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Ref: 11/243/ds32.v2
28 March 2024

FMI Building Innovation Ltd / Vetro Raccordi

ASSESSMENT OF FRAMELESS GLASS BALUSTRADE / POOL FENCE

USING CUBOID FACE FIX SYSTEM & 15.52mm thick EVA TOUGHENED LAMINATED GLASS

Note: Overall Glass Height = 1315mm max

The glass balustrade/pool fence had been tested to comply with AS/NZS 1170.1: 2002 Table 3.3 Minimum Imposed Actions for Barriers under Occupancy Type A, B and C3.

The glass balustrade/pool fence had also been tested for max "Very High" wind load.

Based on the testing, the glass balustrade/pool fence which comprised of 15.52mm thick EVA Toughened Laminated Grade A Safety Glass (6mm Toughened + 1.52 EVA interlayer + 8mm Toughened) supported by Cuboid Face Fix System with top side clips was sufficient for the following:

- Occupancy types A, B, C3
- Up to max "Very High" Wind

Based on the testing, the 15.52mm thick EVA Toughened Laminated Grade A Safety Glass (6mm Toughened + 1.52 EVA interlayer + 8mm Toughened) supported by Cuboid Face Fix System with top side clips had complied with the load and deflection requirements of Acceptable Solution B1/AS1 Clause 7.3.1 (Amendment 15).

The overall height of glass balustrade has been slightly increased to 1315 mm (from 1300mm). Calculations for review were made to see whether the increase in stress and deflections are still acceptable.

As shown in the summary table on page 8, the stress and deflections have increased only by less than 5%. This was checked and noted to be satisfactory.

Therefore, the test results from report DS32 can be used for this slightly higher glass balustrade. Base fixings need to be redesigned – refer to section 7.

7. Design of Base Fixings

Refer to pages 9 - 23 for design calculations.

Refer to Summary Drawing ENG 01 – 03 for reference.

Notes:

1. Any parts of the structure which are not covered by the specific design included with these calculations must comply either with the New Zealand Building Code or specific design as detailed by others. Any exceptions to this should be referred back to this Design Office.

2. The above calculations include structural work for which a Building Consent must be obtained prior to building. It is the Owner's responsibility to obtain all necessary consents.

3. It is assumed that the strength and stiffness of the substrate is sufficient to adequately resist the balustrade loads – this must be confirmed for each installation situation.

4. This design assumes that all the specified members are suitably protected from excess moisture in accordance with Section E1, E2 and E3 of the Building Code. All timber, steelwork, bolts and fasteners to be corrosion protected in accordance with the requirements of NZS 3604:2011 Chapter 4, Durability.

5. This design is for glass panels which comply with AS/NZS 2208 and accessories supplied by FMI Building Innovation Ltd / Vetro Raccordi.

Building Code Clause(s) B1,F2,F4,F9

PRODUCER STATEMENT – PS1 – DESIGN

(Guidance on use of Producer Statements (formerly page 2) is available at www.engineeringnz.org)

ISSUED BY: P & P CONSULTING ENGINEERS LTD
(Design Firm)

TO: FMI Building Innovation Ltd / Vetro Raccordi
(Owner/Developer)

TO BE SUPPLIED TO: VARIOUS
(Building Consent Authority)

IN RESPECT OF: GLASS BALUSTRADE/POOL FENCE USING CUBOID FACE FIX & 15.52EVA TOUGHENED LAMINATED
(Description of Building Work)

AT: VARIOUS SITES (Occupancy Type A,B,E,C3 and Up to max "Very High" Wind)
(Address)

Town/City:………… **LOT**………… **DP**………… **SO**…………
(Address)

We have been engaged by the owner/developer referred to above to provide:

GLASS TESTING REVIEW AND DESIGN FOR BASE FIXING

(Extent of Engagement)

services in respect of the requirements of Clause(s) B1, F2, F4 , F9 of the Building Code for:

☐ All or ☒ Part only (as specified in the attachment to this statement), of the proposed building work.

The design carried out by us has been prepared in accordance with:

☒ Compliance Documents issued by the Ministry of Business, Innovation & Employment B1/VM1 or
(verification method/acceptable solution)

☐ Alternative solution as per the attached schedule…………

The proposed building work covered by this producer statement is described on the drawings titled:

FMI LTD / VETRO RACCORDI - CUBOID FACE FIX and numbered REF:11/243/DS32.v2, DRWG ENG01-03
together with the specification, and other documents set out in the schedule attached to this statement.

On behalf of the Design Firm, and subject to:
(i) Site verification of the following design assumptions REFER NOTES AT THE END OF DESIGN SUMMARY
(ii) All proprietary products meeting their performance specification requirements;

I believe on reasonable grounds that a) the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of the Building Code and that b), the persons who have undertaken the design have the necessary competency to do so. I also recommend the following level of construction monitoring/observation:

☐ CM1 ☐ CM2 ☐ CM3 ☐ CM4 ☐ CM5 (Engineering Categories) or ☒ as per agreement with owner/developer (Architectural)

I, Parmil Prakash am: ☒ CPEng 251801 # ☐ Reg Arch …………… #
(Name of Design Professional)

I am a member of: ☒ Engineering New Zealand ☐ NZIA and hold the following qualifications: BE(Civil), CPEng
The Design Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than $200,000*.
The Design Firm is a member of ACENZ: ☐

SIGNED BY Parmil Prakash (Signature)
(Name of Design Professional)

ON BEHALF OF P & P CONSULTING ENGINEERS LTD Date 28 Mar 2024
(Design Firm)

Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of $200,000.*

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.

2. DESIGN GENERAL

The glass balustrade was tested to comply with the following:

STATUTORY

NZS 4223.3:2016	Glazing In Buildings
AS/NZS 1170:2002	Loadings Code
NZS 3404:1997	Structural Steel
NZS 3101:1995	Concrete
NZS 3603:1993	Timber
AS/NZS 1664.1:1997	Aluminium Structures - Part 1 Limit State Design

LOADS (Lateral Loads Only Considered)

Live Loads (Refer to Table 3.3 of AS/NZS 1170:)

Occupancy	Specific Uses	Top Edge		Infill
A	Internal Domestic Situation Only	0.35 kN/m	0.6 kN	0.5 kPa
B & C3	External Domestic Balconies, Offices and Work Areas. (NOT subject to Over Crowding)	0.75 kN/m	0.6 kN	1 kPa or 0.5 KN

Wind Loads (VERY HIGH)

Design for Very High Winds in terms of the Wind Speed categories in NZS 3604:2011 (up to 50 m/s).

$V_{sit,\beta}$(Ultimate)	=	50.0	m/s
$V_{sit,\beta}$(Serviceability)	=	37.3	m/s
q	=	1.50	kPa (ULS)
and	=	0.83	kPa (SLS)
For external barriers use Cp	=	1.30	
For internal barriers use Cp	=	0.30	
Wind Load = q x Cp	**=**	**1.95**	**kPa (ULS)**
	=	**1.08**	**kPa (SLS)**

LOAD FACTORS and DEFLECTIONS

Importance Level = 2
ULS factor = 1.5Q (Refer Section 4.2.2 of AS/NZS 1170)
Maximum Deflection = Height / 30

3. LOAD TESTS

Location of Tests: 49 Woodside Avenue, Auckland
Date of Tests: August 2018
Test Description: Load testing of Glass Balustrade/Pool Fence
Panel Tested = 1200mm wide x 1300mm high glass panel,
1200mm finished height from FFL

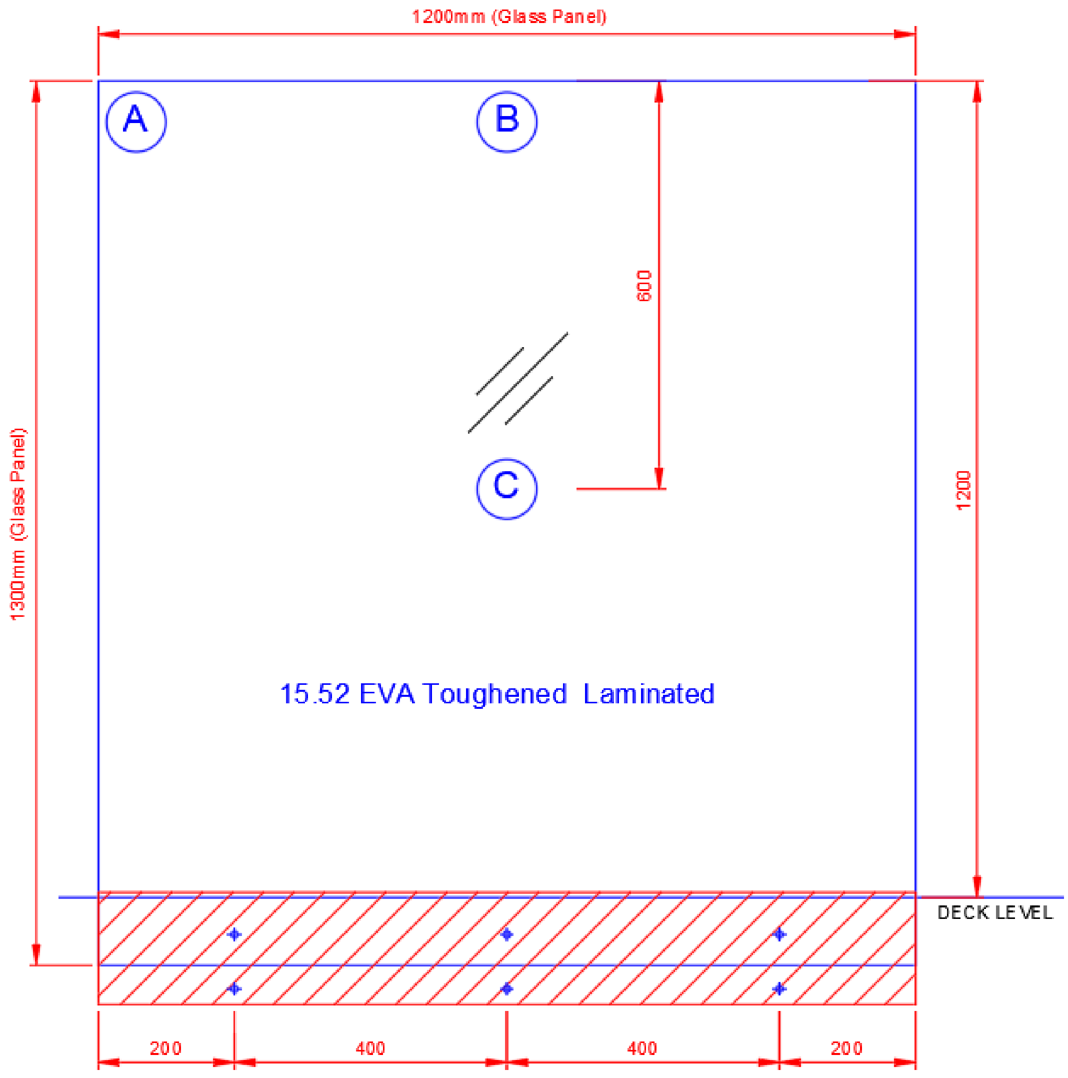
System Description: The glass balustrade/pool fence which was supplied by FMI Building Innovation Ltd / Vetro Raccordi, comprised of 15.52mm thick EVA Toughened Laminated (Grade A) Safety Glass (6mm Toughened + 1.52mm EVA Interlayer + 8mm Toughened), top side clips fixed to side posts and Cuboid Face Fix System.

