P & P CONSULTING ENGINEERS LTD

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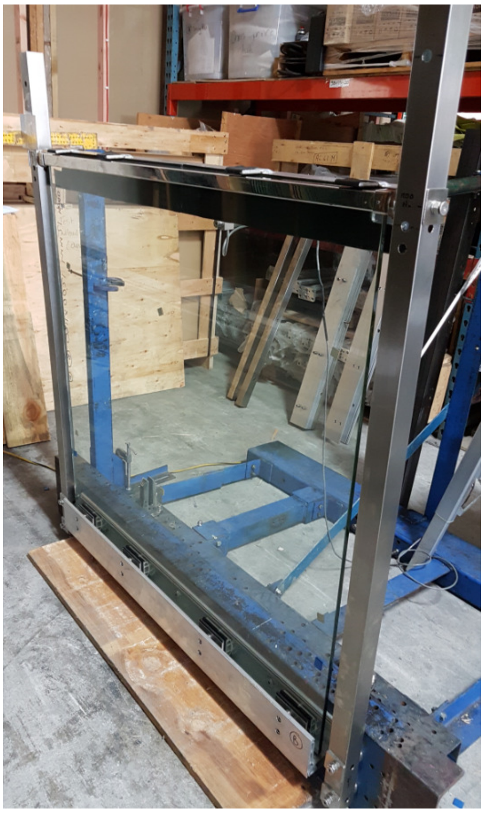
Ref: 11/243/ds52
20 October 2023

FMI Building Innovation Ltd / Vetro Raccordi

ASSESSMENT OF FRAMELESS GLASS BALUSTRADE

USING TILT-LOCK BASE CHANNEL SYSTEM (SIDE MOUNTED) & 12mm thick TOUGHENED GLASS (with Top Capping Rail)



Note:

Case A (done by testing)
= Very High Wind, 1.1m max Glass Height from top of base channel

Case B (additional assessment)
= Extra High Wind, 0.95m max Glass Height from top of base channel

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

Based on the testing, the glass balustrade which comprised of 12mm thick Toughened (Grade A) Safety Glass supported by tilt-lock base channel system (side mounted) and with top capping rail was sufficient for the following:

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

Refer to Summary Drawing ENG 01 for reference.

- For Occupancy type A

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

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

Note: The following are the parameters considered in the assessment.

Case A (done by testing)
= Very High Wind, 1.1m max Glass Height from top of base channel

Case B (additional assessment)
= Extra High Wind, 0.95m max Glass Height from top of base channel

The required bending moment at the base for Case B is less than the Case A by 8%.

Based on this additional assessment, the side-mounted glass balustrade with 0.95m max glass height from top of base channel under Extra High Wind (case B) is less critical than the original test setup (case A).

Therefore, it is concluded that the side-mounted glass balustrade with 0.95m max glass height from top of base channel under Extra High Wind (case B) can be covered from the testing results of the side-mounted glass balustrade with 1.1m max glass height from top of base channel under Very High Wind (case A).

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

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 LOCAL AUTHORITY
(Building Consent Authority)

IN RESPECT OF: Glass Balustrade with Tilt-lock Base Channel(side mounted) and 12mm thick Toughened Glass
(Description of Building Work)

AT: VARIOUS SITES (Refer to drawing sheet ENG01 & ENG02)
(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; ADDITIONAL ASSESSMENT

(Extent of Engagement)

services in respect of the requirements of Clause(s) B1,F2, F4 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 / VETRO RACCORDI LTD-TILT-LOCK BASE CHANNEL and numbered REF:11/243/DS52;DRAWING ENG01-02;
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 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) [signature]
(Name of Design Professional)

ON BEHALF OF P & P CONSULTING ENGINEERS LTD Date 20 Oct 2023
(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: July 2018
Test Description: Load testing of Glass Balustrade
(Panel Tested = 1180mm wide x 1200mm high glass panel)

System Description: The glass balustrade which was supplied by FMI Building Innovations Ltd / Vetro Raccordi Ltd. comprised of 12mm thick Toughened (Grade A) Safety Glass supported by tilt-lock base channel system (side mounted) and with top capping rail fixed to side posts.

Setup / Procedure:
The balustrade was setup with different load tests as noted on page 4. The glass panel was supported at the base with tilt-lock base channel system (side mounted). This channel system was bolted to the steel frame assembly with M12 fixings as shown below. Top capping rail was also installed on the glass panel which was fixed to the side posts acting as the supporting neighboring glass panels.

Hydraulic Body Frame/Ram and load cell or weighing indicator were used to attain the required test loads.

Hydraulic Body Frame

12mm thick Toughened Glass Panel with Top Capping Rail

Weighing Indicator

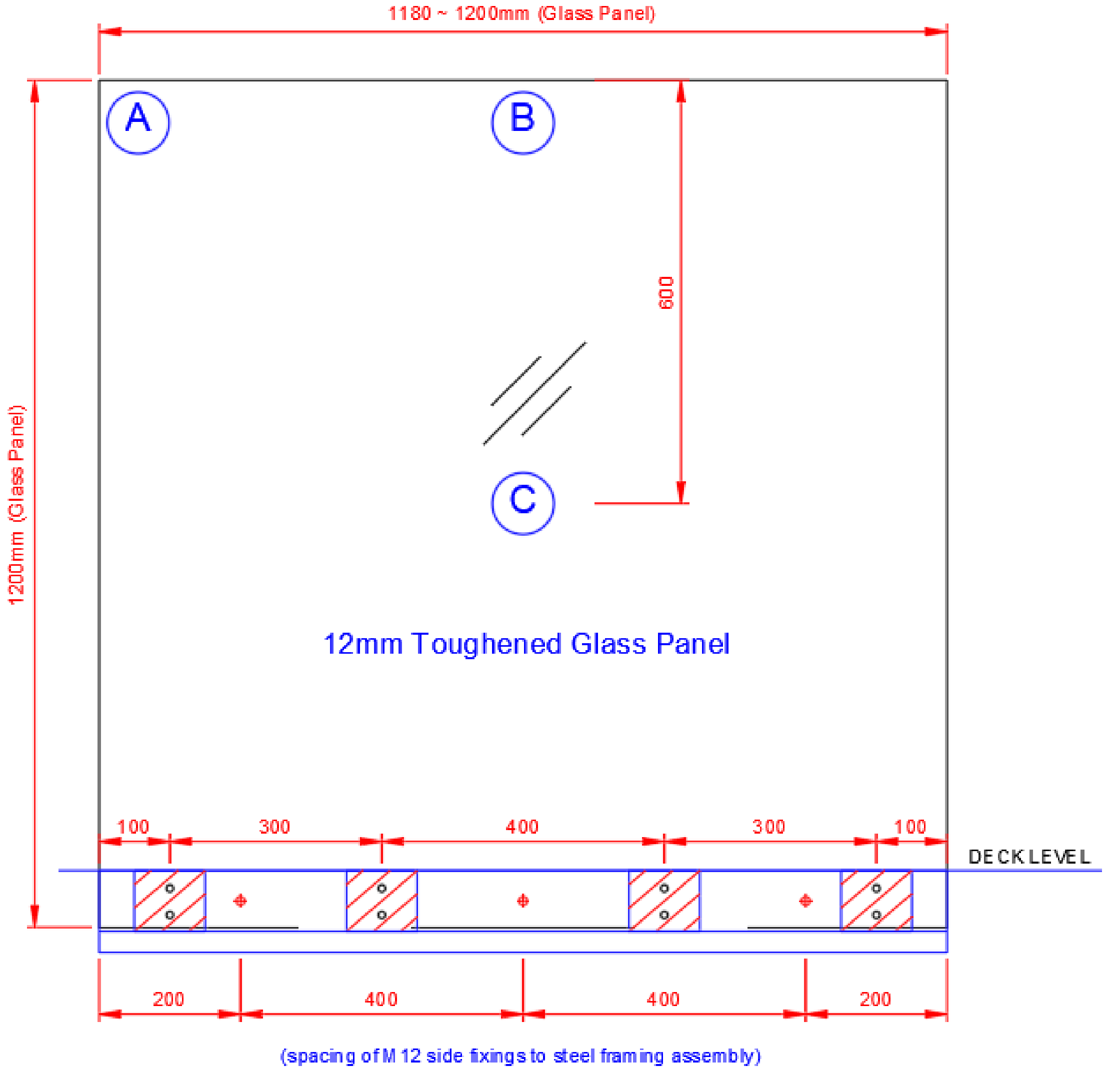
Side Post

Tilt-lock Base Channel System (side mounted)

