TED SINGLETON & ASSOCIATES
CONSULTING ENGINEERS

Project: On Level	Contract: 3135-1
Subject : Glass Balustrade Design	Sheet No. 1
Date: 12/08/2026	By: C.C./R.F.

On Level Ltd.,

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United Kingdom

Glass Balustrade Design
3135-1

Analysis By	Checked By	Approved By
C.C./R.F.	C.K.	T.S.

0	12/08/2026	T.S.	Issued
Revision	**Date**	**Issued By**	**Comment**

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1. Introduction

T. Singleton & Associates Consulting Engineers (TSA) has been commissioned by On Level Ltd to carry out the design of Glass Balustrade using Shoe TF6620, for different loading arrangements.

The performance specifications and loads being applied to the structure are as per Eurocode and the clients' instructions.

Performance Specification

The performance specification is as below. Design completed as per EN 1993-1-1, and EN 1993-1-8.

Self-Weight

The self-weight of the balustrade which includes the weight of the glass.

Imposed Load

A horizontal balustrade load of 0.74kN/m was considered per BS6180:2011.

An infill point load of 0.5kN was considered per BS6180:2011.

An infill uniform load of 1.0kN/m^2 was considered per BS6180:2011.

Serviceability Loads

To determine the deflection of the structural components the dead and live loads were combined.

Ultimate Loads

To determine the ultimate stresses within the structural components, the total self-weight of the glass balustrade section was factored by 1.35, and the imposed loading was factored by 1.5. The above factors are as specified by the relevant Eurocodes of practice.

2. Design Summary

Eurocode/Document Compliance Information:

- Actions to BS6180:2011.

Actions:

- As instructed by On Level Ltd, the Balustrade has been designed to a barrier loading of 0.74kN/m.
- Balustrade Load = 0.74kN/m; BS6180:2011.
- Point Load = 0.5kN; BS6180:2011.
- Uniform Load = 1.0kN/m^2; BS6180:2011.

Assumptions:

- Concrete Grade = C30/37 cracked.
- The Grade 6063 T6 Aluminium Shoe TF6620 is fixed to the top of the concrete with anchors Fischer FH II 18/10 S @ 200mm c/c, minimum anchor depth 80mm
- Laminated glass 10/10/1.52mm with Sentry SGP Interlayer.

Results Summary:

- Shoe TF6620 Grade 6063 T6 aluminium fixed to concrete using Fischer FH II 18/10 S @200mm c/c, minimum anchor depth 80mm.
- Laminated glass 10/10/1.52mm with Sentry SGP Interlayer.

Type of Occupancy for Part of the Building	Examples of Specific Use	Horizontal Uniformly Distributed Line Load (kN/m)	TF-6620 Top Mount 10/10/1.52 SGP Laminated
Domestic and residential activities	(i) all areas within or serving exclusively one single family dwelling including stairs, landings, etc. but excluding external balconies and edges of roofs	0.36	✓
	(ii) other residential, i.e. houses of multiple occupancy and balconies, including Juliette balconies and edges of roofs in single-family dwellings	0.74	✓
Offices and work areas not included elsewhere, including storage areas	(iii) light access stairs and gangways not more than 600 mm wide	0.22	✓
	(iv) light pedestrian traffic routes in industrial and storage buildings except designated escape routes	0.36	✓
	(v) areas not susceptible to overcrowding in office and institutional buildings, also industrial and storage buildings except as given above	0.74	✓
Areas where people might congregate	(vi) areas having fixed seating within 530 mm of the barrier, balustrade, or parapet	1.50	X
Areas with tables or fixed seating	(vii) restaurants and bars	1.50	X
Areas without obstacles for moving people and not susceptible to overcrowding	(viii) stairs, landings corridors ramps	0.74	✓
	(ix) external balconies including Juliette balconies and edges of roofs; footways and pavements within building cartilage adjacent to basement/sunken areas	0.74	✓
Areas susceptible to overcrowding	(x) footways or pavements less than 3 m wide adjacent to sunken areas	1.50	X
	(xi) theatres, cinemas, discotheques, bars, auditoria, shopping malls, assembly areas, studios; footways or pavements greater than 3 m wide adjacent to sunken areas	3.00	X
	(xii) grandstands and stadia	(Note 1)	-
Retail areas	(xiii) all retail areas including public areas of banks/building societies or betting shops	1.50	X
Vehicular	(xiv) pedestrian areas in car parks, including stairs, landings, ramps, edges of internal floors, footways, edges of roofs	1.50 (Note 2)	X
	(xv) horizontal loads imposed by vehicles	(Note 2)	-

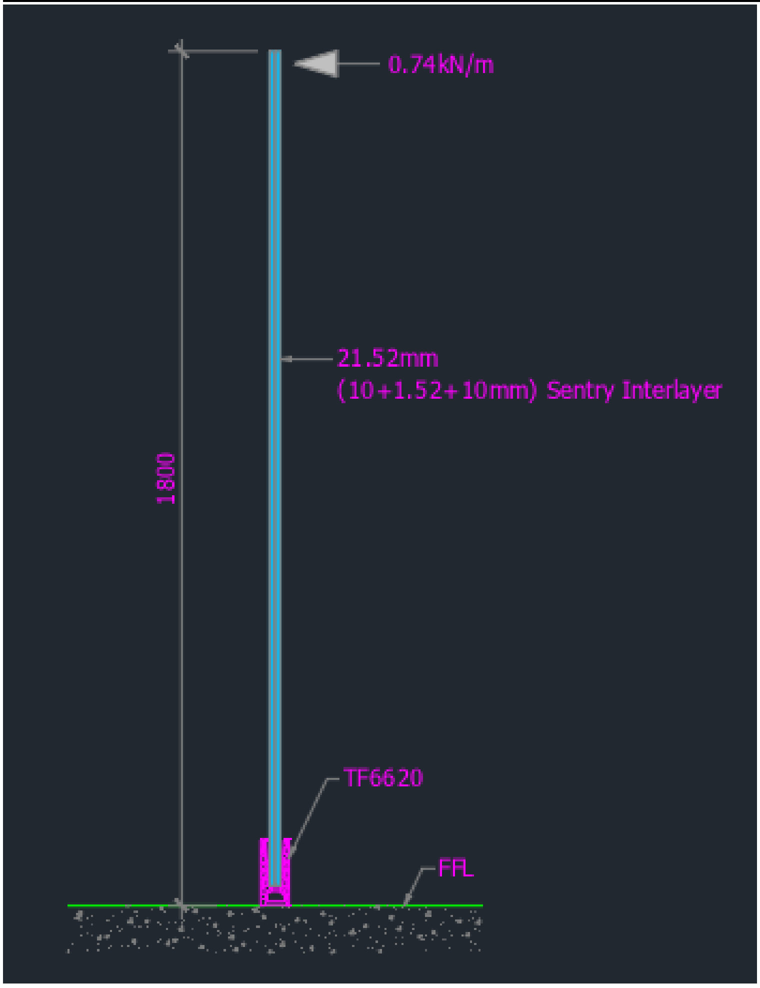
Note 1 – See requirements of the appropriate certifying authority
Note 2 – Clause 8.1.1 of BS 6180:2011 states that "glass should not be used for vehicle protection barriers"

Drawing Alterations:

No alterations as issued.

3. Sketch of System:

3.1 Sketch - 21.52mm – 0.74kN/m (Glass) Sentry SGP Interlayer and TF 6620:



NOTE:

- Combined Deflection 10.37mm (Shoe) plus 9.19mm (Glass) = 19.56mm < 25mm. **OK in deflection**

