Building Code Clause(s)… B1 & B2 /VM1……

PRODUCER STATEMENT – PS1 – DESIGN

(Guidance notes on the use of this form are printed on page 2)

ISSUED BY:............................ SET ENGINEERING...
(Design Firm)

TO:…………………………………OWNER/DEVELOPERS IN NEW ZEALAND..……………………………….
(Owner/Developer)

TO BE SUPPLIED TO:………… BUILDING CONSENT AUTHORITIES IN NEW ZEALAND ……………………
(Building Consent Authority)

IN RESPECT OF:………………… JOIST GRIPPA BRACKET ……………………………………………………….
(Description of Building Work)

AT:………………………………… VARIOUS LOCATIONS IN NEW ZEALAND.……………………………………..
(Address)

……………………………………………………………………… **LOT**…………………… **DP** ……………………… **SO** ……………

We have been engaged by the owner/developer referred to above to provide JOIST GRIPPA BRACKET FIXINGS TO TIMBER DECK AREAS…………………………………………………… services in respect of the requirements of
(Extent of Engagement)
Clause(s) ………B1 & B2 /VM1…………………………………………………………………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…………………………………or
(verification method / acceptable solution)
☒ Alternative solution as per the attached schedule JOIST GRIPPA TEST DATA AND DESIGN INFORMATION

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

…FIXING PLAN & INSTALLATION PROCEDURE…and numbered …JANUARY 2015……………;
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 …BRACKETS INSTALLED AS PER SPECIFICATION…
(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, ………Matt Peacock………………………… am: ☐CPEng …1008048……………#
(Name of Design Professional)

☐Reg Arch …………………… .#

I am a Member of : ☒ IPENZ ☐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 ………… Matt Peacock………………… ON BEHALF OF ……..… Set Engineering…………………
(Design Firm)

Date……January 2016………..…… (signature)…… ………………………………………………………………

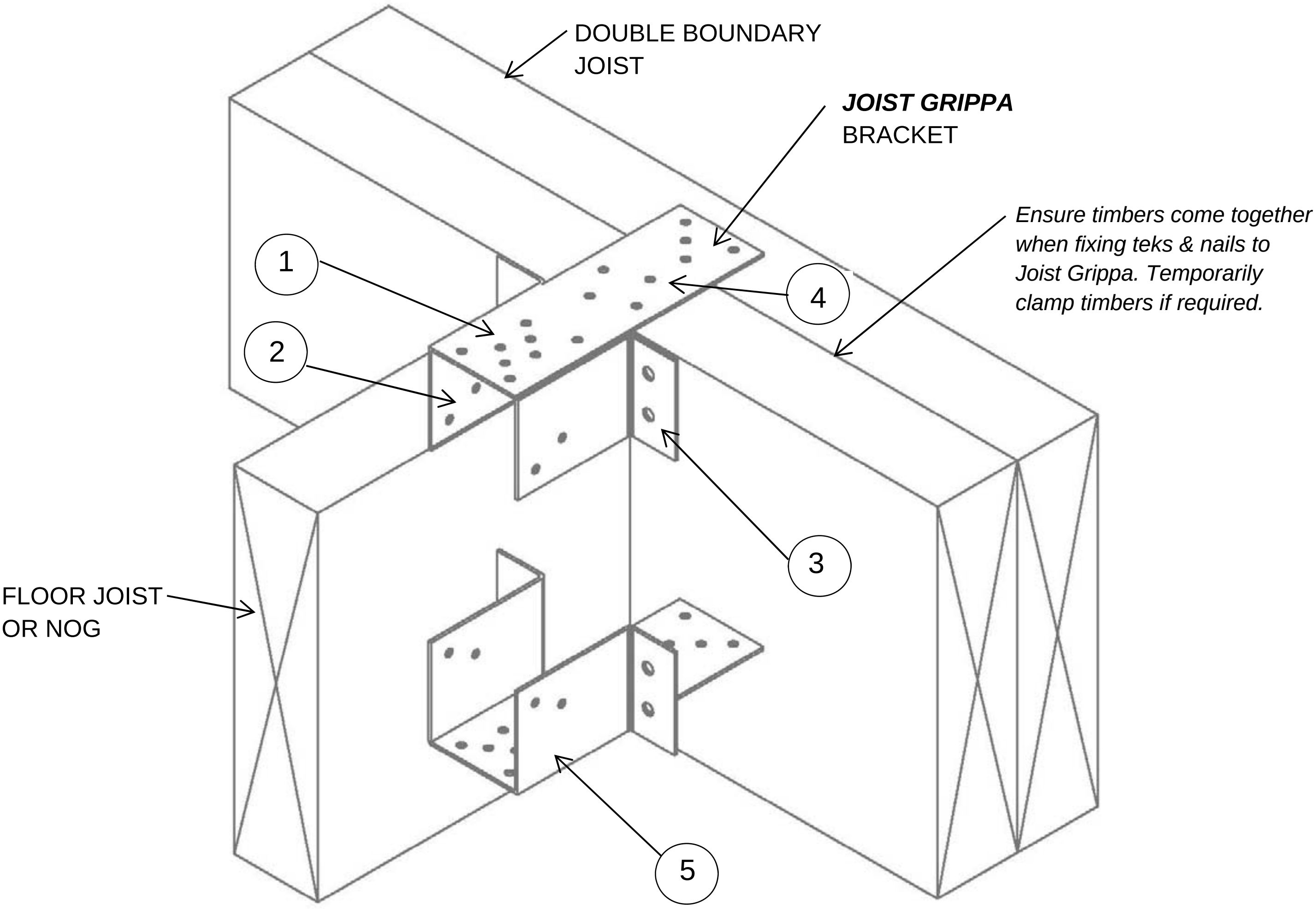
Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in 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.