Steel Frame Assembly

4. TESTS ARRANGEMENT & RESULTS

4.1 BALUSTRADE



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	380.7	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	13	14	13	Passed
B	91.7	14	15	14	Passed
C	159.2	10	11	10	Passed

Allowable Deflection = H/30 = 40 mm

Based on the testing, the glass balustrade which comprised of 12mm thick Toughened (Grade A) Safety Glass supported by tilt-lock base channel system (side mounted) and with top capping rail was sufficient for the following:

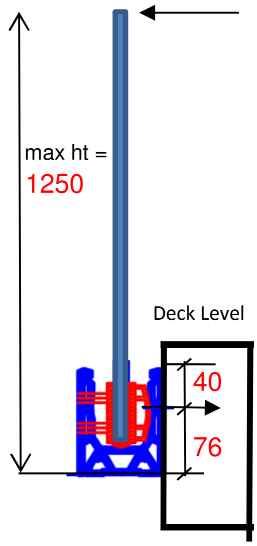
- Occupancy types A, B, C3
- Up to max “Very High” Wind

5.0 Base Fixings

Refer to Summary Drawing ENG 01 for reference.

5.1 BASE FIXINGS FOR INTERNAL BALUSTRADE

- For Occupancy type A



Maximum Tributary Spacing of Fixings = 400 mm
Number of base fixings per panel = 3

A loading	1.5Q1:	1.5 x 0.6 kN / (no of base fixings) =	0.3	kN
	1.5Q2:	1.5 x 0.35kN/m x trib spacing =	0.21	kN
	1.5Q3:	1.5 x 0.5kPa =	0.75	kPa
Wind - internal	Wuls:	0.6 x 50 x 50 /1000 x 0.3 =	0.45	kPa

Tension Force for Upper Fixing @ 400 mm max spacing (Central Bolts):

1.5Q1:	N*/anchor =	8.51	kN
1.5Q2:	N*/anchor =	5.95	kN
1.5Q3:	N*/anchor =	4.77	kN
Wuls:	N*/anchor =	2.86	kN

Max N*/anchor = **8.51** kN

Shear Force per Fixing (1.2G)

1.2 x Weight of Glass Panel = 1.2 x (28 kN/m3 x thickness x Area) = 0.302 kN
1.2 x Weight of Al Channel= 1.2 x (0.5 kN/m x spacing) = 0.24 kN

1.2G: V*/anchor = **0.54** kN

A. Fixing to Concrete

Refer to page 8 for design calculations.

Anchor Spacing= 400 mm — Concrete Strength, f'c = 20MPa min
Concrete Edge Dist= 60mm min — Considered as Cracked concrete

Using M10 Chemset Anchors with Epcon C8 Series Epoxy.

øN = **8.80** kN **OK** CDR= 1.04 **< 1.2 OK**
øV = **7.80** kN **OK**

Use M10 Chemset Anchors (Grade 5.8 Steel) with Epcon C8 Series Epoxy.
Drilled hole depth to be 120 mm min into concrete.
(spacing = 400mm max centres)

B. Fixing to Steel

Using M10 Grade 4.6/S

øN = **18.56** kN OK CDR= 0.51 OK
øV = **9.62** kN OK

Use M10 Grade 4.6/S Steel Bolts with metric round washer per fixing.
(spacing = 400mm max centres)

C. Fixing to Timber Using Bolt

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 50x50x5 Square Washers

øQ = **16.99** kN (dry) **OK**

Use M10 Grade 4.6/S Steel Bolts with 50x50x5 Square Washers.

(spacing = 400mm max centres)

D. Fixing to Timber Using Coach Screws

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

øQ = 74.9 N/mm (dry) Min Penetration = **114** mm (dry)

Using M12 Coach Screws

øQ = 82.6 N/mm (dry) Min Penetration = **103** mm (dry)

(spacing = 400mm max centres)

Cracked Concrete - ChemSet Anchor Stud Design Calculator

European Technical Approval: ETA-10/0309

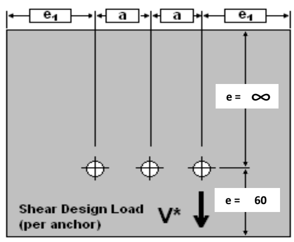
Ramset™

CRACKED Concrete - EPCON™ C8

Anchor Type: Anchor Stud - Gr 5.8 Anchor Size d_b = M 10

Input Description (Strength Limit State Design)	Input Data (per anchor)		
1. Number of anchors (n)	n =	3	-
2. Anchor Spacing (a)	a =	400	mm
3. Concrete Edge Distance (e)	e =	60	mm
4. Concrete Cylinder Strength (f'c)	f'c =	20	MPa
5. Cracked Conc. (C) or Non-Cracked (N)	C or N	C	-
6. Effective Depth (h>6xdh)	h =	120	mm
7. Anchor Stud size (d_b) - M8 → M30	d_b =	10	mm
8. Concrete Edge Distance Corner (e1)	e_1 =	60	mm
9. Internal to a row (I) or end of row (E)	I or E	E	row
10. Dry Hole (D) or Wet hole (W)	D or W	W	-
11. Min Concrete Sub'te Thickness (b_m)	b_m =	150	mm
12. Anchor Stud Grade (5.8, 8.8, 316 SS)	Grade =	5.8	Gr
13. Fixture Thickness (t)	t =	5	mm
14. Effective Length (L_e)	L_e =	125	mm
15. Design Tensile Load-per anchor (N*)	N* =	0	kN
16. Design Shear Load-per anchor (V*)	V* =	0	kN
17. Direction of Shear design load (α)	α =	0	°
18. Service Temperature (˚C)	-40˚C to	+40˚C	-

Plan View - Generic
Dimensions in (mm)



Project Details

Project Name:-

Project Site Address:-

Company Name:-

Design Identification:-

Date:-

ChemSet™ Anchor Stud "Specification"

Special Length - Use Typ Thr'd Rod Gr 8.8 or Diff.Size

EPCON™ C8 "Specification"

Part No. C8-450

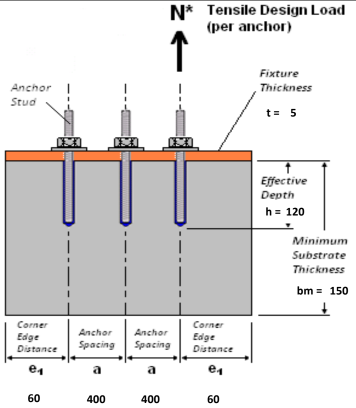
Hole Diameters (mm)	Capacity Reduction Factors
Drill d_h = 12	Conc Tension $1/\gamma_{Msp} = \phi_c = 0.56$
Fixture d_f = 12	Conc Shear $1/\gamma_{Mc} = \phi_c = 0.67$

Direction of Shear Design Load - α

α = 0˚- towards edge
α = 180˚ - away from edge

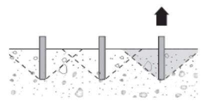
Output Description (Strength Limit State Design)	Output Data (per anchor)		
DESIGN O.K.	MIN. CRITERIA for a,e & h - O.K.		
Des.Pullout & CONC.Tensile Resistance	$N_{Rd,p}$ =	8.8	kN
Cracked Conc. STEEL Tensile Resistance	$N_{Rd,s}$ =	19.3	kN
Design CONC. Edge Shear Resistance	$V_{Rd,c}$ =	7.8	kN
Cracked Conc. STEEL Shear Resistance	$V_{Rd,s}$ =	12.0	kN
Des. Cracked Conc. Pryout Failure	$V_{Rd,cp}$ =	22.6	kN
Drill hole diameter	d_h =	12	mm
TENSION O.K.			
Design Tensile Resistance	N_{Rd} =	8.8	kN
Tension Design Check	N^*/N_{Rd} =	0.00	< 1
SHEAR O.K.			
Design Shear Resistance	V_{Rd} =	7.8	kN
Shear Design Check	V^*/V_{Rd} =	0.00	< 1
COMBINED TENSION SHEAR O.K.			
Combined Check - $N^*/N_{Rd} + V^*/V_{Rd}$ =		0.00	< 1.2

Elevation View - Generic
Dimensions in (mm)

