TECTONUS
RESILIENT SEISMIC SOLUTIONS

PRODUCT GUIDE

CUTTING EDGE SEISMIC PROTECTION TECHNOLOGY

SEISMIC CONNECTIONS. MAXIMUM RESILIENCE

Tectonus next-generation seismic connections significantly improve the seismic resilience of buildings in earthquake-prone regions.

Trusted by leading engineers on over 20 projects, the patented technology dampens and self-centers all in one, creating new possibilities in structural design – whether new build or retrofit, mass timber, steel and concrete.

Unlike seismic devices that are one and done, Tectonus connections protect structures continuously through effective energy dissipation and automatic self-centering. The device itself needs no repair or replacement after an event, and building damage is greatly minimized allowing owners and occupiers to get back to work quickly.

Tectonus-based designs are often cost neutral or even cost positive. Thanks to a much lower overstrength factor than alternative devices, structural members can be reduced, saving on material cost and labor.

Sustainability is a key driver. Less concrete and steel means less embodied carbon, and Tectonus enables multi-story mass timber structures in high seismic areas. Not to mention the carbon cost of knocking whole buildings down after an earthquake.

PROJECT BENEFITS

DESIGN AND BUILD STAGE

- Can reduce materials used in the lateral system and foundations
- Can reduce embodied carbon
- Can result in less on site labour
- Quick to install – simply bolt in place
- Every unit is tested to the design level earthquake, giving ultimate assurance

IN USE

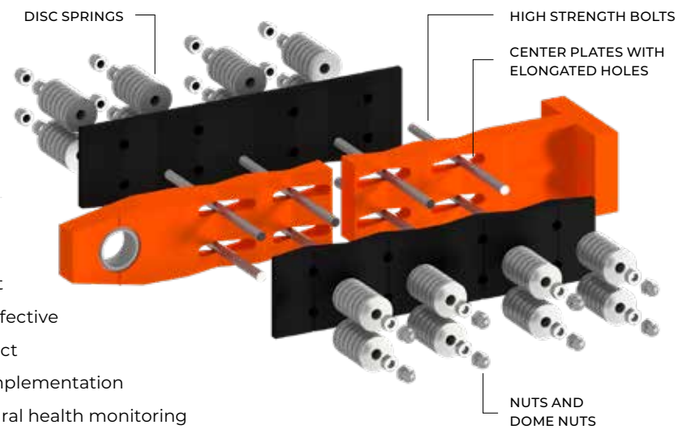
- Rugged, durable design
- Zero maintenance (only visual inspection at 25 years)

AFTER EARTHQUAKE

- Continuous protection through earthquake and aftershocks – devices do not need repair or replacement
- Limits damage by minimizing residual drift
- Enables occupants and operations to get back up running in days

THE TECTONUS DEVICE

The device consists of two outer cap plates and two center plates with elongated holes. The outer cap plates and the center plates are grooved and clamped together with high-strength bolts and disc springs.



ADVANTAGES

- Effectively dissipates energy
- Self-centering
- Continued damage avoidance
- No post event maintenance required
- Applicable to all types of buildings
- Retrofit
- Cost-effective
- Compact
- Easy implementation
- Structural health monitoring

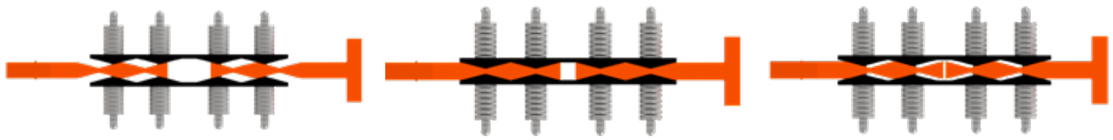
KEY CHARACTERISTICS

- Bolts only work in tension
- Cap plate can't "jump" the ridge
- At F_{ult} , disc springs are fully flattened
- Gap in center allows for compression deformation
- All parts remain within their elastic range up to F_{ult}
- Device returns to its original "rest" position every time

HOW IT WORKS

When the applied force overcomes the frictional resistance between the sloped bearing surfaces, the center plates start to slide and energy will be dissipated through friction during cycles of sliding. The patented shape of the plate ridges along with the use of disc springs and high strength bolts provide the desirable self-centering characteristic.

The angle of the grooves is designed such that at the time of unloading, the reversing force induced by the elastically compacted disc springs is larger than the friction force acting between the facing surfaces. Therefore, the system is recentered upon unloading.

