Project: Angle Design	**Contract:** 1472-2
Subject: DESIGN D – 2400x1200mm	**Sheet No.** 0
Date: 19/10/2021	**By:** A.N

Concorde Glass Ltd.,

Linx House,

104 Waterloo Rd,

Mablethorpe,

LN12 1LE,

UK.

Angle Design

1472-2

DESIGN C – 2400x1200mm

8mm Angle

Analysis By	Checked By
A.N	T.S.

Revision	Date	Issued By	Comment
1	06/12/2021	T.S	Amended
0	19/10/2021	T.S.	Issued

TSA
TED SINGLETON & ASSOCIATES
CONSULTING ENGINEERS

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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 2400×1200 Glass Floor.

Actions:

Load = 4kN/m² (As per client instruction)

Assumption:

Steel Grade S235

Result Summary:

Angle: 75x50x8mm 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:

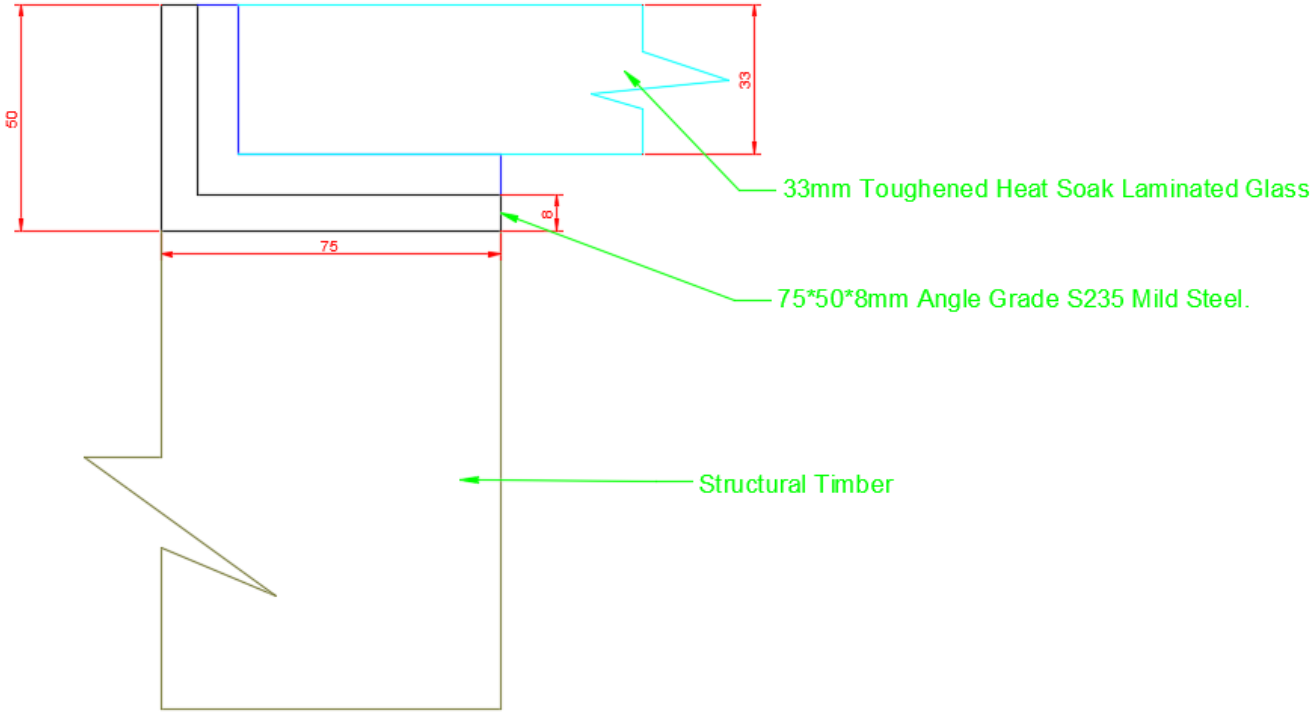

FIGURE 1 SHOWS AN ELEVATION VIEW

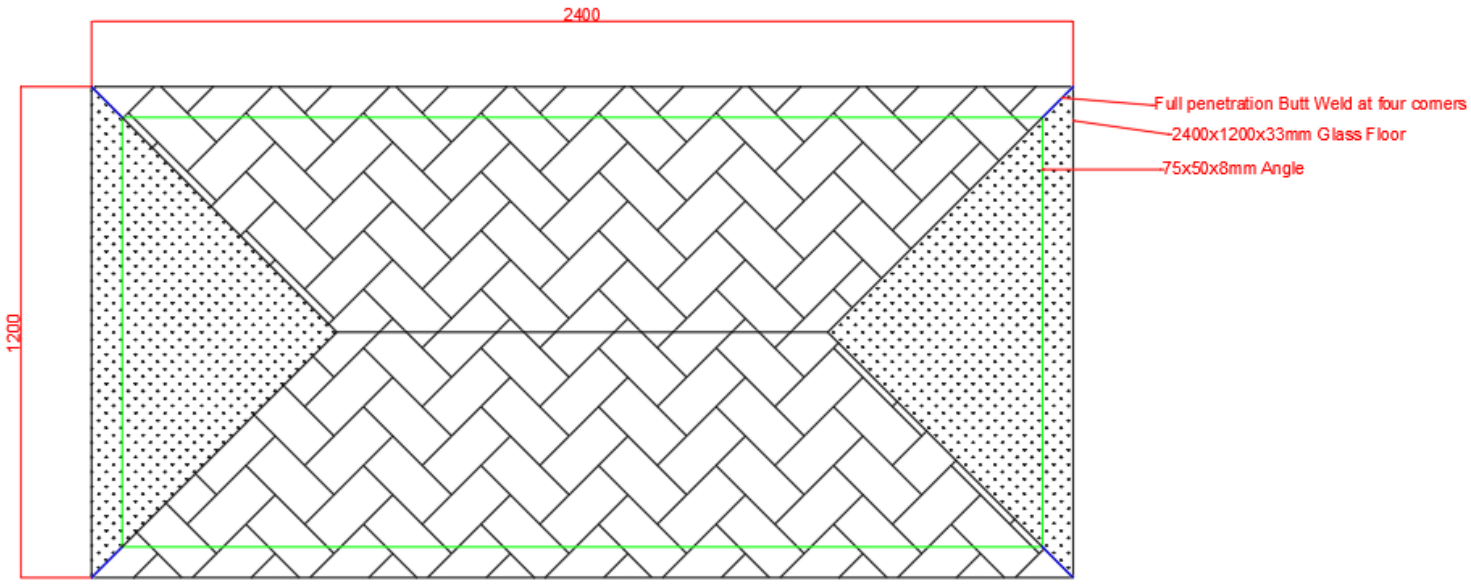

FIGURE 2 SHOWS THE PATTERN OF THE LOAD DISTRIBUTED ON THE GLASS FLOOR

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Loading:

Live load $= 4\text{kN/m}^2$ (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 75x50x8mm Angle:

Capacity of angle Based on 2400mm×1200mm Glass floor – (worst case):

Check 1 – 2400mm Long leg:

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

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

$I = 520000mm^4$ (75×50×8mm Angle)

$Z = 10400mm^3$ (75×50×8mm Angle)

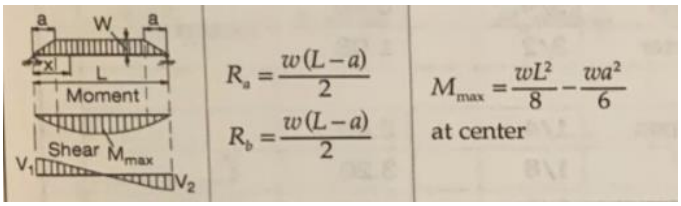
$\gamma_Q = 1.5$ (Table 6.10 EN 1991-1-1:2002)

$$\text{Maximum Moment} = \left(\frac{\frac{7.11\text{kN}}{\text{m}^2} \times 0.6\text{m} \times 2.4^2\text{m}}{8}\right) - \left(\frac{\frac{7.11\text{kN}}{\text{m}^2} \times 0.6\text{m} \times 1.2^2\text{m}}{6}\right) = 2.05\text{kNm}$$

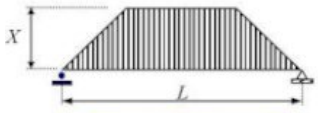
Maximum Stress:

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