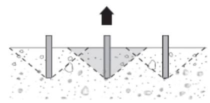


Anchor Loaded

"E" *Anchor end of a row*



"I" *Anchor internal to a row*



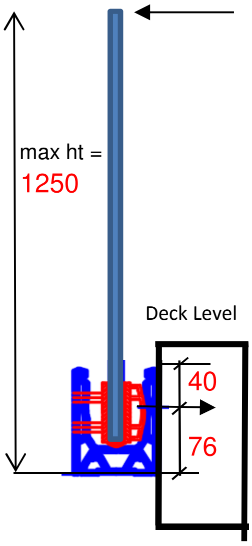
Anchor Size	d_b	Metric	8	10	12	16	20	24	30	36
Drill hole diameter	d_h	(mm)	10	12	14	18	24	26	N/A	N/A
Stressed Area	A_b	(mm²)	33	53	79	154	232	337	N/A	N/A
Anchor Stud Yield Strength	f_y	(MPa)	430	430	430	420	420	420	N/A	N/A
Cracked Conc. Steel Tensile Resistance	$N_{Rd,s}$	(kN)	12.0	19.3	28.0	52.7	82.0	118.0	N/A	N/A
Cracked Conc. Steel Shear Resistance	$V_{Rd,s}$	(kN)	7.2	12.0	16.8	31.2	48.8	70.4	N/A	N/A
Edge distance for no conc.cone reduction	e_c	(mm)	1xh	1xh	1xh	1xh	1xh	1xh	N/A	N/A
Anchor spacing for no conc.cone reduction	a_c	(mm)	2xh	2xh	2xh	2xh	2xh	2xh	N/A	N/A
Absolute Minimum edge dist. & anc'r spac.	e_m & a_m	(mm)	40	50	60	80	100	120	N/A	N/A

Effective Depth - h		Design tensile resistance N_{Rd} (kN per anchor) Based on edge distance (e_c) and anchor spacing (a_c) for no conc.cone reduction							
65	(mm)	6.0							
70	(mm)	6.5	8.1						
80	(mm)	7.4	9.3						
90	(mm)	8.4	10.4	11.9					
100	(mm)	9.3	11.6	13.2					
110	(mm)	10.2	12.8	14.5	16.5				
120	(mm)	11.1	13.9	15.8	18.8				
125	(mm)	11.6	14.5	16.5	20.0				
150	(mm)	12.0	17.4	19.8	24.9	26.2			
160	(mm)	12.0	18.6	21.1	26.6	28.9	28.9		
170	(mm)	12.0	19.3	22.4	28.2	31.6	31.6		
190	(mm)	12.0	19.3	25.1	31.6	37.4	37.4		
210	(mm)	12.0	19.3	27.7	34.9	43.4	43.4		
240	(mm)	12.0	19.3	28.0	39.9	49.8	53.1	N/A	
280	(mm)	12.0	19.3	28.0	46.5	58.2	66.9	N/A	
350	(mm)	12.0	19.3	28.0	52.7	72.7	87.2	N/A	
450	(mm)	12.0	19.3	28.0	52.7	82.0	112.2	N/A	N/A
550	(mm)	12.0	19.3	28.0	52.7	82.0	118.0	N/A	N/A

The design engineer should ensure the structural element is capable of supporting these loads. Refer to Ramset™ Specifiers Anchorng Resource Book ANZ for more information or explanation of Tech. Data.

5.2 BASE FIXINGS FOR EXTERNAL BALUSTRADE (at 400mm max centres)

- For Occupancy types B, C3
- For Up to max “Very High” Wind



Maximum Tributary Spacing of Fixings = 400 mm
Number 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 =	0.45	kN
		1.5Q3:	1.5 x 1.0kPa =	1.5	kPa
(V.H)	Wind - external	Wuls:	0.6 x 50 x 50 /1000 x 1.3 =	1.95	kPa

Tension Force for Upper Fixing @ 400 mm max spacing (Central Bolts):

1.5Q1:	N*/anchor =	8.51	kN
1.5Q2:	N*/anchor =	12.76	kN
1.5Q3:	N*/anchor =	9.54	kN
Wuls:	N*/anchor =	12.41	kN

Max N*/anchor = <u>12.76</u> kN

Shear Force per Fixing (1.2G)

1.2 x Weight of Glass Panel = 1.2 x (28 kN/m3 x thickness x Area) = 0.302 kN
1.2 x Weight of Al Channel= 1.2 x (0.5 kN/m x spacing) = 0.24 kN

1.2G: V*/anchor = <u>0.54</u> kN

A. Fixing to Concrete

<u>Refer to page 11 for design calculations.</u>
Anchor Spacing= 400 mm — Concrete Strength, f'c = 20MPa min
Concrete Edge Dist= 60mm min — Considered as Cracked concrete

<u>Using M12 Chemset Anchors with Epcon C8 Series Epoxy.</u>

ØN = **12.90** kN **OK** CDR= 1.06 **< 1.2 OK**
ØV = **8.10** kN **OK**

Use M12 Chemset Anchors (Grade 316 Stainless Steel) with Epcon C8 Series Epoxy.
Drilled hole depth to be 200 mm min into concrete.

(spacing = 400mm max centres)

B. Fixing to Steel

<u>Using M10 Grade A4/316 SS (A4-70)</u>

ØN = **27.20** kN OK CDR= 0.36 OK
ØV = **17.86** kN OK

Use M10 Grade 316 Stainless Steel (A4-70) Bolts with metric round washer per fixing.

(spacing = 400mm max centres)

C. Fixing to Timber Using Bolt

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 75x75x5 Square S/S plate

øQ = **23.37** kN (wet) **OK**

Use M10 Grade 316 Stainless Steel (A4-70) Bolts with 75x75x5 Square S/S Plate.

(spacing = 400mm max centres)

D. Fixing to Timber Using Coach Screws

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

øQ = 52.43 N/mm (wet) Min Penetration = **244** mm (wet)

Using M12 Coach Screws

øQ = 57.82 N/mm (wet) Min Penetration = **221** mm (wet)

(spacing = 400mm max centres)

Cracked Concrete - ChemSet Anchor Stud Design Calculator

European Technical Approval: ETA-10/0309

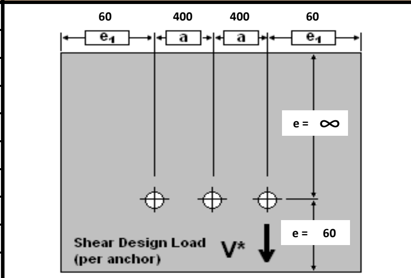
Ramset™

CRACKED Concrete - EPCON™ C8

Anchor Type: Anchor Stud - Gr 316 | Anchor Size d_b = M 12

Input Description (Strength Limit State Design)	Input Data (per anchor)		
1. Number of anchors (n)	n =	3	-
2. Anchor Spacing (a)	a =	400	mm
3. Concrete Edge Distance (e)	e =	60	mm
4. Concrete Cylinder Strength (f'c)	f'c =	20	MPa
5. Cracked Conc. (C) or Non-Cracked (N)	C or N	C	-
6. Effective Depth (h>6xdh)	h =	200	mm
7. Anchor Stud size (d_b) - M8 → M30	d_b =	12	mm
8. Concrete Edge Distance Corner (e1)	e_1 =	60	mm
9. Internal to a row (I) or end of row (E)	I or E	E	row
10. Dry Hole (D) or Wet hole (W)	D or W	W	-
11. Min Concrete Sub'te Thickness (b_m)	b_m =	250	mm
12. Anchor Stud Grade (5.8, 8.8, 316 SS)	Grade =	316	SS
13. Fixture Thickness (t)	t =	5	mm
14. Effective Length (L_e)	L_e =	205	mm
15. Design Tensile Load-per anchor (N*)	N* =	0	kN
16. Design Shear Load-per anchor (V*)	V* =	0	kN
17. Direction of Shear design load (α)	α =	0	°
18. Service Temperature (˚C)	-40˚C to	+40˚C	-

Plan View - Generic
Dimensions in (mm)



Project Details

Project Name:-

Project Site Address:-

Company Name:-

Design Identification:-

Date:-

ChemSet™ Anchor Stud "Specification"

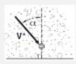
Special Length - Use Typ Thr'd Rod or Diff.Size

EPCON™ C8 "Specification"

Part No. C8-450

Hole Diameters (mm)	Capacity Reduction Factors
Drill d_h = 14	Conc Tension $1/\gamma_{Msp} = \phi_c = 0.56$
Fixture d_f = 15	Conc Shear $1/\gamma_{Mc} = \phi_c = 0.67$