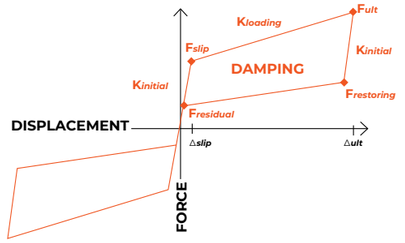


IN TENSION AT REST IN COMPRESSION

FLAG SHAPE BEHAVIOUR

The compact and scalable configuration of the Tectonus device offers design freedom for any application as any flag shape response can be achieved.

The device load deformation is geometrically non-linear and all parts remain within their material elastic range within the design earthquake. The device provides 10 to 15% hysteretic damping depending on the range of deformation specified. All parts of the device are capacity designed.



THIS PRODUCT GUIDE

Follow this product guide for overview of application options using Tectonus devices. Refer to page 10 for the product table. To design with Tectonus devices, refer to the Structural Modelling Guide which can be found on the Tectonus website.

Our in-house engineering team provides custom support from project concept to peer review.

Structural analysis and design software ETABS / SAP2000.

SAP2000® ETABS®

TENSION & COMPRESSION BRACE

The Tectonus devices are installed within the brace member and provide the axial fuse while ensuring that the buckling resistance is not compromised.

ADVANTAGES

- Self-centering & NO post event maintenance
- Can be installed in parallel to increase the capacity
- Arrives on site ready for installation
- Installation can be carried out by a 2 person team
- Length of diagonal brace can be adjusted for site imperfections
- NO out of plane buckling

APPLICATIONS

New and retrofit projects, and can be implemented to all types of buildings;

Steel, timber, concrete, or a hybrid of any.

- Multi story
- Industrial applications
- Industrial pallet racks

SHEARWALLS & COLUMNS

The Tectonus devices resist the rocking shear wall over-turning forces and are designed for out-of-plane deformation compatibility.

ADVANTAGES

- Self-centering
- No post event maintenance: Reduced costs when considering earthquake sequences
- Scalability: can be installed in groups to increase the capacity
- Arrives on site ready for installation (no secondary steps required)
- The pin and swivel bearing allow for +/- 5% rotation

APPLICATIONS

New and retrofit projects, and can be implemented to all types of buildings;

Steel, timber, concrete, or a hybrid of any.

- Multi story
- Industrial applications

TENSION ONLY BRACES

The Tectonus devices provide the tension fuse to the braces and prevent out-of-plane buckling.

ADVANTAGES

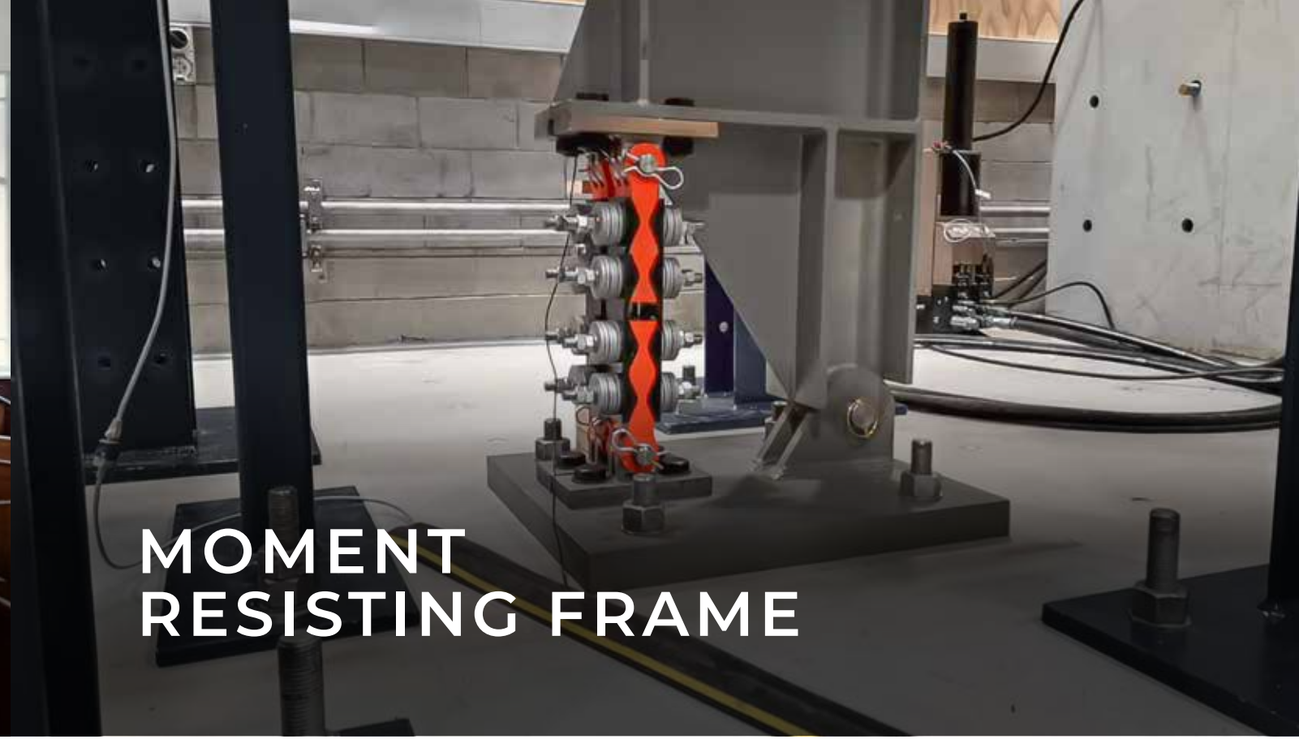
- Self-centering & NO post event maintenance
- Can be installed in parallel to increase the capacity
- Arrives on site ready for installation
- Installation can be carried out by a 2 person team
- Length of diagonal brace can be adjusted for site imperfections
- NO out of plane buckling