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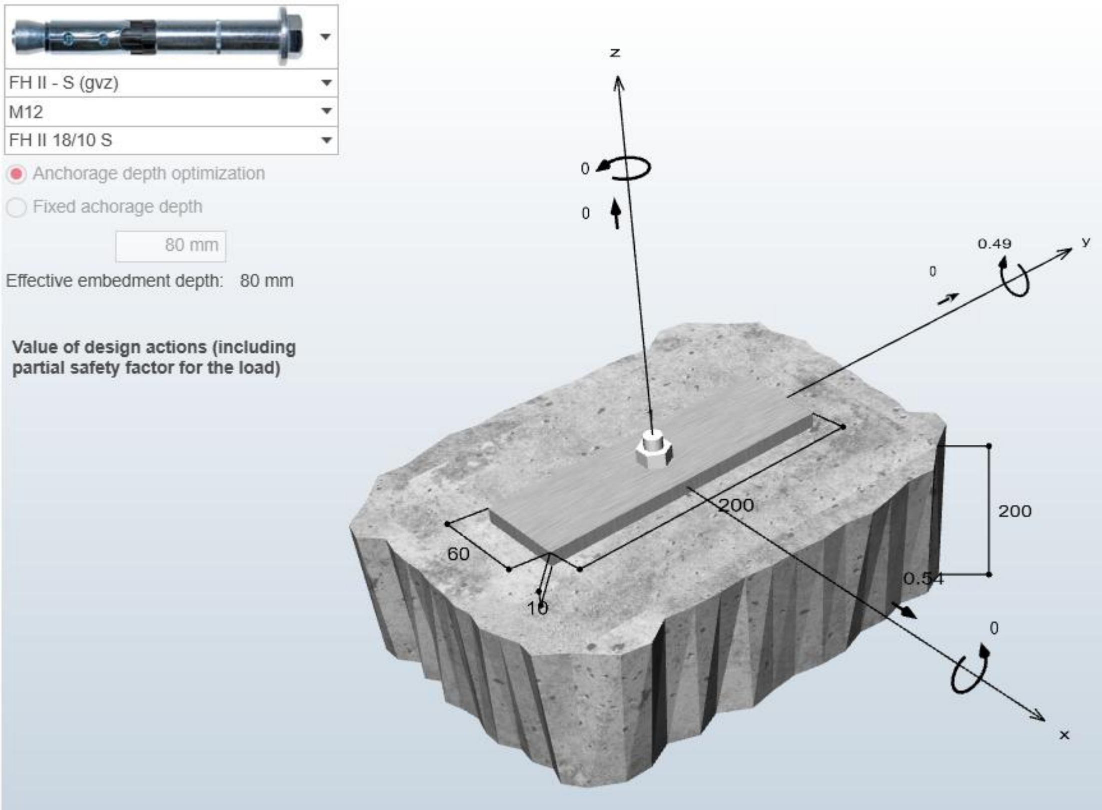
4. Connection To Concrete Design:

4.1 Loading at Connection:

$\text{Shear Load} = 0.74\text{kN/m} \times 1.5 \times 0.2\text{m} = 0.222\text{kN (ULS)}$
$\text{Maximum Moment} = 0.74\text{kN/m} \times 1.5 \times 0.2\text{m} \times 1.8\text{m} = 0.4\text{kNm (ULS)}$
$\text{Shear Load} = 1.0\text{kN/m}^2 \text{ x } 1.8 \times 1.5 \times 0.2\text{m} = 0.54\text{kN (ULS)}$
$\text{Maximum Moment} = 0.54\text{kN} \times 1.8\text{m}/2 = 0.49\text{kNm (ULS)}$

Therefore use 1no. Fischer FH II 18/10 S @200mm c/c, minimum anchor depth 80mm. See design in Appendix C.



5. Glass Analysis

TSA have checked the Glass for the following most critical load cases:

LC 1	SLS	Infill Load per Appendix A: 1.0kN/m^2 + $V_{\text{weight of the glass}}$
LC 2	ULS	Infill Load per Appendix A: 1.5kN/m^2 + $V_{\text{weight of the glass}}$ x 1.35
LC 3	SLS	0.74kN/m Balustrade Load @ 1800mm above FFL + $V_{\text{weight of the glass}}$
LC 4	ULS	1.11kN/m Balustrade Load @ 1800mm above FFL + $V_{\text{weight of the glass}}$ x 1.35
LC 5	SLS	0.5kN Infill Point Load + $V_{\text{weight of the glass}}$
LC 6	ULS	0.75kN Infill Point Load + $V_{\text{weight of the glass}}$ x 1.35

Table 1 – Load Cases

The results are summarised below in Table 2 and shown in detail on the pages to follow:

Load Case	Description	Bending Stress	Deflection
LC 1 & LC 2	Infill Load	27.13N/mm^2 < 84.2N/mm^2	8.72*mm < 25mm
LC 3 & LC 4	Balustrade Load	25.13N/mm^2 < 84.2N/mm^2	**9.19*mm < 25mm**
LC 5 & LC 6	Infill Point Load	8.05N/mm^2 < 84.2N/mm^2	2.55*mm < 25mm
	Shoe Analysis	159.3N/mm^2 < 160N/mm^2	**10.37*mm < 25mm**
Combined	-	-	**19.56*mm < 25mm**

* The deflection is checked @1100mm above the FFL

Table 2 – Summary of Results

Assumptions:

- Glass Panel Size 1000mm width x 1800mm height per drawings received
- Horizontally Toughened Laminated Glass of thickness 21.52mm – 10mm/1.52mm/10mm
- 1.52mm Interlayer Analysed with properties, E= 549 MPa, G = 184.23 MPa Sentry Glass
- On Level Top Profile Shoe, Model TF6620, Size: 75x135mm, Aluminium 6063 T6
- Loads applied per Appendix A
- Glass Strength Properties per Appendix B

Results:

Use 21.52mm Glass 10mm/1.52mm Sentry Interlayer/10mm for Balustrade & On Level Profile Shoe, Model TF6620

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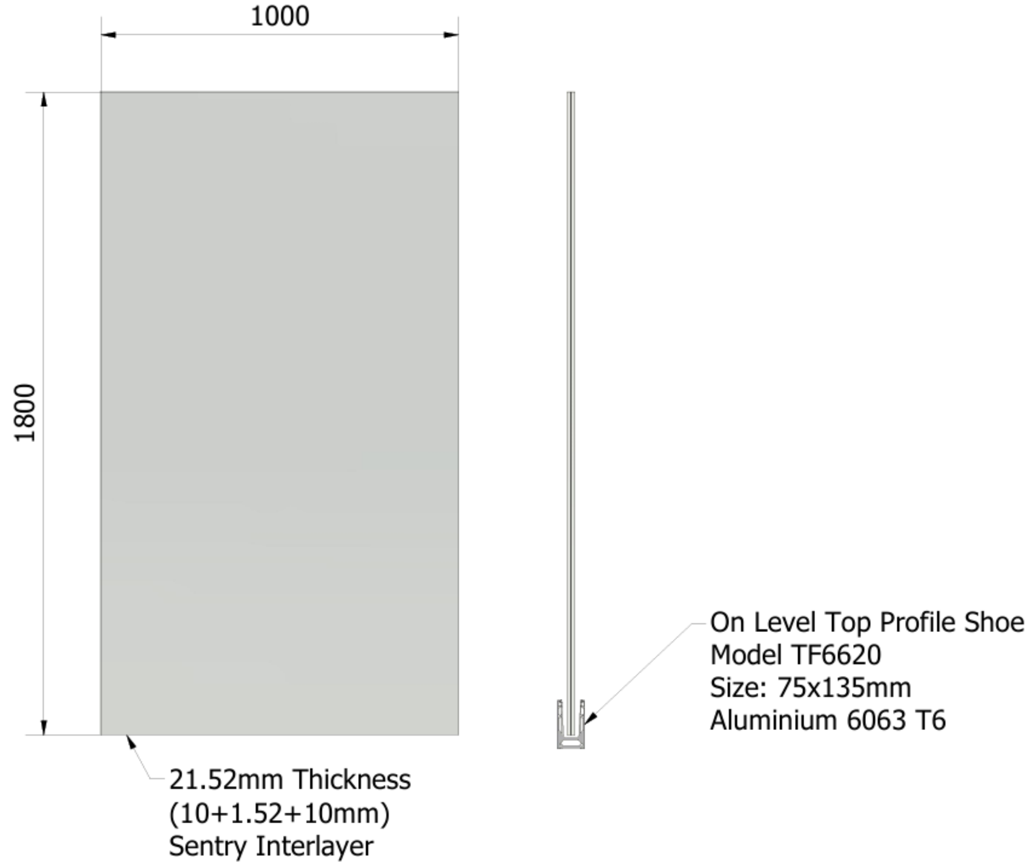
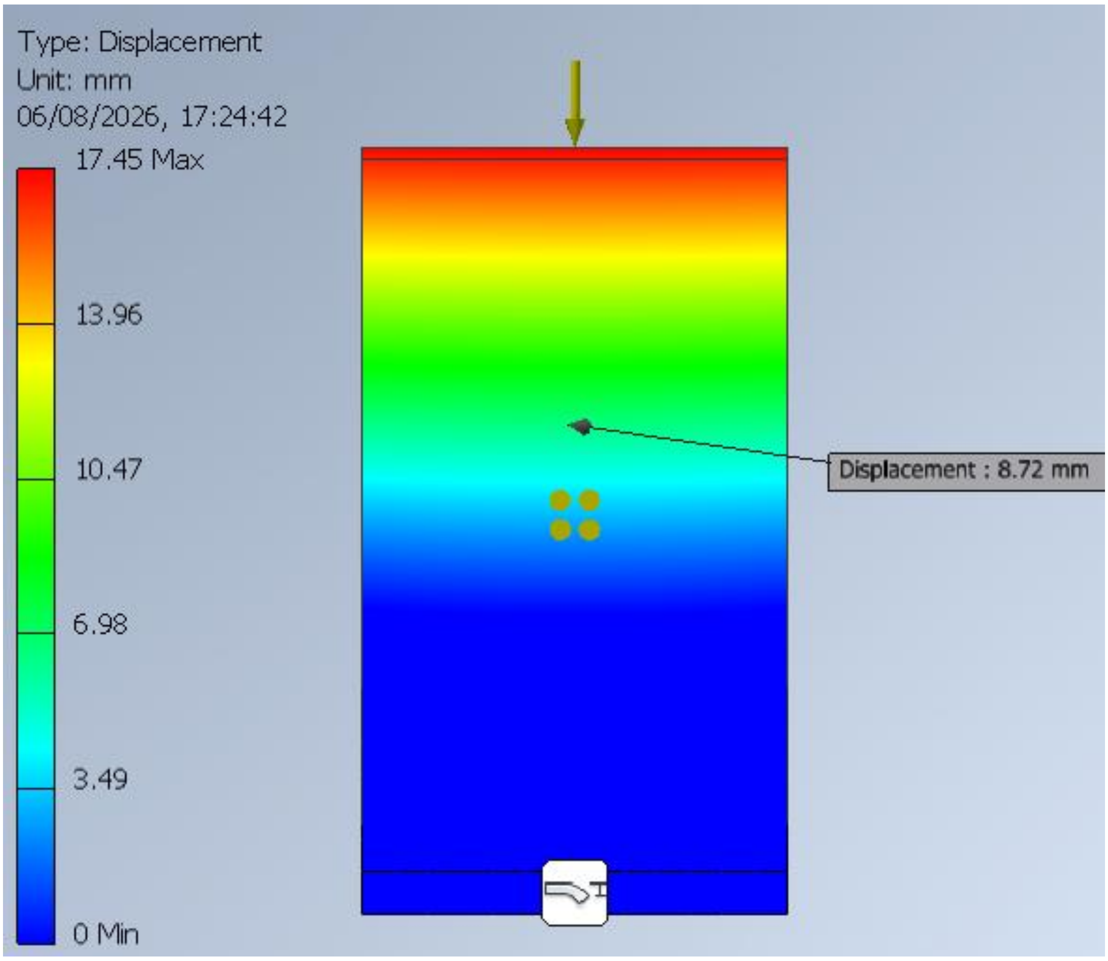
5.1 Glass Panel Analysed:



$$\text{Glass}_{weight} = 1.0\text{m} \times 1.8\text{m} \times 0.02152\text{m} \times 25\text{kN/m}^3 = 0.968\text{kN (SLS)}$$

$$= 0.968\text{kN} \times 1.35 = 1.307\text{kN (ULS)}$$

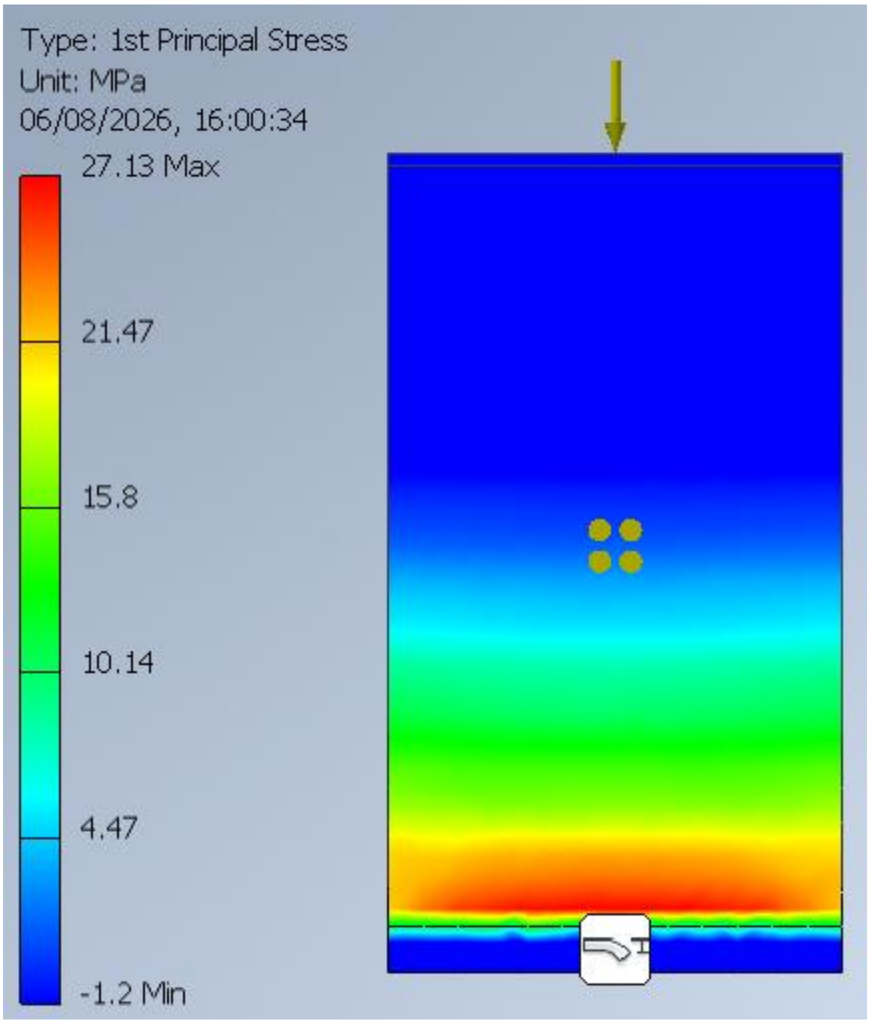
5.2 Load Case 1: SLS Infill Pressure Load



NOTE:
In this case the 17.45mm is the deflection at the top of the glass. The most appropriate deflection to be considered is 8.72mm, at 1100mm above the FFL.

Result:
Max. Deflection = 8.72mm < 25mm {BS6180:2011 cl. 6.4.1} **Pass**

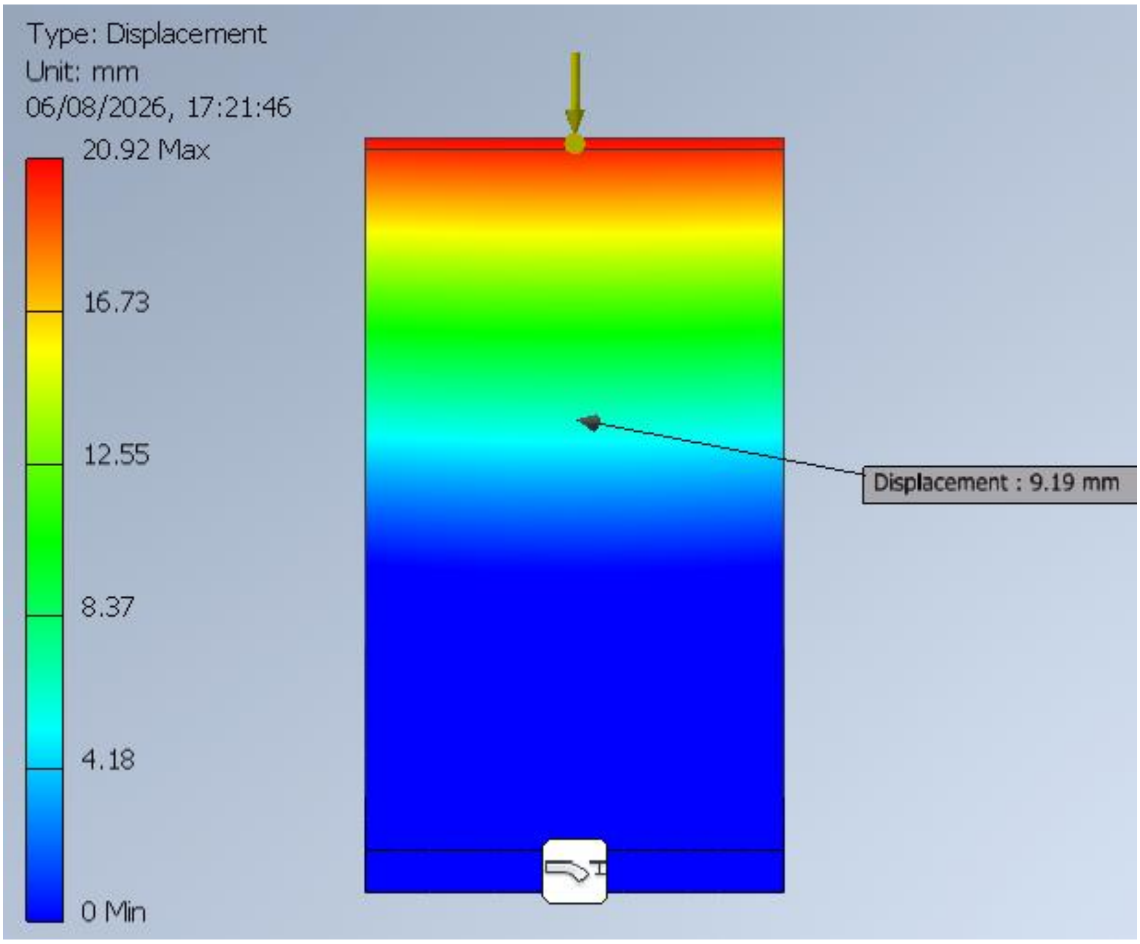
5.3 Load Case 2: ULS Infill Pressure Load