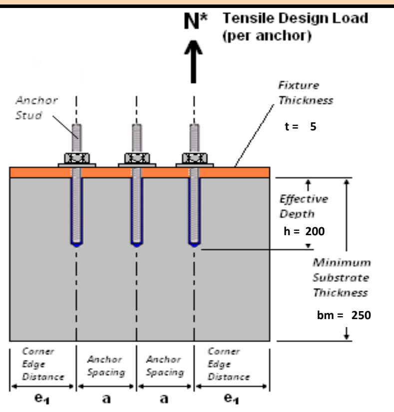
Direction of Shear Design Load - α



α = 0˚ - towards edge
α = 180˚ - away from edge

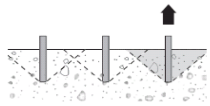
Output Description (Strength Limit State Design)	Output Data (per anchor)		
DESIGN O.K.	MIN. CRITERIA for a,e & h - O.K.		
Des.Pullout & CONC.Tensile Resistance	$N_{Rd,p}$ =	12.9	kN
Cracked Conc. STEEL Tensile Resistance	$N_{Rd,s}$ =	31.6	kN
Design CONC. Edge Shear Resistance	$V_{Rd,c}$ =	8.1	kN
Cracked Conc. STEEL Shear Resistance	$V_{Rd,s}$ =	19.2	kN
Des. Cracked Conc. Pryout Failure	$V_{Rd,cp}$ =	24.3	kN
Drill hole diameter	d_h =	14	mm
TENSION O.K.			
Design Tensile Resistance	N_{Rd} =	12.9	kN
Tension Design Check	N^*/N_{Rd} =	0.00	< 1
SHEAR O.K.			
Design Shear Resistance	V_{Rd} =	8.1	kN
Shear Design Check	V^*/V_{Rd} =	0.00	< 1
COMBINED TENSION SHEAR O.K.			
Combined Check - $N^*/N_{Rd} + V^*/V_{Rd}$ =		0.00	< 1.2

Elevation View - Generic
Dimensions in (mm)

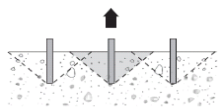


Anchor Loaded

"E" *Anchor end of a row*



"I" *Anchor internal to a row*



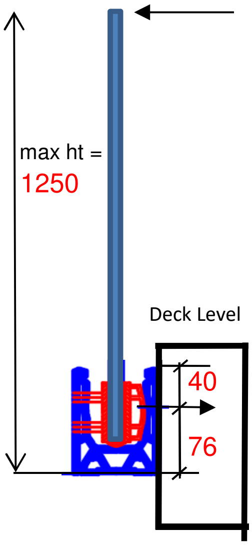
Anchor Size	d_b	Metric	8	10	12	16	20	24	30	36
Drill hole diameter	d_h	(mm)	10	12	14	18	24	26	N/A	N/A
Stressed Area	A_b	(mm²)	33	53	79	154	232	337	N/A	N/A
Anchor Stud Yield Strength	f_y	(MPa)	450	450	450	450	450	450	N/A	N/A
Cracked Conc. Steel Tensile Resistance	$N_{Rd,s}$	(kN)	13.9	21.9	31.6	58.8	92.0	132.1	N/A	N/A
Cracked Conc. Steel Shear Resistance	$V_{Rd,s}$	(kN)	8.3	12.8	19.2	35.3	55.1	79.5	N/A	N/A
Edge distance for no conc.cone reduction	e_c	(mm)	1xh	1xh	1xh	1xh	1xh	1xh	N/A	N/A
Anchor spacing for no conc.cone reduction	a_c	(mm)	2xh	2xh	2xh	2xh	2xh	2xh	N/A	N/A
Absolute Minimum edge dist. & anc'r spac.	e_m & a_m	(mm)	40	50	60	80	100	120	N/A	N/A

Effective Depth - h		Design tensile resistance N_{Rd} (kN per anchor) Based on edge distance (e_c) and anchor spacing (a_c) for no conc.cone reduction							
65	(mm)	6.0							
70	(mm)	6.5	8.1						
80	(mm)	7.4	9.3						
90	(mm)	8.4	10.4	11.9					
100	(mm)	9.3	11.6	13.2					
110	(mm)	10.2	12.8	14.5	16.5				
120	(mm)	11.1	13.9	15.8	18.8				
125	(mm)	11.6	14.5	16.5	20.0				
150	(mm)	13.9	17.4	19.8	24.9	26.2			
160	(mm)	13.9	18.6	21.1	26.6	28.9	28.9		
170	(mm)	13.9	19.7	22.4	28.2	31.6	31.6		
190	(mm)	13.9	21.9	25.1	31.6	37.4	37.4		
210	(mm)	13.9	21.9	27.7	34.9	43.4	43.4		
240	(mm)	13.9	21.9	31.6	39.9	49.8	53.1	N/A	
280	(mm)	13.9	21.9	31.6	46.5	58.2	66.9	N/A	
350	(mm)	13.9	21.9	31.6	58.2	72.7	87.2	N/A	
450	(mm)	13.9	21.9	31.6	58.8	92.0	112.2	N/A	N/A
550	(mm)	13.9	21.9	31.6	58.8	92.0	132.1	N/A	N/A

The design engineer should ensure the structural element is capable of supporting these loads. Refer to Ramset™ Specifiers Anchorng Resource Book ANZ for more information or explanation of Tech. Data.

5.3 BASE FIXINGS FOR EXTERNAL BALUSTRADE (at 200mm max centres)

- For Occupancy types B, C3
- For Up to max “Very High” Wind



Maximum Tributary Spacing of Fixings = 200 mm
Number of base fixings per panel = 5

	C3 loading	1.5Q1:	1.5 x 0.6 kN / (no of base fixings) =	0.18	kN
		1.5Q2:	1.5 x 0.75kN/m x trib spacing =	0.225	kN
		1.5Q3:	1.5 x 1.0kPa =	1.5	kPa
(V.H)	Wind - external	Wuls:	0.6 x 50 x 50 /1000 x 1.3 =	1.95	kPa

Tension Force for Upper Fixing @ 200 mm max spacing (Central Bolts):

1.5Q1:	N*/anchor =	5.10	kN
1.5Q2:	N*/anchor =	6.38	kN
1.5Q3:	N*/anchor =	4.77	kN
Wuls:	N*/anchor =	6.20	kN

Max N*/anchor = <u>**6.38**</u> kN

Shear Force per Fixing (1.2G)

1.2 x Weight of Glass Panel = 1.2 x (28 kN/m3 x thickness x Area) = 0.151 kN
1.2 x Weight of Al Channel= 1.2 x (0.5 kN/m x spacing) = 0.12 kN

1.2G: V*/anchor = <u>**0.27**</u> kN

A. Fixing to Concrete

<u>Refer to page 14 for design calculations.</u>
Anchor Spacing= 200 mm — Concrete Strength, f'c = 20MPa min
Concrete Edge Dist= 60mm min — Considered as Cracked concrete

<u>Using M10 Chemset Anchors with Epcon C8 Series Epoxy.</u>

ØN = **8.10** kN **OK** CDR= 0.85 **< 1.2 OK**
ØV = **4.70** kN **OK**

Use M10 Chemset Anchors (Grade 316 Stainless Steel) with Epcon C8 Series Epoxy.
Drilled hole depth to be 120 mm min into concrete.

(spacing = 200mm max centres)

B. Fixing to Steel

<u>Using M10 Grade A4/316 SS (A4-70)</u>

ØN = **27.20** kN OK CDR= 0.18 OK
ØV = **17.86** kN OK

Use M10 Grade 316 Stainless Steel (A4-70) Bolts with metric round washer per fixing.

(spacing = 200mm max centres)

C. Fixing to Timber Using Bolt

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 50x50x5 Washers

ØQ = **10.12** kN (wet) **OK**

Use M10 Grade 316 Stainless Steel (A4-70) Bolts with 50x50x5 Square S/S Washers.

