ITW Australia Pty. Ltd. T/A Ramset™

A founding board member of AEFAC

Product Engineering Laboratory

Ramset Product Engineering Laboratory
Seismic shear testing has been performed by Swinburne University, an independent testing laboratory. All static testing has been performed by Melbourne Testing Services, a Nata accredited laboratory and the PEL, an ITW facility. See below for details.

Fastener Technical Assessment

FTA-25/0008
of 22/04/2026

This Technical Assessment meets the requirements in accordance with AS 4100:2020 (A1) cl 9.2.2.4, NZS 3404.1:1997 cl 9.3.2.4 & EOTA TR 049: 2016-08 cl 2.3.3 and cl 2.4.4

Trade name of the construction product	OrbiPlate™ Post Installed Fastener Connections
Product family to which the construction product belongs	OrbiPlate™ structural connections for steel to concrete post-installed connections ORB2020PIAGH, ChemSet™ Reo502™ Xtrem™
Manufacturer	Ramset 1 Ramset Drive Chirnside Park Victoria 3116 Australia
Manufacturing plant	Ramset™
This Technical Assessment contains	23 pages & 11 Annexes which form an integral part of this assessment.
This Technical Assessment has been conducted as per the provisions for standard bolted connections as required by the Australian and New Zealand Steel Structures Standards, AS 4100:2020 (A1) section 9.2.2.4 and NZS 3404.1:1997 section 9.3.2.4 and provisions for Seismic Shear as required by EOTA TR 049: 2016-08 cl 2.3.3 & cl 2.4.4	Tests performed by, – Swinburne University (SWUT), – ITW Product Engineering Laboratory (PEL) Reference reports: • SWUT: Report Date November 2023 • ITW PEL: TRR287 (2024) • ITW PEL: TRR339 (2025) • ITW PEL: Assessment report - Reo502 PLUS vs Reo502 Xtrem – OrbiPlate (2026)
This version replaces:	The FTA with the same number issued on 06/05/2025

1. Technical description of the product

OrbiPlate™ is a proprietary bolted connection system which overcomes cumulative construction tolerances.

All OrbiPlate™ components in this report are steel elements consisting of a serrated orbital plate, toothed washer, and proprietary M20 ChemSet™ Anchor Stud. They can be used for steel to concrete connection with the proprietary adhesive anchor - ChemSet™ Reo 502™ Xtrem™.

The illustration and the description of the product is given in Annex A.

2. Specification of intended use

The performances given in Section 3 are only valid if the Post-installed Connection System is used in compliance with the specifications and conditions given in Annex B.

3. Performance of the product and references to the methods used for its assessment

3.1 Performance Requirement of OrbiPlate™ Post-Installed Connections

Criteria	Performance
Rotational & Longitudinal Static Shear Performance Steel to Concrete Connection AS 3600:2018 (A2) S.19, NZS 3101:2006 (A3) S.17, AS 4100:2020 (A1) and NZS 3404.1:1997	See Annex C1 (Table)
Rotational & Longitudinal Seismic C1 Steel Shear Performance AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Seismic Category C1 (ACI 355.2) Seismic C1	See Annex C2 (Table)
Rotational & Longitudinal Seismic C2 Steel Shear Performance AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Seismic Category C2 Seismic C2	See Annex C3 (Table)
Rotational & Longitudinal Static Shear Performance Steel to Concrete Connection AS 3600:2018 (A2) S.19, NZS 3101:2006 (A3) S.17, AS 4100:2020 (A1) and NZS 3404.1:1997	See Annex C4 (Graph)
Rotational & Longitudinal Seismic C1 Steel Shear Performance AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Seismic Category C1 (ACI 355.2) Seismic C1	See Annex C5 (Graph)
Rotational & Longitudinal Seismic C2 Steel Shear Performance AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Seismic Category C2 Seismic C2	See Annex C6 (Graph)
Tensile Performance Steel to Concrete Connections: European Technical Assessment ETA 25/0648. AS 5216:2026 and EN 1992-4:2018	See Annex C7 (Table)

Testing Methodology of Mechanical Connections

OrbiPlate™, ORB2020PIAGH, ChemSet™ Anchor Stud and ChemSet™ Reo 502™ Xtrem™ Connection assemblies for Steel to concrete connections to be **fastened as per the installation guidelines.**

3.2.1 Rotational & Longitudinal Shear Steel to Concrete Connections-
AS 3600:2018 (A2), AS 4100:2020 (A1), NZS 3101: 2006 (A3) and NZS 3404.1:1997

Configure test plates in the following way,

Set-up 1 (M20 & 16mm plate – slot aligned vertically & bolt central to washer)

- Post-install M20 ChemSet Anchor Stud with ChemSet Reo 502 into centre of concrete block in readiness for connection to a 16mm thick plate with a 70mm diam through hole and incorporating a welded lug to allow test rig draw bar attachment. Achieve connection using an ORB2020PIAGH with the slot vertically aligned and the bolt central to the washer.

Set-up 2 (M20 & 12mm plate – slot aligned vertically & bolt central to washer)

- Post-install M20 ChemSet Anchor Stud with ChemSet Reo 502 into centre of concrete block in readiness for connection to a 12mm thick plate with a 70mm diam through hole and incorporating a welded lug to allow test rig draw bar attachment. Achieve connection using an ORB2020PIAGH with the slot vertically aligned and the bolt central to the washer.

Set-up 3 (M20 & 32mm plate – slot aligned vertically & bolt central to washer)

- Post-install M20 ChemSet Anchor Stud with ChemSet Reo 502 into centre of concrete block in readiness for connection to a 32mm thick plate with a 70mm diam through hole and incorporating a welded lug to allow test rig draw bar attachment. Achieve connection using an ORB2020PIAGH with the slot vertically aligned and the bolt central to the washer.

Set-up 4 (M20 & 16mm plate – slot horizontally aligned and bolt at extremity)

- Post-install M20 ChemSet Anchor Stud with ChemSet Reo 502 into centre of concrete block in readiness for connection to a 16mm thick plate with a 70mm diam through hole and incorporating a welded lug to allow test rig draw bar attachment. Achieve connection using an ORB2020PIAGH with the slot horizontally aligned and the bolt at the extremity of slot.

