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TECTONIC

FULL-HEIGHT PARTITION RESTRAINT.

DESIGN GUIDE

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CONTENTS

Prepared by:

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Motovated Design & Analysis provide mechanical design engineering and analysis services to large and small businesses around the globe.

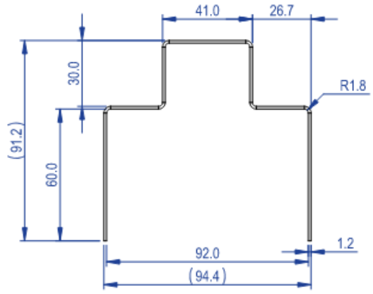
1.1. Materials

Floating Head Track is manufactured in New Zealand from 250 MPa, hot dipped galvanised mild steel. Standard material properties are presented below.

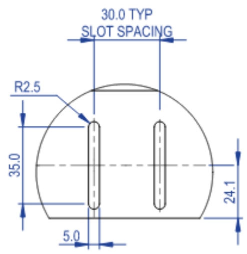
Standard length	2.970 m
Total depth	91 mm
Recess depth	30 mm
Gauge	1.2 mm

1.2. Section Properties

Refer to drawings TRIS 015 for detailed drawings of the head-track and shoulder washer. Excerpts from these drawings are shown below, showing profile dimensions and slot sizes:



DETAIL A
SCALE 1 : 2



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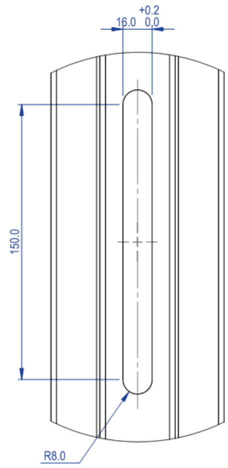


Table 1: Section properties of the head-track profile.

	Gross Properties				**Effective Properties ****	
	Area (mm²)	Weight (kg/m)	Ix (10^3 *mm^4)	Iy (10^3 *mm^4)	Iy_eff* (10^3 *mm^4)	ΦMy* (Nm)
92mm x 1.15BMT	322	2.53 kg/m (steel only)	228	418	200	811

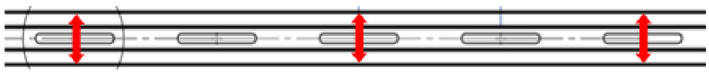
* Effective section properties and moment capacity determined using the direct strength method for a reduced section by disregarding the contribution of the slotted part of the flange.

** Note that when determining the capacity and deflection of the system, the data on the following page should be used. This is because local bending at the connection locations is typically limiting.

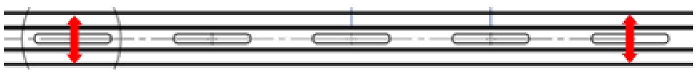
2. Horizontal Capacity and Deflection

The head-track capacity under horizontal loads (seismic, wind and impact) is shown below. The system capacity and deflection is dependent on the anchor spacing.

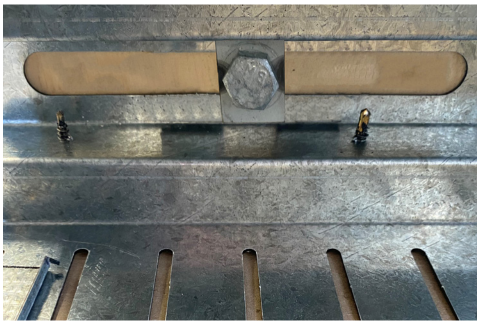
Fixing Spacing = 600mm, stud spacing 600mm:

ULS Capacity	2.75 kN/m	
SLS1 Capacity (5mm deflection)	1.5 kN/m	

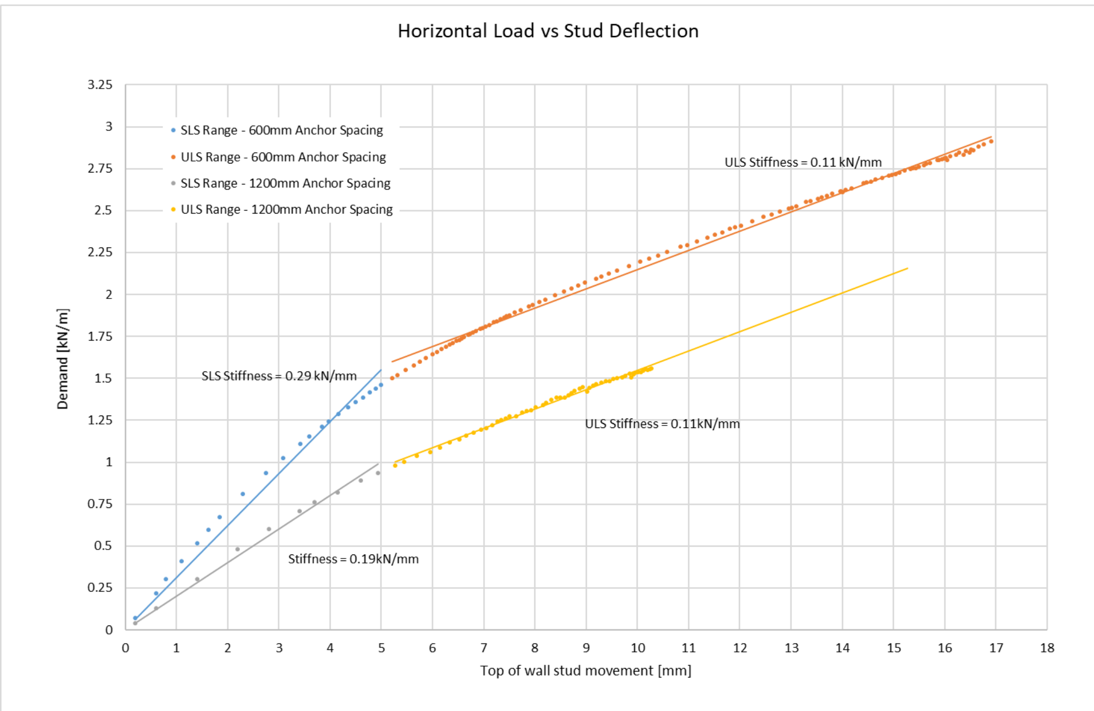
Fixing Spacing = 1200mm, stud spacing 600mm:

ULS Capacity	1.5 kN/m	
SLS1 Capacity (5mm deflection)	1.0 kN/m	

Fastener Detail:



Deflection Data:
Load vs deflection data is based off a combination of test data and analysis results. A bi-linear model gives a good approximation of the system behavior in the SLS and ULS range.



3. Performance Under Building Drift

Displacement controlled shake table testing has been carried out on the system. During testing building movement of up to 30mm was tested with no damage to the linings of framing, very minor damage to the stopped joints was observed. This is equivalent to 1% drift for a 3m high wall. Refer to the Holmes Solutions test report for further information.

Corner junctions were designed specifically to improve performance under building drift, by allowing the return wall to deform. These corner junctions are detailed in the installation drawings TRIS 015.

Note: Drift performance has been evaluated and tested for non-structural walls fitted with the T&R headtrack only, using connections detailed in the installation drawings. When connecting to structural walls, a seismic joint is recommended.

Summary of Tested System:

- Tectonic head-track.
- 92x0.75 steel stud at 600mm crs, 2.4m high wall.
- 13mm Gib Noiseline both sides, installed as per GIB Fire Rated Systems Guide.