APPLICATIONS

New and retrofit projects, and can be implemented to all types of buildings;

Steel, timber, concrete, or a hybrid of any.

- Multi story
- Industrial applications
- Industrial pallet racks



MOMENT RESISTING FRAME

The Tectonus devices provide moment resistance to the beam-column connections through their tension-compression axial resistance.

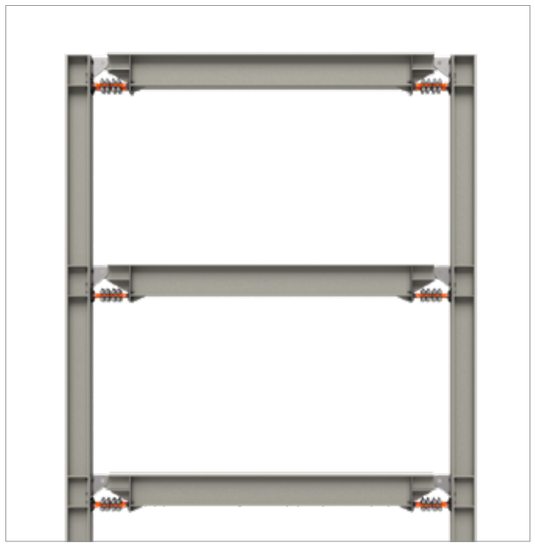
ADVANTAGES

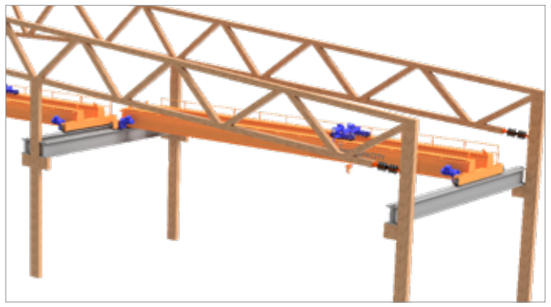
- Self-centering
- No post event maintenance: Reduced costs when considering earthquake sequences
- Scalability: Can be installed as single unit or combined with others to increase the capacity
- Arrives on site ready for installation

APPLICATIONS

New and retrofit projects, and can be implemented to all types of buildings; steel, timber, concrete, or a hybrid of any.

- Multi story
- Portal frames

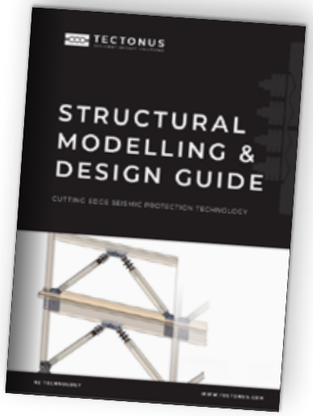




DESIGN GUIDANCE

STRUCTURAL MODELLING & DESIGN GUIDE

To design with the Tectonus devices, refer to the Structural Modelling & Design Guide for the recommended design approach. The guide can be found on the Tectonus website.



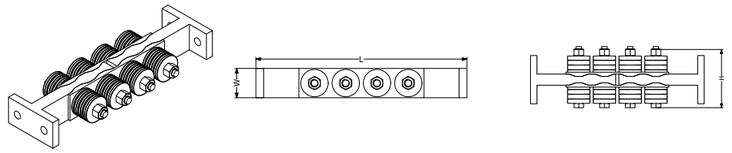
DEVICE CAPACITY

Tectonus devices can be designed to meet any targeted capacity and deflection. The standard range devices can be applied in multiples in a modular pattern to achieve larger capacities.