Set-up 5 (M20 & 6mm plate – slot horizontally aligned and bolt at extremity)

- Post-install M20 ChemSet Anchor Stud with ChemSet Reo 502 into centre of concrete block in readiness for connection to a 6mm thick plate with a 70mm diam through hole and incorporating a welded lug to allow test rig draw bar attachment. Achieve connection using an ORB2020PIAGH with the slot horizontally aligned and the bolt at the extremity of slot.

Set-up 6 (M20 & 12mm plate – slot horizontally aligned and bolt at extremity)

- Post-install M20 ChemSet Anchor Stud with ChemSet Reo 502 into centre of concrete block in readiness for connection to a 12mm thick plate with a 70mm diam through hole and incorporating a welded lug to allow test rig draw bar attachment. Achieve connection using an ORB2020PIAGH with the slot horizontally aligned and the bolt at the extremity of slot.

Set-up 7 (M20 & 32mm plate – slot horizontally aligned and bolt at extremity)

- Post-install M20 ChemSet Anchor Stud with ChemSet Reo 502 into centre of concrete block in readiness for connection to a 32mm thick plate with a 70mm diam through hole and incorporating a welded lug to allow test rig draw bar attachment. Achieve connection using an ORB2020PIAGH with the slot horizontally aligned and the bolt at the extremity of slot.

Conduct test for each set-up by attaching draw bar to lug with displacement extensometer. Apply tensile force at a constant rate and continue until the onset of ChemSet™ Anchor Stud shear or rupture of the OrbiPlate washer is evident. Test data, including applied force and test displacement, to be recorded autographically throughout the test.

Note: Consideration should also be given to performance of concrete in bearing and of ChemSet Anchor Stud bending when assessing the test results.

3.2.2 Longitudinal Seismic Shear Performance Steel to Steel – AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Seismic Category C1 (ACI 355.2)

Configure test plates in the following way,

- For the M20 ChemSet Anchor Stud OrbiPlate System, mate a reaction plate to a 16mm thick plate with a 70mm diam through hole. Achieve connection using an ORB2020PIAGH with the slot vertically aligned upwards and locating the anchor stud 10mm off centre (half-way of the slot). Ensure the anchor stud is fastened through the assembly by using a corresponding nut and with a torque level suited to the system.
- For the M20 ChemSet Anchor Stud OrbiPlate System, mate a reaction plate to a 32mm thick plate with a 70mm diam through hole. Achieve connection using an ORB2020PIAGH with the slot vertically aligned upwards and locating the anchor stud 10mm off centre (half-way of the slot). Ensure the Anchor Stud is fastened through the assembly by using a corresponding nut and with a torque level suited to the system.

Conduct test by gripping each end of the test plates between pinned clevis test fixtures. Apply force to the system and commence cyclic shear loading protocol in accordance with EOTA TR 049: 2016-08 clause 2.3.3. After completion of cyclic shear protocol, test assembly to failure in shear. Test data, including applied force and test displacement, to be recorded autographically throughout the test.

3.2.3 Rotational Seismic Shear Performance Steel to Steel – AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Seismic Category C1 (ACI 355.2)

Configure test plates in the following way,

- For the M20 ChemSet Anchor Stud OrbiPlate System, mate a reaction plate to a 6mm thick plate with a 70mm diam through hole. Achieve connection using an ORB2020PIAGH with the slot horizontally aligned and the anchor stud positioned 20mm off-centre (outer-most position on the slot). Ensure the anchor stud is fastened through the assembly by using a corresponding nut and with a torque level suited to the system.
- For the M20 ChemSet Anchor Stud OrbiPlate System, mate a reaction plate to a 16mm thick plate with a 70mm diam through hole. Achieve connection using an ORB2020PIAGH with the slot horizontally aligned and the anchor stud positioned 20mm off-centre (outer-most position on the slot). Ensure the anchor stud is fastened through the assembly by using a corresponding nut and with a torque level suited to the system.
- For the M20 ChemSet Anchor Stud OrbiPlate System, mate a reaction plate to a 32mm thick plate with a 70mm diam through hole. Achieve connection using an ORB2020PIAGH with the slot horizontally aligned and the anchor stud positioned 20mm off-centre (outer-most position on the slot). Ensure the anchor stud is fastened through the assembly by using a corresponding nut and with a torque level suited to the system.

Conduct test by gripping each end of the test plates between pinned clevis test fixtures. Apply force to the system and commence cyclic shear loading protocol in accordance with EOTA TR 049: 2016-08 clause 2.3.3. After completion of cyclic shear protocol, test assembly to failure in shear. Test data, including applied force and test displacement, to be recorded autographically throughout the test.

3.2.4 Longitudinal Seismic Shear Performance Steel to Steel – AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Seismic Category C2

Configure test plates in the following way,

- For the M20 ChemSet Anchor Stud OrbiPlate System, mate a reaction plate to a 16mm thick plate with a 70mm diam through hole. Achieve connection using an ORB2020PIAGH with the slot vertically aligned upwards and locating the anchor stud 10mm off centre (half-way of the slot). Ensure the anchor stud is fastened through the assembly by using a corresponding nut and with a torque level suited to the system.
- For the M20 ChemSet Anchor Stud OrbiPlate System, mate a reaction plate to a 32mm thick plate with a 70mm diam through hole. Achieve connection using an ORB2020PIAGH with the slot vertically aligned upwards and locating the anchor stud 10mm off centre (half-way of the slot). Ensure the Anchor Stud is fastened through the assembly by using a corresponding nut and with a torque level suited to the system.

Conduct test by gripping each end of the test plates between pinned clevis test fixtures. Apply force to the system and commence cyclic shear loading protocol in accordance with EOTA TR 049: 2016-08 clause 2.4.4. After completion of cyclic shear protocol, test assembly to failure in shear. Test data, including applied force and test displacement, to be recorded autographically throughout the test.