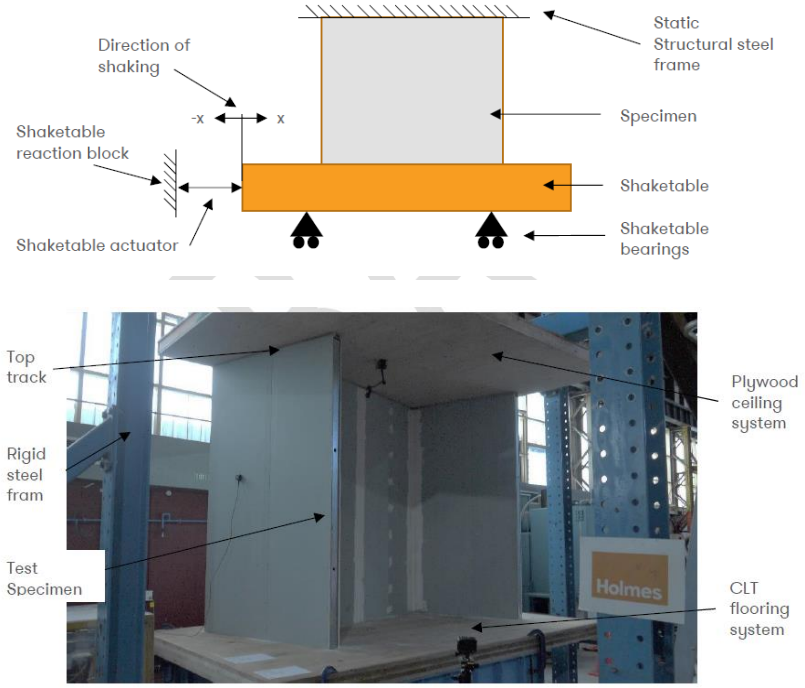


Figure 1: Shake table testing setup (See Holmes report[1])

[1] *Holmes Solutions, 144222.00 RP1.0 0522, T&R Interiors Seismic Displacement Testing, Revision 1.0, 10 June 2022*

The shake table response spectra and time history charts are shown below:

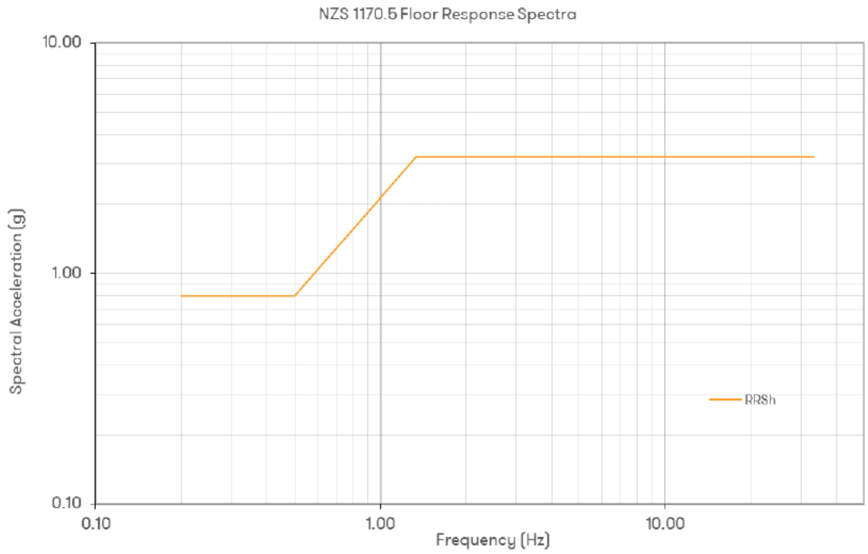


Figure 2: Shake table floor response spectra as per NZS1170.5.