INSTALLATION PROCEDURE

Issue date January 2015

THE PURPOSE OF THE JOIST GRIPPA BRACKET IS TO REPLACE THE M12 COACH SCREWS & 6kN STRAPS DETAILED IN NZS3604 FIGURES 7.10(b) & 7.10(c) FOR TIMBER FRAMED DECKS.



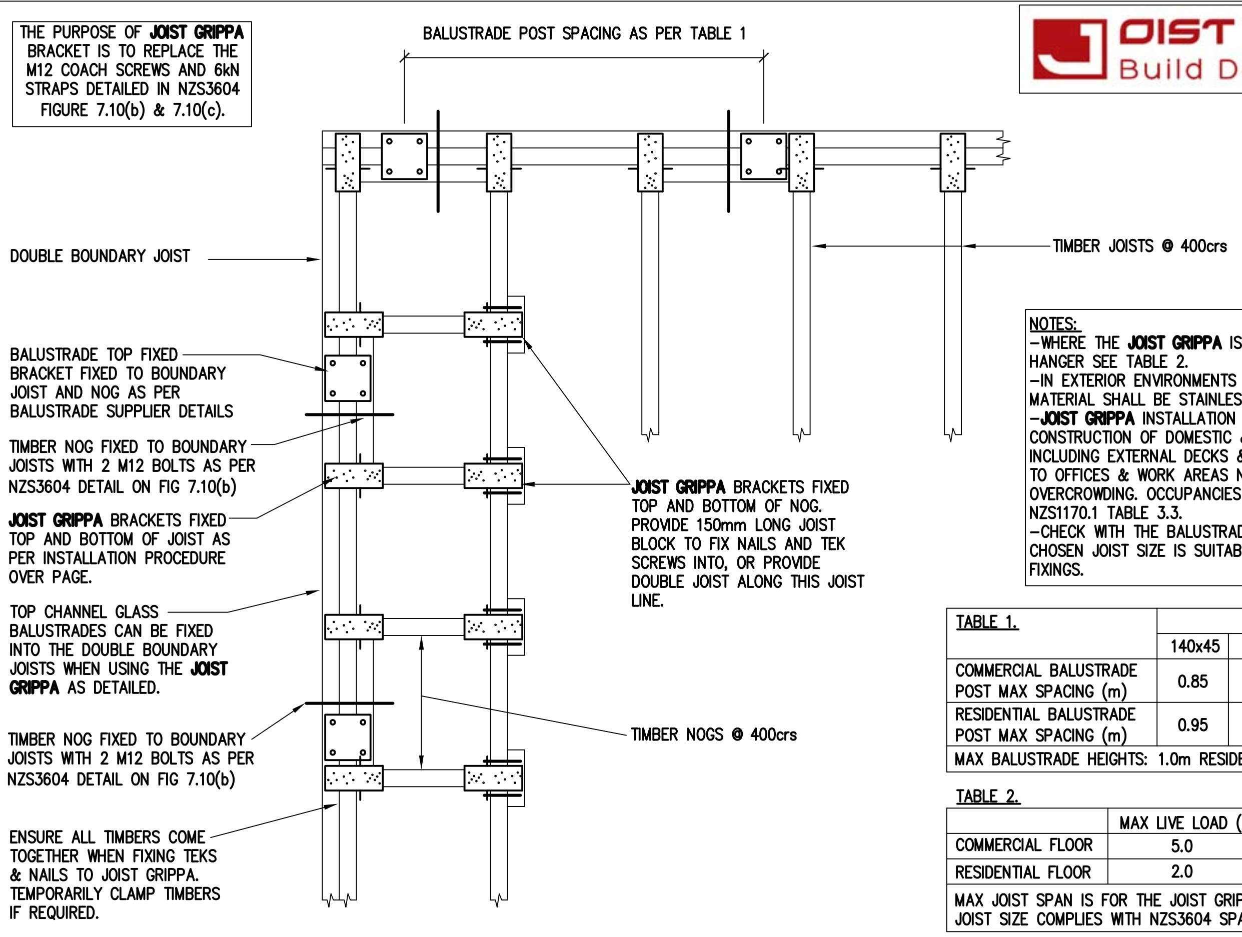
NAIL FIX BOUNDARY JOISTS TO FLOOR JOISTS TO SET THE FLOOR FRAMING TOGETHER. THE METHOD BELOW IS REQUIRED TO SECURE A TIGHT CONNECTION BETWEEN THE JOIST AND DOUBLE BOUNDARY JOISTS.