3.2.5 Rotational Seismic Shear Performance Steel to Steel – AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Seismic Category C2

Configure test plates in the following way,

- For the M20 ChemSet Anchor Stud OrbiPlate System, mate a reaction plate to a 6mm thick plate with a 70mm diam through hole. Achieve connection using an ORB2020PIAGH with the slot horizontally aligned and the anchor stud positioned 20mm off-centre (outer-most position on the slot). Ensure the anchor stud is fastened through the assembly by using a corresponding nut and with a torque level suited to the system.
- For the M20 ChemSet Anchor Stud OrbiPlate System, mate a reaction plate to a 16mm thick plate with a 70mm diam through hole. Achieve connection using an ORB2020PIAGH with the slot horizontally aligned and the anchor stud positioned 20mm off-centre (outer-most position on the slot). Ensure the anchor stud is fastened through the assembly by using a corresponding nut and with a torque level suited to the system.
- For the M20 ChemSet Anchor Stud OrbiPlate System, mate a reaction plate to a 32mm thick plate with a 70mm diam through hole. Achieve connection using an ORB2020PIAGH with the slot horizontally aligned and the anchor stud positioned 20mm off-centre (outer-most position on the slot). Ensure the anchor stud is fastened through the assembly by using a corresponding nut and with a torque level suited to the system.

Conduct test by gripping each end of the test plates between pinned clevis test fixtures. Apply force to the system and commence cyclic shear loading protocol in accordance with EOTA TR 049: 2016-08 clause 2.4.4. After completion of cyclic shear protocol, test assembly to failure in shear. Test data, including applied force and test displacement, to be recorded autographically throughout the test.

4 **Material Safety Data Sheet** (N/A).

OrbiPlate™ Post-Installed Connections
ORB2020PIAGH and ChemSet™ Reo 502™ Xrem™

OrbiPlate™ Kit

Anchor size, d_s (mm)	Description		Part No.
			Gal
M20 x Serrated Plates	Washer OD (mm)	Fixture hole (mm)	ORB2020PIAGH
	80	70 ± 1	
M20 x 240	ChemSet Anchor Stud Galvanised		

ChemSet™ Adhesive Anchoring System Design

Description	Size	Part No.
ChemSet Reo502 Xtrem	600ml	CREO502X

OrbiPlate™ Connection assemblies	**Annex A 1**
Product description Mechanical connection (Steel to Steel or Steel to Concrete)	

OrbiPlate™ and ChemSet™ Anchor Stud Engineering Properties M20

1)

OrbiPlate™ and ChemSet™ Anchor Stud Combination

Anchor Stud Size, d_b	Overall Length, L (mm)	Effective Length, L_e (mm)	Max Fixture Thickness, t (mm)	Stress Area , A_s (mm^2)	Grade 5.8 Steel Studs		Section Modulus, Z (mm^3)
					Yield Strength, f_y (MPa)	Carbon Steel UTS, f_u (MPa)	
M20	240	225	32	232.4	420	520	540.9

Notes:
1) Used for Steel to Concrete Post-Installed Connections

OrbiPlate™ and ChemSet Anchor Stud Engineering Properties	Annex A 2
Product description OrbiPlate™ and ChemSet™ Anchor Stud	

Specifications of intended use

Anchorages subject to:

- Static and quasi-static load.
- Seismic load

Base materials

Steel to Concrete Connections

- Non-cracked and cracked concrete for bolted connections M20.
- Reinforced or unreinforced normal weight concrete of strength class f'c = 20 MPa at minimum and f'c = 50 MPa at maximum for use in construction in accordance with AS 5216:2026, AS 3600:2018 (A2) or NZS 3101:2006 (A3).

Design:

Steel to Concrete Connections

- Mechanical anchorage connections are designed in accordance with NZS 3101:2006 (A3) S17 or AS 5216:2026 under the responsibility of an engineer experienced in structural design and concrete work.
- Verifiable calculation notes and drawings are prepared taking into account the loads to be anchored. The position of the anchor or connection is indicated on the design drawings.
  .

Installation:

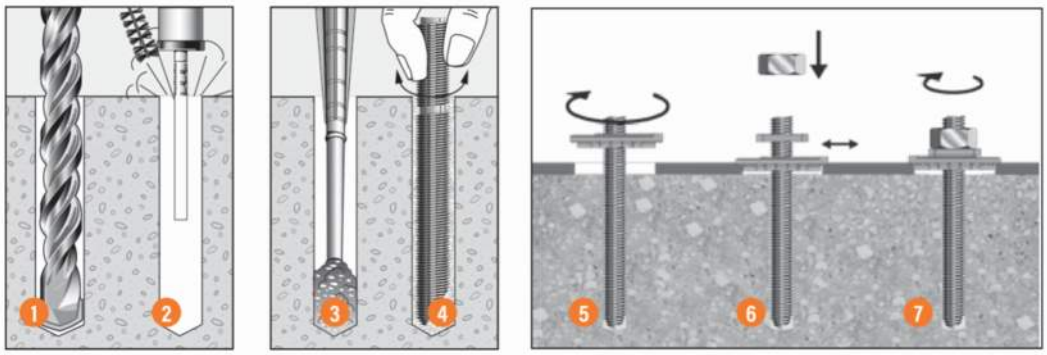
- Installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

OrbiPlate™ Components	**Annex B 1**
Intended use Specifications	

Installation Procedure

1.Steel to Concrete Connections

Installation



1. Drill recommended diameter and depth hole.
2. **Important:** For hammer drilling technique clean dust and debris from hole with stiff wire brush and blower in the following sequence: blow x 2, brush x 2, blow x 2, brush x 2, blow x 2. For diamond drilling technique refer to **ETA-25/0648.**
3. Screw mixing nozzle onto cartridge and dispense adhesive to waste until colour is uniform orange. Insert mixing nozzle to bottom of hole. Fill hole to 2/3 the hole depth slowly, ensuring no air pockets form.
4. Insert **Ramset**™ ChemSet™ Anchor Stud to bottom of hole while turning. Allow ChemSet™ Reo 502™ Xtrem™ to cure as per setting times.
5. Place the large washer in the 70mm fixture hole and rotate until the slot lines up with the M20 ChemSet Anchor Stud.
6. Move the small washer along slot until it aligns with the M20 ChemSet Anchor Stud.
7. Attach the nut and tighten to the specified torque.