Setup / Procedure:
The balustrade was setup with different load tests as noted on page 4. The glass panel was supported at the base with Cuboid Face Fix system. This channel system was bolted to the steel frame assembly with M10 fixings as shown below. The glass panel was also clipped at each side to the supporting posts acting as the supporting neighboring glass panels.

The hydraulic body frame/ram and load cell or weighing indicator were used to attain the required test loads.

4. TESTS ARRANGEMENT & RESULTS

4.1 BALUSTRADE/ POOL FENCE



TESTS	LOAD LOCATION
A	Point Load @ Top Corner with steel round disc
B	Horizontal UDL Load @ Top with Solid Steel Beam
C	Infill & Wind Load @ Middle Centre with Framing

NOTE:
1. Assuming a coefficient of variation (Vr) of 10% for the glass, the variability factor kt is taken as 1.33 for 3 test samples.
2. The structure to which the balustrade system is attached was not tested or analysed. The strength and stiffness of the substrate structure must be specifically confirmed for each situation.

TEST RESULTS (Fracture Check)

Tests	Target Load (Kg)	Duration (mins)	Observation for Samples 1,2,3
A	122.0	16	No Fracture
B	183.0	16	No Fracture
C	412.4	16	No Fracture

TEST RESULTS (Deflection Check)

Tests	Target Load @ SLS (Kg)	Deflection @ Top (mm)			Remarks
		Sample 1	Sample 2	Sample 3	
A	61.2	16	16	17	Passed
B	91.7	16	17	16	Passed
C	172.4	13	13	12	Passed

Allowable Deflection = H/30 = 40.0 mm

Based on the testing, the glass balustrade/pool fence which comprised of 15.52mm thick EVA Toughened Laminated Grade A Safety Glass (6mm Toughened + 1.52 EVA interlayer + 8mm Toughened) supported by Cuboid Face Fix System with top side clips was sufficient for the following:

- Occupancy types A, B, C3
- Up to max "Very High" Wind

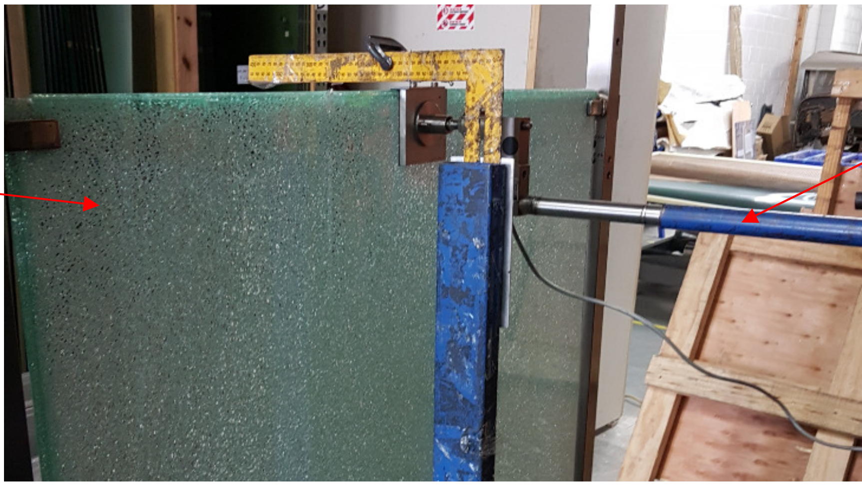
5. Testing to Demonstrate Compliance of Structural Glass Barrier without an Interlinking Rail

The toughened laminated glass panel had also been tested in accordance with the requirement of Acceptable Solution B1/AS1 Clause 7.3.1 (Amendment 15).

According to this clause, to demonstrate compliance with this requirement, the toughened laminated safety glass barrier without interlinking rails, when both panes of the laminate are fractured, must resist a 0.2 kN concentrated load and must not deflect more than 250mm. The concentrated load shall be applied over an area of 100mm x 100mm and for at least one minute.

The following were used in this testing (see photo below):

- 15.52mm thick EVA Toughened Laminated Grade A Safety Glass (6mm Toughened + 1.52 EVA interlayer + 8mm Toughened)
- with top side clips fixed to side posts
- Cuboid Face Fix System



Procedure: Both panes of the laminate were fractured first and then a 20kg was applied at the top center location of the glass panel using the hydraulic ram.

The test load and deflection were recorded as follows:

Load applied	Deflection at Top (after 1 minute load)
20 kg	70mm < Allowable (250mm)

~ OK

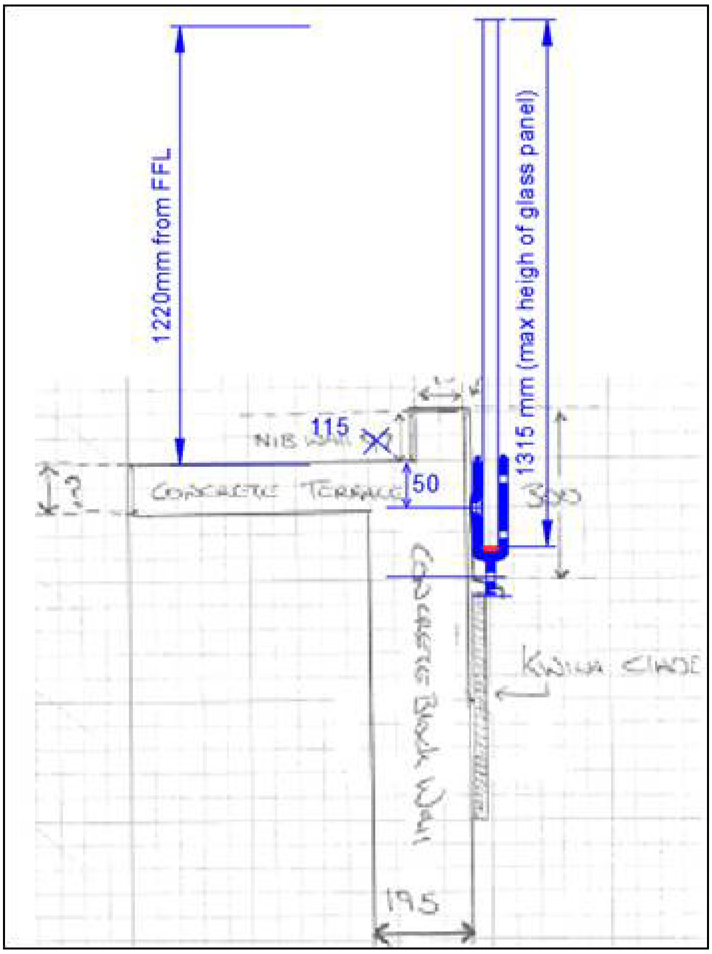
Based on the testing, the 15.52mm thick EVA Toughened Laminated Grade A Safety Glass (6mm Toughened + 1.52 EVA interlayer + 8mm Toughened) supported by Cuboid Face Fix System with top side clips had complied with the load and deflection requirements of Acceptable Solution B1/AS1 Clause 7.3.1 (Amendment 15).

6. Assessment of slightly higher Glass Balustrade

The overall height of glass balustrade has been slightly increased to 1315 mm (from 1300mm). Calculations for review were made to see whether the increase in stress and deflections are still acceptable.