Result:

Max. Bending Stress = 27.13N/mm^2 < 84.2N/mm^2 **Pass**

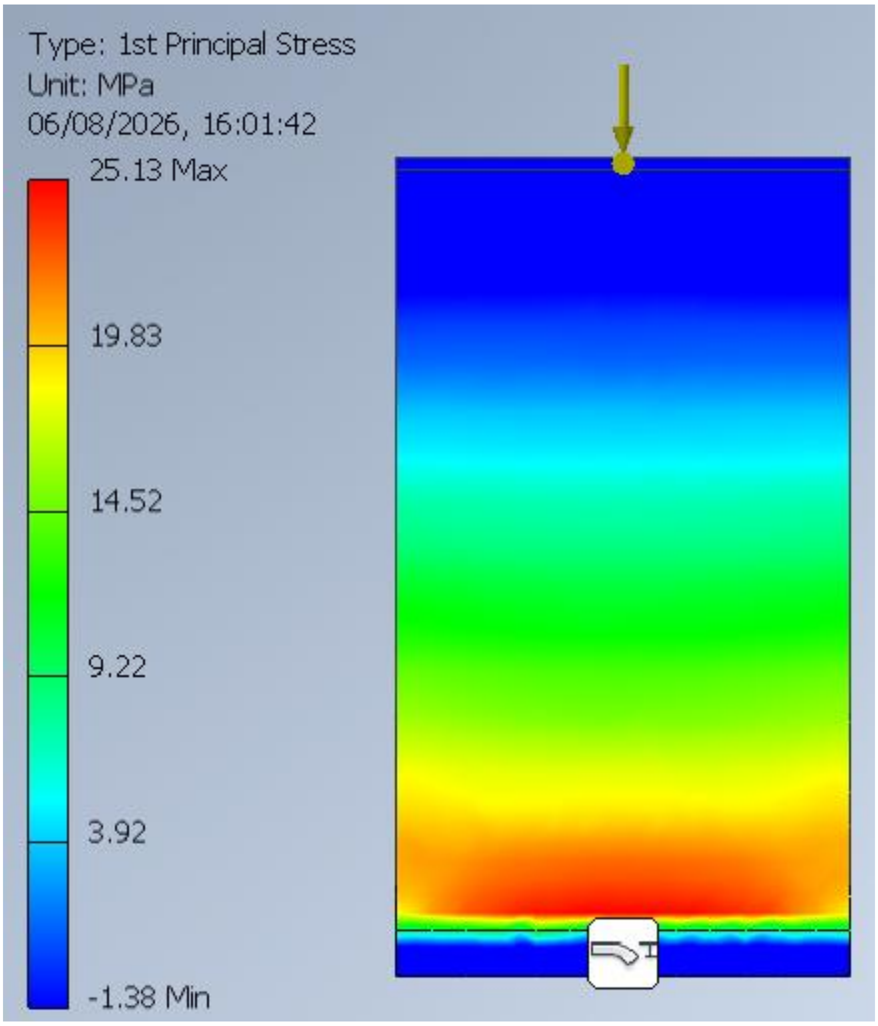
5.4 Load Case 3: SLS Balustrade Load



NOTE:
In this case the 20.92mm is the deflection at the top of the glass. The most appropriate deflection to be considered is 9.19mm, at 1100mm above the FFL.

Result:
Max. Deflection = 9.19mm < 25mm {BS6180:2011 cl. 6.4.1} **Pass**

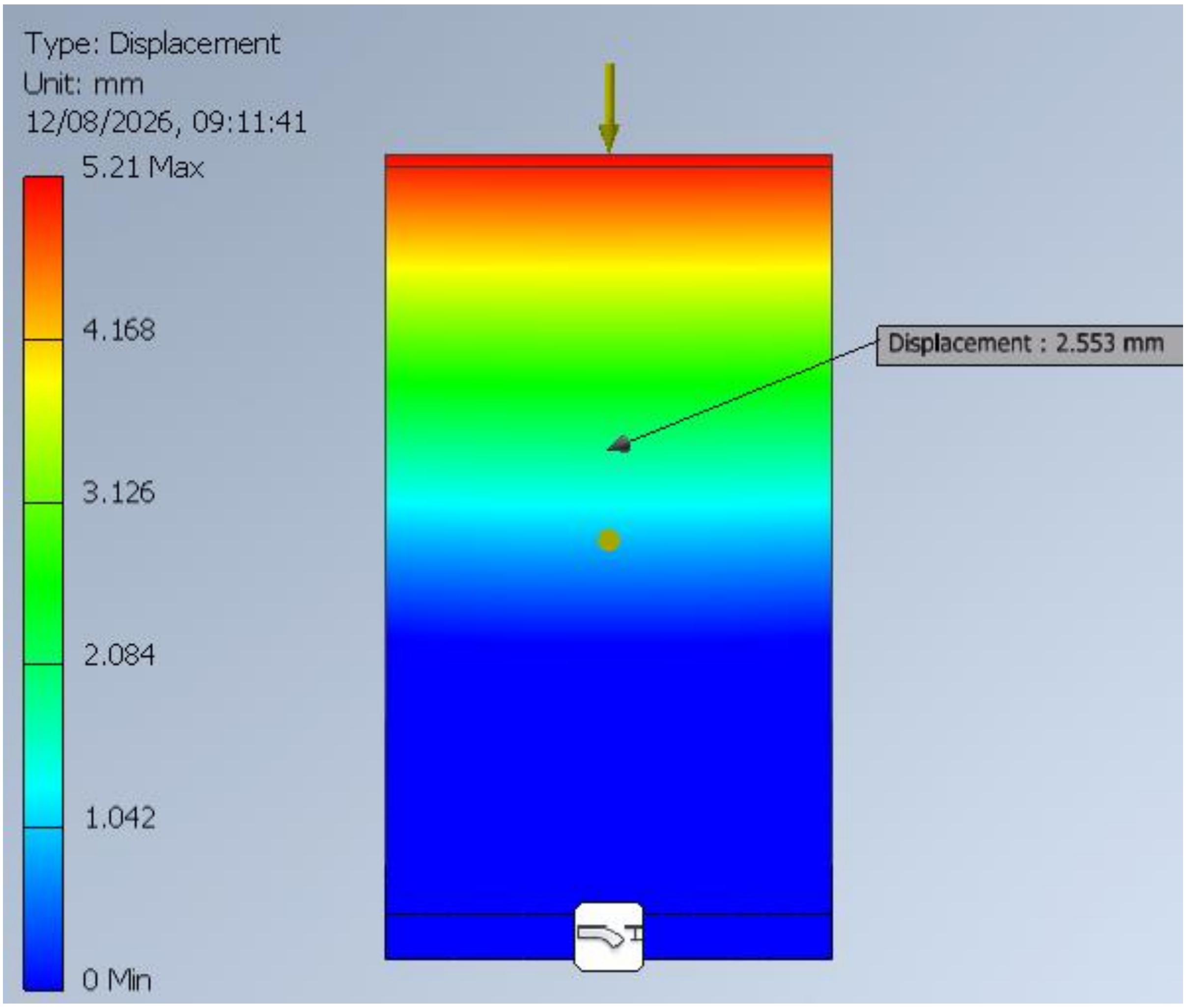
5.5 Load Case 4: ULS Balustrade Load



Result:

Max. Bending Stress = 25.13N/mm2 < 84.2N/mm2 **Pass**

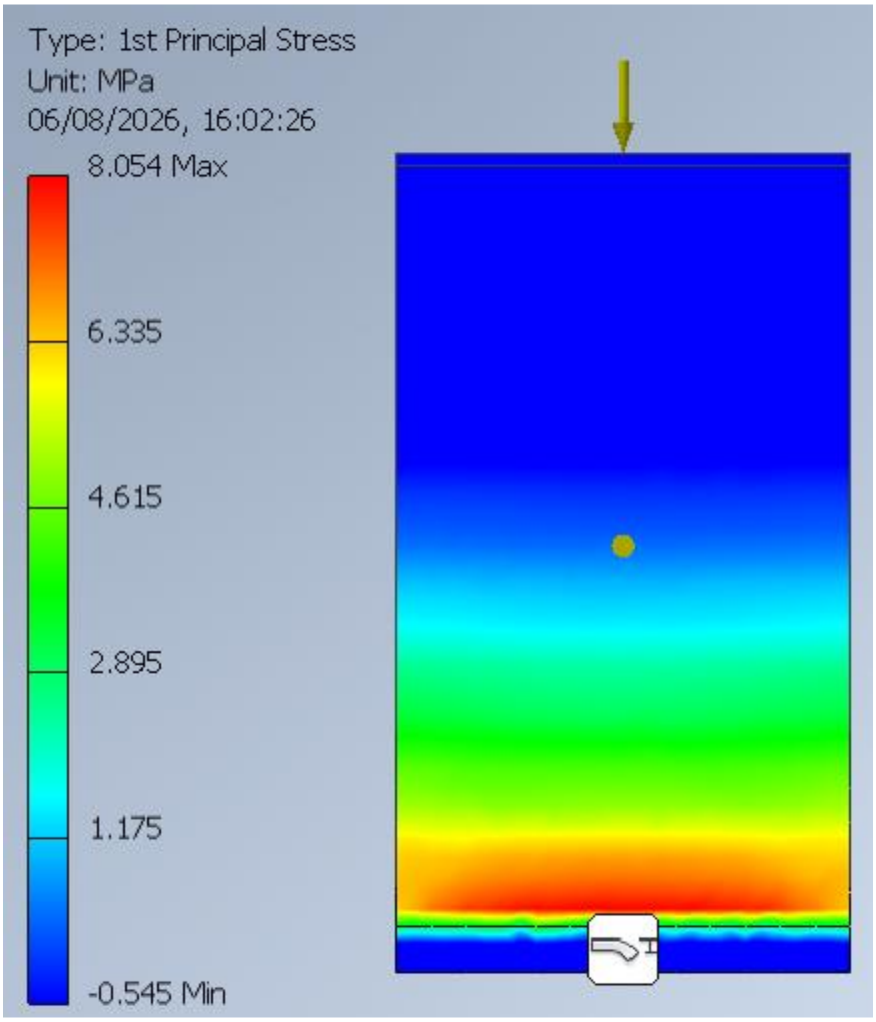
5.6 Load Case 5: SLS Infill Point Load



NOTE:
In this case the 5.21mm is the deflection at the top of the glass. The most appropriate deflection to be considered is 2.55mm, at 1100mm above the FFL.

Result:
Max. Deflection = 2.55mm < 25mm {BS6180:2011 cl. 6.4.1} **Pass**

5.7 Load Case 6: ULS Infill Point Load



Result:

Max. Bending Stress = 8.05N/mm2 < 84.2N/mm2 **Pass**

6. Shoe Analysis:

6.1 Shoe Load:

Load:

- $\text{Vertical}_{Weight\ of\ the\ glass} = 0.968\ (\text{SLS})\ \&\ 1.307\text{kN}\ (\text{ULS})$
- $\text{Horizontal}_{Balustrade} = 0.74\text{kN/m} \times 1.0\text{m} = 0.74\text{kN}\ (\text{SLS})$
- $\text{Horizontal}_{Infill} = \frac{1.0\text{kN}}{\text{m}^2} \times 1.0\text{m} \times 1.8\text{m} = 1.8\text{kN}\ (\text{SLS})\ \&\ 2.7\text{kN}\ (\text{ULS})$ **Worst case**

Moment:

- $\text{Moment}_{Balustrade} = 0.74\text{kN} \times 1.8\text{m} = 1.33\text{kNm}\ (\text{SLS})$
- $\text{Moment}_{Infill} = 1.8\text{kN} \times \frac{1.8\text{m}}{2} = 1.62\text{kNm}(\text{SLS})$ **Worst case**

$= 1.62\text{kNm} \times 1.5 = 2.43\text{kNm}\ (\text{ULS})$ **Worst case**

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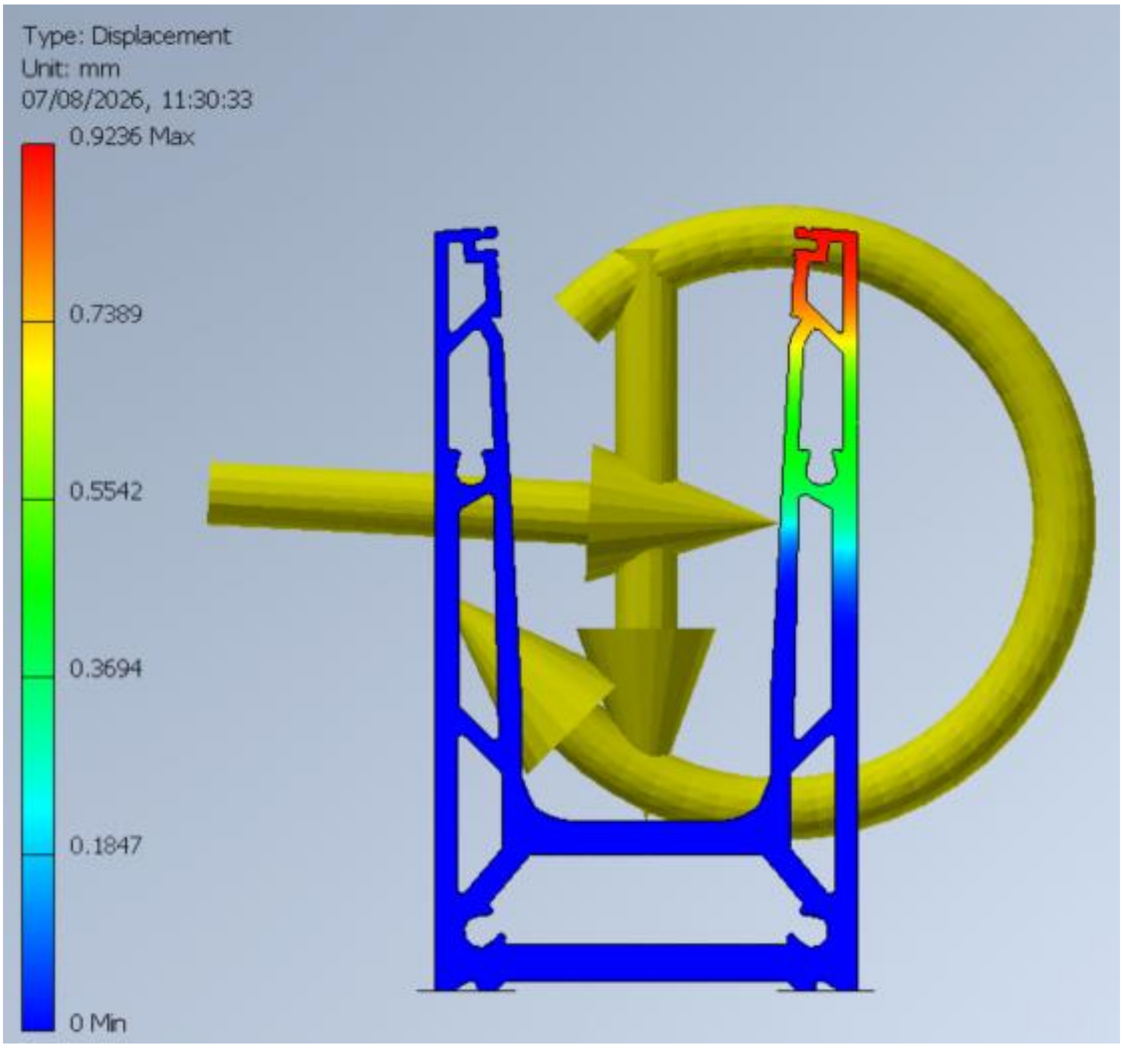
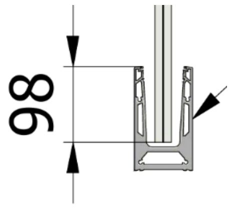
6.2 SLS Shoe Load