ChemSet™ Reo 502™ Xtrem™ installation temperatures and curing detail

Recommended Installation Temperatures

	Minimum	Maximum
Substrate	5°C	40°C
Adhesive	5°C	40°C

Service Temperature Limits

T1: -40°C to +40°C
T2: -40°C to +60°C
T3: -40°C to +75°C

Curing detail

Temperature of base material	Gel Time	Curing time in dry concrete	Curing time in wet and flooded concrete
5°C	75 min	30h	60 h
10°C	45 min	22h	44 h
15°C	35 min	14h	28 h
20°C	22 min	7h	14 h
25°C	14 min	5h	10 h
30°C	8 min	4h	8 h
35°C	6 min	3h	6h
40°C	4 min	2h 45min	5h 30min

Table C1: Rotational & Longitudinal Shear Performance Steel to Concrete Connections

AS 3600:2018 (A2) S.19, NZS 3101:2006 (A3) S.17, AS 4100:2020 (A1) and NZS 3404.1:1997

OrbiPlate Post-installed System Part No.	ChemSet Anchor Stud Size	Effective Depth in concrete h_{ef} (mm)	No. (of samples tested)	Anchor Stud orientation and alignment	Plate Thickness t [mm]	Mean Test Results			Test report reference [ITW]
						Mode of Failure [MoF]	Shear Load Ultimate V_{us} [kN]	Peak Displacement Δd [mm]	
ORB2020PIAGH	M20 x G5.8	150	5	Vertically aligned bolt central	16	Steel/Stud Failure	96.5	21.6	TRR287
ORB2020PIAGH	M20 x Gr5.8	150	5	Vertically aligned bolt central	32	Steel/Stud Failure	112.1	29.1	TRR287
ORB2020PIAGH	M20 x Gr5.8	150	3[1)]	Vertically aligned bolt central	12	Steel/Stud Failure	95.4	18.71	TRR287
ORB2020PIAGH	M20 x Gr5.8	150	5	Horizontally aligned bolt offset extremity	16	Steel/Stud Failure	87.6	14.7	TRR287
ORB2020PIAGH	M20 x Gr5.8	150	1[1)]	Horizontally aligned bolt offset extremity	6	Steel/Stud Failure	106.8	11.7	TRR287
ORB2020PIAGH	M20 x Gr5.8	150	5	Horizontally aligned bolt offset extremity	32	Steel/Stud Failure	98.8	23.2	TRR287
ORB2020PIAGH	M20 x Gr5.8	100	3	Vertically aligned bolt central	32	Concrete Pryout	78.3	27.3	TRR339
ORB2020PIAGH	M20 x Gr5.8	100	5	Horizontally aligned bolt offset extremity	32	Steel/Stud[2)] Failure	82.7	23.2	TRR339

Notes:

1) Tested 5 samples, however only recorded results for 3 given on the last 2 specimens the test was stopped prematurely.

2) For 1 out of the 5 samples tested, the Mode of Failure was Concrete Pryout

3) For Static Shear tests graphs refer to Annex C4

Table C2: Rotational & Longitudinal Seismic C1 Steel Shear Performance

AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Seismic Category C1
(ACI 355.2)[4)] Seismic C1

Residual Shear Capacity

OrbiPlate Post-Installed System Part No.	Orientation Type	No. of samples tested	Anchor Stud orientation and alignment	Plate Thick's t [mm]	Mean Test Results			Seismic Load Shear V_{eq} [kN]	Ratio of $V_{res,m}/V_{eq}$[1)]	Test report ref. [SWUT]
					Mode of Failure [MoF]	Average residual shear capacity $V_{res,m}$ [kN]	Peak Displacement[2)] Δd [mm]			
ORB2020PIAGH	Longitudinal	5	Vertically aligned upwards bolt central	16	Steel serrated tooth washer	72.8	7.4	42.3	1.7	SWUT-Report Date Nov 2023
ORB2020PIAGH	Longitudinal	5	Vertically aligned upwards bolt central	32	Anchor Stud Shear	73.8	14.3	28.8	2.6	SWUT-Report Date Nov 2023
ORB2020PIAGH	Rotational	5	Horizontally aligned and bolt at extremity of slot	6	Anchor Stud Shear	108.6	4.7	42.3	2.6	SWUT-Report Date Nov 2023
ORB2020PIAGH	Rotational	5	Horizontally aligned and bolt at extremity of slot	16	Anchor Stud Shear	98.3	6.9	42.3	2.3	SWUT-Report Date Nov 2023
ORB2020PIAGH	Rotational	5	Horizontally aligned and bolt at extremity of slot	32	Anchor Stud Shear	78.3	11.9	28.8	2.7	SWUT-Report Date Nov 2023

Notes:

1) *Capacity Reduction Factor for Seismic C1 for the stated orientations is $\alpha_{V,C1}$ = 1.0 if $V_{res,m}/V_{eq} \geq 1.6$*
2) *Average displacements are derived from graphs in Swinburne University Report Date November 2023*
3) *For Cyclic Shear tests graphs (C1 Seismic), refer to Annex C5*
4) *The C1 seismic shear testing protocol in EOTA TR 049: 2016-08 is equivalent to the seismic shear testing protocol in ACI 355.2*

Table C3: Rotational & Longitudinal Seismic C2 Steel Shear Performance

AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Seismic Category C2

Residual Shear Capacity

OrbiPlate Post-Installed System Part No.	Orientation Type	No. of samples tested	Anchor Stud orientation and alignment	Plate Thick's t [mm]	Mean Test Results			Seismic Load Shear V_{max}[1)] [kN]	Ratio of $V_{res,m}/V_{max}$	Test report ref. [SWUT]
					Mode of Failure [MoF]	Average residual shear capacity $V_{res,m}$ [kN]	Peak Displacement [2)] Δd [mm]			
ORB2020PIAGH	Longitudinal	5	Vertically aligned upwards bolt central	16	Steel serrated tooth washer	78.3	6.9	31.9	2.5	SWUT-Report Date Nov 2023
ORB2020PIAGH	Longitudinal	5	Vertically aligned upwards bolt central	32	Anchor Stud Shear	91.2	16.5	31.9	2.9	SWUT-Report Date Nov 2023
ORB2020PIAGH	Rotational	5	Horizontally aligned and bolt at extremity of slot	6	Anchor Stud Shear	111.0	4.5	31.9	3.5	SWUT-Report Date Nov 2023
ORB2020PIAGH	Rotational	5	Horizontally aligned and bolt at extremity of slot	16	Anchor Stud Shear	99.8	7.1	31.9	3.1	SWUT-Report Date Nov 2023
ORB2020PIAGH	Rotational	5	Horizontally aligned and bolt at extremity of slot	32	Anchor Stud Shear	76.4	10.6	31.9	2.4	SWUT-Report Date Nov 2023