1. PLACE THE ***JOIST GRIPPA*** OVER THE JOIST AND BOUNDARY JOIST AND NAIL 8 x Φ3.15 x 30mm LONG NAILS THROUGH HOLES INTO THE JOIST.
2. INSERT 2 x 14g x 35mm LONG TEK SCREWS EITHER SIDE OF THE ***JOIST GRIPPA*** INTO THE SIDE OF THE JOIST. SCREW TIGHT & DO NOT SPIN SCREW IN TIMBER.
3. INSERT 2 x 14g x 75mm LONG TEK SCREWS EITHER SIDE OF THE ***JOIST GRIPPA*** INTO THE BOUNDARY JOISTS. SCREW TIGHT & DO NOT SPIN SCREW IN TIMBER.
4. NAIL 8 x Φ3.15 x 30mm LONG NAILS THROUGH HOLES INTO THE BOUNDARY JOISTS.
5. REPEAT STEPS 1 – 4 ABOVE FOR THE BOTTOM ***JOIST GRIPPA***.

- IN EXTERIOR ENVIRONMENTS ALL FIXINGS SHALL BE STAINLESS STEEL GRADE 316 AND JOIST GRIPPA MATERIAL STAINLESS STEEL GRADE 304.
- ALL TIMBER SHALL BE SG8 GRADE OR HIGHER WITH TIMBER TREATMENT AS PER NZS 3604.
- AVOID PLACING NAILS AND TEK SCREWS INTO KNOTTED TIMBER. RELOCATE JOIST IF POSSIBLE.
- SEE ***JOIST GRIPPA*** FIXING PLAN OVER PAGE FOR ARRANGEMENT OF JOISTS AND NOGS AND SPACING REQUIREMENTS FOR BALUSTRADE POSTS FOR VARIOUS JOIST SIZES.
- ENSURE THAT THE BALUSTRADE POST IS FIXED TO THE BOUNDARY JOISTS AS PER THE SUPPLIER DETAILS AND THAT THE BALUSTRADE IS ABLE TO BE FIXED INTO THE SPECIFIED JOIST SIZE.

OIST GRIPPA
Build Decks Faster

THE PURPOSE OF **JOIST GRIPPA** BRACKET IS TO REPLACE THE M12 COACH SCREWS AND 6kN STRAPS DETAILED IN NZS3604 FIGURE 7.10(b) & 7.10(c).



NOTES:
- WHERE THE **JOIST GRIPPA** IS USED AS A JOIST HANGER SEE TABLE 2.
- IN EXTERIOR ENVIRONMENTS THE **JOIST GRIPPA** MATERIAL SHALL BE STAINLESS STEEL 304.
- **JOIST GRIPPA** INSTALLATION APPLIES TO BALUSTRADE CONSTRUCTION OF DOMESTIC & RESIDENTIAL BUILDINGS INCLUDING EXTERNAL DECKS & INTERNAL AREAS AND TO OFFICES & WORK AREAS NOT SUSCEPTIBLE TO OVERCROWDING. OCCUPANCIES A, B, C3 & E IN NZS1170.1 TABLE 3.3.
- CHECK WITH THE BALUSTRADE SUPPLIER THAT THE CHOSEN JOIST SIZE IS SUITABLE FOR THE BALUSTRADE FIXINGS.