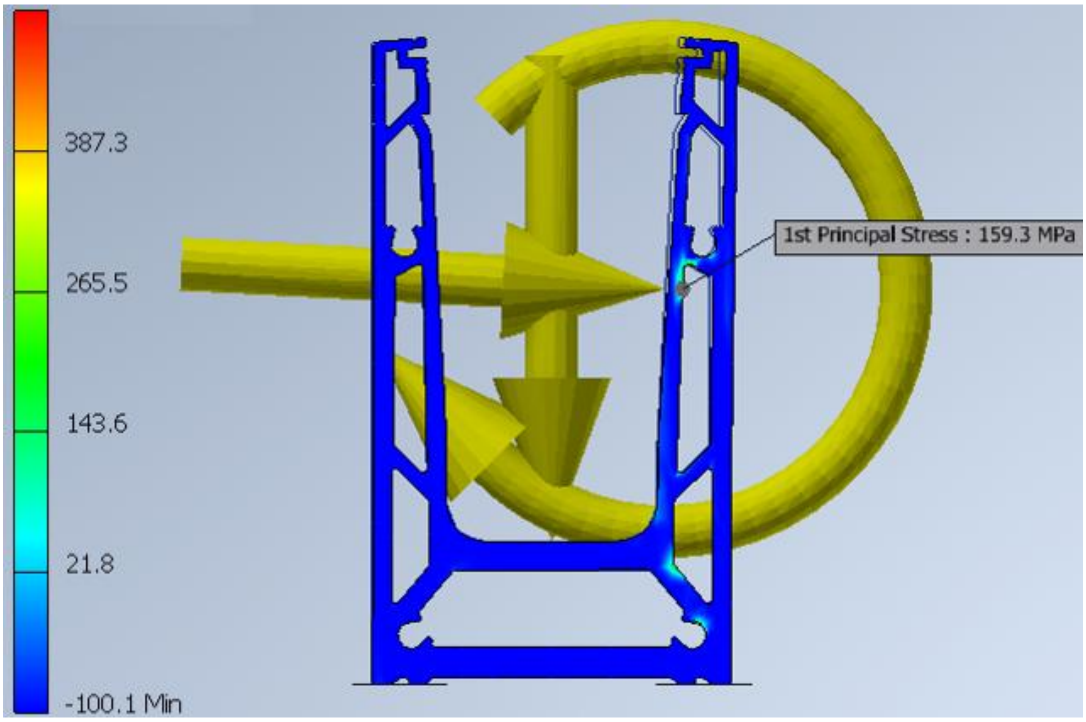
Result:

Max. Deflection at 1100mm above the FFL = (0.924 x 1100)/98* = 10.37mm

*The maximum stress at the top of the shoe occurs 98 mm from the glass.



6.3 ULS Shoe Load



Result:

Max. Bending Stress = 159.3N/mm2 < 160N/mm2 **Pass**

Appendix A: - Infill Loading

Infill Load Calculations

Table 2 **Minimum horizontal imposed loads for parapets, barriers and balustrades**

Type of occupancy for part of the building or structure	Examples of specific use	Horizontal uniformly distributed line load (kN/m)	Uniformly distributed load applied to the infill (kN/m^2)	A point load applied to part of the infill (kN)
Domestic and residential activities	(i) All areas within or serving exclusively one single family dwelling including stairs, landings, etc. but excluding external balconies and edges of roofs	0.36	0.5	0.25
	(ii) Other residential, i.e. houses of multiple occupancy and balconies, including Juliette balconies and edges of roofs in single family dwellings	0.74	1.0	0.5
Offices and work areas not included elsewhere, including storage areas	(iii) Light access stairs and gangways not more than 600 mm wide	0.22	—	—
	(iv) Light pedestrian traffic routes in industrial and storage buildings except designated escape routes	0.36	0.5	0.25
	(v) Areas not susceptile to overcrowding in office and institutional buildings, also industrial and storage buildings except as given above	0.74	1.0	0.5
Areas where people might congregate	(vi) Areas having fixed seating within 530 mm of the barrier, balustrade or parapet	1.5	1.5	1.5
Areas with tables or fixed seatings	(vii) Restaurants and bars	1.5	1.5	1.5
Areas without obstacles for moving people and not susceptible to overcrowding	(viii) Stairs, landings, corridors, ramps	0.74	1.0	0.5
	(ix) External balconies including Juliette balconies and edges of roofs. Footways and pavements within building curtilage adjacent to basement/sunken areas	0.74	1.0	0.5

Appendix B: - Glass Strength

Glass Strength Calculations

Horizontally Toughened Glass

Balustrade Loading: < 5mins duration => $k_{mod} = 0.77$

$f_{gd} = (k_{mod})(k_{sp})(f_{gk})/\ \gamma_{ma} + k_v(f_{bk}\text{-}f_{gk})/\gamma_{mv}$
$f_{gd} = (0.77)(1.0)(45)/1.6 + 1.0(120\text{-}45)/1.2$

$\underline{f_{gd} = 84.2\text{N/mm}^2}$

Wind Loading: 10min duration, Multiple Gust Storm => $k_{mod} = 0.74$

$f_{gd} = (k_{mod})(k_{sp})(f_{gk})/\ \gamma_{ma} + k_v(f_{bk}\text{-}f_{gk})/\gamma_{mv}$
$f_{gd} = (0.74)(1.0)(45)/1.6 + 1.0(120\text{-}45)/1.2$

$\underline{f_{gd} = 83.3\text{N/mm}^2}$

Appendix C: - Fischer Report

TSA is Both the Designer and the Specifier of the Fixings.

MASONRY FIXINGS

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Comment

Case 1

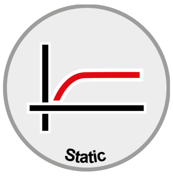
Design Specifications

Anchor

Anchor system	fischer High performance anchor FH II
Anchor	High performance anchor FH II 18/10 S, zinc plated steel
Calculated anchorage depth	80.00 mm
Design Data	Anchor design in Concrete according European Technical Assessment ETA-07/0025, Option 1, Issued 23/09/2020

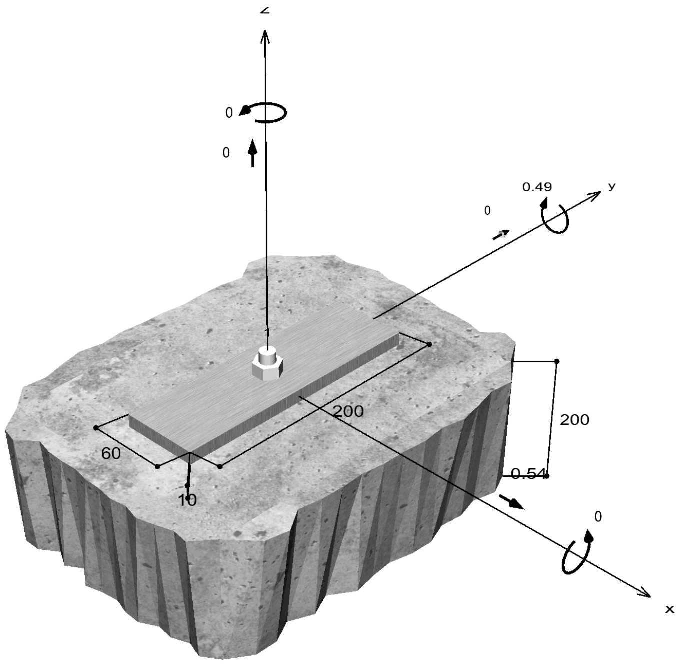
Geometry / Loads / Scale units

mm, kN, kNm



Value of design actions (including

partial safety factor for the load)



Not drawn to scale

Input data

Design method	EN 1992-4:2018 mechanical fastener
Base material	C30/37, EN 206
Concrete condition	Cracked, dry hole
Reinforcement	No or standard reinforcement. No edge reinforcement. With reinforcement against splitting
Drilling method	Hammer drilling
Installation type	Push-through installation
Annular gap	acc. user input
Type of loading	Permanent-Transient/Static
Base plate location	Base plate flush installed on base material
Base plate geometry	60 mm x 200 mm x 10 mm
Profile type	None

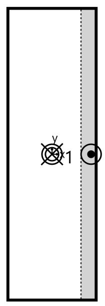
Design actions *)