Notes:

1) For Seismic C2, V_{max} is calculated as per the following equation

$V_{max} = 0.85 * V_{um} * \alpha_{c2.4a}$

V_{um} = 62.5 kN from EAD testing for the corresponding European Technical Assessment

$\alpha_{c2.4a}$ = 0.6 from EAD testing for the corresponding European Technical Assessment

2) Average displacements are derived from graphs in Swinburne University Report Date November 2023

3) For Cyclic Shear tests graphs (C2 Seismic), refer to Annex C6

Graph C4: Rotational & Longitudinal Shear Performance Steel to Concrete Connections (Graph)

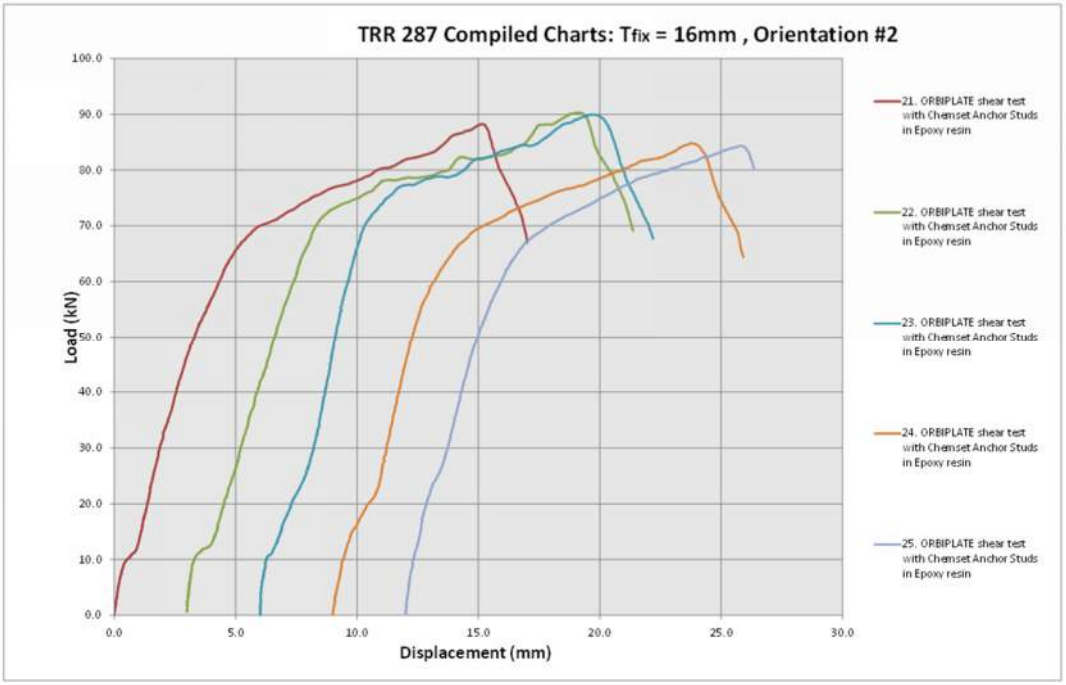
Shear Load vs Displacement Curve ORB2020PIAGH Longitudinal Vertically aligned upwards bolt central 16mm plate thickness, M20 ChemSet Anchor Stud

Shear Load vs Displacement Curve ORB2020PIAGH Longitudinal Vertically aligned upwards bolt central 32mm plate thickness, M20 ChemSet Anchor Stud

Graph C4: Rotational & Longitudinal Shear Performance Steel to Concrete Connections (Graph)

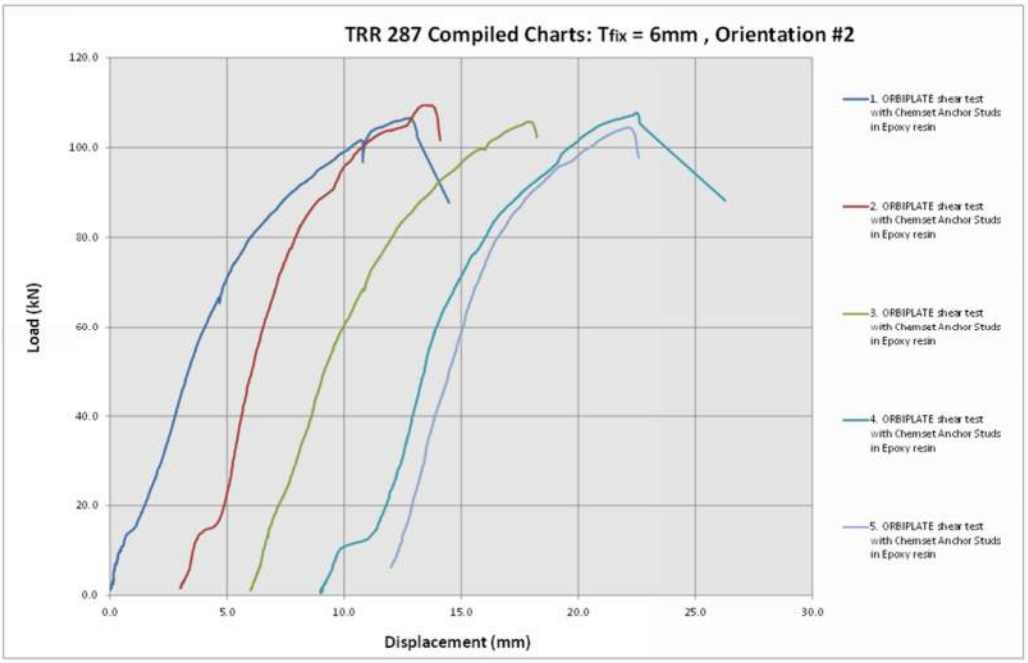
Shear Load vs Displacement Curve ORB2020PIAGH Longitudinal Vertically aligned upwards bolt central 12mm plate thickness, M20 ChemSet Anchor Stud

Shear Load vs Displacement Curve ORB2020PIAGH Rotational Horizontally aligned and bolt at extremity of slot 16mm plate thickness, M20 ChemSet Anchor Stud



