Ramset™

APRIL 2024 - NZ ONLY

ReidBrace™ Xtrem™

Powered by Tectonus™

Design Guide

This document contains important user information relating to the ReidBrace™ Xtrem™ Engineered Bracing System

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ReidBrace™

ReidBrace by Ramset is an off the shelf, out of the box system that provides design engineers and installers with an economic solution for tension bracing of structures, tie-back applications, retrofits and temporary works bracing with proven performance. Utilising the well-known 500E Grade continuously threaded ReidBar™, ReidBrace is commonly used in steel framed buildings (warehouses, large format retail, commercial & industrial structures) to give lateral strength against wind and earthquakes. It is also used by engineers in seismic retrofits of existing buildings.

Tectonus™

Born in the aftermath of the 2010-2011 Christchurch earthquakes, Tectonus aims to protect buildings from damage - to reduce residual drift so that damage would be minimal and the occupants could go back in almost immediately & to do this in a way that didn't involve throwing more concrete and steel at the problem.

Tectonus devices provide multi-cycle energy dissipation & self-centering. In doing so, building owners and occupiers reduce the risk of injury, minimise post-quake damage, and experience reduced downtime in a significant seismic event. The protection provided is not a one-off.

Our Partnership

The combination between the easy to use ReidBrace system and Tectonus self-centering dampers creates a cost-effective solution for new buildings and seismic retrofits. It significantly increases the seismic capacity of the ReidBrace system by introducing efficient earthquake energy absorption, allowing it to be used in broader building types in high seismic regions.

In seismic retrofits, the combined system lowers demand on the structure and foundations which can result in significant cost savings for building owners. It can be installed with minimal disruption to building occupiers.

Ramset and Tectonus recognised the benefits the combined system could offer customers, which subsequently led to the development of **ReidBrace™ Xtrem™ - Powered by Tectonus™**

ReidBrace™ Xtrem™

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Features & Benefits

Experience the revolutionary ReidBrace Xtrem, where safety meets innovation. Transforming construction with structures that not only ensure minimal damage in the event of seismic activity but also prioritises the well-being of every occupant.

ReidBrace™ Features

Readily available, off-the-shelf solution:
comes in box sets with all the required components

Easy to install:
the simplest tension bracing system in the market

Confidence in performance:
independently tested by University of Auckland's Structural Test Laboratory

Quality assured:
ReidBrace load bearing components are QA tested to destruction at Ramset testing facilities

Tectonus™ Features

Acting as damper:
providing efficient earthquake energy absorption

Self-centering after every cycle:
providing continuous protection for the building

Increases ductility by up to 300%:
resulting in reduction in seismic loads

Quality assured:
Tectonus dampers are proof-tested at Tectonus testing facilities

Client Benefits

Quick Installation

Simple & easy to install bracing system with efficient energy absorption capability

Cost-Savings

Ability to utilise higher ductility in designs results in a reduction to the size of structural members

Minimum Disruption

For retrofits/remodels the simplicity of the system leads to minimally intrusive installation procedures

Future Proof Construction

The self-centering nature of ReidBrace Xtrem will minimise post-quake damage, enabling less downtime to reoccupancy

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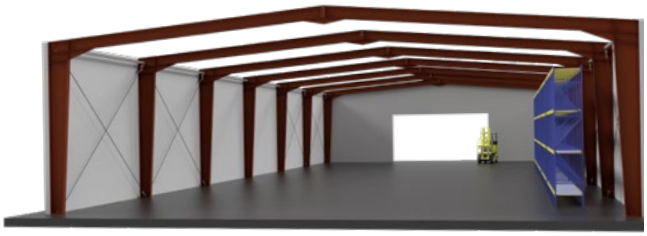
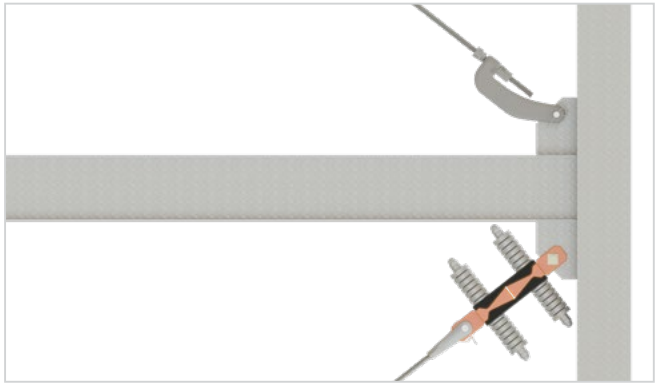
Applications