$$\sigma_{max} = \frac{2.05 \times 10^6}{10400} = 198\frac{N}{mm^2} < 235\frac{N}{mm^2}$$ **Okay**



Maximum Deflection:



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

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

$$w_e^4 = \delta\, w\, X$$

$$\sigma = \left(1 - 1.6\left(\frac{0.6}{2.4}\right)^2 + 0.64\left(\frac{0.6}{2.4}\right)^4\right) = 0.9025$$

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

$$w_e^{\Delta} = 0.9025 \times 4.825\text{kN/m}^2 \times 0.6\text{m} = 2.62\text{kN/m}$$

$$\alpha_{max} = \frac{5 \times 2.62\text{N/mm} \times 2400^4 mm}{384 \times 210000\text{N/mm}^2 \times 520000\text{mm}^4} = 10.4\text{mm} < 12\text{mm}\ \left(\frac{2400}{200}\right)$$ **Okay**

Therefore, use 75x50x8mm Grade S235 Mild Steel Angle.

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Check 2 – 1200mm Long leg:

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

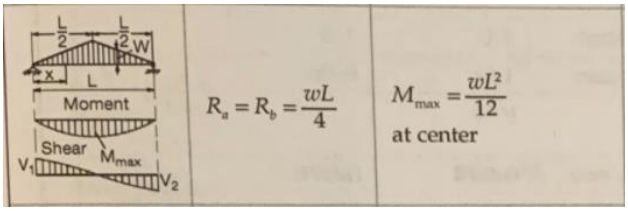
$E = 210{,}000\ MPa$ (Grade S235 Mild Steel, Table 3.1 EN 1993-1-1:2005)

$I = 520000mm^4$ (75×50×8mm Angle)

$Z = 10400mm^3$ (75×50×8mm Angle)

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

$$\text{Maximum Moment} = \frac{\frac{7.11\text{kN}}{\text{m}^2} \times 0.6\text{m} \times 1.2^2\text{m}}{12} = 0.512\text{kNm}$$



Maximum Stress:

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

$$\sigma_{max} = \frac{0.512 \times 10^6}{10400} = 50\ \frac{N}{mm^2} < 235\ \frac{N}{mm^2}$$ **Okay**

Maximum Deflection:

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

$$w = 4.825\text{kN/m}^2 \times 0.6\text{m} = 2.895\text{kN/m}$$

$$\alpha_{max} = \frac{2.895\text{N/mm} \times 1200^4 mm}{120 \times 210000\text{N/mm}^2 \times 520000\text{mm}^4} = 0.46\text{mm} < 6\text{mm}\ \left(\frac{1200}{200}\right)$$ **Okay**

Therefore, use 75x50x8mm Grade S235 Mild Steel Angle.