Graph C4: Rotational & Longitudinal Shear Performance Steel to Concrete Connections (Graph)

Shear Load vs Displacement Curve ORB2020PIAGH Rotational Horizontally aligned and bolt at extremity of slot 6mm plate thickness, M20 ChemSet Anchor Stud



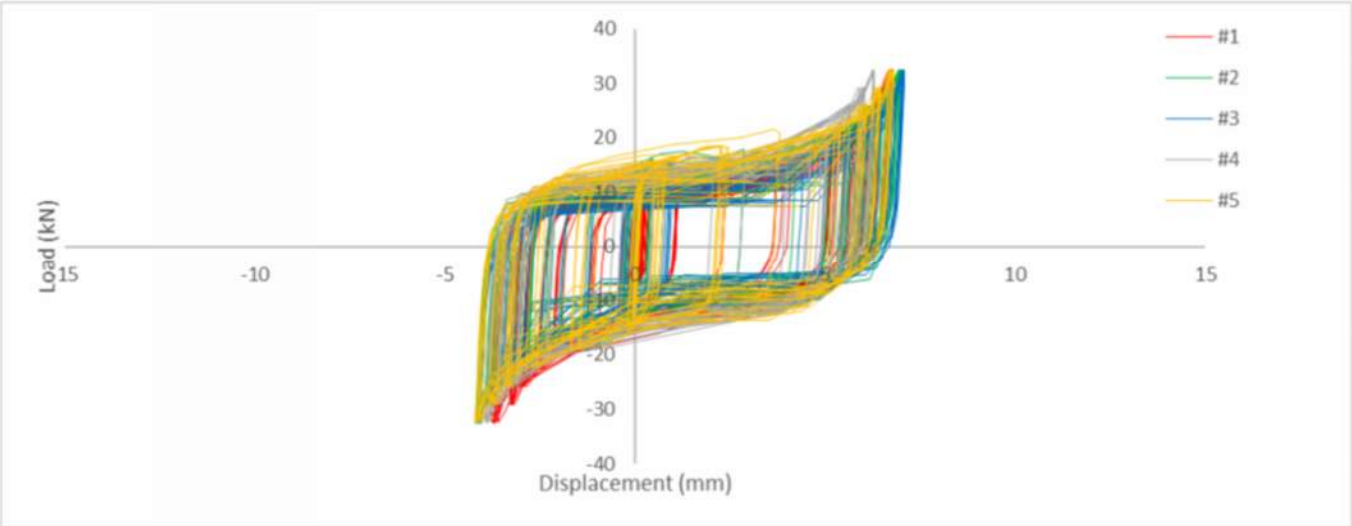
Shear Load vs Displacement Curve ORB2020PIAGH Rotational Horizontally aligned and bolt at extremity of slot 32mm plate thickness, M20 ChemSet Anchor Stud

Graph C4: Rotational & Longitudinal Shear Performance Steel to Concrete Connections (Graph)

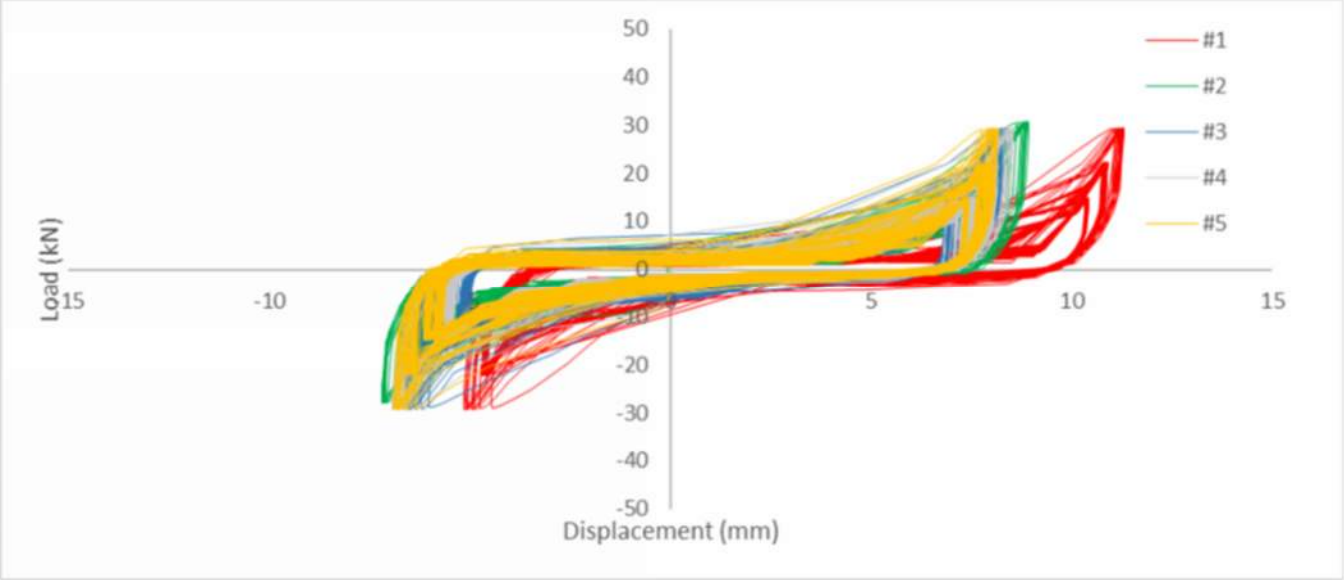
Shear Load vs Displacement Curve ORB2020PIAGH Rotational Horizontally aligned and bolt at extremity of slot 12mm plate thickness, M20 ChemSet Anchor Stud

Graph C5: Rotational & Longitudinal Seismic C1 Steel Shear Performance

Cyclic Loading for ORB2020PIAGH Longitudinal Vertically aligned upwards bolt central 16mm plate thickness, M20 ChemSet Anchor Stud



