{mm}^4} = 1.55\text{mm} < 7.5\text{mm} \left(\frac{1500}{200}\right) \quad \text{Okay}$$



$$w_e^{\Delta} = \delta w X$$

$$\delta = \left\{1.0 - 1.6 \left(\frac{X}{L}\right)^2 + 0.64 \left(\frac{X}{L}\right)^4\right\}$$

Therefore, use 75x50x6mm Grade S235 Mild Steel Angle.

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Check 2 – 1000mm Long leg:

$$f_y = 235 \text{ MPa} \quad (\text{Grade S235 Mild Steel, Table 3.1 EN 1993-1-1:2005})$$

$$E = 210,000 \text{ MPa} \quad (\text{Grade S235 Mild Steel, Table 3.1 EN 1993-1-1:2005})$$

$$I = 405000 \text{ mm}^4 \quad (75 \times 50 \times 6 \text{ mm Angle})$$

$$Z = 8010 \text{ mm}^3 \quad (75 \times 50 \times 6 \text{ mm Angle})$$

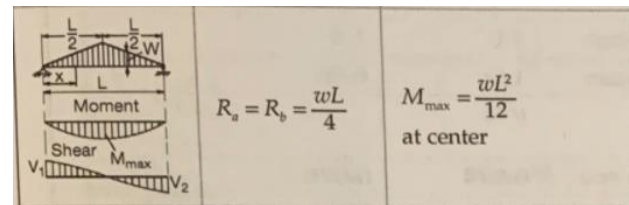
$$\gamma_Q = 1.5 \quad (\text{Table 6.10 EN 1991-1-1:2002})$$

$$\text{Maximum Moment} = \frac{7.11 \text{ kN}}{\text{m}^2} \times 0.5 \text{ m} \times 1^2 \text{ m} \div 12 = 0.3 \text{ kNm}$$

Maximum Stress:

$$\sigma_{\max} = \frac{M}{Z}$$

$$\sigma_{\max} = \frac{0.3 \times 10^6}{8010} = 38 \frac{\text{N}}{\text{mm}^2} < 235 \frac{\text{N}}{\text{mm}^2} \quad \text{Okay}$$



Maximum Deflection:

$$\alpha_{\max} = \frac{wl^4}{120EI}$$

$$w = 4.825 \text{ kN/m}^2 \times 0.5 \text{ m} = 2.412 \text{ kN/m}$$

$$\alpha_{\max} = \frac{2.412 \text{ N/mm} \times 1000^4 \text{ mm}}{120 \times 210000 \text{ N/mm}^2 \times 405000 \text{ mm}^4} = 0.24 \text{ mm} < 5 \text{ mm} \left(\frac{1000}{200} \right) \quad \text{Okay}$$

Therefore, use 75x50x6mm Grade S235 Mild Steel Angle.