(spacing = 200mm max centres)

D. Fixing to Timber Using Coach Screws

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

ØQ = 52.43 N/mm (wet) Min Penetration = **122** mm (wet)

Using M12 Coach Screws

ØQ = 57.82 N/mm (wet) Min Penetration = **111** mm (wet)

(spacing = 200mm max centres)

Cracked Concrete - ChemSet Anchor Stud Design Calculator

European Technical Approval: ETA-10/0309

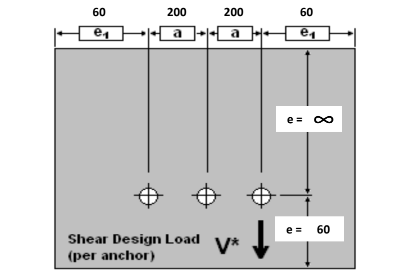
CRACKED Concrete - EPCON™ C8




Anchor Type: Anchor Stud - Gr 316 Anchor Size d_b = M 10

Input Description (Strength Limit State Design)	Input Data (per anchor)		
1. Number of anchors (n)	n =	5	-
2. Anchor Spacing (a)	a =	200	mm
3. Concrete Edge Distance (e)	e =	60	mm
4. Concrete Cylinder Strength (f'c)	f'c =	20	MPa
5. Cracked Conc. (C) or Non-Cracked (N)	C or N	C	-
6. Effective Depth (h>6xdh)	h =	120	mm
7. Anchor Stud size (d_b) - M8 → M30	d_b =	10	mm
8. Concrete Edge Distance Corner (e1)	e_1 =	60	mm
9. Internal to a row (I) or end of row (E)	I or E	E	row
10. Dry Hole (D) or Wet hole (W)	D or W	W	-
11. Min Concrete Sub'te Thickness (b_m)	b_m =	150	mm
12. Anchor Stud Grade (5.8, 8.8, 316 SS)	Grade =	316	SS
13. Fixture Thickness (t)	t =	5	mm
14. Effective Length (L_e)	L_e =	125	mm
15. Design Tensile Load-per anchor (N*)	N* =	0	kN
16. Design Shear Load-per anchor (V*)	V* =	0	kN
17. Direction of Shear design load (α)	α =	0	°
18. Service Temperature (˚C)	-40˚C to	+40˚C	-

Plan View - Generic
Dimensions in (mm)



Project Details

Project Name:-

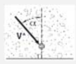
Project Site Address:-

Company Name:-

Design Identification:-

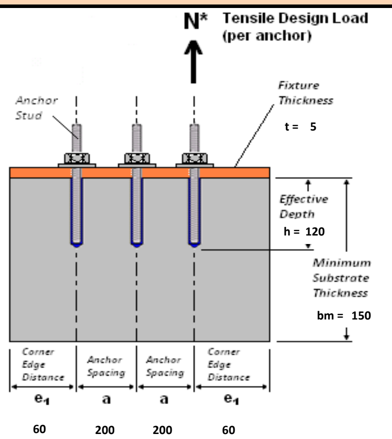
Date:-

ChemSet™ Anchor Stud "Specification"		EPCON™ C8 "Specification"
Special Length - Use Typ Thr'd Rod or Diff.Size		Part No. C8-450
Hole Diameters (mm)	**Capacity Reduction Factors**	**Direction of Shear Design Load - α**
Drill d_h = 12	Conc Tension $1/\gamma_{Msp} = \phi_c = 0.56$	α = 0˚- towards edge
Fixture d_f = 12	Conc Shear $1/\gamma_{Mc} = \phi_c = 0.67$	α = 180˚ - away from edge



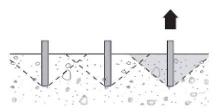
Output Description (Strength Limit State Design)	Output Data (per anchor)		
DESIGN O.K.	MIN. CRITERIA for a,e & h - O.K.		
Des.Pullout & CONC.Tensile Resistance	$N_{Rd,p}$ =	8.1	kN
Cracked Conc. STEEL Tensile Resistance	$N_{Rd,s}$ =	21.9	kN
Design CONC. Edge Shear Resistance	$V_{Rd,c}$ =	4.7	kN
Cracked Conc. STEEL Shear Resistance	$V_{Rd,s}$ =	12.8	kN
Des. Cracked Conc. Pryout Failure	$V_{Rd,cp}$ =	20.8	kN
Drill hole diameter	d_h =	12	mm
TENSION O.K.			
Design Tensile Resistance	N_{Rd} =	8.1	kN
Tension Design Check	N^*/N_{Rd} =	0.00	< 1
SHEAR O.K.			
Design Shear Resistance	V_{Rd} =	4.7	kN
Shear Design Check	V^*/V_{Rd} =	0.00	< 1
COMBINED TENSION SHEAR O.K.			
Combined Check - $N^*/N_{Rd} + V^*/V_{Rd}$ =		0.00	< 1.2

Elevation View - Generic
Dimensions in (mm)

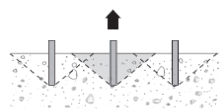


Anchor Loaded

"E" *Anchor end of a row*



"I" *Anchor internal to a row*



Anchor Size	d_b	Metric	8	10	12	16	20	24	30	36
Drill hole diameter	d_h	(mm)	10	12	14	18	24	26	N/A	N/A
Stressed Area	A_b	(mm²)	33	53	79	154	232	337	N/A	N/A
Anchor Stud Yield Strength	f_y	(MPa)	450	450	450	450	450	450	N/A	N/A
Cracked Conc. Steel Tensile Resistance	$N_{Rd,s}$	(kN)	13.9	21.9	31.6	58.8	92.0	132.1	N/A	N/A
Cracked Conc. Steel Shear Resistance	$V_{Rd,s}$	(kN)	8.3	12.8	19.2	35.3	55.1	79.5	N/A	N/A
Edge distance for no conc.cone reduction	e_c	(mm)	1xh	1xh	1xh	1xh	1xh	1xh	N/A	N/A
Anchor spacing for no conc.cone reduction	a_c	(mm)	2xh	2xh	2xh	2xh	2xh	2xh	N/A	N/A
Absolute Minimum edge dist. & anc'r spac.	e_m & a_m	(mm)	40	50	60	80	100	120	N/A	N/A

Effective Depth - h		Design tensile resistance N_{Rd} (kN per anchor) Based on edge distance (e_c) and anchor spacing (a_c) for no conc.cone reduction							
65	(mm)	6.0							
70	(mm)	6.5	8.1						
80	(mm)	7.4	9.3						
90	(mm)	8.4	10.4	11.9					
100	(mm)	9.3	11.6	13.2					
110	(mm)	10.2	12.8	14.5	16.5				
120	(mm)	11.1	13.9	15.8	18.8				
125	(mm)	11.6	14.5	16.5	20.0				
150	(mm)	13.9	17.4	19.8	24.9	26.2			
160	(mm)	13.9	18.6	21.1	26.6	28.9	28.9		
170	(mm)	13.9	19.7	22.4	28.2	31.6	31.6		
190	(mm)	13.9	21.9	25.1	31.6	37.4	37.4		
210	(mm)	13.9	21.9	27.7	34.9	43.4	43.4		
240	(mm)	13.9	21.9	31.6	39.9	49.8	53.1	N/A	
280	(mm)	13.9	21.9	31.6	46.5	58.2	66.9	N/A	
350	(mm)	13.9	21.9	31.6	58.2	72.7	87.2	N/A	
450	(mm)	13.9	21.9	31.6	58.8	92.0	112.2	N/A	N/A
550	(mm)	13.9	21.9	31.6	58.8	92.0	132.1	N/A	N/A

The design engineer should ensure the structural element is capable of supporting these loads. Refer to Ramset™ Specifiers Anchorng Resource Book ANZ for more information or explanation of Tech. Data.

6. Additional Assessment of Glass Balustrade in Extra High Wind

The side-mounted glass balustrade with 0.95m max glass height from top of base channel under Extra High Wind (case B) has been assessed to see whether the required bending stress at the base is less than the original test setup (case A).The following are the parameters considered in the assessment.

Case A (done by testing)
= Very High Wind, 1.1m max Glass Height from top of base channel

Case B (additional assessment)
= Extra High Wind, 0.95m max Glass Height from top of base channel

Wind Load Calculations:

- **Case A**

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)**

- **Case B**

Wind Loads (EXTRA HIGH)

Design for EXTRA HIGH Winds in terms of the Wind Speed categories in NZS 3604:2011 (up to 55 m/s).