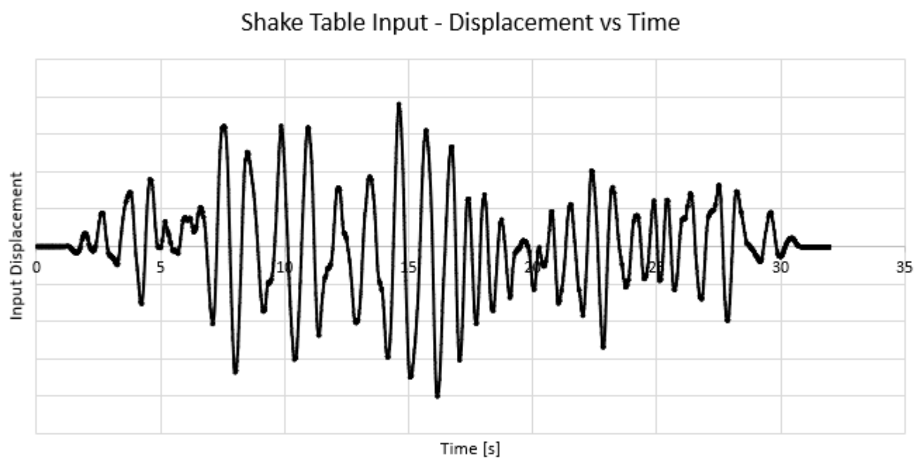


Figure 3: Typical shake table time history.

4. Fragility Curves for Damage States - Imformative

Fragility functions for the wall junctions can be used to determine the probability of damage occurring due to building drift. These fragility functions have been developed off data from the shake table test, and from testing done at the University of Canterbury[2].

The information below is based off the 2.4m high wall tested, however can be applied to higher walls. It is expected that higher walls will typically perform better, as the wall itself will be more flexible and able to accommodate some of the building drift below the head-track.

The damage states assessed are detailed below:

Table 2: Description of damage states.

Damage State	Expected Damage	Repairs required
1	- Cracking in plaster and paint at corners and lining butt joints. - Minor screw damage (pull through or shearing)	- Reapply plaster and paint in affected areas. - Replace damaged fasteners near the original location.
2	- Lining damage, such as cracks forming and separation of sheets at joints.	- May require replacement of linings in damaged areas.
3	- Damage to wall framing (studs and/or head-track). - Failure of screwed connections between studs	- Linings and framing require replacement. Damage may be limited to junctions, in which case parts of the wall may not require replacement.

Note that although wall framing may need to be replaced at DS3, testing has shown that the wall is expected to still be standing at this damage state. Damage will likely be localised at wall junctions.

[2] *Mulligan, Joshua. Experimental Study on the Seismic Performance of Low Damage Systems for Non-structural Light Framed Plasterboard Partition Walls. University of Canterbury. 2020*

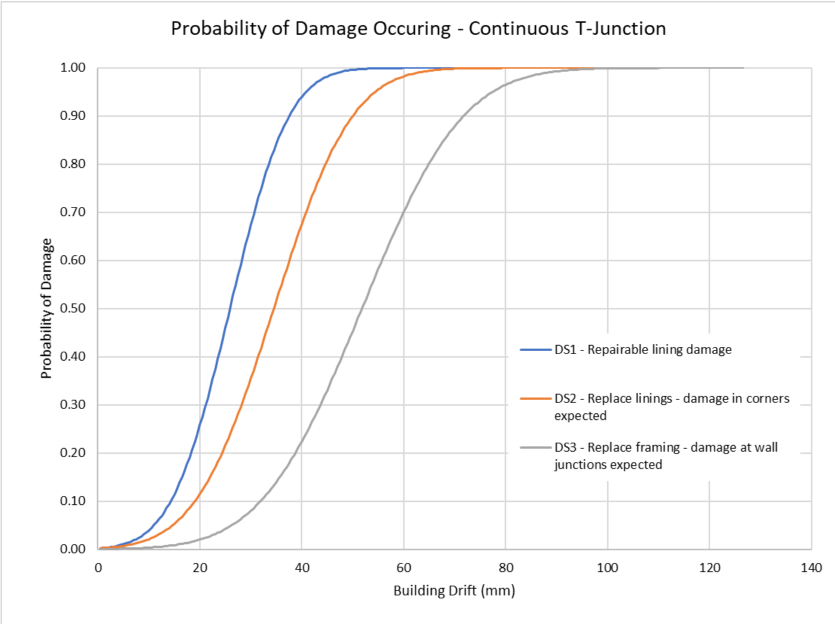


Figure 4: Probability of damage due to building drift - continuous T-junction.