The following are the design parameters and considerations used in this design check:

- test report DS32 was used as the basis of the calculations
- overall glass height = 1315 mm (from 1300 mm)
- height from FFL = 1220 mm
- setup of fixings as shown below:
  -top concrete edge distance for top fixings = 50 mm from bottom side of nib wall
- horizontal spacing of fixings = 300 mm max
- 190 mm thick masonry wall with concrete strength of 20 MPa minimum
- side thickness of masonry shells = 35 – 40 mm (assumed)



The following are the results of the design check:

Stresses (ULS)		
Load Case	Stress new / Stress old	% increase
1.5Q	1.012	1.15%
Wuls	1.023	2.32%

Deflection (SLS)		
Load Case	Deflection new / Deflection old	% increase
Q	1.035	3.50%
Wsls	1.047	4.70%

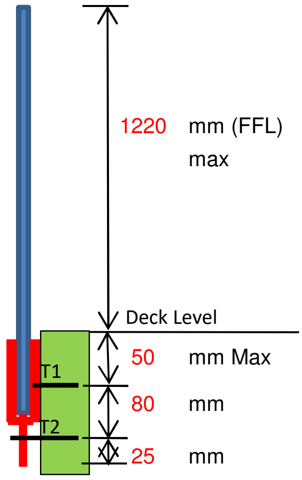
As shown above, the stress and deflections have increased only by less than 5%. This was checked and noted to be satisfactory.

Therefore, the test results from report DS32 can be used for this slightly higher glass balustrade. Base fixings need to be redesigned – refer to section 7.

7. Design of Base Fixings

Maximum Tributary Spacing of Fixings = 300 mm
Number of row of base fixings per panel = 3

C3 loading	1.5Q1:	1.5 x 0.6 kN / (no of base fixings) =	0.3	kN
	1.5Q2:	1.5 x 0.75kN/m x trib spacing =	0.338	kN
	1.5Q3:	1.5 x 1.0kPa =	1.5	kPa
Wind -Very High	Wuls:	0.6 x 50x 50 /1000 x 1.3 =	1.95	kPa



Tension Forces (central bolts)

		T1	T2	
1.5Q1:	N*/anchor =	5.06	4.76	kN
1.5Q2:	N*/anchor =	5.70	5.36	kN
1.5Q3:	N*/anchor =	5.12	4.51	kN
Wuls:	N*/anchor =	6.66	5.86	kN

Max N*/anchor = **6.66** kN

ht (Glass finished height from top fixings)	=1270mm

Shear Force per Fixing (1.2G)

1.2 x Weight of Glass Panel = 1.2 x (28 kN/m3 x thickness x Area) = 0.249 kN
1.2 x Weight of Al Channel= 1.2 x (0.5 kN/m x spacing) = 0.18 kN

1.2G: V*/anchor = **0.43** kN

Option 1: Fixing into Steel

Using M10 Grade A4/316 SS (A4-70)

ØN = **27.20** kN OK CDR= 0.20 OK
ØV = **17.86** kN OK

Use M10 316 SS (A4-70) Bolts with M10 316 SS Metric Nuts and M10 x 25 OD x 3 SS 316 Metric Round Washers per fixing.
(spacing = 300mm max centres)

Option 2: Fixing into Timber using Engineering Bolts

Capacity is controlled by bearing on washers. (ØQ = Ø k1 x k3 x Fp x Aw)

where: Ø=0.8, k1=1 (brief), k3=1, Fp = 5.3MPa (wet) or 8.9 Mpa (dry)

Using 50x50 Square Washers 316 SS

ØQ = **10.12** kN (wet) **OK** N*/ØQ = 0.66 ok

Use M10 316 SS (A4-70) Bolts with M10 316 SS Metric Nuts and 50mm x 50mm x 5mm SS 316 Metric Square Washers per fixing.
(spacing = 300mm max centres)

Option 3: Fixing into Timber using Coach Screws / Lagscrews

As per NZS3603, Timber Group J5, Screws in Withdrawal.(øQ = Ø n k1 K p Qk)

where: Ø=0.7, k1=1 (brief), K=0.7 (wet) or 1 (dry)

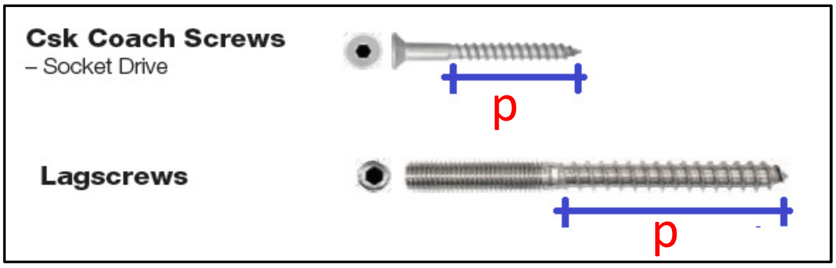
Qk = 107N/mm (M10 Coach Screws) or 118N/mm (M12 Coach Screws)

Using M10 Coach Screws (spacing = 300mm max centres)

øQ =	52.43 N/mm (wet)	Min Screw Penetration, p=	**128**	mm (wet)
øQ =	74.9 N/mm (dry)	Min Screw Penetration, p=	**89**	mm (dry)

Using M12 Coach Screws (spacing = 300mm max centres)

øQ =	57.82 N/mm (wet)	Min Screw Penetration, p=	**116**	mm (wet)
øQ =	82.6 N/mm (dry)	Min Screw Penetration, p=	**81**	mm (dry)



MINIMUM REQUIREMENTS FOR COACHSCREWS / LAGSCREWS			
Option 1: Using M10 Stainless Steel 316	Minimum Screw Penetration (p) into timber (mm) =	**128**	external
		89	internal
Option 2: Using M12 Stainless Steel 316	Minimum Screw Penetration (p) into timber (mm) =	**116**	external
		81	internal

(spacing = 300mm max centres)

Option 4: Fixing into Masonry Block Wall

Refer to HILTI design calculations sheets (page 12 - 23).
Considered as 190 mm thick masonry wall with concrete strength of 20 MPa minimum
Considered as Cracked Concrete
No water standing in the hole (assumed water saturated hole in the design)
Side thickness of masonry shells = 35 – 40 mm
Effective Concrete Wall Thickness (excluding masonry shells) = 190 - 40 - 40 = 110 mm

Anchor Spacing = 300 mm (horizontally) , 80 mm (vertically)
Concrete Edge Distance, ev = 50 mm min (top)
Concrete Edge Side Distance, eh = 150 mm min (corner / end fixings)

Total Embedment into Masonry Wall = 40mm (masonry shell) + 80mm (hef) = 120mm

From Hilti Anchor Design:

Anchor rod item #
2223844 HAS-U A4 M12x160

Adhesive item #
2262131 HIT-HY 200-R V3

Embedment depth h_ef
80 mm

Stand-off
Stand-off withou...

Distance: 40 mm
Rotational restraint: 1

Nut and washer height: 10 mm

ANCHOR LOADS

Anchor	N [kN]	Vx [kN]	Vy [kN]
1	-6.438	0	-0.225
2	7.238	0	-0.225

ANCHOR DESIGN

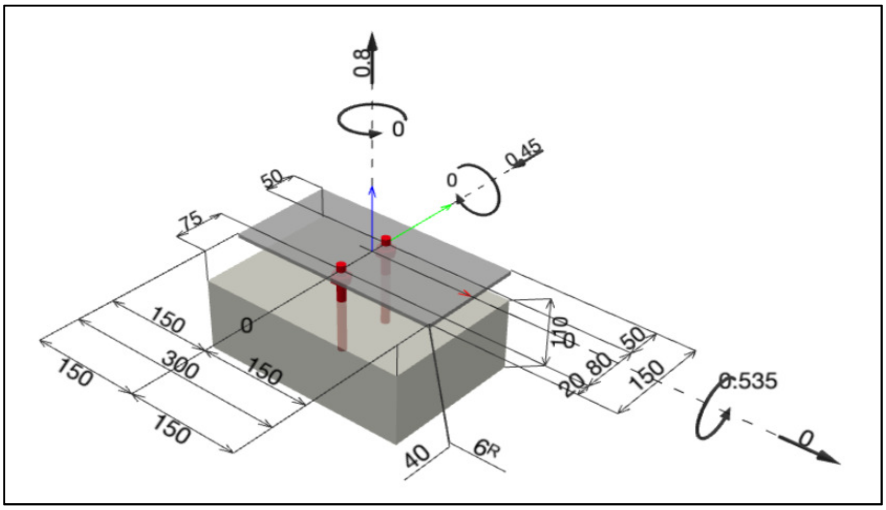
Tension

Steel	23%
Concrete breakout	73%
Combined pullout and concrete breakout	65%
Splitting	95%

Shear

Steel	25%
Concrete edge breakout	8%
Pryout	2%

Combination
100%



Use M12 A4 HAS-U (Stainless Steel) Anchors + HILTI HIT-HY 200-R V3 Adhesive.
Minimum total embedment into masonry block wall to be 120 mm.
(spacing = 300mm max centres)

www.hilti.co.nz

Company:		Page:	1
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Base Fixing Design - 2	Date:	27/03/2024
Fastening point:			