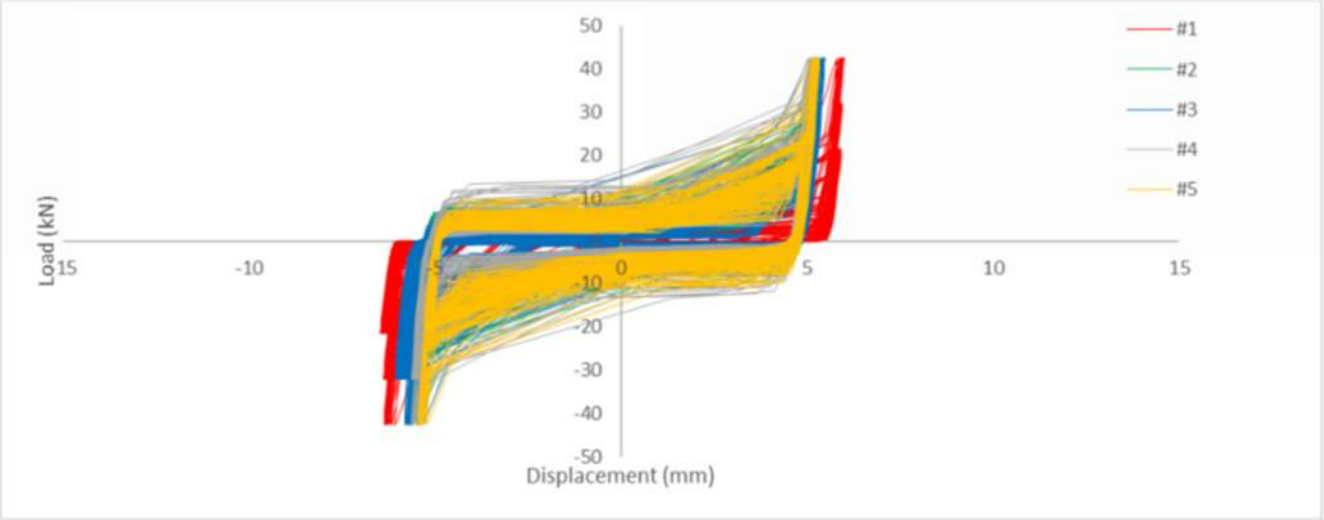
Cyclic Loading for ORB2020PIAGH Longitudinal Vertically aligned upwards bolt central 32mm plate thickness, M20 ChemSet Anchor Stud



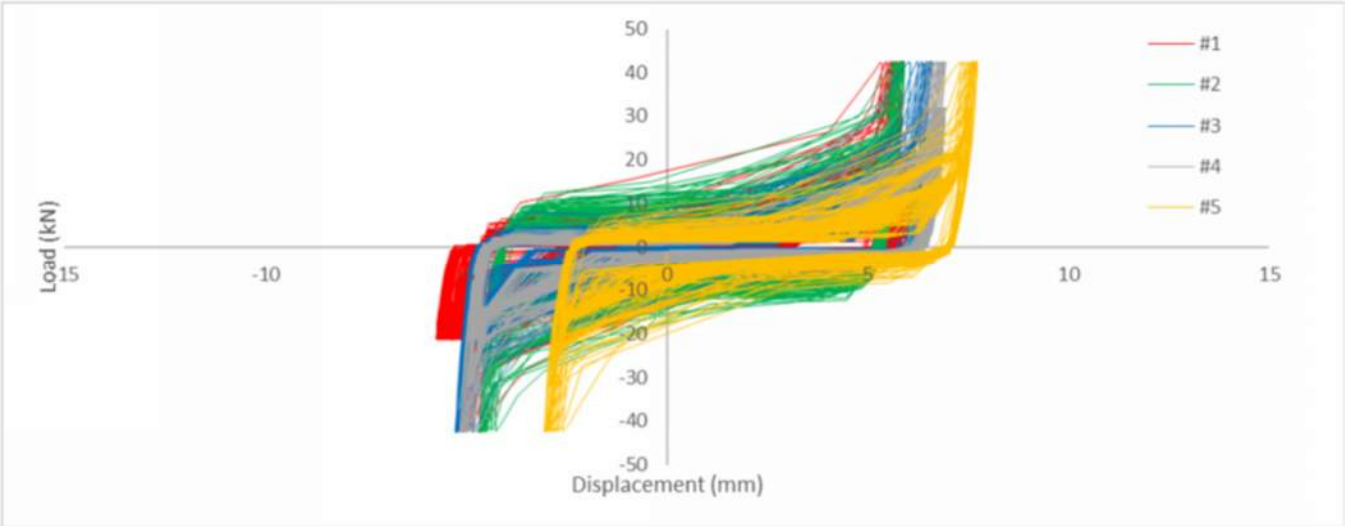
OrbiPlate™ Post-Installed Connection System (Steel Shear)	
Performances: Shear under seismic force (Graph) According to AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Cat.C1	**Annex C 5**

Graph C5: Rotational & Longitudinal Seismic C1 Steel Shear Performance

Cyclic Loading for ORB2020PIAGH Rotational Horizontally aligned and bolt at extremity of slot 6mm plate thickness, M20 ChemSet Anchor Stud