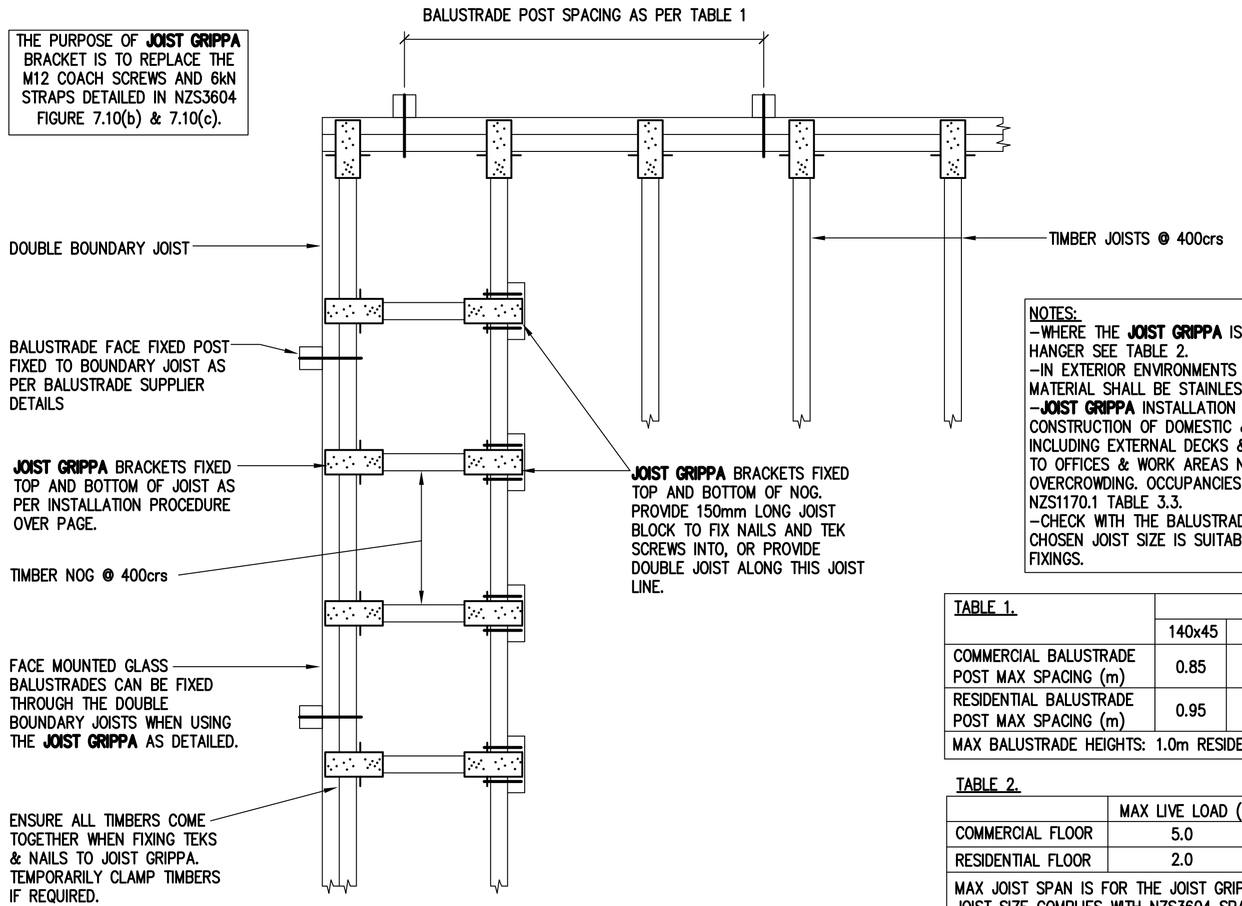
TABLE 1.	JOIST SIZE			
	140x45	190x45	240x45	290x45
COMMERCIAL BALUSTRADE POST MAX SPACING (m)	0.85	1.10	1.20	1.20
RESIDENTIAL BALUSTRADE POST MAX SPACING (m)	0.95	1.20	1.20	1.20
MAX BALUSTRADE HEIGHTS: 1.0m RESIDENTIAL, 1.1m COMMERCIAL.				

TABLE 2.

	MAX LIVE LOAD (kPa)	MAX JOIST SPAN (m)
COMMERCIAL FLOOR	5.0	4.0
RESIDENTIAL FLOOR	2.0	9.0
MAX JOIST SPAN IS FOR THE JOIST GRIPPA CAPACITY ONLY. CHECK JOIST SIZE COMPLIES WITH NZS3604 SPAN TABLES.		

TOP FIXED BALUSTRADE POST - JOIST GRIPPA FIXING

THE PURPOSE OF **JOIST GRIPPA** BRACKET IS TO REPLACE THE M12 COACH SCREWS AND 6kN STRAPS DETAILED IN NZS3604 FIGURE 7.10(b) & 7.10(c).