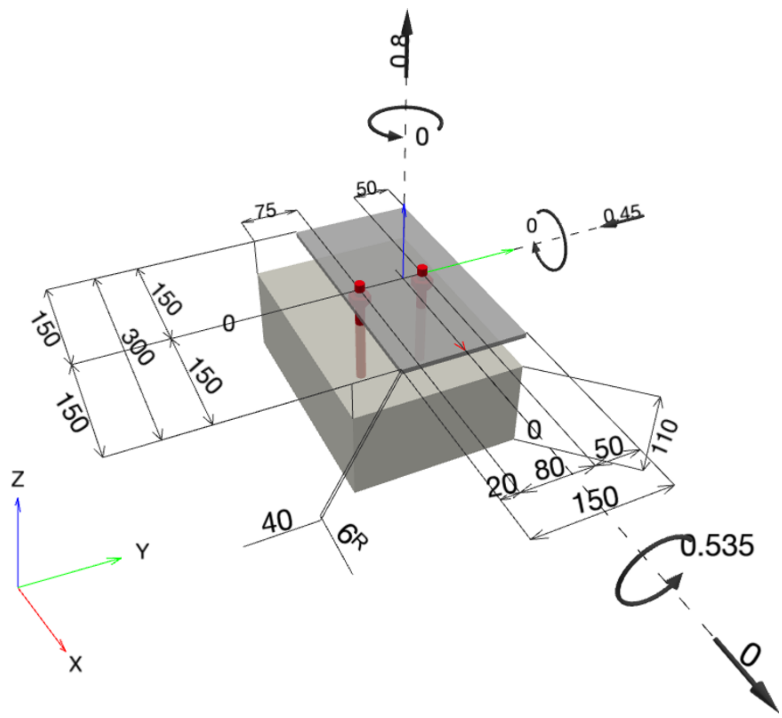
Specifier's comments:

1 Input data

Anchor type and diameter:	**HIT-HY 200-R V3 + HAS-U A4 M12**
Return period (service life in years):	50
Item number:	2223844 HAS-U A4 M12x160 (element) / 2262131 HIT-HY 200-R V3 (adhesive)
Effective embedment depth:	$h_{ef,act}$ = 80.0 mm ($h_{ef,limit}$ = - mm)
Material:	A4
Evaluation Service Report:	ETA 19/0601
Issued I Valid:	29/01/2024 | -
Proof:	Design Method New Zealand NZS 3101, chapter 17.5.5 – ETAG Design; EOTA TR 029
Stand-off installation:	without clamping (anchor); restraint level (anchor plate): 1.00; e_b = 40.0 mm; t = 6.0 mm
Anchor plate[R] :	l_x x l_y x t = 300.0 mm x 150.0 mm x 6.0 mm; (Recommended plate thickness: not calculated)
Profile:	no profile
Base material:	cracked concrete, C20/25, $f_{c,cube}$ = 25.00 N/mm^2; h = 110.0 mm, Temp. short/long: 40/24 °C
Installation:	**hammer drilled hole, Installation condition: Water saturated**
Reinforcement:	no reinforcement or reinforcement spacing >= 150 mm (any Ø) or >= 100 mm (Ø <= 10 mm)
	no longitudinal edge reinforcement

[R] - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [mm] & Loading [kN, kNm]



1.1 Load combination

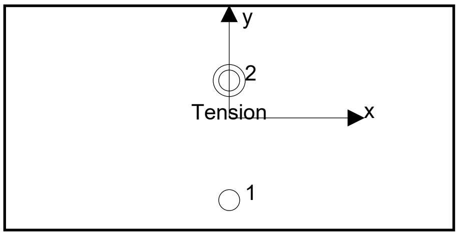
Case	Description	Forces [kN] / Moments [kNm]	Seismic	Fire	Max. Util. Anchor [%]
1	Combination 1	$N = 0.800$; $V_x = 0.000$; $V_y = -0.450$; $M_x = 0.535$; $M_y = 0.000$; $M_z = 0.000$;	no	no	100

2 Load case/Resulting anchor forces

Anchor reactions [kN]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	-6.438	0.225	0.000	-0.225
2	7.237	0.225	0.000	-0.225



max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [N/mm^2]
resulting tension force in (x/y)=(150.0/100.0): 7.238 [kN]
resulting compression force in (x/y)=(0.0/0.0): 0.000 [kN]

Anchor forces are calculated based on the assumption of a rigid anchor plate.

Company:		Page:	3
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Base Fixing Design - 2	Date:	27/03/2024
Fastening point:			

3 Tension load (EOTA TR 029, Section 5.2.2)

	Load [kN]	Capacity [kN]	Utilization β_N [%]	Status
Steel Strength*	7.237	31.556	23	OK
Combined pullout-concrete cone failure**	7.237	11.162	65	OK
Concrete Breakout Failure**	7.237	10.035	73	OK
Splitting failure**	7.237	7.624	95	OK

* highest loaded anchor **anchor group (anchors in tension)

3.1 Steel Strength

$N_{Sd} \leq N_{Rd,s} = \frac{N_{Rk,s}}{\gamma_{M,s}}$ EOTA TR 029, Table 5.2.2.1

$N_{Rk,s}$ [kN]	$\gamma_{M,s}$	$N_{Rd,s}$ [kN]	N_{Sd} [kN]
59.010	1.870	31.556	7.237

3.2 Combined pullout-concrete cone failure

$N_{Sd} \leq N_{Rd,p} = \frac{N_{Rk,p}}{\gamma_{M,p}}$	EOTA TR 029, Table 5.2.2.1
$N_{Rk,p} = N^0_{Rk,p} \cdot \frac{A_{p,N}}{A^0_{p,N}} \cdot \psi_{s,Np} \cdot \psi_{g,Np} \cdot \psi_{ec1,Np} \cdot \psi_{ec2,Np} \cdot \psi_{re,Np}$	EOTA TR 029, Eq. (5.2)
$N^0_{Rk,p} = \pi \cdot d \cdot h_{ef} \cdot \tau_{Rk}$	EOTA TR 029, Eq. (5.2a)
$A^0_{p,N} = s_{cr,Np} \cdot s_{cr,Np}$	EOTA TR 029, Eq. (5.2b)
$s_{cr,Np} = 20 \cdot d \cdot \left(\frac{\tau_{Rk,ucr}}{7.5}\right)^{0.5} \leq 3 \cdot h_{ef}$	EOTA TR 029, Eq. (5.2c)
$c_{cr,Np} = \frac{s_{cr,Np}}{2}$	EOTA TR 029, Eq. (5.2d)
$\psi_{s,Np} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,Np}} \leq 1.00$	EOTA TR 029, Eq. (5.2e)
$\psi_{g,Np} = \psi^0_{g,Np} - \left(\frac{s}{s_{cr,Np}}\right)^{0,5} \cdot (\psi^0_{g,Np} - 1) \geq 1.00$	EOTA TR 029, Eq. (5.2f)
$\psi^0_{g,Np} = \sqrt{n} - (\sqrt{n} - 1) \cdot \left(\frac{d \cdot \tau_{Rk}}{k \cdot \sqrt{h_{ef} \cdot f_{ck,cube}}}\right)^{1,5} \geq 1.00$	EOTA TR 029, Eq. (5.2g)
$\psi_{ec1,Np} = \frac{1}{1 + \frac{2 \cdot e_{c1,N}}{s_{cr,Np}}} \leq 1.00$	EOTA TR 029, Eq. (5.2h)
$\psi_{ec2,Np} = \frac{1}{1 + \frac{2 \cdot e_{c2,N}}{s_{cr,Np}}} \leq 1.00$	EOTA TR 029, Eq. (5.2h)
$\psi_{re,Np} = 0.5 + \frac{h_{ef}}{200} \leq 1.00$	EOTA TR 029, Eq. (5.2i)

$A_{p,N}$ [mm²]	$A^0_{p,N}$ [mm²]	$\tau_{Rk,ucr,25}$ [N/mm²]	$s_{cr,Np}$ [mm]	$c_{cr,Np}$ [mm]	c_{min} [mm]
40,800	57,600	18.00	240.0	120.0	50.0

ψ_c	$\tau_{Rk,cr}$ [N/mm²]	k	$\psi^0_{g,Np}$	$\psi_{g,Np}$
1.000	9.50	2.300	1.000	1.000

$e_{c1,N}$ [mm]	$\psi_{ec1,Np}$	$e_{c2,N}$ [mm]	$\psi_{ec2,Np}$	$\psi_{s,Np}$	$\psi_{re,Np}$
0.0	1.000	0.0	1.000	0.825	1.000

$N^0_{Rk,p}$ [kN]	$N_{Rk,p}$ [kN]	$\gamma_{M,p}$	$N_{Rd,p}$ [kN]	N_{Sd} [kN]
28.651	16.743	1.500	11.162	7.237

Group anchor ID
2

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3.3 Concrete Breakout Failure

$N_{Sd} \leq N_{Rd,c} = \frac{N_{Rk,c}}{\gamma_{M,c}}$ EOTA TR 029, Table 5.2.2.1

$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N}$ EOTA TR 029, Eq. (5.3)

$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck,cube}} \cdot h_{ef}^{1,5}$ EOTA TR 029, Eq. (5.3a)

$A^0_{c,N} = s_{cr,N} \cdot s_{cr,N}$ EOTA TR 029, Eq. (5.3b)

$\psi_{s,N} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}} \leq 1.00$ EOTA TR 029, Eq. (5.3c)

$\psi_{re,N} = 0.5 + \frac{h_{ef}}{200} \leq 1.00$ EOTA TR 029, Eq. (5.3d)

$\psi_{ec1,N} = \frac{1}{1 + \frac{2 \cdot e_{c1,N}}{s_{cr,N}}} \leq 1.00$ EOTA TR 029, Eq. (5.3e)

$\psi_{ec2,N} = \frac{1}{1 + \frac{2 \cdot e_{c2,N}}{s_{cr,N}}} \leq 1.00$ EOTA TR 029, Eq. (5.3e)

$A_{c,N}$ [mm^2]	$A^0_{c,N}$ [mm^2]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]
40,800	57,600	120.0	240.0

$e_{c1,N}$ [mm]	$\psi_{ec1,N}$	$e_{c2,N}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
0.0	1.000	0.0	1.000	0.825	1.000

k_1	$N^0_{Rk,c}$ [kN]	$\gamma_{M,c}$	$N_{Rd,c}$ [kN]	N_{Sd} [kN]
7.200	25.760	1.500	10.035	7.237