Note: Performance of T-Junctions can be improved by cutting the head-track at the junction, effectively forming two L-junctions. See installation drawings for more details.

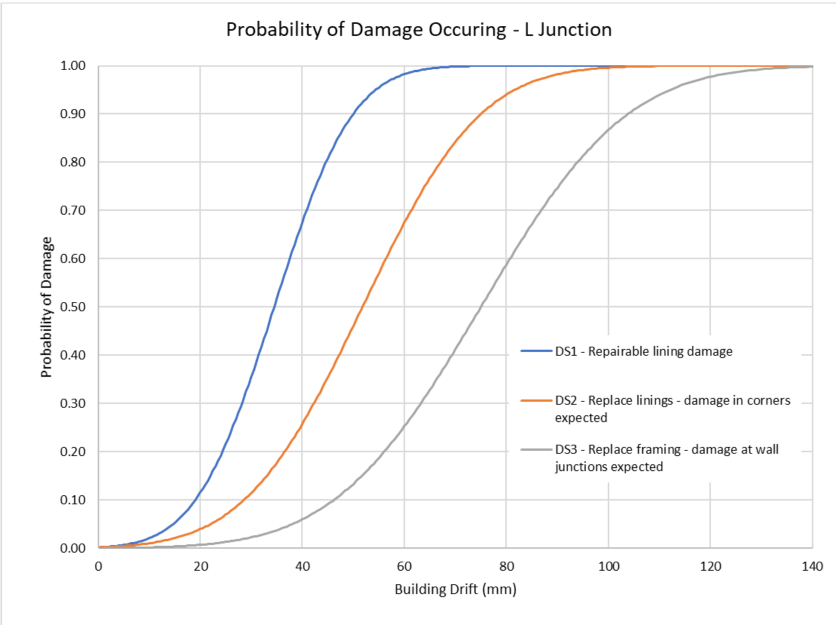


Figure 5: Probability of damage due to building drift - continuous T-junction.

Figure 6: Examples of damage at DS1. Minor movement in linings may cause cracking and/or screw pull through.

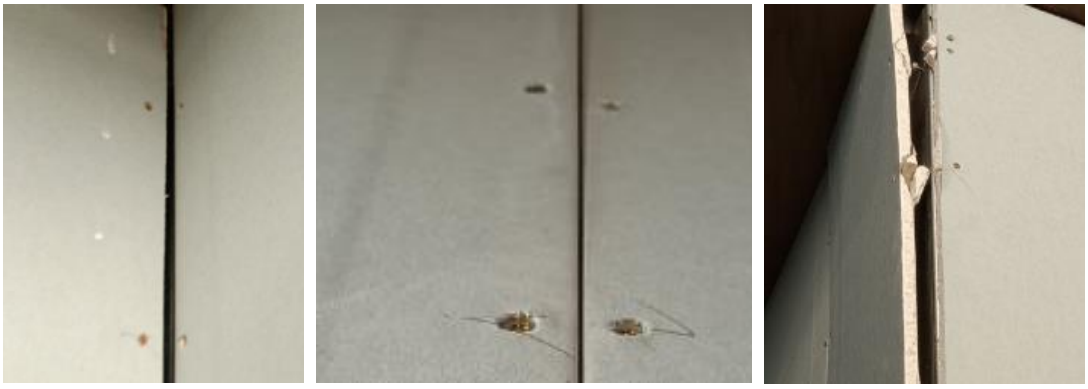


Figure 7: Examples of damage at DS3. Lining separation/movement and further damage around screws.

Figure 8: Damage at DS3. Failure of stud connections at corners and damage to framing.

5. Installation Information and Drawings

5.1 General

Steel studs and linings are to be installed as per Gib Fire Rated Systems Guide 2018, for a GBS60 wall. A summary of requirements is below:

- Min 92x0.75mm steel studs at 600mm crs max. Stud sizes should be specified by an engineer, or determined using the manufacturers span tables.
- Friction fit studs to bottom track, screw each steel stud to the centre of the slots in the head-track.
- Linings shall be touch fitted, use fire sealant as required.
- Screw linings at 300mm crs up each stud, linings may be fixed to the bottom track.
- Do not fix linings to the slotted head-track.
- Nogging track is not required below the head-track, as the studs are screwed into the head-track slots.