NOTES:
- WHERE THE **JOIST GRIPPA** IS USED AS A JOIST HANGER SEE TABLE 2.
- IN EXTERIOR ENVIRONMENTS THE **JOIST GRIPPA** MATERIAL SHALL BE STAINLESS STEEL 304.
- **JOIST GRIPPA** INSTALLATION APPLIES TO BALUSTRADE CONSTRUCTION OF DOMESTIC & RESIDENTIAL BUILDINGS INCLUDING EXTERNAL DECKS & INTERNAL AREAS AND TO OFFICES & WORK AREAS NOT SUSCEPTIBLE TO OVERCROWDING. OCCUPANCIES A, B, C3 & E IN NZS1170.1 TABLE 3.3.
- CHECK WITH THE BALUSTRADE SUPPLIER THAT THE CHOSEN JOIST SIZE IS SUITABLE FOR THE BALUSTRADE FIXINGS.

TABLE 1.	JOIST SIZE			
	140x45	190x45	240x45	290x45
COMMERCIAL BALUSTRADE POST MAX SPACING (m)	0.85	1.10	1.20	1.20
RESIDENTIAL BALUSTRADE POST MAX SPACING (m)	0.95	1.20	1.20	1.20
MAX BALUSTRADE HEIGHTS: 1.0m RESIDENTIAL, 1.1m COMMERCIAL.				

TABLE 2.

	MAX LIVE LOAD (kPa)	MAX JOIST SPAN (m)
COMMERCIAL FLOOR	5.0	4.0
RESIDENTIAL FLOOR	2.0	9.0
MAX JOIST SPAN IS FOR THE JOIST GRIPPA CAPACITY ONLY. CHECK JOIST SIZE COMPLIES WITH NZS3604 SPAN TABLES.		

FACE FIXED BALUSTRADE POST - JOIST GRIPPA FIXING

JOIST GRIPPA FIXING PLAN

JOIST GRIPPA
PROVISIONAL PATENT # 608653
REGISTRATION OF DESIGN # 417474

ISSUED JANUARY 2015

SET ENGINEERING
Civil and Structural Engineers
PO Box 1059
New Plymouth

1.0 Joist Grippa Strength Calculation - Peak Load Gravity Test

In accordance with Brandz EM1 - Structural joints & NZS1170:2002

Loads in kN
All timber arrangements were tested as green timber, SG8 grade

1.1 TENSION TEST

Load test Data (see attached Scion test results)

test sample	Pu (kN)
Test 1	32
Test 2	27
Test 3	34.5
Test 4	29.5
Test 5	32.5
Test 6	29
Test 7	22
Test 8	31
Test 9	32
Test 10	30.5
Test 11	30.5

Average (mean) ẋ =	30.05	*kN*
Std deviation	3.32	
Coeff of variance Vsc =	0.11	
$P_{0.05}$ = (ẋ-1.65Vsc) =	24.57	*(5th percentile of Pu from EM1 paper)*
R_k =	**22.36**	*kN (Characteristic strength for Peak Load gravity test equation 2 in EM1 paper)*

Strength reduction Φ =	0.8	*(combination of nails and type 17 wood screws)*
metal plate factor Kp =	1.0	
wet timber factor Kw =	1.0	*(timber tested wet so factor not required)*
load duration K1 =	1.0	*(brief load on balustrade)*

Bracket nominal tensile capacity
ΦQnt = ΦR_k K = **8.94** *kN*

Balustrade Horizontal Design loads *Design load from NZS1170.1 table 3.3*

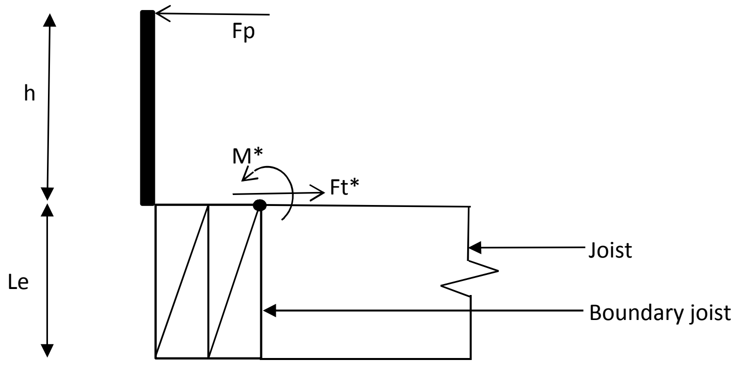


Fig 1. Force Diagram

The following tables calculate the applied force Ft in the Joist Grippa bracket based on NZS1170.1 table 3.3 loads for given balustrade post spacings for residential and commercial occupancies. One table shows full load applied to one Joist Grippa and the second table shows the loading being shared between two adjacent Joist Grippa connections which will be the actual loading case. Max load of 75% applied to one Joist Grippa connection.*