Group anchor ID
2

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3.4 Splitting failure

$N_{Sd} \leq N_{Rd,sp} = \frac{N_{Rk,sp}}{\gamma_{M,sp}}$ EOTA TR 029, Table 5.2.2.1

$N_{Rk,sp} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N} \cdot \psi_{h,sp}$ EOTA TR 029, Eq. (5.4)

$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck,cube}} \cdot h_{ef}^{1,5}$ EOTA TR 029, Eq. (5.3a)

$A^0_{c,N} = s_{cr,sp} \cdot s_{cr,sp}$ EOTA TR 029, Eq. (5.3b)

$\psi_{s,N} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,sp}} \leq 1.00$ EOTA TR 029, Eq. (5.3c)

$\psi_{ec1,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{c1,N}}{s_{cr,sp}}\right)} \leq 1.00$ EOTA TR 029, Eq. (5.3e)

$\psi_{ec2,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{c2,N}}{s_{cr,sp}}\right)} \leq 1.00$ EOTA TR 029, Eq. (5.3e)

$\psi_{h,sp} = \left(\frac{h}{h_{min}}\right)^{2/3}$ EOTA TR 029, Eq. (5.4a)

$1 \leq \psi_{h,sp} = \left(\frac{2 \cdot h_{ef}}{h_{min}}\right)^{2/3}$ EOTA TR 029, Eq. (5.4b)

$h'_{ef} = \max\left(\frac{c_{max}}{c_{cr,sp}}, \frac{s_{max}}{s_{cr,sp}}\right) \cdot h_{ef}$

$A_{c,N}$ [mm²]	$A^0_{c,N}$ [mm²]	$c_{cr,sp}$ [mm]	$s_{cr,sp}$ [mm]	$\psi_{h,sp}$
61,500	96,100	170.0	340.0	1.000

h'_{ef} [mm]	$c'_{cr,sp}$ [mm]	$s'_{cr,sp}$ [mm]
72.9	155.0	310.0

$e_{c1,N}$ [mm]	$\psi_{ec1,N}$	$e_{c2,N}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$	k_1
0.0	1.000	0.0	1.000	0.797	1.000	7.200

$N^0_{Rk,c}$ [kN]	$\gamma_{M,sp}$	$N_{Rd,sp}$ [kN]	N_{Sd} [kN]
22.427	1.500	7.624	7.237

Group anchor ID
2

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4 Shear load (EOTA TR 029, Section 5.2.3)

	Load [kN]	Capacity [kN]	Utilization β_V [%]	Status
Steel Strength (without lever arm)*	N/A	N/A	N/A	N/A
Steel failure (with lever arm)*	0.225	0.924	25	OK
Pryout Strength**	0.450	24.203	2	OK
Concrete edge failure in direction y-**	0.450	6.374	8	OK

* highest loaded anchor **anchor group (relevant anchors)

4.1 Steel failure (with lever arm)

$$V_{Sd} \leq V^M_{Rd,s} = \frac{V^M_{Rk,s}}{\gamma_{M,s,b}}$$ EOTA TR 029, Table 5.2.3.1

$$V^M_{Rk,s} = \frac{\alpha_M \cdot M_{Rk,s}}{l}$$ EOTA TR 029, Eq. (5.6)

$$M_{Rk,s} = M^0_{Rk,s} \cdot \left(1 - \frac{N_{Sd}}{N_{Rd,s}}\right)$$ EOTA TR 029, Eq. (5.6a)

$$l = e_c + \frac{t}{2} + a_3$$ EOTA TR 029, Eq. (4.2)

l [mm]	α_M
49.0	1.00

N_{Sd} / $N_{Rd,s}$	1 - N_{Sd} / $N_{Rd,s}$	$M^0_{Rk,s}$ [kNm]	$M_{Rk,s} = M^0_{Rk,s}$ (1 - N_{Sd}/ $N_{Rd,s}$) [kNm]
0.229	0.771	0.092	0.071

$V^M_{Rk,s} = \alpha_M$ * $M_{Rk,s}$ / l [kN]	$\gamma_{Ms,b,V}$	$V^M_{Rd,s}$ [kN]	V_{Sd} [kN]
1.442	1.560	0.924	0.225

4.2 Pryout Strength (Concrete Breakout Strength controls)

$V_{Sd} \le V_{Rd,cp} = \frac{V_{Rk,cp}}{\gamma_{M,c,p}}$	EOTA TR 029, Table 5.2.3.1
$V_{Rk,cp} = k \cdot \min (N_{Rk,p}; N_{Rk,c})$	EOTA TR 029, Eq. (5.7), (5.7a)
$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N}$	EOTA TR 029, Eq. (5.3)
$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck,cube}} \cdot h_{ef}^{1,5}$	EOTA TR 029, Eq. (5.3a)
$A^0_{c,N} = s_{cr,N} \cdot s_{cr,N}$	EOTA TR 029, Eq. (5.3b)
$\psi_{s,N} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}} \le 1.00$	EOTA TR 029, Eq. (5.3c)
$\psi_{re,N} = 0.5 + \frac{h_{ef}}{200} \le 1.00$	EOTA TR 029, Eq. (5.3d)
$\psi_{ec1,N} = \frac{1}{1 + \frac{2 \cdot e_{c1,V}}{s_{cr,N}}} \le 1.00$	EOTA TR 029, Eq. (5.3e)
$\psi_{ec2,N} = \frac{1}{1 + \frac{2 \cdot e_{c2,V}}{s_{cr,N}}} \le 1.00$	EOTA TR 029, Eq. (5.3e)

$A_{c,N}$ [mm^2]	$A^0_{c,N}$ [mm^2]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]	k-factor	k_1
49,200	57,600	120.0	240.0	2.000	7.200

$e_{c1,V}$ [mm]	$\psi_{ec1,N}$	$e_{c2,V}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
0.0	1.000	0.0	1.000	0.825	1.000

$N^0_{Rk,c}$ [kN]	$\gamma_{M,c,p}$	$V_{Rd,cp}$ [kN]	V_{Sd} [kN]
25.760	1.500	24.203	0.450

Group anchor ID
1, 2

4.3 Concrete edge failure in direction y-

$V_{Sd} \leq V_{Rd,c} = \frac{V_{Rk,c}}{\gamma_{M,c}}$	EOTA TR 029, Table 5.2.3.1
$V_{Rk,c} = V^0_{Rk,c} \cdot \frac{A_{c,V}}{A^0_{c,V}} \cdot \psi_{s,V} \cdot \psi_{h,V} \cdot \psi_{\alpha,V} \cdot \psi_{ec,V} \cdot \psi_{re,V}$	EOTA TR 029, Eq. (5.8)
$V^0_{Rk,c} = k_1 \cdot d^{\alpha}_{nom} \cdot h^{\beta}_{ef} \cdot \sqrt{f_{ck,cube}} \cdot c_1^{1,5}$	EOTA TR 029, Eq. (5.8a)
$\alpha = 0.1 \cdot \left(\frac{h_{ef}}{c_1}\right)^{0,5}$	EOTA TR 029, Eq. (5.8b)
$\beta = 0.1 \cdot \left(\frac{d_{nom}}{c_1}\right)^{0,2}$	EOTA TR 029, Eq. (5.8c)
$A^0_{c,V} = 4.5 \cdot c_1^2$	EOTA TR 029, Eq. (5.8d)
$\psi_{s,V} = 0.7 + 0.3 \cdot \frac{c_2}{1.5 \cdot c_1} \leq 1.00$	EOTA TR 029, Eq. (5.8e)
$\psi_{h,V} = \left(\frac{1.5 \cdot c_1}{h}\right)^{0,5} \geq 1.00$	EOTA TR 029, Eq. (5.8f)
$\psi_{\alpha,V} = \sqrt{\frac{1}{(\cos \alpha_V)^2 + \left(\frac{\sin \alpha_V}{2.5}\right)^2}} \geq 1.00$	EOTA TR 029, Eq. (5.8g)
$\psi_{ec,V} = \frac{1}{1 + \frac{2 \cdot e_{c,V}}{3 \cdot c_1}} \leq 1.00$	EOTA TR 029, Eq. (5.8h)

h_{ef} [mm]	d_{nom} [mm]	k_1	α	β
80.0	12.00	1.700	0.103	0.069

c_1 [mm]	$A_{c,V}$ [mm^2]	$A^0_{c,V}$ [mm^2]
75.0	24,750	25,312

$\psi_{s,V}$	$\psi_{h,V}$	α_V [°]	$\psi_{\alpha,V}$	$e_{c,V}$ [mm]	$\psi_{ec,V}$	$\psi_{re,V}$
1.000	1.011	0.00	1.000	0.0	1.000	1.000

$V^0_{Rk,c}$ [kN]	$\gamma_{M,c}$	$V_{Rd,c}$ [kN]	V_{Sd} [kN]
9.669	1.500	6.374	0.450

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5 Combined tension and shear loads (EOTA TR 029, Section 5.2.4)

β_N	β_V	α	Utilization $\beta_{N,V}$ [%]	Status
0.949	0.243	1.000	100	OK

$(\beta_N + \beta_V) / 1.2 \leq 1.0$

6 Displacements (highest loaded anchor)

Short term loading:

N_{Sk} = 5.361 [kN]		δ_N = 0.1244 [mm]	
V_{Sk} = 0.167 [kN]		δ_V = 0.0083 [mm]	
		δ_{NV} = 0.1247 [mm]	

Long term loading:

N_{Sk} = 5.361 [kN]		δ_N = 0.2844 [mm]	
V_{Sk} = 0.167 [kN]		δ_V = 0.0133 [mm]	
		δ_{NV} = 0.2847 [mm]	

Comments: Tension displacements are valid with half of the required installation torque moment for uncracked concrete! Shear displacements are valid without friction between the concrete and the anchor plate! The gap due to the drilled hole and clearance hole tolerances are not included in this calculation!