$V_{sit,\beta}$(Ultimate)	=	55.0	m/s
$V_{sit,\beta}$(Serviceability)	=	37.3	m/s
q	=	1.82	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	**=**	**2.36**	**kPa (ULS)**
	=	**1.08**	**kPa (SLS)**

The required bending moment at the base under Wind load for each case was calculated as follows:

Case A (done by testing)

= Very High Wind

= 1.1m max Glass Height from top of base channel

Wind Load (VH) = 1.95kPa

Full Height = 1235mm

Bending Moment (per metre width):

M* = (1.95kPa)(1.0m)(1.235)(1.235) / 2

M* = 1.4871 kNm

Case B (additional assessment)

= Extra High Wind

= 0.95m max Glass Height from top of base channel

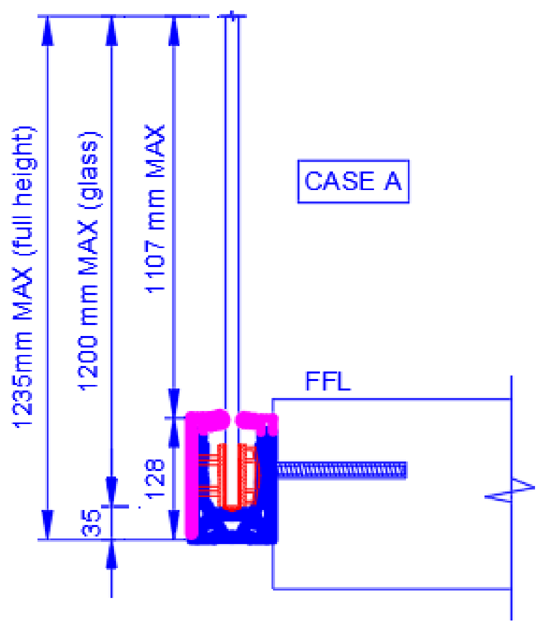
Wind Load (EH) = 2.36kPa

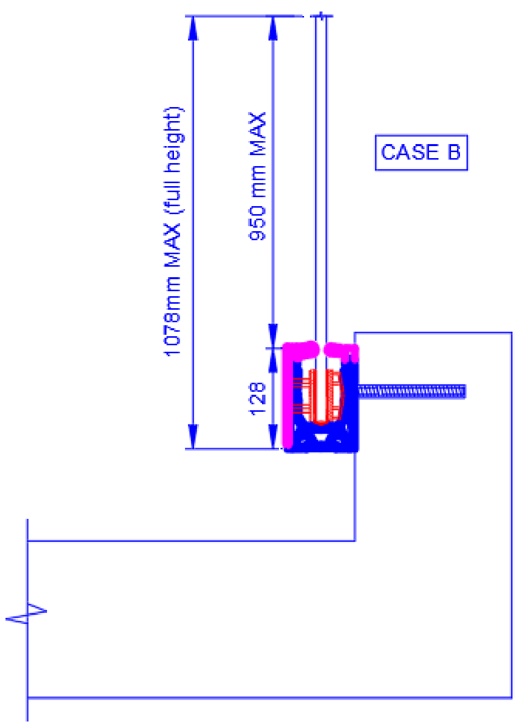
Full Height = 1078mm

Bending Moment (per metre width):

M* = (2.36kPa)(1.0m)(1.078)(1.078) / 2

M* = 1.371 kNm < 1.4871 kNm (OK)





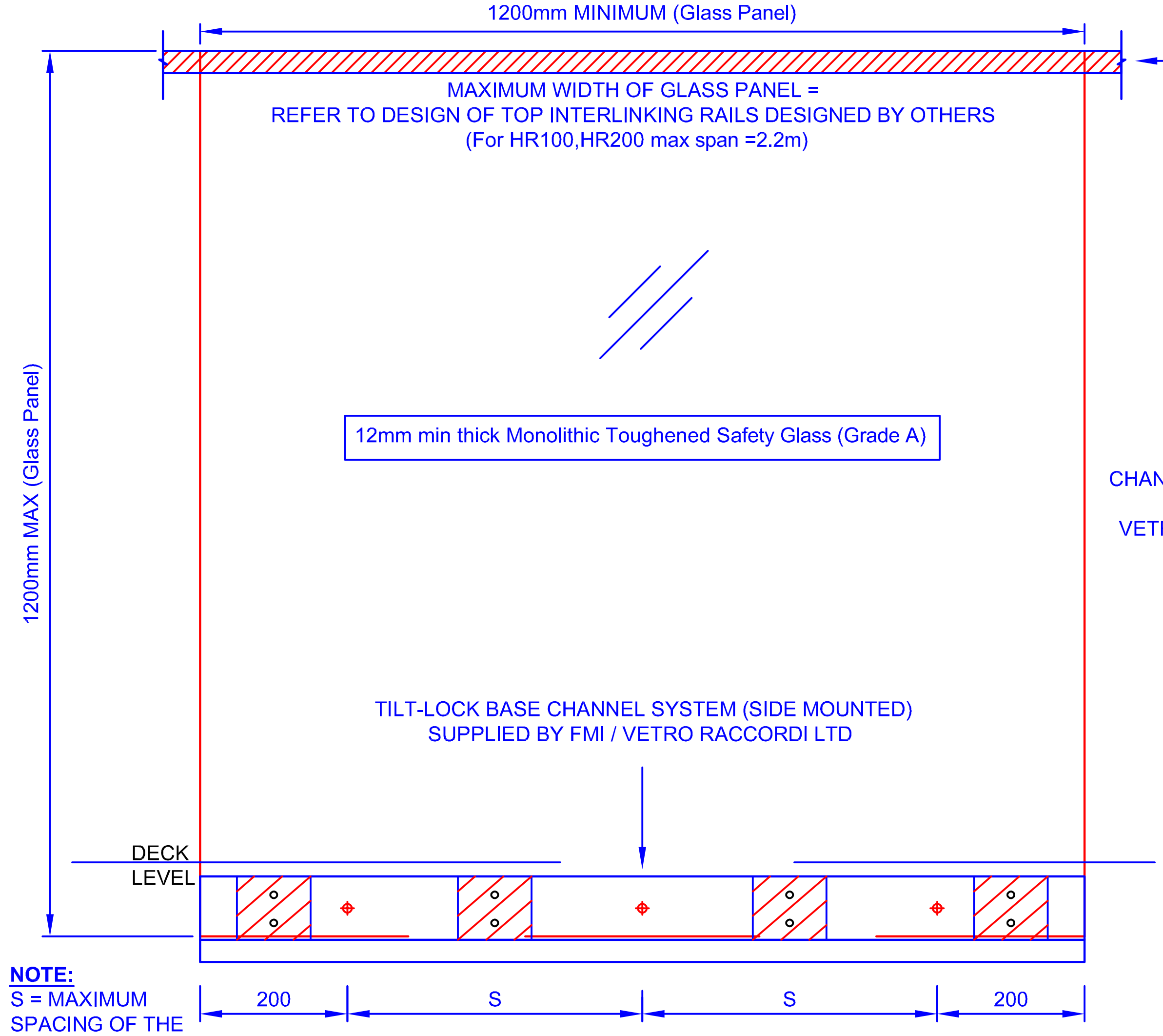
% Difference for bending Moment M* = 7.8 %

The required bending moment at the base for Case B is less than the Case A by 8%.

Based on this additional assessment, the side-mounted glass balustrade with 0.95m max glass height from top of base channel under Extra High Wind (case B) is less critical than the original test setup (case A).

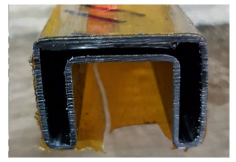
Therefore, it is concluded that the side-mounted glass balustrade with 0.95m max glass height from top of base channel under Extra High Wind (case B) can be covered from the testing results of the side-mounted glass balustrade with 1.1m max glass height from top of base channel under Very High Wind (case A).