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Table A1. Residential balustrade height of 1.0m and a single Joist Grippa taking full applied load

	Joist size depth				
	140	***190***	***240***	***290***	
Design load (kN/m) W =	0.75	0.75	0.75	0.75	
Live load factor Φ =	1.5	1.5	1.5	1.5	
Post spacing (m) S =	**0.95**	**1.2**	**1.2**	**1.2**	
balustrade height (m) h =	1.0	1.0	1.0	1.0	
Force @ top post Fp = ΦWS	1.07	1.35	1.35	1.35	
Moment M* = h x Fp	1.07	1.35	1.35	1.35	
Bracket Leaver arm Le =	0.14	0.19	0.24	0.29	*Depth of joist*
Tension force Ftr* = Fp(h+Le)/Le	**8.70**	**8.46**	**6.98**	**6.01**	

>> Design tension force Ftr < ΦQnt (less than Joist Grippa nominal tension capacity) for the specified post spacings.*

Table A2. Residential balustrade height of 1.0m with adjacent Joist Grippa's sharing the applied load.
Max load of 75% applied to one Joist Grippa.

	Joist size depth				
	140	***190***	***240***	***290***	
Design load (kN/m) W =	0.75	0.75	0.75	0.75	
Live load factor Φ =	1.5	1.5	1.5	1.5	
Post spacing (m) S =	**0.95**	**1.2**	**1.2**	**1.2**	
balustrade height (m) h =	1.0	1.0	1.0	1.0	
Force @ top post Fp = ΦWS	1.07	1.35	1.35	1.35	
Moment M* = h x Fp	1.07	1.35	1.35	1.35	
Bracket Leaver arm Le =	0.14	0.19	0.24	0.29	*Depth of joist*
Tension force Ftr* = (Fp(h+Le)/Le)*0.75	**6.53**	**6.34**	**5.23**	**4.50**	

>> Design tension force Ftr < ΦQnt (less than Joist Grippa nominal tension capacity) for the specified post spacings.*

Table B1. Commercial balustrade height 1.1m in offices & work areas not susceptible to over crowding
and a single Joist Grippa taking full applied load

	Joist size depth				
	140	***190***	***240***	***290***	
Design load (kN/m) W =	0.75	0.75	0.75	0.75	
Live load factor Φ =	1.5	1.5	1.5	1.5	
Post spacing (m) S =	**0.85**	**1.1**	**1.2**	**1.2**	
balustrade height (m) h =	1.1	1.1	1.1	1.1	
Force @ top post Fp = ΦWS	0.96	1.24	1.35	1.35	
Moment M* = h x Fp	1.05	1.36	1.49	1.49	
Bracket Leaver arm Le =	0.14	0.19	0.24	0.29	*Depth of joist*
Tension force Ftc* = Fp(h+Le)/Le	**8.47**	**8.40**	**7.54**	**6.47**	

>> Design tension force Ftc < ΦQnt (less than Joist Grippa nominal tension capacity) for the specified post spacings.*

Table B2. Commercial balustrade height 1.1m in offices & work areas not susceptible to over crowding
with adjacent Joist Grippa's sharing the applied load. Max load of 75% applied to one Joist Grippa.

	Joist size depth				
	140	***190***	***240***	***290***	
Design load (kN/m) W =	0.75	0.75	0.75	0.75	
Live load factor Φ =	1.5	1.5	1.5	1.5	
Post spacing (m) S =	**0.85**	**1.1**	**1.2**	**1.2**	
balustrade height (m) h =	1.1	1.1	1.1	1.1	
Force @ top post Fp = ΦWS	0.96	1.24	1.35	1.35	
Moment M* = h x Fp	1.05	1.36	1.49	1.49	
Bracket Leaver arm Le =	0.14	0.19	0.24	0.29	*Depth of joist*
Tension force Ftc* = (Fp(h+Le)/Le)*0.75	**6.35**	**6.30**	**5.65**	**4.85**	

>> Design tension force Ftc < ΦQnt (less than Joist Grippa nominal tension capacity) for the specified post spacings.*

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1.2 COMPRESSION TEST (Joist hanger function)

Load test data (see attached Scion test result)