#	N_{Ed} kN	$V_{Ed,x}$ kN	$V_{Ed,y}$ kN	$M_{Ed,x}$ kNm	$M_{Ed,y}$ kNm	$M_{T,Ed}$ kNm	Type of loading
1	0.00	0.54	0.00	0.00	0.49	0.00	Permanent-Transient/Static

*) The required partial safety factors for actions are included

Resulting anchor forces

Anchor no.	Tensile action kN	Shear Action kN	Shear Action x kN	Shear Action y kN
1	18.45	0.54	0.54	0.00



max. concrete compressive strain :	0.55 ‰
max. concrete compressive stress :	17.9 N/mm²
Resulting tensile actions :	18.4 kN , X/Y position (0 / 0)
Resulting compression actions :	18.4 kN , X/Y position (26.6 / 0)

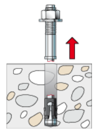
Resistance to tension loads

Proof	Action kN	Capacity kN	Utilisation β_N %
Steel failure *	18.4	44.9	41.1
Pullout failure *	18.4	20.3	**90.7**
Concrete cone failure	18.4	35.8	51.5

* Most unfavourable anchor

Steel failure

$$N_{Ed} \leq \frac{N_{Rk,s}}{\gamma_{Ms}} \quad (\ \mathbf{N_{Rd,s}}\ )$$

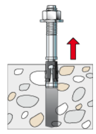


$N_{Rk,s}$ kN	γ_{Ms}	$N_{Rd,s}$ kN	N_{Ed} kN	$\beta_{N,s}$ %
67.4	1.50	44.9	18.4	41.1

Anchor no.	$\beta_{N,s}$ %	Group N°	Decisive Beta
1	41.1	1	$\beta_{N,s;1}$

Pullout failure

$$N_{Ed} \leq \frac{N_{Rk,p}}{\gamma_{Mp}} \quad (\ \mathbf{N_{Rd,p}}\ )$$



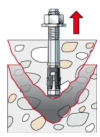
$N_{Rk,p}$ kN	Ψ_c	γ_{Mp}	$N_{Rd,p}$ kN	N_{Ed} kN	$\beta_{N,p}$ %
30.5	1.220	1.50	20.3	18.4	90.7

The given Psi,c-factor may has been determined by interpolation.

Anchor no.	$\beta_{N,p}$ %	Group N°	Decisive Beta
1	90.7	1	$\beta_{N,p;1}$

Concrete cone failure

$$N_{Ed} \leq \frac{N_{Rk,c}}{\gamma_{Mc}} \quad (\ \mathbf{N_{Rd,c}}\ )$$



$$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \Psi_{s,N} \cdot \Psi_{re,N} \cdot \Psi_{ec,N} \cdot \Psi_{M,N}$$ Eq. (7.1)

$$N_{Rk,c} = 30.18kN \cdot \frac{57{,}600mm^2}{57{,}600mm^2} \cdot 1.000 \cdot 1.000 \cdot 1.000 \cdot 1.779 = 53.67kN$$

$$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck}} \cdot h_{ef}^{1.5} = 7.7 \cdot \sqrt{30.0N/mm^2} \cdot \left(80mm\right)^{1.5} = 30.18kN$$ Eq. (7.2)

$$\Psi_{s,N} = min\left(1;\ 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}}\right) = min\left(1;\ 0.7 + 0.3 \cdot \frac{\infty}{120mm}\right) = 1.000 \leq 1$$ Eq. (7.4)

$$\Psi_{re,N} = 1.000$$ Eq. (7.5)

$$\Psi_{ec,N} = \frac{1}{1+\frac{2e_n}{s_{cr,N}}} \Rightarrow \Psi_{ec,Nx} \cdot \Psi_{ec,Ny} = 1.000 \cdot 1.000 = 1.000 \leq 1$$ Eq. (7.6)

$$\Psi_{ec,Nx} = \frac{1}{1+\frac{2 \cdot 0mm}{240mm}} = 1.000 \leq 1 \qquad \Psi_{ec,Ny} = \frac{1}{1+\frac{2 \cdot 0mm}{240mm}} = 1.000 \leq 1$$

$$\Psi_{M,N} = 2 - \frac{z}{1.5 \cdot h_{ef}} = 2 - \frac{27mm}{1.5 \cdot 80mm} = 1.78 \geq 1$$ Eq. (7.7)

$N_{Rk,c}$ kN	γ_{Mc}	$N_{Rd,c}$ kN	N_{Ed} kN	$\beta_{N,c}$ %
53.7	1.50	35.8	18.4	51.5

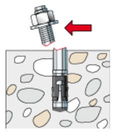
Anchor no.	$\beta_{N,c}$ %	Group N°	Decisive Beta
1	51.5	1	$\beta_{N,c;1}$

Resistance to shear loads

Proof	Action kN	Capacity kN	Utilisation β_V %
Steel failure without lever arm *	0.5	60.8	0.9
Concrete pry-out failure	0.5	40.2	**1.3**

* Most unfavourable anchor

Steel failure without lever arm



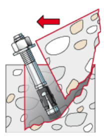
$$V_{Ed} \leq \frac{V_{Rk,s}}{\gamma_{Ms}} \qquad (\mathbf{V_{Rd,s}})$$

$$V_{Rk,s} = k_7 \cdot V^0_{Rk,s} = 1.00 \cdot 76.00kN = 76.00kN$$ Eq. (7.35)/ (7.36)

$V_{Rk,s}$ kN	γ_{Ms}	$V_{Rd,s}$ kN	V_{Ed} kN	β_{Vs} %
76	1.25	60.8	0.5	0.9

Anchor no.	β_{Vs} %	Group N°	Decisive Beta
1	0.9	1	$\beta_{Vs;1}$

Concrete pry-out failure



$$V_{Ed} \leq \frac{V_{Rk,cp}}{\gamma_{Mc}} \qquad (\mathbf{V_{Rd,cp}})$$

$$V_{Rk,cp} = k_8 \cdot N_{Rk,c} = 2 \cdot 30.18kN = 60.36kN$$ Eq. (7.39a)

$$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \Psi_{s,N} \cdot \Psi_{re,N} \cdot \Psi_{ec,N} \cdot \Psi_{M,N}$$ Eq. (7.1)

$$N_{Rk,c} = 30.18kN \cdot \frac{57{,}600mm^2}{57{,}600mm^2} \cdot 1.000 \cdot 1.000 \cdot 1.000 \cdot 1.000 = 30.18kN$$

$$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck}} \cdot h^{1.5}_{ef} = 7.7 \cdot \sqrt{30.0N/mm^2} \cdot \left(80mm\right)^{1.5} = 30.18kN$$ Eq. (7.2)

$$\Psi_{s,N} = min\left(1;\ 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}}\right) = min\left(1;\ 0.7 + 0.3 \cdot \frac{\infty}{120mm}\right) = 1.000 \leq 1$$ Eq. (7.4)

$$\Psi_{re,N} = 1.000$$ Eq. (7.5)

$$\Psi_{ec,N} = \frac{1}{1 + \frac{2e_n}{s_{cr,N}}} \Rightarrow \Psi_{ec,Nx} \cdot \Psi_{ec,Ny} = 1.000 \cdot 1.000 = 1.000 \leq 1$$ Eq. (7.6)

$$\Psi_{M,N} = 1.00 \geq 1$$ Eq. (7.7)

$V_{Rk,cp}$ kN	γ_{Mc}	$V_{Rd,cp}$ kN	V_{Ed} kN	$\beta_{V,cp}$ %
60.4	1.50	40.2	0.5	1.3

Anchor no.	$\beta_{V,cp}$ %	Group N°	Decisive Beta
1	1.3	1	$\beta_{V,cp;1}$

Utilization of tension and shear loads

Tension loads	Utilisation βN %
Steel failure *	41.1
Pullout failure *	**90.7**
Concrete cone failure	51.5

Shear Loads	Utilisation βV %
Steel failure without lever arm *	0.9
Concrete pry-out failure	**1.3**

* Most unfavourable anchor

Resistance to combined tensile and shear loads

Utilisation steel

$$\beta_{N.s} = \beta_{N,s;1} = 0.41 \leq 1$$
$$\beta_{V.s} = \beta_{Vs;1} = 0.01 \leq 1$$
$$\beta^2_N + \beta^2_V = \beta^2_{N,s;1} + \beta^2_{Vs;1} = 0.17 \leq 1$$ Eq. (7.55)

Utilisation concrete

Proof successful

$$\beta_{N,p} = \beta_{N,p;1} = 0.91 \leq 1$$
$$\beta_{V.cp} = \beta_{V,cp;1} = 0.01 \leq 1$$
$$\frac{\beta_N + \beta_V}{1.2} = \frac{\beta_{N,p;1} + \beta_{V,cp;1}}{1.2} = 0.77 \leq 1$$ Eq. (7.57)

Information concerning the anchor plate

Base plate details

Plate thickness specified by user without proof t = 10 mm

Profile type None

Technical remarks

The transmission of the anchor loads to the supports of the concrete member shall be shown for the ultimate limit state and the serviceability limit state; for this purpose, the normal verifications shall be carried out under due consideration of the actions introduced by the anchors. For these verifications the additional provisions given in the current design method shall be taken into account.
As a pre-condition the anchor plate is assumed to be flat when subjected to the actions. Therefore, the plate (if present) must be sufficiently stiff. The C-Fix anchor plate design is based on a proof of stresses and does not allow a statement about the stiffness of the plate. The proof of the necessary stiffness is not carried out by C-Fix.