Case A (done by testing)
=Very High Wind, 1.1m max Glass Height from top of base channel

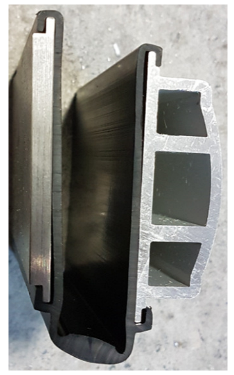


NOTE:
S = MAXIMUM SPACING OF THE SIDE FIXINGS

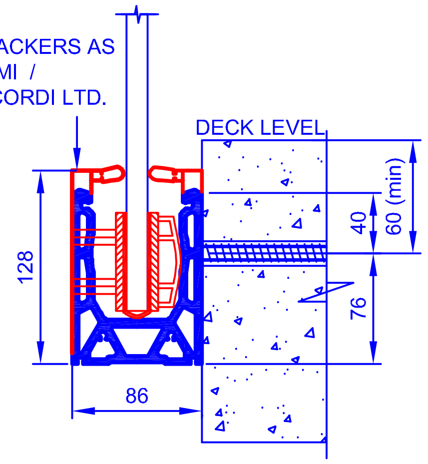
TYPICAL ELEVATION



TOP CAPPING RAIL



PACKER DETAILS



CROSS SECTION

CHANNEL DETAILS

THIS GLASS BALUSTRADE 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 & C3	EXTERNAL DOMESTIC BALCONIES, OFFICES AND WORK AREAS. (NOT SUBJECT TO OVER CROWDING)

WIND LOAD: (Case A) 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 TIMBER FRAMING:

* 1. TO RESIST THE ROTATION AT THE BASE, FIX THE SUPPORTING BOUNDARY / END JOISTS TO THE SUPPORTING DECK TIMBER FRAMING AS PER THE DETAILS FROM NZS3604:2011 FIGURE 7.10.

(OTHERWISE THOSE STRAPS, BOLTS,ETC - TO BE SPECIFICALLY DESIGNED BY OTHERS.)

INTERNAL BALUSTRADE (A)

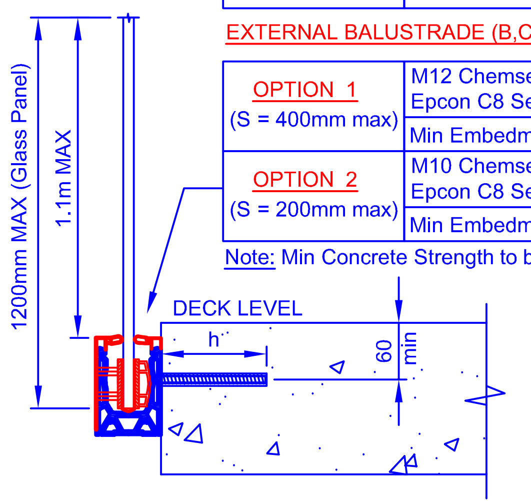
S = 400mm max	M10 Chemset Anchors Grade 5.8 with Epcon C8 Series Epoxy
	Min Embedment into Concrete, h= 120mm

EXTERNAL BALUSTRADE (B,C3,VH)

OPTION 1 (S = 400mm max)	M12 Chemset Anchors (Grade 316 SS) with Epcon C8 Series Epoxy
	Min Embedment into Concrete, h= 200mm
OPTION 2 (S = 200mm max)	M10 Chemset Anchors (Grade 316 SS) with Epcon C8 Series Epoxy
	Min Embedment into Concrete, h= 120mm

Note: Min Concrete Strength to be 20 MPa

NOTE:
BASE CHANNEL TO BE PLACED WITH FULL BEARING AGAINST THE SIDE OF THE SUPPORTING STRUCTURE.



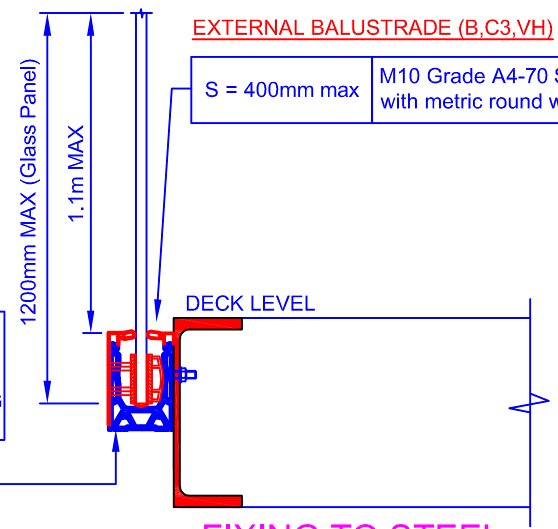
FIXING TO CONCRETE

INTERNAL BALUSTRADE (A)

S = 400mm max	M10 Grade 4.6/S Bolts with metric round washers

EXTERNAL BALUSTRADE (B,C3,VH)

S = 400mm max	M10 Grade A4-70 SS Bolts with metric round washers



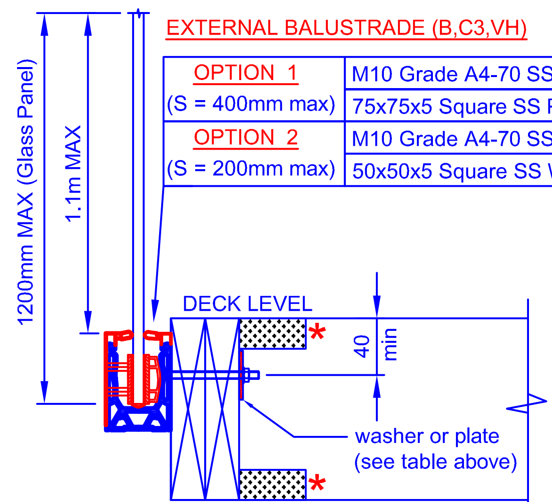
FIXING TO STEEL

INTERNAL BALUSTRADE (A)

S = 400mm max	M10 Grade 4.6/S Bolts
	50x50x5 Square Washers

EXTERNAL BALUSTRADE (B,C3,VH)

OPTION 1 (S = 400mm max)	M10 Grade A4-70 SS Bolts
	75x75x5 Square SS Plate
OPTION 2 (S = 200mm max)	M10 Grade A4-70 SS Bolts
	50x50x5 Square SS Washers



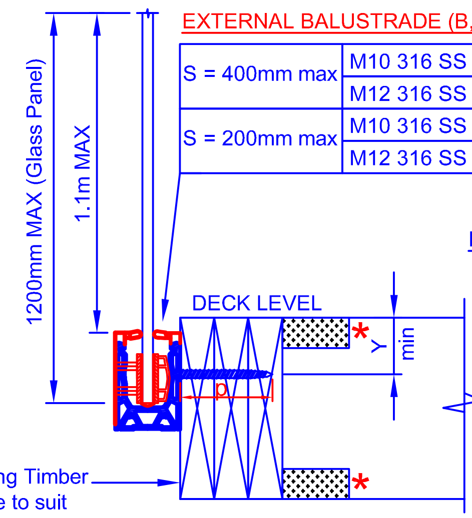
FIXING TO TIMBER (BOLTS)

INTERNAL BALUSTRADE (A)

S = 400mm max	M10 316 SS Lagscrews	p = 114mm
	M12 316 SS Lagscrews	p = 103mm

EXTERNAL BALUSTRADE (B,C3,VH)

S = 400mm max	M10 316 SS Lagscrews	p = 244mm
	M12 316 SS Lagscrews	p = 221mm
S = 200mm max	M10 316 SS Lagscrews	p = 122mm
	M12 316 SS Lagscrews	p = 111mm



Supporting Timber Substrate to suit (timber shown is indicative only)

Note:
1. Lagscrews to have locking nuts(on the threaded part)
2. p = minimum screw thread penetration into structural timber framing
3. Minimum Edge Distance (Y)
Y = 50mm (using M10)
Y = 60mm (using M12)

FIXING TO TIMBER (LAGSCREW)

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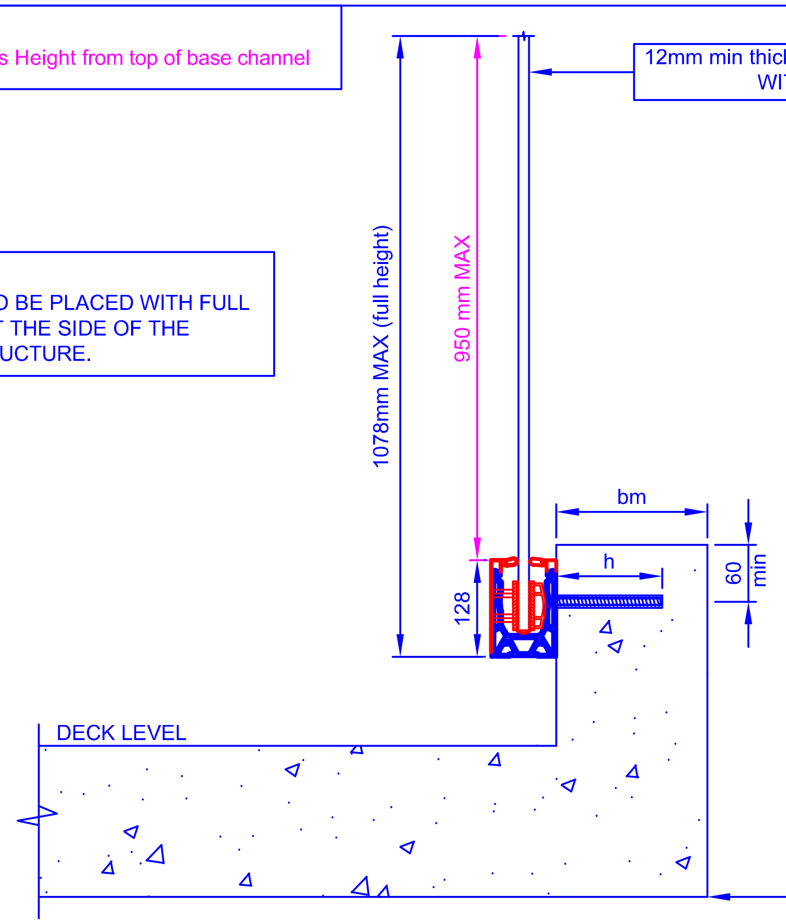
Civil and Structural Engineering
6A Montel Avenue, Henderson ph: 836-1853