Qn =	39	*kN (for 2 joints tested ie 4 brackets. See joist hanger test result)*
Coeff of variance Vsc =	0.15	*(based on the result of tension tests)*
kt factor =	1.79	*(from NZS1170.0 table B1)*
R_k = Qn/Kt =	21.79	*kN (Characteristic strength NZS1170.0)*
Strength reduction Φ =	0.8	*(combination of nails and type 17 wood screws)*
load duration K1 =	0.8	*(medium term load 1.2G+1.5Q)*
wet timber factor Kw =	1.0	*(timber tested wet so factor not required)*
Joint nominal compression capacity ΦQnc = ΦKR_k=	**6.97**	*kN (per joist connection with 2 brackets per connection)*

Balustrade Vertical Design Load Design load from NZS1170.1 table 3.3

	Post	*Frameless glass*
Design load (kN/m) Wv =	0.75	0.75
Live load factor Φ =	1.5	1.5
Fixing spacing (m) S =	1.2	0.45
Design Force Fc* = ΦWvS	**1.35**	**0.51**

>> The Joist Grippa has sufficient capacity ΦQnc to resist the applied design force Fc.*

Joist Hanger Design Load

Table C.

	Res. Deck	*Commercial*	
Max Live load (kPa) Q =	*2.0*	*5.0*	
ULS load (kPa) Wu =1.2G+1.5Q =	3.6	8.1	*G = 0.5kPa*
Joist spacing (m) Lw =	0.4	0.4	
Max Joist span (m) L =	9.0	4.0	*between joist supports*
Design Force Fc* = WuLwL/2 =	**6.48**	**6.48**	

>> The Joist Grippa has sufficient capacity ΦQnc to resist the applied design force Fc for the given joist spans in table C.*

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2.0 Current NZS3604 Joist to Boundary Joist fixing method

This is a calculation of the current NZS3604 Fig 7.10 (c) fixing capacity.

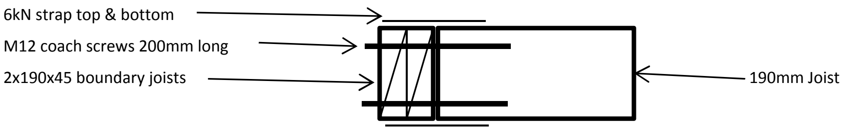

Fig 2. NZS3604 fixing detail

The design moment in the double boundary joist based on the loadings for a 190mm joist in table A1 above & a leaver arm of 190mm and posts at 1.0m centres.

M* = 1.34 kNm

6kN strap: A proprietary metal strap by Lumberlok provides 6kN characteristic load using 6x30mm long x Φ3.15mm nails (note this has a higher capacity than if the nails were designed using NZS3603.)

>> 6kN strap nominal capacity ΦQns = ΦnkQk where : Φ=0.8 & k=0.85 (green timber)

>> ΦQns = 4.08 kN

& moment capacity ΦMns = 0.78 kNm (for 190mm joist)

M12 Coach Screw: Using NZS3603 to design the tension capacity of a 200mm long M12 coach screw into end grain

ΦQnc = ΦnkpQk where: Φ=0.7, k1=0.7 (green), k2=0.67 (end grain) p=110mm, Qk=118N/mm

>> ΦQnc = 4.26 kN

& moment capacity ΦMnc = 0.64 kNm (the nails in 6kN strap are 30mm long so the coach screw must be 40mm to centre line below top of joist ie d = 150mm)

From the above calculations there is either some load sharing between the 6kN strap and the coach screw, but as one connection is in shear and the other in tension, there is likely to be a dominant fixing. Therefore the applied load on the balustrade to the double boundary joist must be shared between 2 adjacent joists & fixings. If this occurs then the moment capacity of the 6kN strap on 2 adjacent joists is equal to 2 x ΦMns = 1.56kNm and the joint has adequate capacity to resist the applied moment M* = 1.34kNm

3.0 Determination of Joist Grippa Capacity using NZS3603 method

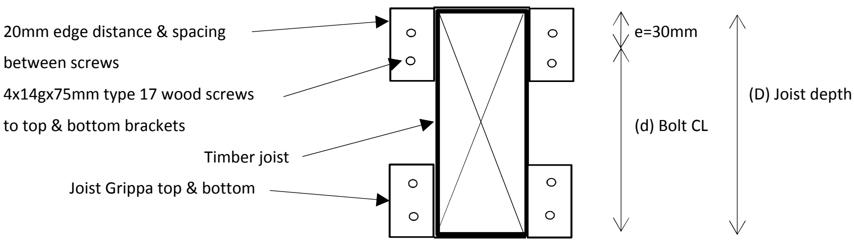

Fig 3. Joist Grippa section

Based on the assumption that the combination of nails in shear and screws in tension will result in one fixing type being the dominate fixing type. Taking the 14g type 17 screws to provide the tension capacity in the connection into the double boundary joist.