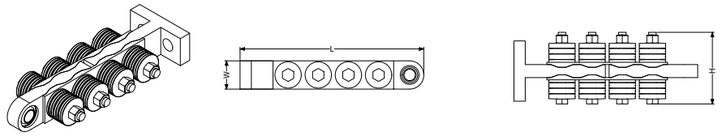
Refer to table on page 10.

APPLICATIONS & DIMENSIONS

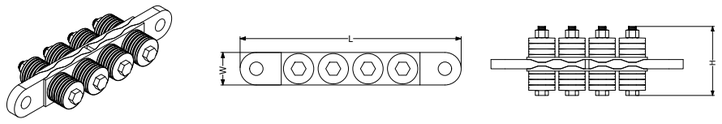
BRACE



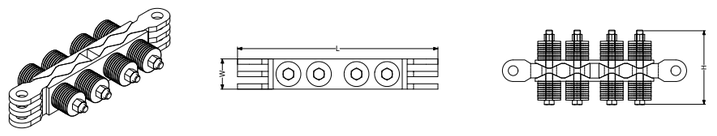
SHEARWALL



TENSION ONLY BRACE



MOMENT RESISTING FRAME



DIMENSIONS

The dimensions of the Tectonus devices depend on the demand deflection. To support the application of devices in a wide range of brace sizes, the devices are provided up to 4 different ranges of deflections.

NO. OF BOLTS	L (mm)	W (mm)	H (mm) *Note: H value is approximate*
2	*refer to page 10*	80	$2.83\,\Delta_{ult} + 100$
4		80	
6		80	
8		160	
16		160	
18		240	

CONFIGURATION OPTIONS

Tectonus device capacity options are listed in the product table on page 10. Some capacities can be designed in more than one configuration giving engineers design options that can be beneficial for space constraints and ease of installation.

SINGLE

Device has single row of bolts

DOUBLE

Device has 2 rows of bolts

TRIPLE

Device has 3 rows of bolts

DEVICES INSTALLED IN PARALLEL

Multiple Tectonus devices can be installed in parallel in order to achieve higher capacity demands.

FOR BRACES

The Tectonus devices in brace applications are installed with anti-buckling tubes.

QUALITY ASSURANCE

Each Tectonus device is assembled and performance tested in the New Zealand Tectonus facilities. Testing of each unit is certified with riguouous quality controls and a certificate of flag shape performance is provided for each device.

DESIGN SUPPORT

From concept to peer review, our expert team provides custom engineering design support. Contact us for further information and to discuss support options.