Refer to installation drawings for more information.

5.2 Anchor/fastener requirements

The top fastener is loaded in shear, and tension due to the prying action on the anchor. The following fasteners have sufficient capacity to withstand the maximum loads in section 3.

Substrate	Fastener*
Concrete	Hilti HUS3H-10 – 85mm min embedment
	Hilti HST3-10 – 60mm min effective anchorage depth
Timber	12mm x 65 coach screw (60mm min embedment)
	M12 Bolt
Steel	M12 Bolt

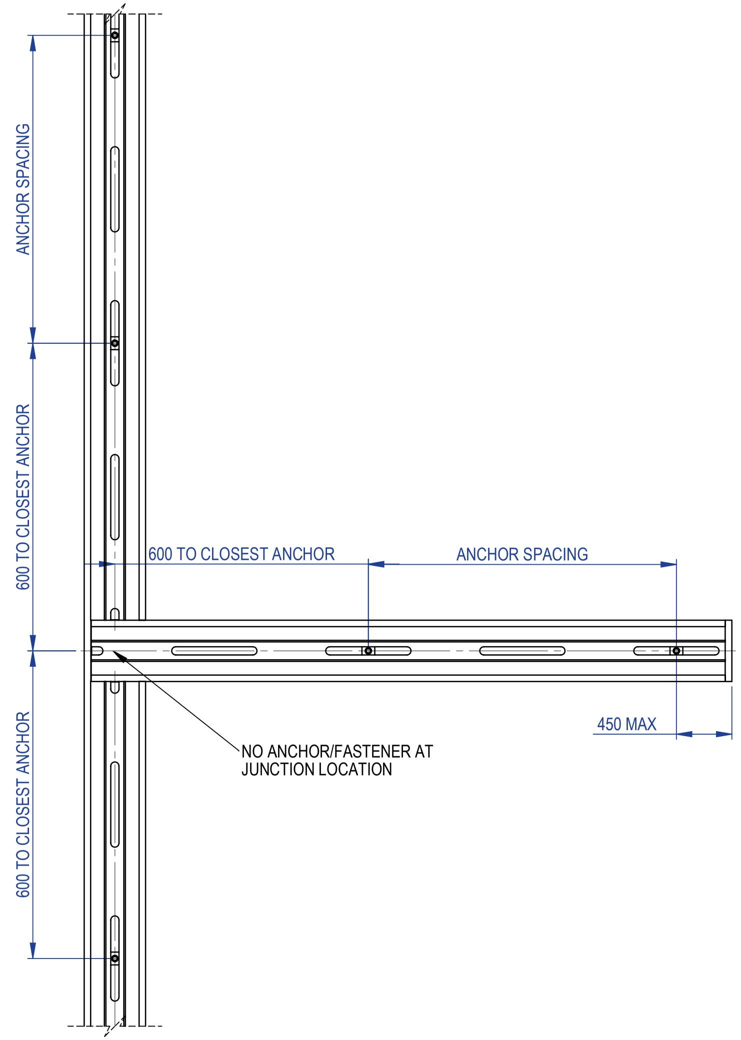
*Note that edge distance has not been considered.

Other fasteners may be selected by an engineer if required, the following conditions should be met:

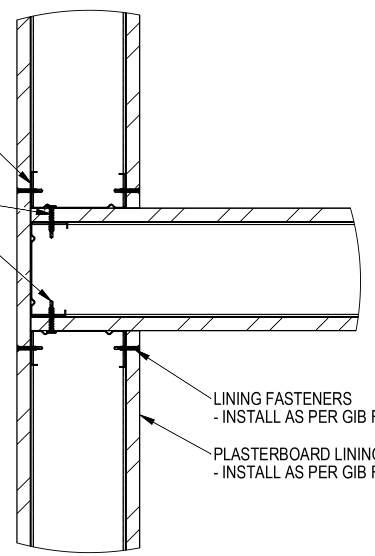
- Concrete anchors should be C2 seismically rated.
- Anchor shear load = horizontal wind/seismic/impact load
- Anchor tension load (due to prying) = 1.5 x anchor shear load

See the following drawings for head-track installation details, and recommended installation details at wall junctions.