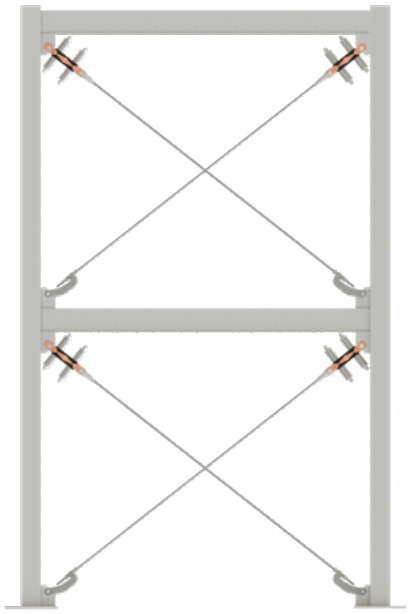
New builds or Retrofitting of existing earthquake-prone buildings

Single-storey - Industrial/Warehousing Applications





Multi-storey - Commercial/Residential Applications



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Project Spotlight: 48 Greys Avenue, Auckland, New Zealand

Design

48 Greys Avenue in Central Auckland, is an existing 10-storey concrete office building undergoing a major refurbishment that will see the addition of a new 900 square metre upper level.

Proposing a lightweight steel frame structure, TEKTON Consulting Engineers wanted to avoid heavy steel bracing, unnecessary additional loads and inertia forces on the existing concrete structure below it.

ReidBrace is an off-the-shelf system that utilises threaded rods arranged as tension members. The system is lightweight and easy to install with minimum extra processes onsite. However, ReidBrace alone could not provide the level of damping required.

Design solution

Combining ReidBrace cross bracing with Tectonus tension-only dampers.

The combination delivered sufficient damping at a high global ductility, removing the need for any additional members or strengthening to the existing structure.

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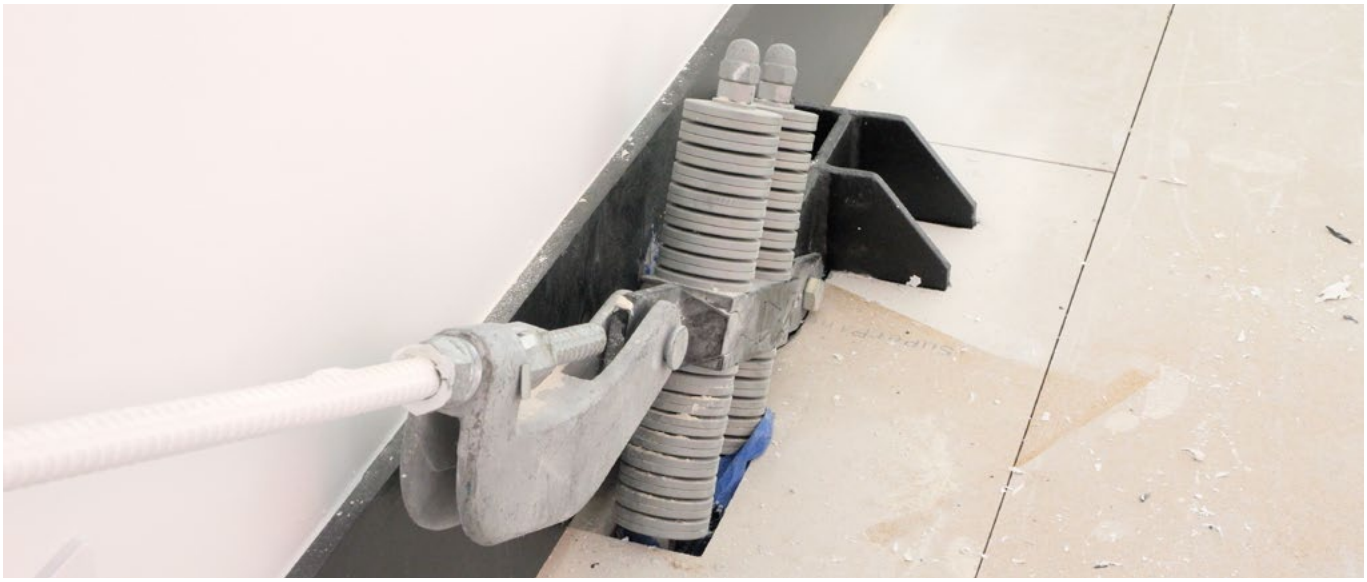
Project Spotlight: 48 Greys Avenue, Auckland, New Zealand