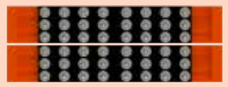
METRIC					DEVICE CONFIGURATION OPTIONS	APPLICATION				IMPERIAL				
Approximate Length			Δ_{ult}	Approx. Capacity	Rows *Note: refer to page 9 for examples*	Brace	Shearwall	X-Brace	MRF	Approx Capacity	Δ_{ult}	Approximate Length		
single row (mm)	double row (mm)	triple row (mm)	(mm)	Fult (kN)						Fult (kips)	(inch)	single row (inch)	double row (inch)	triple row (inch)
550	--	--	25 to 50	50	**Single** 	✔	✔	✔	✔	10	1 to 2	22	--	--
550	--	--	25 to 50	75		✔	✔	✔	✔	15	1 to 2	22	--	--
550	--	--	25 to 50	100		✔	✔	✔	✔	20	1 to 2	22	--	--
700	550	--	25 to 50	150	**Single or double**	✔	✔	✔	✔	35	1 to 2	28	22	--
700	550	--	25 to 100	200		✔	✔	✔	✔	45	1 to 4	28	22	--
850	550	--	25 to 100	250		✔	✔	✔	✔	55	1 to 4	34	22	--
1000	550	--	25 to 100	300		✔	✔	✔	✔	65	1 to 4	40	22	--
1250	700	--	25 to 100	350		✔	✔	---	✔	80	1 to 4	50	28	--
1400	700	--	25 to 100	400		✔	✔	---	✔	90	1 to 4	56	28	--
--	700	--	25 to 100	450	**Double**	✔	✔	---	✔	100	1 to 4	--	28	--
--	850	--	25 to 100	500		✔	✔	---	✔	110	1 to 4	--	34	--
--	850	--	25 to 100	550		✔	✔	---	---	125	1 to 4	--	34	--
--	1000	--	25 to 100	600		✔	✔	---	---	135	1 to 4	--	40	--
--	1000	--	25 to 100	650		✔	✔	---	---	145	1 to 4	--	40	--
--	1150	--	25 to 100	700		✔	✔	---	---	155	1 to 4	--	46	--
--	1150	--	25 to 100	750		✔	✔	---	---	170	1 to 4	--	46	--
--	1300	--	25 to 100	800		✔	✔	---	---	180	1 to 4	--	52	--
--	1300	1200	25 to 100	850	**Double or triple**	✔	✔	---	---	190	1 to 4	--	52	48
--	1400	1200	25 to 100	900		✔	✔	---	---	200	1 to 4	--	56	48
--	1400	1200	25 to 100	950		✔	✔	---	---	215	1 to 4	--	56	48
--	1400	1200	25 to 100	1000		✔	✔	---	---	225	1 to 4	--	56	48
--	--	1250	25 to 100	1050	**Triple**	✔	✔	---	---	235	1 to 4	--	--	50
--	--	1250	25 to 100	1100		✔	✔	---	---	245	1 to 4	--	--	50
--	--	1250	25 to 100	1150		✔	✔	---	---	260	1 to 4	--	--	50
--	--	1300	25 to 100	1200		✔	✔	---	---	270	1 to 4	--	--	52
--	--	1300	25 to 100	1250		✔	✔	---	---	280	1 to 4	--	--	52
--	--	1400	25 to 100	1300		✔	✔	---	---	290	1 to 4	--	--	56
--	--	1450	25 to 100	1350		✔	✔	---	---	305	1 to 4	--	--	58
--	--	1500	25 to 100	1400		✔	✔	---	---	315	1 to 4	--	--	60
--	--	1550	25 to 100	1450		✔	✔	---	---	325	1 to 4	--	--	62
Multiple devices installed in parallel			25 to 100	1500	**Multiple devices installed in parallel** 	✔	✔	---	---	335	1 to 4	Multiple devices installed in parallel		
			25 to 100	1550		✔	✔	---	---	350	1 to 4			
			25 to 100	1600		✔	✔	---	---	360	1 to 4			
			25 to 100	1650		✔	✔	---	---	370	1 to 4			
			25 to 100	1700		✔	✔	---	---	380	1 to 4			
			25 to 100	1750		✔	✔	---	---	395	1 to 4			
			25 to 100	1800		✔	✔	---	---	405	1 to 4			
			25 to 100	1850		✔	✔	---	---	415	1 to 4			
			25 to 100	1900		✔	✔	---	---	425	1 to 4			
			25 to 100	1950		✔	✔	---	---	440	1 to 4			
			25 to 100	2000		✔	✔	---	---	450	1 to 4			
			25 to 100	2100		---	✔	---	---	470	1 to 4			
			25 to 100	2200		---	✔	---	---	495	1 to 4			
			25 to 100	2300		---	✔	---	---	515	1 to 4			
			25 to 100	2400		---	✔	---	---	540	1 to 4			
			25 to 100	2500		---	✔	---	---	560	1 to 4			
			25 to 100	2600		---	✔	---	---	585	1 to 4			
			25 to 100	2700		---	✔	---	---	605	1 to 4			
			25 to 100	2800		---	✔	---	---	630	1 to 4			
			25 to 100	2900		---	✔	---	---	650	1 to 4			
			25 to 100	3000		---	✔	---	---	675	1 to 4			
			25 to 100	3500		---	✔	---	---	785	1 to 4			
			25 to 100	4000		---	✔	---	---	900	1 to 4			
			25 to 100	4500		---	✔	---	---	1010	1 to 4			
			25 to 100	5000		---	✔	---	---	1125	1 to 4			

TABLE NOTES

- Devices are designed to provide deflection with self-centering even beyond Δ_{ult} (as a secondary fuse) with $\Delta_{max} = 1.5\,\Delta_{ult}$ and an overstrength factor of 1.35
- Given the slight non linearity at the device slip stage, the F_{slip} is determined as the intersect of the straight lines matching the initial and second stiffness of the flag-shaped curve.
- Δ_{slip} (comparable to SLS) is kept to be about 1mm, 1.5mm and 2mm for 2-bolt, 4-bolt and 6-bolt devices, respectively (excluding the deflection resulting from the attachments such as pins, brackets and anchor bolts.

CONTACT US

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Tectonus' dedicated engineering team supports project design from concept to finish. Contact us for further information and to discuss support options.

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