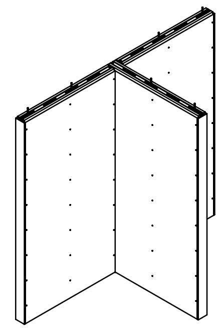
REVISIONS			
REV.	DESCRIPTION	DATE	BY



WALL T-JUNCTION
PLAN



WALL T-JUNCTION
DETAIL



WALL T-JUNCTION
ISOMETRIC

NOTE: THIS INSTALLATION DETAIL HAS BEEN SHOWN TO REDUCE EARTHQUAKE DAMAGE TO THE PARTITION WALL VIA SEISMIC TESTING, WHEN ALL WALLS USE THE T&R SEISMIC HEADTRACK. WHEN CONNECTING TO OTHER WALL TYPES (SUCH AS STRUCTURAL WALLS) A SEISMIC JOINT IS RECOMMENDED.

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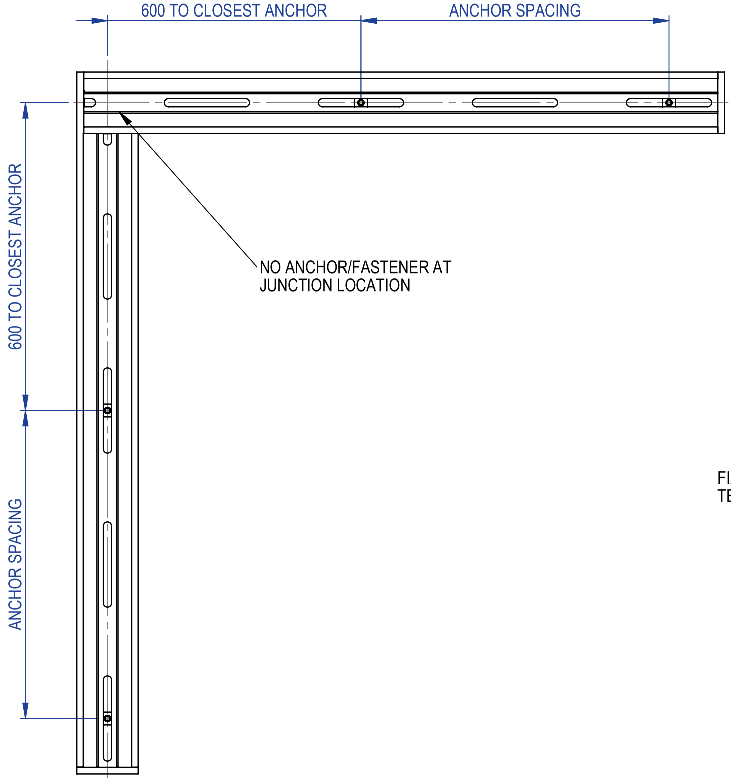
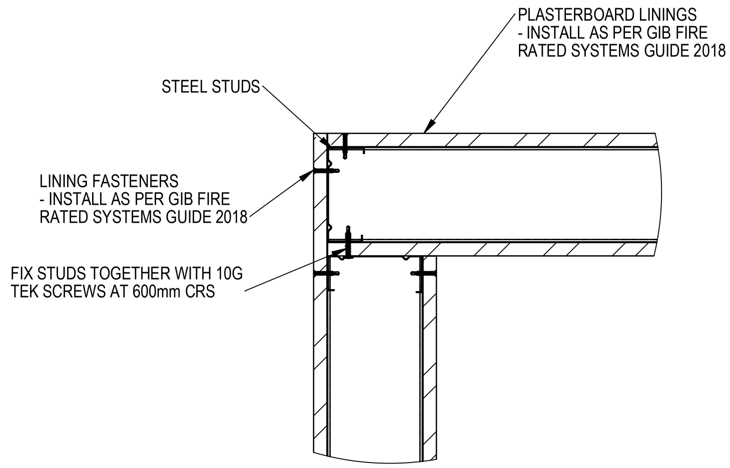
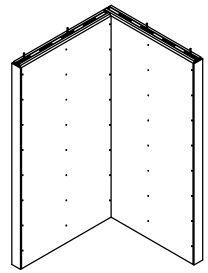