Design Capacities*

ReidBrace Xtrem Part No.	Description	Capacity (kN)
RBRACEX16	Ramset RBRACE16-SET + Tectonus RSFJ16	65
RBRACEX20	Ramset RBRACE20-SET + Tectonus RSFJ20	75
RBRACEX25	Ramset RBRACE25-SET + Tectonus RSFJ25	150
RBRACEX32	Ramset RBRACE32-SET + Tectonus RSFJ32	250

*Preliminary value, to be confirmed by Tectonus during detailed design. Higher capacities are achievable by utilising multiple ReidBrace Xtrem in parallel (eg. 2 x RBRACEX32 providing 500kN capacity).

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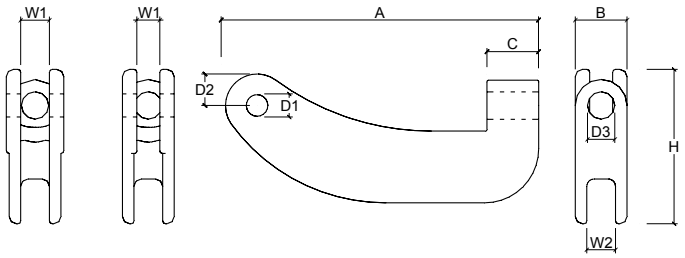
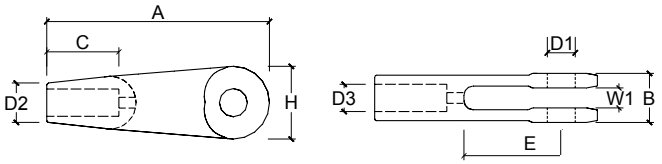
Dimensions

Product Specification - Dimensions of RBRACE (mm)



RBRACE									
Size	A	B	C	D1	D2	D3	H	W1	W2
12/16	276	36	46	17	25	19	107	16	20
20	345	45	58	21	32	24	134	21	25
25	382	53	73	31	40	29	149	26	29
32	436	68	72	31	44	38	170	36	36

Product Specification - Dimensions of RBRACE-END (mm)



RBRACE-END									
Size	A	B	C	D1	Pin	E	H	W1	D3
16	160	36	55	17	16	67	50	16	Bar Diameter
20	195	45	60	21	20	88	60	21	"
25	247	50	80	31	30	108	80	26	"
32	265	62	85	31	30	120	88	32	"

ReidBrace™ Pin sizes (mm)

RBRACE Set	Pin Size (Diameter x Length, mm)
RBRACE12-SET & RBRACE16-SET	16 x 50
RBRACE20-SET	20 x 59
RBRACE25-SET	30 x 68
RBRACE32-SET	30 x 83

HDG Pin with SS316 Clip

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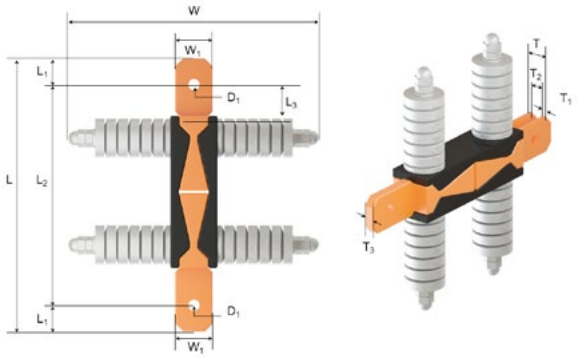
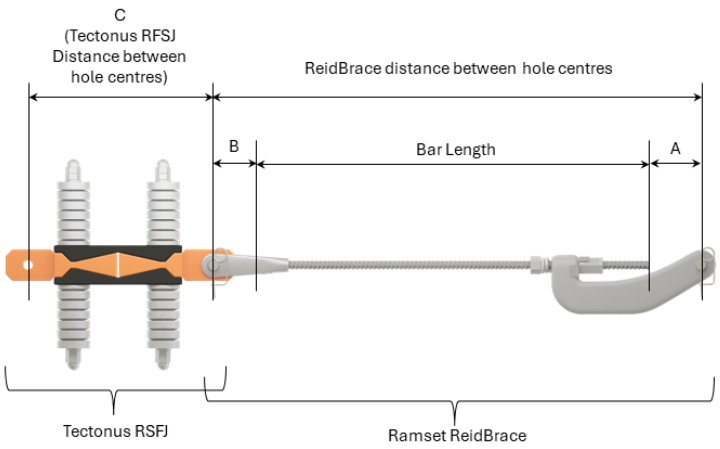
Dimensions

