TSA
TED SINGLETON & ASSOCIATES
CONSULTING ENGINEERS

Project: Angle Design	**Contract:** 1472-2
Subject: DESIGN C – 1500x1000mm	**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 – 1500x1000mm

6mm Angle

Analysis By	Checked By
A.N	T.S.

Revision	Date	Issued By	Comment
2	08/12/2021	T.S	Amended
1	06/12/2021	T.S	Amended
0	19/10/2021	T.S.	Issued

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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 S355

Result Summary:

Angle: 75x50x6mm Grade S355 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:

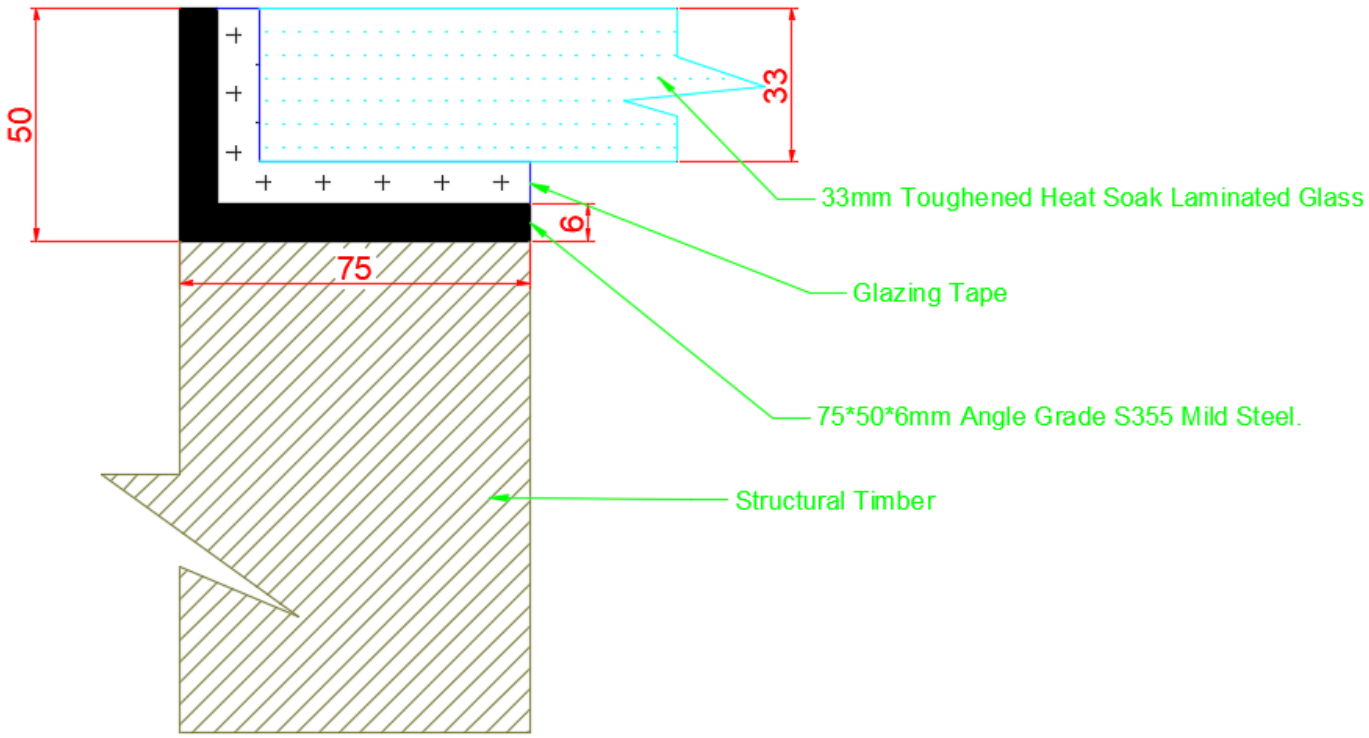

FIGURE 1 -SHOWS AN ELEVATION SKETCH

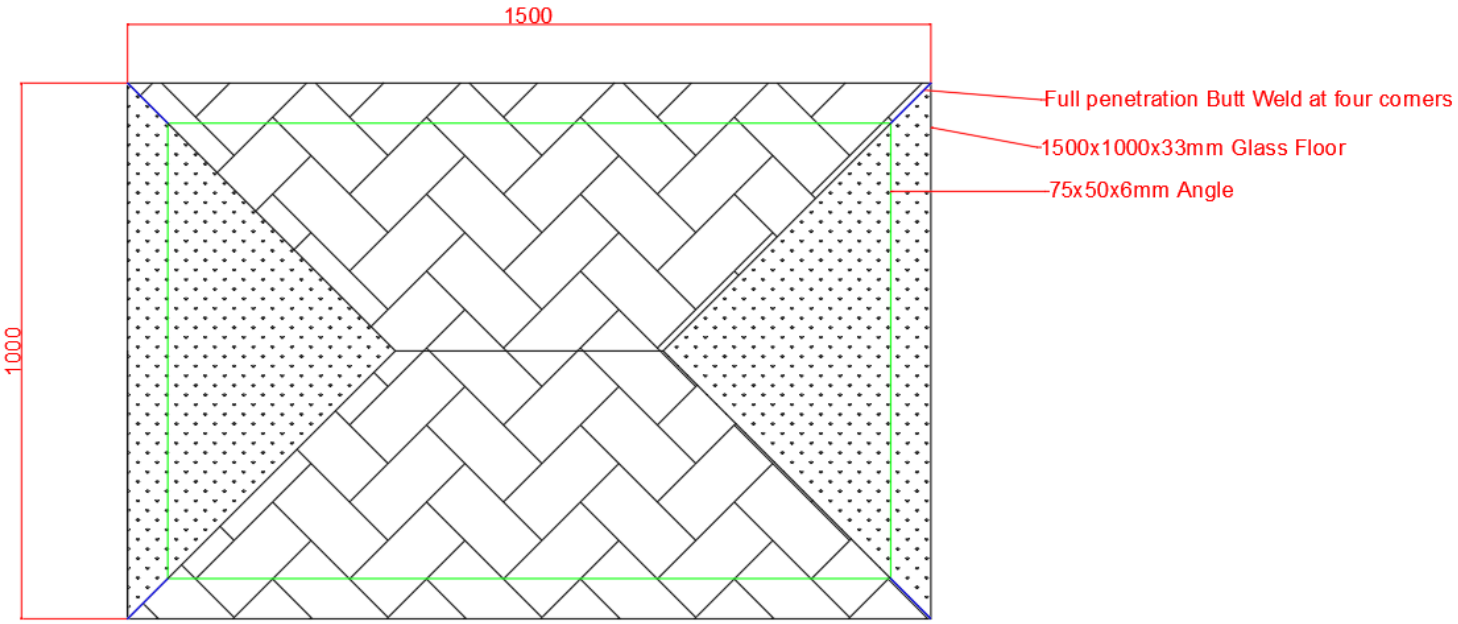

FIGURE 2 - SHOWS THE PATTERN OF THE LOAD DISTRIBUTED ON THE GLASS FLOOR PANEL

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Loading:

Live load $= 4\text{kN/m}^2$ (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 75x50x6mm Angle:

Capacity of angle Based on 1500mm×1000mm Glass floor:

Check 1 – 1500mm Long leg:

$f_y = 355\ MPa$ (Grade S355 Mild Steel, Table 3.1 EN 1993-1-1:2005)

$E = 210{,}000\ MPa$ (Grade S355 Mild Steel, Table 3.1 EN 1993-1-1:2005)

$I = 405000mm^4$ (75×50×6mm Angle)

$Z = 8010mm^3$ (75×50×6mm Angle)

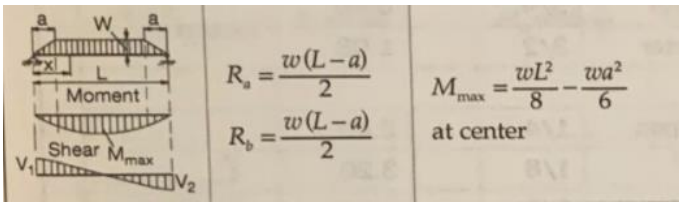
$\gamma_Q = 1.5$ (Table 6.10 EN 1991-1-1:2002)

$$\text{Maximum Moment} = \left(\frac{\frac{7.11\text{kN}}{\text{m}^2} \times 0.5\text{m} \times 1.5^2\text{m}}{8}\right) - \left(\frac{\frac{7.11\text{kN}}{\text{m}^2} \times 0.5\text{m} \times 0.5^2\text{m}}{6}\right) = 0.85\text{kNm}$$

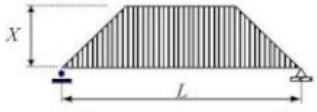
Maximum Stress:

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

$$\sigma_{max} = \frac{0.85 \times 10^6}{8010} = 107\ \frac{N}{mm^2} < 355\ \frac{N}{mm^2}$$ **Okay**



Maximum Deflection:



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

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

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

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

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

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

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

Therefore, use 75x50x6mm Grade S355 Mild Steel Angle.

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Check 2 – 1000mm Long leg:

$f_y = 355\ MPa$ (Grade S355 Mild Steel, Table 3.1 EN 1993-1-1:2005)

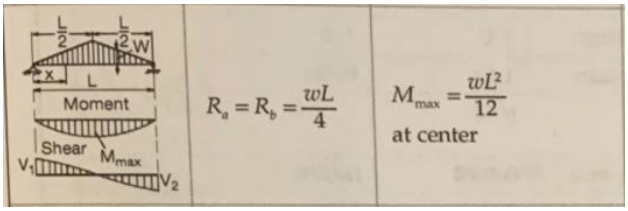
$E = 210{,}000\ MPa$ (Grade S355 Mild Steel, Table 3.1 EN 1993-1-1:2005)

$I = 405000mm^4$ (75×50×6mm Angle)

$Z = 8010mm^3$ (75×50×6mm Angle)

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

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



Maximum Stress:

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

$$\sigma_{max} = \frac{0.3\times10^6}{8010} = 38\ \frac{\text{N}}{\text{mm}^2} < 355\ \frac{\text{N}}{\text{mm}^2}$$ **Okay**

Maximum Deflection:

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

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

$$\alpha_{max} = \frac{2.412\text{N/mm} \times 1000^4 mm}{120\times210000\text{N/mm}^2\times405000\text{mm}^4} = 0.24\text{mm} < 5\text{mm}\ \left(\frac{1000}{200}\right)$$ **Okay**

Therefore, use 75x50x6mm Grade S355 Mild Steel Angle.