WALL L-JUNCTION PLAN



WALL L-JUNCTION DETAIL



WALL L-JUNCTION ISOMETRIC

NOTE: THIS INSTALLATION DETAIL HAS BEEN SHOWN TO REDUCE EARTHQUAKE DAMAGE TO THE PARTITION WALL VIA SEISMIC TESTING, WHEN ALL WALLS USE THE T&R SEISMIC HEADTRACK. WHEN CONNECTING TO OTHER WALL TYPES (SUCH AS STRUCTURAL WALLS) A SEISMIC JOINT IS RECOMMENDED.

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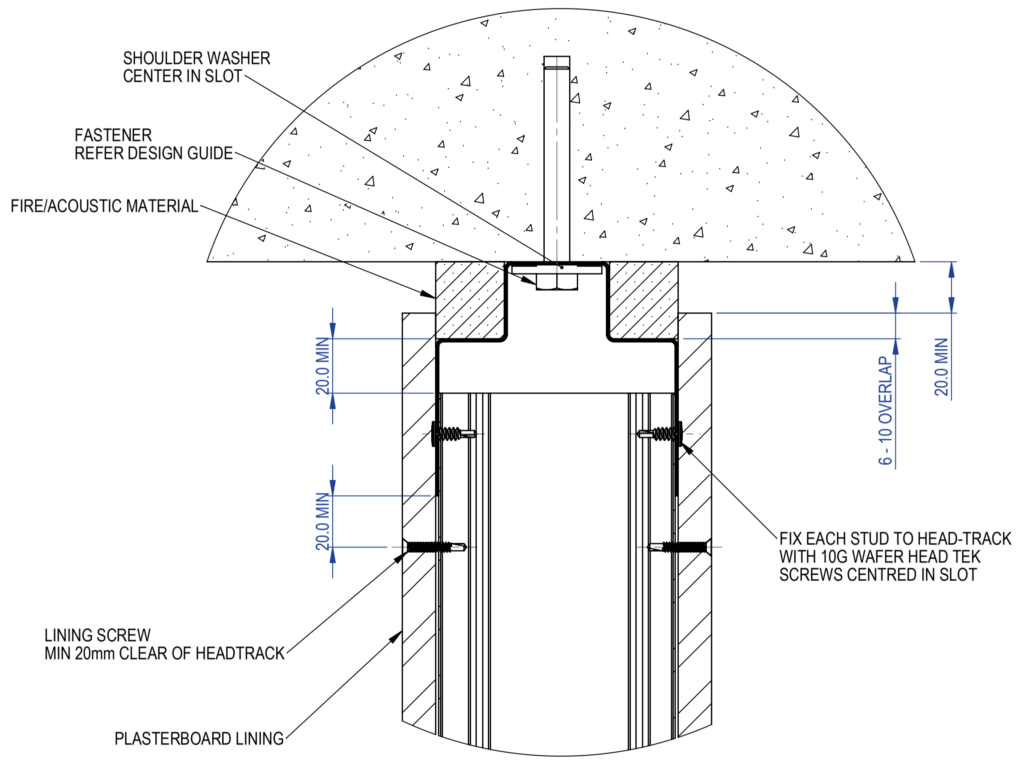

HEADTRACK INSTALLATION
SECTION

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