The acceptable anchor displacements depend on the fastened construction and must be defined by the designer!

7 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Checking the transfer of loads into the base material is required in accordance with EOTA TR 029, Section 7!
- Attention! In case of compressive anchor forces a buckling check as well as the proof of the local load transfer into and within the base material (incl. punching) has to be done separately.
- The design is only valid if the clearance hole in the fixture is not larger than the value given in Table 4.1 of EOTA TR029! For larger diameters of the clearance hole see Chapter 1.1. of EOTA TR029!
- The accessory list in this report is for the information of the user only. In any case, the instructions for use provided with the product have to be followed to ensure a proper installation.
- Bore hole cleaning must be performed according to instructions for use (blow twice with oil-free compressed air (min. 6 bar), brush twice, blow twice with oil-free compressed air (min. 6 bar)).
- Characteristic bond resistances depend on short- and long-term temperatures.
- Edge reinforcement is not required to avoid splitting failure
- The characteristic bond resistances depend on the return period (service life in years): 50

Fastening meets the design criteria!

8 Installation data

Anchor plate, steel: S 235; E = 210,000.00 N/mm^2; f_{yk} = 235.00 N/mm^2

Profile: no profile

Hole diameter in the fixture: d_f = 14.0 mm

Plate thickness (input): 6.0 mm

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

Anchor type and diameter: HIT-HY 200-R V3 + HAS-U A4 M12

Item number: 2223844 HAS-U A4 M12x160 (element) / 2262131 HIT-HY 200-R V3 (adhesive)

Maximum installation torque: 40 Nm

Hole diameter in the base material: 14.0 mm

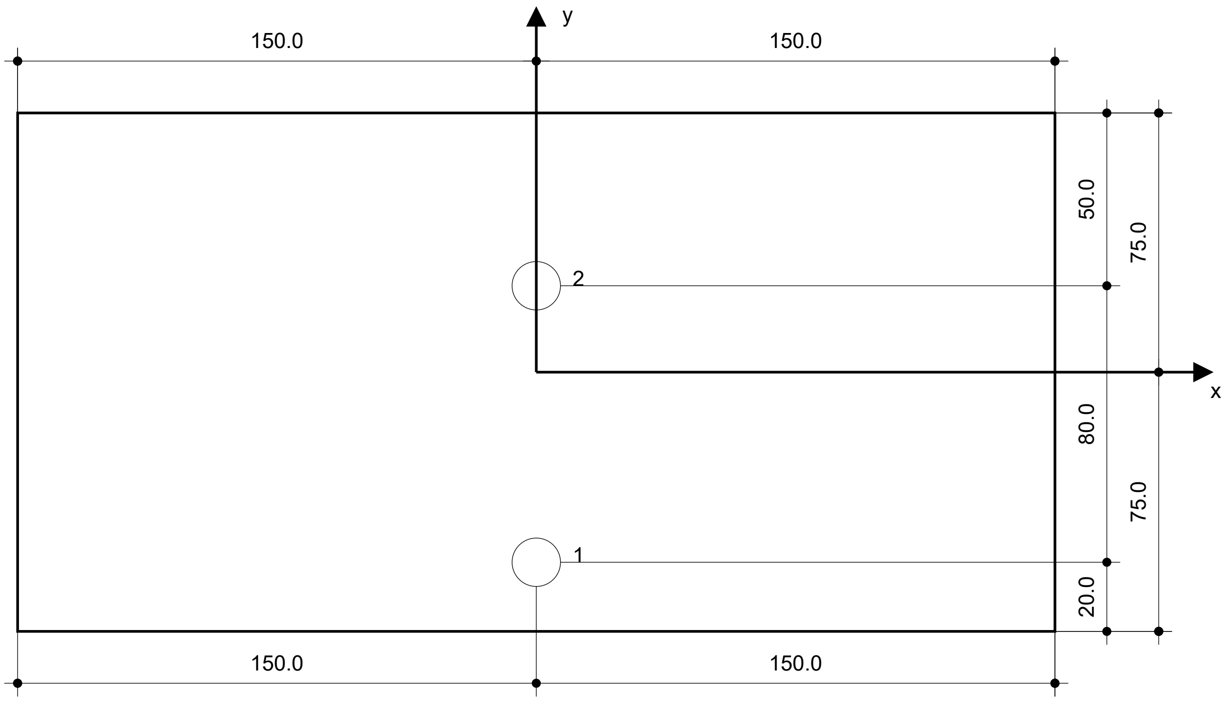
Hole depth in the base material: 80.0 mm

Minimum thickness of the base material: 110.0 mm

Hilti HAS-U threaded rod with HIT-HY 200-R V3 injection mortar with 80 mm embedment h_ef, M12, Stainless steel, Hammer drilled installation per ETA 19/0601

8.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• Compressed air with required accessories to blow from the bottom of the hole • Proper diameter wire brush	• Dispenser including cassette and mixer • For deep installations, a piston plug is necessary • Torque wrench



Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	0.0	-55.0	150.0	150.0	75.0	130.0
2	0.0	25.0	150.0	150.0	155.0	50.0

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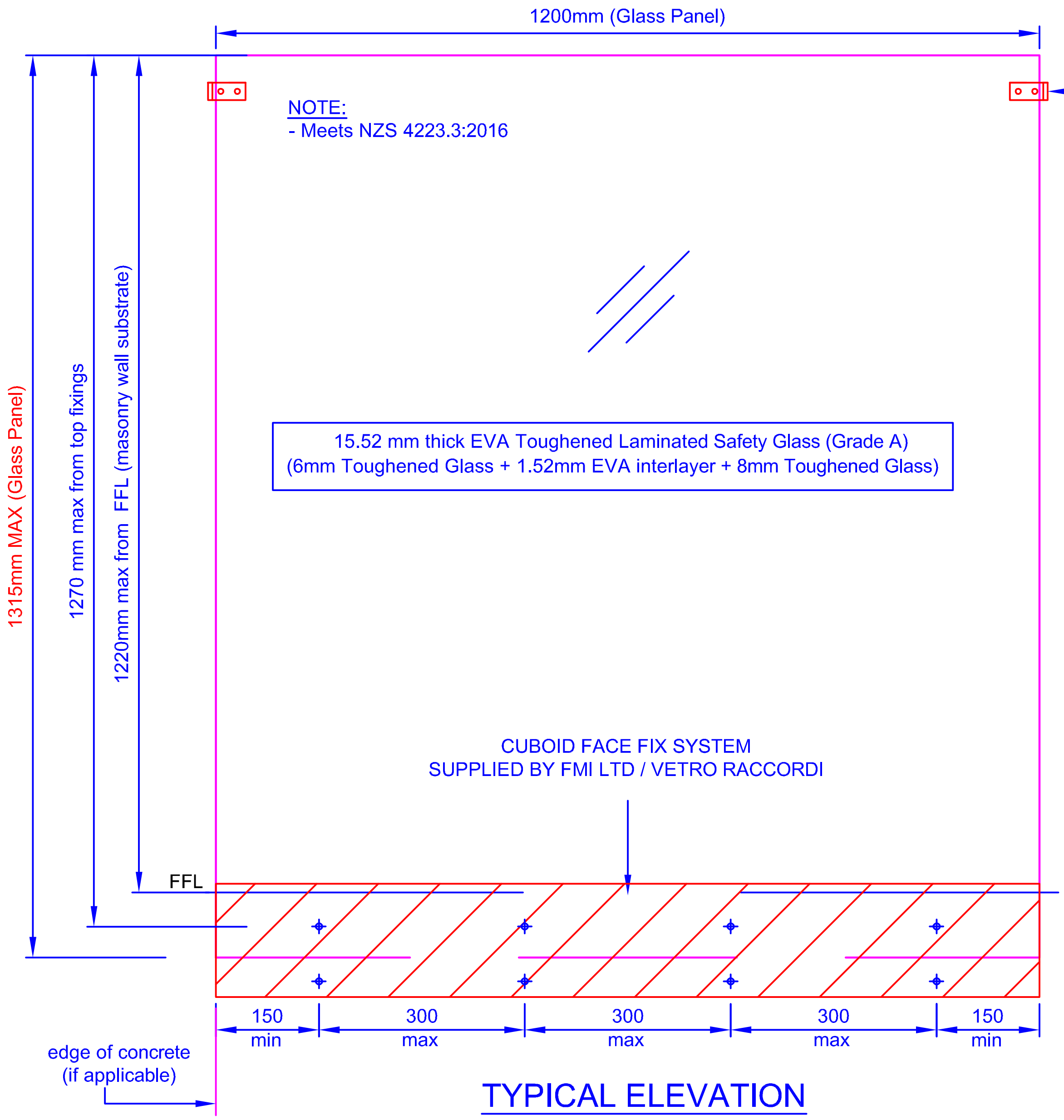
9 Remarks; Your Cooperation Duties

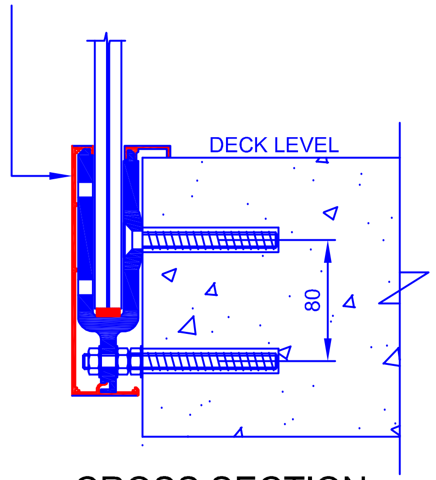
- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.