Product Specification – Dimensions of Tectonus RSFJ



Tectonus RSFJ											
Size	L	L1	L2	L3	W	W1	T	T1	T2	T3	D1
16	514	50	414	60	546 max	70	36	10	16	15	17
20	514	50	414	60	478 max	70	41	10	21	20	21
25	871	70	731	90	478 max	100	50	12	26	25	31
32	1118	70	978	90	478 max	100	62	15	32	30	31

Combined Measurements *



ReidBrace Xtrem					
ReidBrace Xtrem Part No.	ReidBar Size	A ± 5mm	B ± 5mm	C ± 5mm	A + B + C ± 15mm
RBRACEX16	RBA16	130	80	414	624
RBRACEX20	RB20	170	105	414	689
RBRACEX25	RB25	175	125	731	1031
RBRACEX32	RB32	200	135	978	1313

ReidBar Length = Distance between hole centres – (A + B + C)

*Pending confirmation by the Tectonus engineering team, some designs may require Tectonus dampers at both ReidBrace ends. In this scenario, the system combined dimensions will have to be calculated separately.

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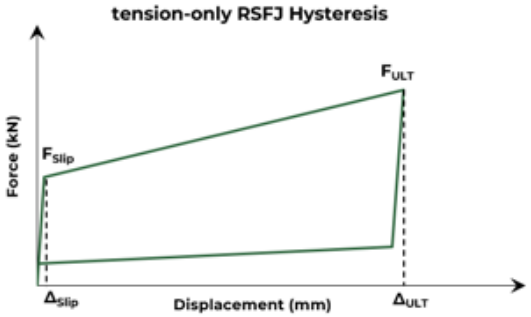
Simple Steps to Use ReidBrace™ Xtrem™

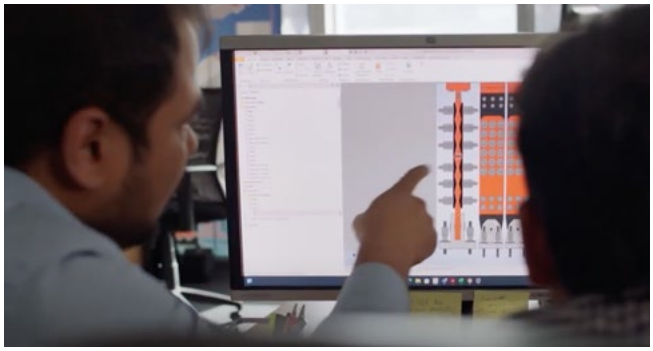
Step 1:

Commence preliminary/concept design using the system ductility factor provided in page 10 of this document (typically between 2.5 – 4.0).



Step 2:

If the preliminary/concept design looks favourable, contact the Tectonus engineering team for validation on the ductility factor used.



Step 3:

Upon project commencement, Tectonus will supply the RSFJ along with the Producer Statement. ReidBrace can be sourced from Ramset or their distribution partners.

Step 4:

Builder installs the combined Tectonus RSFJ and ReidBrace System, following the guidance provided by Tectonus & Ramset.

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Seismic Design Guidance for Specifiers

System Ductility

The following table compares the ReidBrace Xtrem with the conventional tension only (T/O) braces using rebars/rods in terms of the seismic design parameters to be adopted. This system could reduce the seismic load demand to **as low as a third** of those conventional cross braces, providing significant cost savings.

	System performance ductility factor (μ)	S_p	Overstrength factor (ø OMS)	C_s	k_μ [8]	$\frac{S_p C_s}{k_\mu}$
ReidBrace Xtrem	2.5-4.0[1]	0.7-1.0[2]	1.3[4]	1.0[6]	1.86-2.71	0.26-0.54
Typical T/O braces (with rebars/rods)	1.0-1.25	0.9-1.0[3]	1.0-1.3[5]	1.0-1.25[7]	1.0-1.14	0.79-1.25

1. The equivalent ductility factor to be verified by modelling and calculations (peer-reviewed by an independent CPEng). Please contact the Tectonus engineering team via the email info@tectonus.com for worked examples of single & multi-storey buildings.
2. As per NZS 1170.5 Clause 12.2.2.1, S_p factor of 0.7 could be adopted for ductile structures depending on the structural performance.
3. As per NZS 3404 Clause 12.2.2.1
4. Based on the secondary fuse incorporated within the Tectonus device (through yielding of the clamping bolts).
5. As per NZS 3404 Table 12.2.8(1)
6. Given the repeatable hysteresis performance with no strength and stiffness degradation. Further details are provided in a journal publication, titled "Proposed design procedure for steel self-centring tension-only braces with resilient connections."
7. Depending on the number of storeys as per NZS 3404 Clause 12.12.6.3.2
8. Estimated for soil classes A/B/C/D & $T_1 < 0.7$s. It should be noted by the upcoming new seismic loading standard (TS 1170.5), more load demand reduction could be provided (given $k_\mu = \mu$ for all the periods).