3.1 Tension capacity of screws fixed through the bracket into the double boundary joist.

Screw tension capacity ΦQns = ΦnkpQk

where Φ = 0.8, n = 4, k1 = 0.8 (green timber) k2 = 20/31.5 = 0.63 (screw spacing), Qk = 5.44kN

>> Φ Qns = 8.77 kN

Joist Grippa moment capacity ΦMns = ΦQns.d (where d is the distance to bolt group centre)

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As per the NZS3604 fixing detail we have allowed for load sharing between joists adjacent to the balustrade post fixed to the double boundary joist. For a worst case loading where the balustrade shall be a minimum of 100mm away from a joist we have taken 75% of the balustrade load to be applied to one Joist Grippa connection.

Table D below shows Joist Grippa capacity for various joist depths with the maximum design moment Mj* = 0.75.Ft*.D where Ft* is from tables A1 & B1 above.

Table D.	Joist size				
	140x45	190x45	240x45	290x45	
D (mm)	140	190	240	290	
max 0.75.Ft* (kN)	6.53	6.35	5.66	4.85	*(75% of highest value in tables A1 & B1*
Mj* (kNm)	0.91	1.21	1.36	1.41	
d (mm)	110	160	210	260	
Φ Qns (kN)	8.77	8.77	8.77	8.77	
ΦMns (kNm)	0.97	1.40	1.84	2.28	
ΦMns > Mj*	yes	yes	yes	yes	

>> The tension capacity of the 4x14gx75mm long type 17 wood screws is adequate to resist the applied loads for the balustrade spacings indicated in tables A & B above. Note for a 190mm deep joist the Joist Grippa moment capacity ΦMns = 1.4kNm and the moment capacity for the current NZS3604 6kN strap is ΦMns = 0.78kNm. The Joist Grippa provides almost double the moment capacity of the current NZS3604 6kN strap.

3.2 Shear capacity of Joist Grippa connection into the Joist.

For this connection as the nails and 14g wood screws are all acting in shear we have combined the shear capacity of the nails and screws.

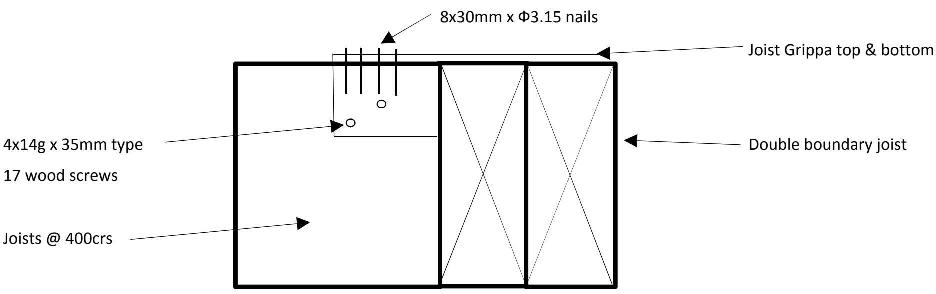

Fig 4. Joist Grippa side elevation

Using NZS3603 method:

Nail shear capacity Φ Qnn = ΦnkQk where: Φ = 0.8, n=8, k1=0.85 (green timber), k2 = 1.25 (steel plate), k3 = 0.7 (nail spacing), Qk=0.631kN

>> Φ Qnn = 3.00 kN *(note this value compared to Lumberlok 6kN strap with only 6 nails and similar nail spacing. The Lumberlok value is larger)*

14g type 17 screw shear capacity Φ Qns = ΦnkQk where: Φ = 0.8, n=4, k1=0.80 (green timber), k2 = 1.25 (steel plate), k3 = 0.63 (screw spacing), Qk=2.663kN

>> Φ Qns = 5.37 kN

>> total shear capacity ΦQnt = of Joist Grippa fixed into joist 8.37 kN (this value is approximately equal to the test result Nominal tensile capacity ΦQnt determined in 1.0 above.)

Table E below shows the Design force on the Joist Grippa bracket for each joist depth for 75% of design load 0.75Ft* (as per table D above.)

Table E	Joist size			
	140x45	190x45	240x45	290x45
0.75Ft* (kN)	6.53	6.35	5.66	4.85
ΦQnt > 0.75Ft*	yes	yes	yes	yes

>> Therefore the nail and screw shear connection has adequate capacity ΦQnt to resist the applied 0.75Ft force for the various joist sizes and specified balustrade post spacings.*