During the design process, the following hints and warnings were issued:

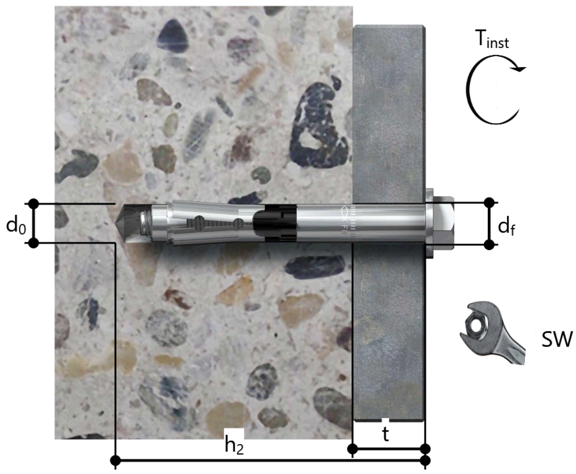
- The factor $\psi_{M,N}$ is taking into account the effect of a compression force between the fixture and concrete in case of bending moments with or without axial force. If the bending moment does not act continuously, please also check this load case. See EN 1992-4, 7.2.1.4 (7)

Installation data

Anchor

Anchor system	**fischer High performance anchor FH II**	
Anchor	High performance anchor FH II 18/10 S, zinc plated steel	Art.-No. 46847
Accessories	Blow-out pump ABG big	Art.-No. 567792
	SDS Plus-V II 18/150/200	Art.-No. 531836
	or alternatively	
	FHD 18/320/450	Art.-No. 546600
	Hammer drilling with or without suction	

Installation details



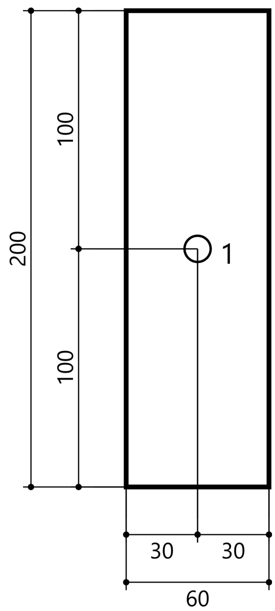
Thread diameter	M 12
Drill hole diameter	d_0 = 18 mm
Drill hole depth	h_2 = 115 mm
Calculated anchorage depth	h_{ef} = 80.00 mm
Installation depth	h_{nom} = 80 mm
Drilling method	Hammer drilling
Borehole cleaning	Clear the borehole with a hand blower. No borehole cleaning required in case of using a hollow drill bit, e.g. fischer FHD.
Installation type	Push-through installation
Annular gap	acc. user input
Installation torque	T_{inst} = 80.0 Nm
Socket size	19 mm
Base plate thickness	t = 10 mm
Total fixing thickness	t_{fix} = 10 mm
Tfix,max	$t_{fix,\ max}$ = 10 mm

Base plate details

Base plate material	Not available
Base plate thickness	t = 10 mm
Clearance hole in base plate	d_f=20 mm

Attachment

Profile type	None



Anchor coordinates

Anchor no.	x mm	y mm
1	0	0

Appendix D:- TSA Design Team

TSA
TED SINGLETON & ASSOCIATES
CONSULTING ENGINEERS

TSA Consulting Engineers Limited TEAM

Timothy (Ted) Singleton (Director)

Professional Qualifications:

Dip Eng Structural Engineering (1983)	Cork Institute of Technology
Certificate Quality Management (1985)	University of Limerick
MSc. Ops Management (2010) 1st Class Honours.	Dublin City University
Master Lean / Six Sigma (2012) final grade +90%	University of Villanova
Chartered Engineer	Engineers Ireland
Building Information Modelling Technologies	Cork Institute of Technology

Colm Cronin

Professional Qualifications:

Bachelor of Engineering Honours Degree	
Civil Engineering (1986)	University College Cork
Chartered Engineer (2001)	Engineers Ireland

Kiran KM

Professional Qualifications:

Bachelor of Engineering Honours Degree	
Civil Engineering (2008)	DR. AIT, Visvesvaraya Technological University, Bengaluru
Master of Engineering	
Structural Engineering (2012)	UVCE, Bangalore University, Bengaluru
Chartered Engineer	Institute of Engineers (India) Engineering Council (UK)

Karuna S

Professional Qualifications:

Bachelor of Engineering Honours Degree	
Civil Engineering (2008)	DR. AIT, Visvesvaraya Technological University, Bengaluru
Master of Engineering	
Structural Engineering (2010)	UVCE, Bangalore University, Bengaluru

TSA
TED SINGLETON & ASSOCIATES
CONSULTING ENGINEERS

Mohan Kumar K G

Professional Qualifications:

Bachelor of Engineering Honours Degree Civil Engineering (2008)	DR. AIT, Visvesvaraya Technological University, Bengaluru
Master of Engineering Earthquake Engineering (2012)	UVCE, Bangalore University, Bengaluru

Girish H

Professional Qualifications:

Bachelor of Engineering Honours Degree Civil Engineering (2021)	The National Institute of Engineering, Mysuru
Master of Engineering Structural Engineering (2023)	The National Institute of Engineering, Mysuru

Caitríona Henn

Professional Qualifications:

Bachelor of Engineering Honours Degree Structural Engineering (2010)	Cork Institute of Technology

Roberta Foletto

Professional Qualifications:

Bachelor of Engineering Honours Degree Architecture (2007)	National Faculty Vitoria, ES
MBA in Effective Management of Building (2012)	Castelo Branco University, RJ
Bachelor of Engineering Honours Degree Civil Engineering (2014)	Centro-Leste Faculty, Serra, ES
L9 Certificate in BIM & Lean Construction Management (2020)	Sligo Institute of Technology

TSA
TED SINGLETON & ASSOCIATES
CONSULTING ENGINEERS

Abhishek Gowda M R

Professional Qualifications:

Diploma in Civil Engineering (2018)	Government Polytechnic, Mandya
Bachelor of Engineering Honours Degree Civil Engineering (2021)	VVIET, Visvesvaraya Technological University, Mysuru

Christopher Keegan

Professional Qualifications:

Bachelor of Engineering Honours Degree Civil Engineering (2017)	Cork Institute of Technology
Building Information Modelling Technologies (2018)	Cork Institute of Technology
Bachelor of Engineering Honours Degree Structural Engineering (2020)	Cork Institute of Technology

Abhijeet Dudhankar

Professional Qualifications:

Bachelor of Civil Engineering (2022)	Vishwakarma Institute of Information Technology, Pune, India
MSc, Structural Design and Construction Management With Sustainability (2023)	Kingston University London

Brad Bekker

Professional Qualifications:

National Diploma Mechanical Engineering (2011)	Nelson Mandela University (formally NMMU), South Africa

Namratha L

Professional Qualifications:

Diploma in Civil Engineering (2018)	Government C.P.C Polytechnic, Mysuru
Bachelor of Engineering Honours Degree	The National Institute of Engineering,
Mysuru	
Civil Engineering (2021)	Visvesvaraya Technological University
Master of Engineering	The National Institute of Engineering, Mysuru
Structural Engineering (2023)	Visvesvaraya Technological University

Surya H S

Professional Qualifications:

Diploma in Civil Engineering (2019)	Government Polytechnic, Mandya
Bachelor of Engineering Honours Degree	Maharaja Institute of Technology Mysore,
Civil Engineering (2022)	Visvesvaraya Technological University,

Lokesh

Professional Qualifications:

Diploma in Civil Engineering (2022)	Government Polytechnic, Bidar
Bachelor of Engineering Honours Degree	DR. AIT, Visvesvaraya Technological University,
Civil Engineering (2025)	Bengaluru