FMI / VETRO RACCORDI LTD - TILT-LOCK BASE CHANNEL SYSTEM (SIDE MOUNTED)	Scales NOT TO SCALE	Project 11/243 (DS52)
INTERNAL & EXTERNAL BALUSTRADE - 12mm thick TOUGHENED GLASS (WITH TOP CAPPING RAIL)	Drawn JD / Date 20/10/2023	Sheet ENG 01 (Case A)

Case B (additional assessment)
=Extra High Wind, 0.95m max Glass Height from top of base channel

NOTE:
BASE CHANNEL TO BE PLACED WITH FULL BEARING AGAINST THE SIDE OF THE SUPPORTING STRUCTURE.

12mm min thick Monolithic Toughened Safety Glass (Grade A)
WITH TOP INTERLINKING RAILS



FIXING TO CONCRETE

INTERNAL BALUSTRADE (A)

S = 400mm max	M10 Chemset Anchors Grade 5.8 with Epcon C8 Series Epoxy
	Min Embedment into Concrete, h= 120mm
	Min Substrate Thickness, bm = 150mm *

EXTERNAL BALUSTRADE (B,C3,EH)

OPTION 1 (S = 400mm max)	M12 Chemset Anchors (Grade 316 SS) with Epcon C8 Series Epoxy
	Min Embedment into Concrete, h= 200mm
	Min Substrate Thickness, bm = 250mm *
OPTION 2 (S = 200mm max)	M10 Chemset Anchors (Grade 316 SS) with Epcon C8 Series Epoxy
	Min Embedment into Concrete, h= 120mm
	Min Substrate Thickness, bm = 150mm *

Min Concrete Strength to be 20 MPa

* - minimum thickness based only from the requirement of the chemset anchors (not from the design requirement of the supporting concrete structure - must be designed by others)

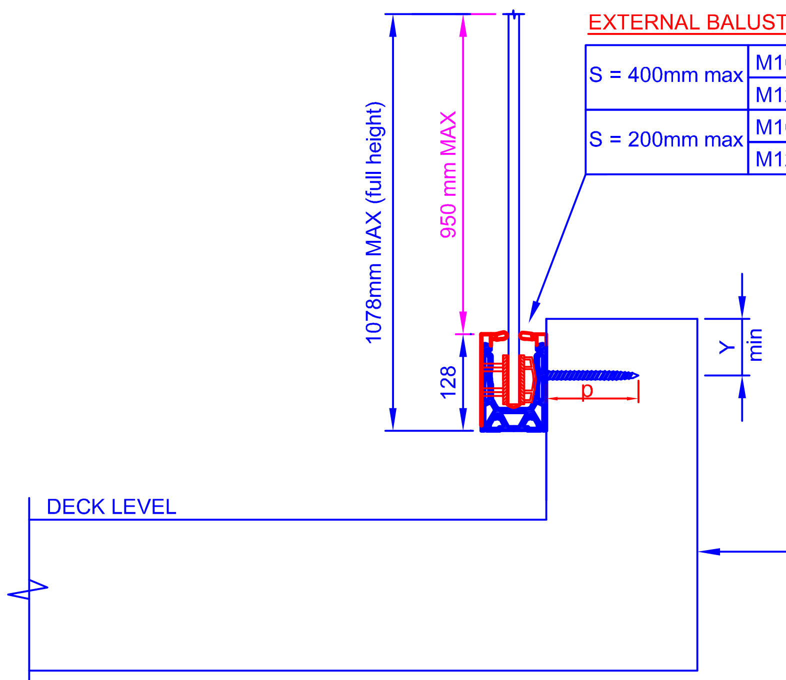
NOTE:
SUPPORTING CONCRETE DECK/UPSTAND WALL (STEEL REINFORCEMENT & REQUIRED THICKNESS) MUST BE DESIGNED BY OTHERS AGAINST BALUSTRADE LOAD

INTERNAL BALUSTRADE (A)

S = 400mm max	M10 316 SS Lagscrews	p = 97 mm
	M12 316 SS Lagscrews	p = 88 mm

EXTERNAL BALUSTRADE (B,C3,VH)

S = 400mm max	M10 316 SS Lagscrews	p = 207 mm
	M12 316 SS Lagscrews	p = 188 mm
S = 200mm max	M10 316 SS Lagscrews	p = 104 mm
	M12 316 SS Lagscrews	p = 94 mm



Note:
1. Lagscrews to have locking nuts(on the threaded part)
2. p = minimum screw thread penetration into structural timber framing
3. Minimum Edge Distance (Y)
   Y = 50mm (using M10)
   Y = 60mm (using M12)

SUPPORTING TIMBER SUBSTRATE TO SUIT
-TIMBER SHOWN IS INDICATIVE ONLY
-MUST BE ABLE TO RESIST BALUSTRADE LOADING/ROTATION
(TO BE CHECKED / DESIGNED BY OTHERS)

FIXING TO TIMBER (LAGSCREW)

THIS GLASS BALUSTRADE 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 & C3	EXTERNAL DOMESTIC BALCONIES, OFFICES AND WORK AREAS. (NOT SUBJECT TO OVER CROWDING)

WIND LOAD: (Case B) UP TO "EXTRA HIGH" (EH) WIND ZONE WITH MAXIMUM BASIC WIND SPEED OF 55 m/s. (DESIGN WIND PRESSURE = 2.36 kPa @ ULS)

FIXINGS:

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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:

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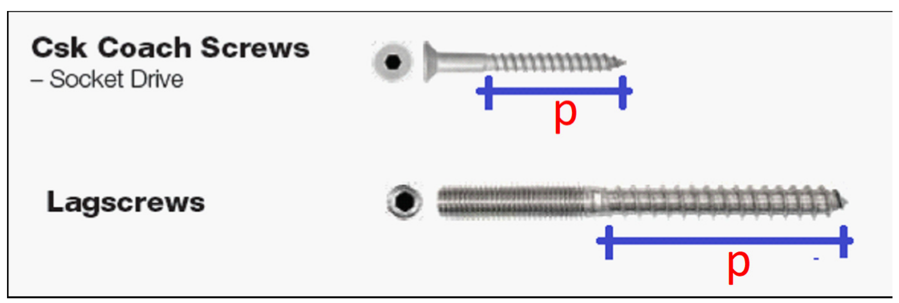
CONNECTION TO SUPPORTING DECK TIMBER FRAMING:

* 1. TO RESIST THE ROTATION AT THE BASE, FIX THE SUPPORTING BOUNDARY / END JOISTS TO THE SUPPORTING DECK TIMBER FRAMING AS PER THE DETAILS FROM NZS3604:2011 FIGURE 7.10.

(OTHERWISE THOSE STRAPS, BOLTS,ETC - TO BE SPECIFICALLY DESIGNED BY OTHERS.)

DETAILS OF COACH SCREWS / LAGSCREWS



p = minimum screw thread penetration into structural timber framing

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FMI / VETRO RACCORDI LTD - TILT-LOCK BASE CHANNEL SYSTEM (SIDE MOUNTED)	Scales NOT TO SCALE		Project 11/243 (DS52)
INTERNAL & EXTERNAL BALUSTRADE - 12mm thick TOUGHENED GLASS (WITH TOP CAPPING RAIL)	Drawn JD	Date 20/10/2023	Sheet ENG 02 (Case B)