TYPICAL ELEVATION

NOTE:
THE CUBOID FACE FIX CHANNEL MUST BE PLACED WITH FULL BEARING AGAINST THE SIDE OF THE SUPPORTING STRUCTURE.

Note:
first row of anchors close to concrete edge or corner must be placed 150mm min from concrete edge (along the glass panel)



CROSS SECTION

CUBOID FACE FIX CHANNEL

THIS GLASS BALUSTRADE/POOL FENCE IS SUITABLE FOR THE FOLLOWING:

LIVE LOAD:

OCCUPANCY TYPE	REFER TABLE 3.3 OF AS/NZS 1170
A	ALL AREAS WITHIN OR SERVING EXCLUSIVELY ONE DWELLING INCLUDING STAIRS, LANDINGS ETC. BUT EXCLUDING EXTERNAL BALCONIES & EDGES OF ROOFS.
B, E & C3	EXTERNAL DOMESTIC BALCONIES, OFFICES AND WORK AREAS. (NOT SUBJECT TO OVER CROWDING)

WIND LOAD: UP TO "VERY HIGH" (VH) WIND ZONE WITH MAXIMUM BASIC WIND SPEED OF 50 m/s. (DESIGN WIND PRESSURE = 1.95 kPa @ ULS)

FIXINGS:

1. ALL ANCHORS MUST BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS REQUIREMENTS.

2. BOLTING ARRANGEMENT MUST COMPLY WITH RELEVANT MATERIAL CODES.

3. STRENGTH & STIFFNESS OF THE SUBSTRATE STRUCTURE MUST BE SUFFICIENT FOR THE BALUSTRADE LOADS - THIS MUST BE SPECIFICALLY CHECKED BY OTHERS FOR EACH SITUATION.

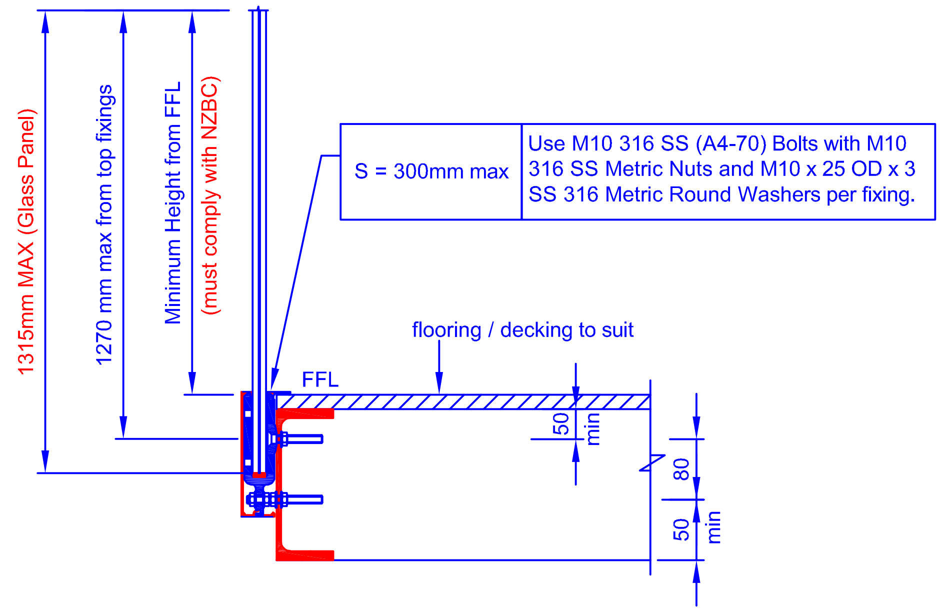
DURABILITY:

1. ALL FIXINGS & STRUCTURAL STEEL MUST COMPLY WITH SECTION 4 "DURABILITY" OF NZS 3604:2011.

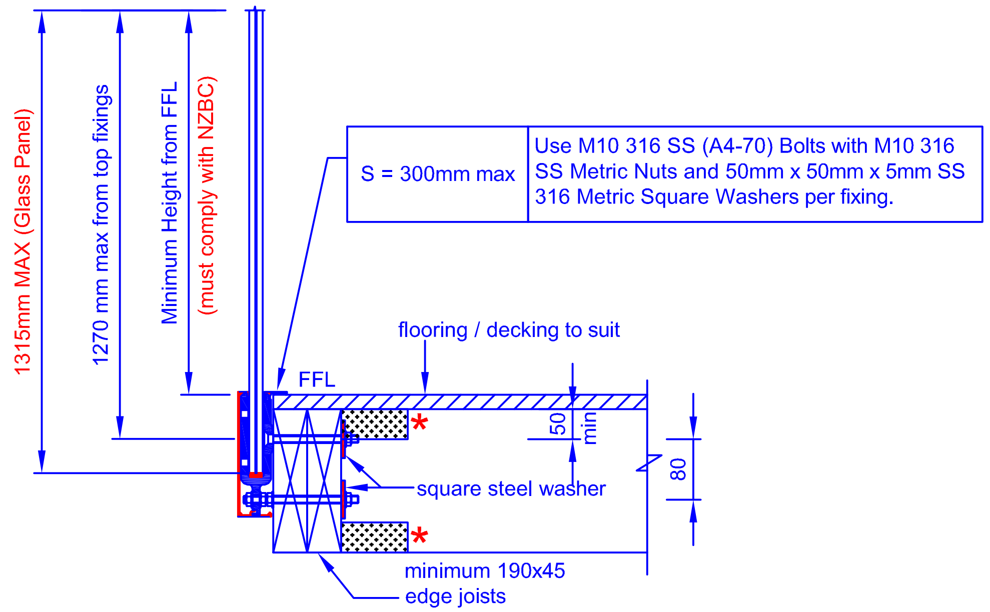
CONNECTION TO SUPPORTING DECK FRAMING:

* 1. FOR FIXING OF BOUNDARY/END JOISTS TO DECK FRAMING (STRAPS, BOLTS,ETC), REFER TO NZS3604:2011 FIGURE 7.10.

(OTHERWISE TO BE SPECIFICALLY DESIGNED BY OTHERS.)



FIXING TO STEEL



FIXING TO TIMBER (BOLTS)

P & P CONSULTING ENGINEERS LTD Civil and Structural Engineering 6A Montel Avenue, Henderson ph: 836-1853	FMI LTD / VETRO RACCORDI - CUBOID FACE FIX	Scales NOT TO SCALE	Project 11/243 (DS32.v2)
	BALUSTRADE / POOL FENCE - 15.52mm thick EVA TOUGHENED LAMINATED GLASS WITH SIDECLIPS	Drawn JD / Date 28/3/2024	Sheet ENG 01

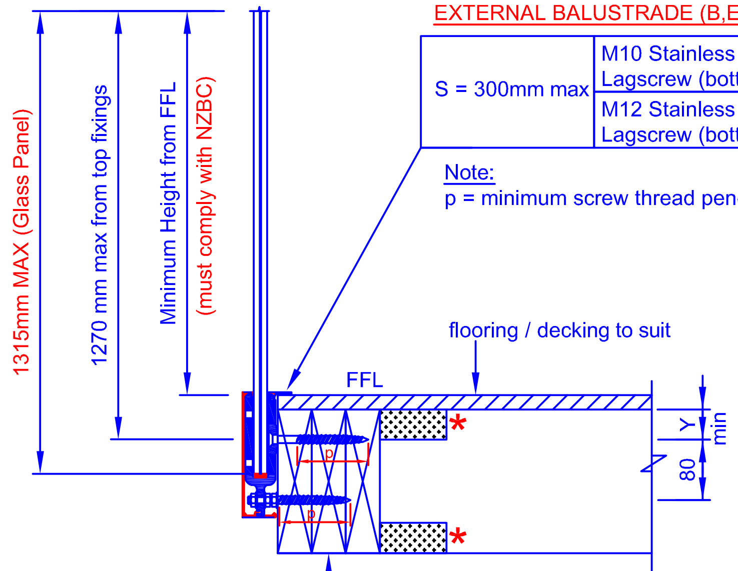
INTERNAL BALUSTRADE (A,B,E,C3,VH)

S = 300mm max	M10 Stainless Steel 316 Coach Screw (top fixing) / Lagscrew (bottom fixing)	p = 89 mm
	M12 Stainless Steel 316 Coach Screw (top fixing) / Lagscrew (bottom fixing)	p = 81 mm

EXTERNAL BALUSTRADE (B,E,C3,VH)

S = 300mm max	M10 Stainless Steel 316 Coach Screw (top fixing) / Lagscrew (bottom fixing)	p = 128 mm
	M12 Stainless Steel 316 Coach Screw (top fixing) / Lagscrew (bottom fixing)	p = 116 mm

Note:
p = minimum screw thread penetration into structural timber framing



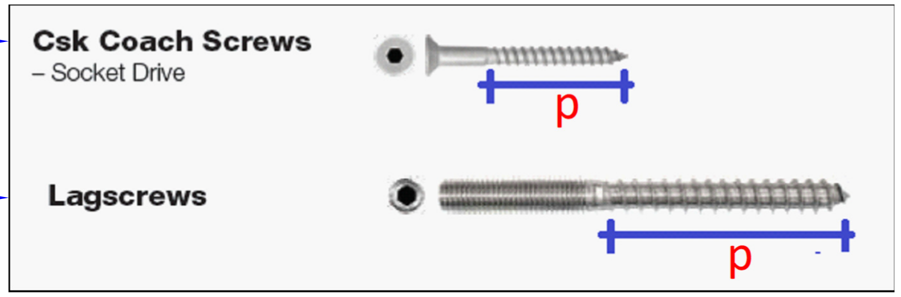
Note:
Minimum Edge Distance (Y)
Y = 50mm (using M10)
Y = 60mm (using M12)