The ReidBrace Xtrem could also be adopted as an efficient alternative to the T/O CBFs. While CBFs could provide limited ductility, this system requires consideration of high value C_S factors (1.5-1.8, depending on the number of storeys) due to less than ideal inelastic behaviour, and therefore would attract higher seismic load demands (up to 100%) compared to the ReidBrace Xtrem. Furthermore, there would be further cost savings due to less labour and erection costs given the lightweight nature of ReidBrace Xtrem compared to heavy steel sections of CBFs.

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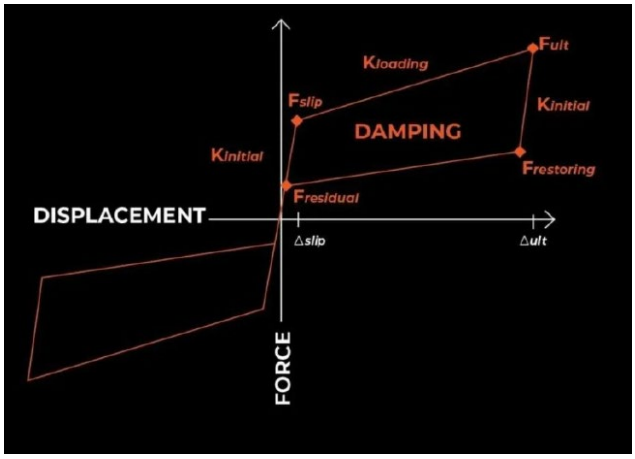
Seismic Design Guidance for Specifiers

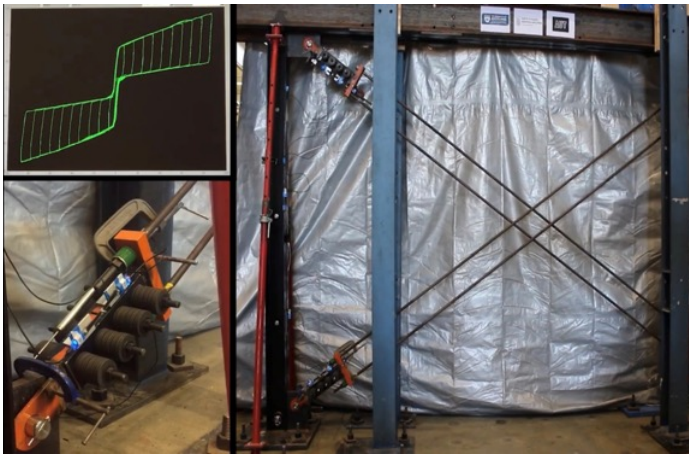
System Modelling

For the structural modelling of the ReidBrace Xtrem system, the two major components are required to be modelled in series: 1) ReidBrace, and 2) Tectonus device.

The flag-shaped hysteresis response of the Tectonus device can be easily integrated in the ETABS and SAP2000 structural analysis and design software using the "Damper – Friction Spring" link element. It allows the designer to accurately calibrate the parameters according to the requirements of the project (F_{slip} to be beyond SLS design level - commonly at about 50% of F_{ult}). The values of $F_{restoring}$ and $F_{residual}$ to be considered as 0.23 F_{ult} and 0.23 F_{slip} respectively. Please refer to the Structural Modelling Design Guide available from the Tectonus website which provides step-by-step guidance with examples.

For any further support, please contact the Tectonus engineering team.





The following table presents the elastic stiffness of different components to be considered for modelling purposes.

ReidBrace Xtrem Part No.	ReidBrace $E_{equivalent}$* [MPa]	Tectonus device [kN/mm]
RBRACEX16	145,000	100
RBRACEX20	140,000	100
RBRACEX25	135,000	90
RBRACEX32	130,000	80

* The equivalent modulus provided includes the deflection of the end connections of ReidBrace.
In case there is a need to increase the initial stiffness of the ReidBrace Xtrem system, double ReidBraces could be adopted to be attached to Tectonus device using simple adaptor plates.

Customer Service

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