Supporting Timber Substrate to suit - minimum 190x45 edge joists (timber shown is indicative only, ensure minimum screw penetration p into timber is achieved)

FIXING TO TIMBER (COACH SCREWS / LAGSCREWS)

Top fixings

Bottom fixings



p = minimum screw thread penetration into structural timber framing

DETAILS OF COACH SCREWS / LAGSCREWS

THIS GLASS BALUSTRADE/POOL FENCE IS SUITABLE FOR THE FOLLOWING:

LIVE LOAD:

OCCUPANCY TYPE	REFER TABLE 3.3 OF AS/NZS 1170
A	ALL AREAS WITHIN OR SERVING EXCLUSIVELY ONE DWELLING INCLUDING STAIRS, LANDINGS ETC. BUT EXCLUDING EXTERNAL BALCONIES & EDGES OF ROOFS.
B, E & C3	EXTERNAL DOMESTIC BALCONIES, OFFICES AND WORK AREAS. (NOT SUBJECT TO OVER CROWDING)

WIND LOAD: UP TO "VERY HIGH" (VH) WIND ZONE WITH MAXIMUM BASIC WIND SPEED OF 50 m/s. (DESIGN WIND PRESSURE = 1.95 kPa @ ULS)

FIXINGS:

1. ALL ANCHORS MUST BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS REQUIREMENTS.

2. BOLTING ARRANGEMENT MUST COMPLY WITH RELEVANT MATERIAL CODES.

3. STRENGTH & STIFFNESS OF THE SUBSTRATE STRUCTURE MUST BE SUFFICIENT FOR THE BALUSTRADE LOADS - THIS MUST BE SPECIFICALLY CHECKED BY OTHERS FOR EACH SITUATION.

DURABILITY:

1. ALL FIXINGS & STRUCTURAL STEEL MUST COMPLY WITH SECTION 4 "DURABILITY" OF NZS 3604:2011.

CONNECTION TO SUPPORTING DECK FRAMING:

* 1. FOR FIXING OF BOUNDARY/END JOISTS TO DECK FRAMING (STRAPS, BOLTS,ETC), REFER TO NZS3604:2011 FIGURE 7.10.

(OTHERWISE TO BE SPECIFICALLY DESIGNED BY OTHERS.)

P & P CONSULTING ENGINEERS LTD
Civil and Structural Engineering
6A Montel Avenue, Henderson ph: 836-1853

FMI LTD / VETRO RACCORDI - CUBOID FACE FIX

BALUSTRADE / POOL FENCE - 15.52mm thick EVA TOUGHENED LAMINATED GLASS WITH SIDECLIPS

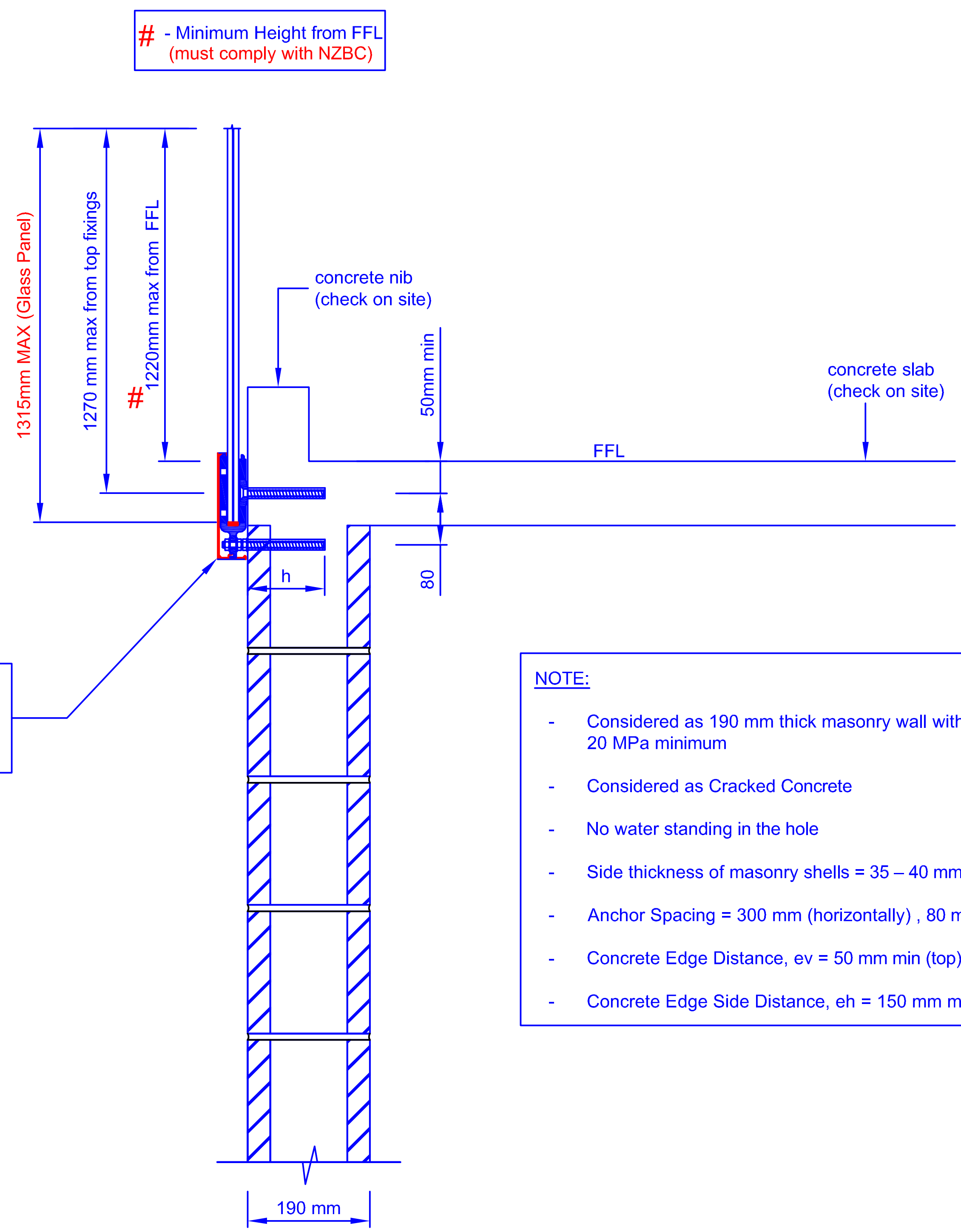
Scales NOT TO SCALE

Project 11/243 (DS32.v2)

Drawn JD

Date 28/3/2024

Sheet ENG 02



S = 300mm max	Use M12 A4 HAS-U (Stainless Steel) Anchors + HILTI HIT-HY 200-R V3 Adhesive. Minimum total embedment (h) into masonry block wall to be 120 mm.

NOTE:

- Considered as 190 mm thick masonry wall with concrete strength of 20 MPa minimum
- Considered as Cracked Concrete
- No water standing in the hole
- Side thickness of masonry shells = 35 – 40 mm
- Anchor Spacing = 300 mm (horizontally) , 80 mm (vertically)
- Concrete Edge Distance, ev = 50 mm min (top)
- Concrete Edge Side Distance, eh = 150 mm min (corner / end fixings)

FIXING TO MASONRY BLOCK WALL

THIS GLASS BALUSTRADE/POOL FENCE IS SUITABLE FOR THE FOLLOWING:

LIVE LOAD:

OCCUPANCY TYPE	REFER TABLE 3.3 OF AS/NZS 1170
A	ALL AREAS WITHIN OR SERVING EXCLUSIVELY ONE DWELLING INCLUDING STAIRS, LANDINGS ETC. BUT EXCLUDING EXTERNAL BALCONIES & EDGES OF ROOFS.
B, E & C3	EXTERNAL DOMESTIC BALCONIES, OFFICES AND WORK AREAS. (NOT SUBJECT TO OVER CROWDING)

WIND LOAD: UP TO "VERY HIGH" (VH) WIND ZONE WITH MAXIMUM BASIC WIND SPEED OF 50 m/s. (DESIGN WIND PRESSURE = 1.95 kPa @ ULS)

FIXINGS:

1. ALL ANCHORS MUST BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS REQUIREMENTS.

2. BOLTING ARRANGEMENT MUST COMPLY WITH RELEVANT MATERIAL CODES.

3. STRENGTH & STIFFNESS OF THE SUBSTRATE STRUCTURE MUST BE SUFFICIENT FOR THE BALUSTRADE LOADS - THIS MUST BE SPECIFICALLY CHECKED BY OTHERS FOR EACH SITUATION.

DURABILITY:

1. ALL FIXINGS & STRUCTURAL STEEL MUST COMPLY WITH SECTION 4 "DURABILITY" OF NZS 3604:2011.

CONNECTION TO SUPPORTING DECK FRAMING:

1. FOR FIXING OF BOUNDARY/END JOISTS TO DECK FRAMING (STRAPS, BOLTS,ETC), REFER TO NZS3604:2011 FIGURE 7.10.

(OTHERWISE TO BE SPECIFICALLY DESIGNED BY OTHERS.)

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