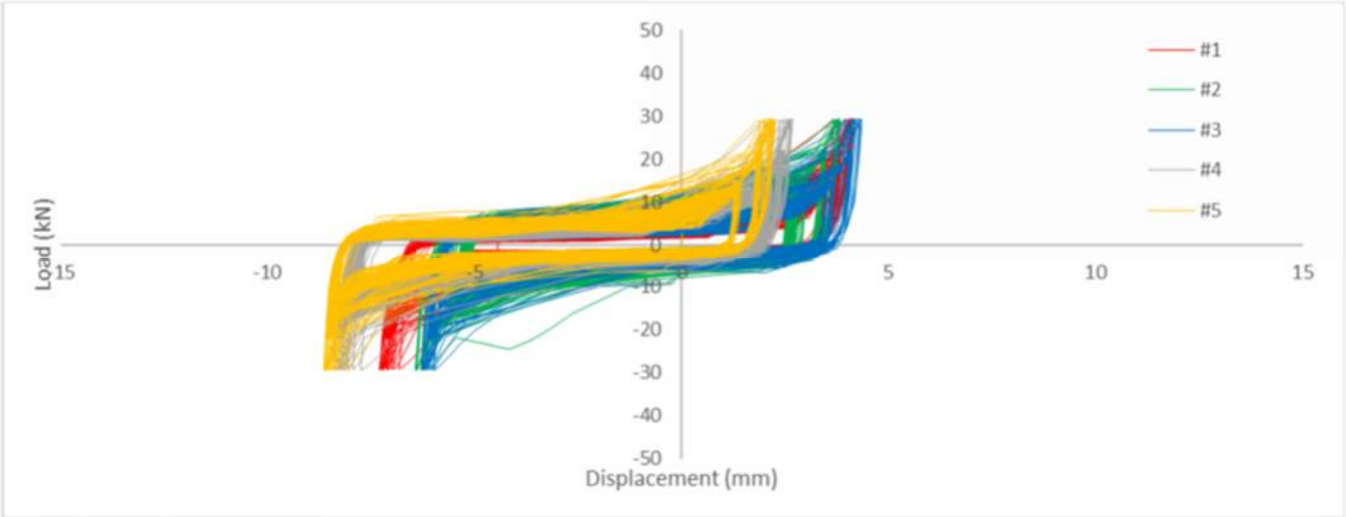


Cyclic Loading for ORB2020PIAGH Rotational Horizontally aligned and bolt at extremity of slot 16mm plate thickness, M20 ChemSet Anchor Stud



Graph C5: Rotational & Longitudinal Seismic C1 Steel Shear Performance

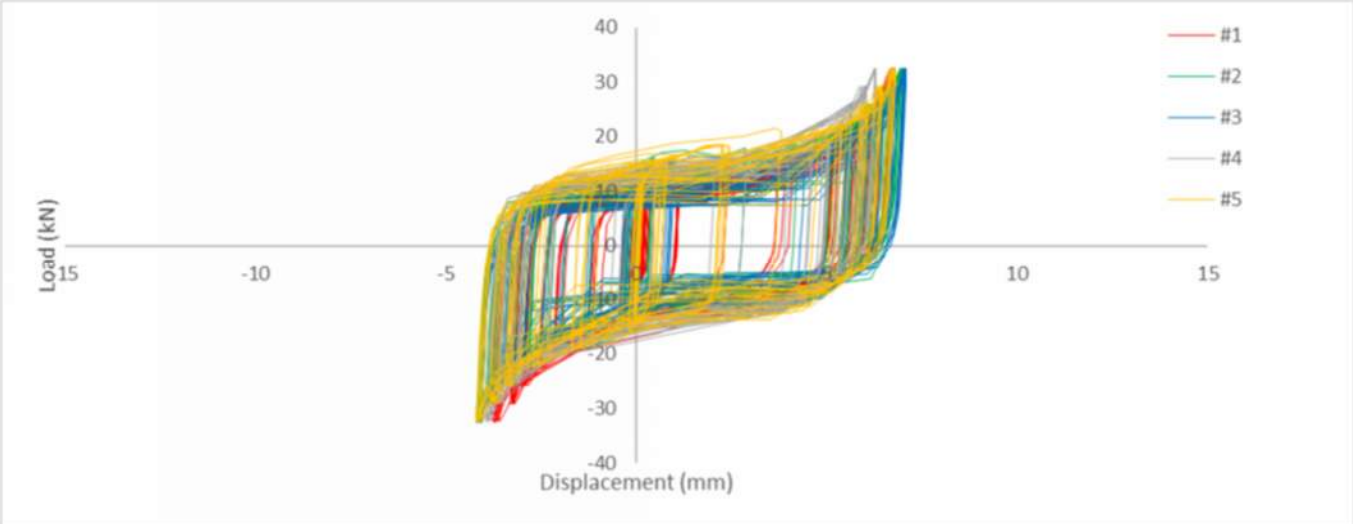
Cyclic Loading for ORB2020PIAGH Rotational Horizontally aligned and bolt at extremity of slot, 32mm plate thickness, M20 ChemSet Anchor Stud



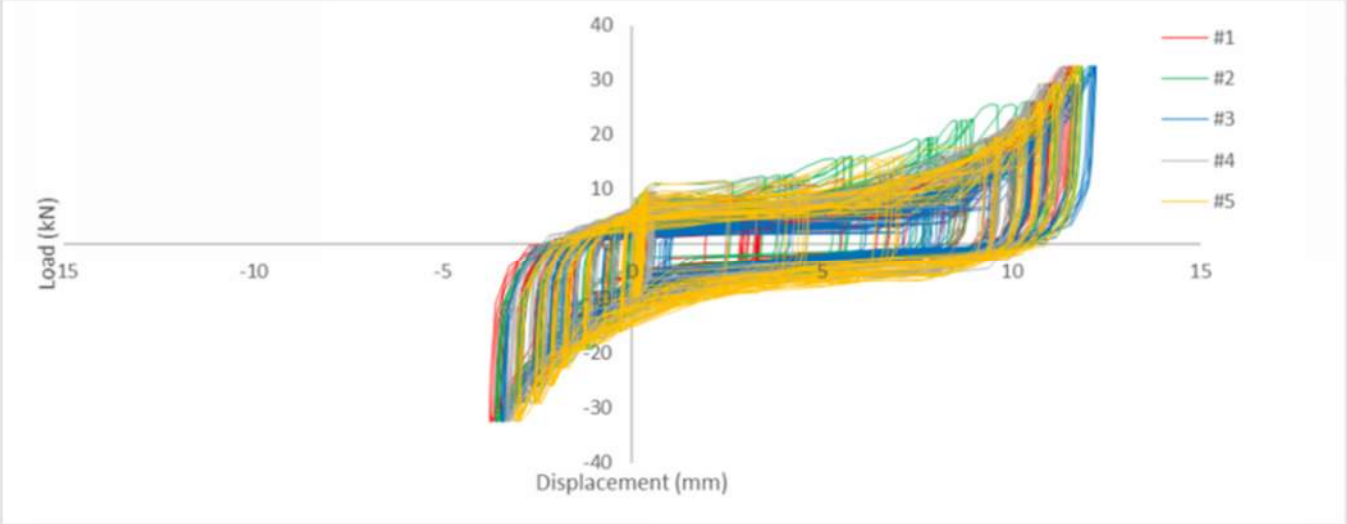
OrbiPlate™ Post-Installed Connection System (Steel Shear)	
Performances: Shear under seismic force (Graph) According to AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Cat.C1	**Annex C5**

Graph C6: Rotational & Longitudinal Seismic C2 Steel Shear Performance

Cyclic Loading for ORB2020PIAGH Longitudinal Vertically aligned upwards bolt central 16mm plate thickness, M20 ChemSet Anchor Stud



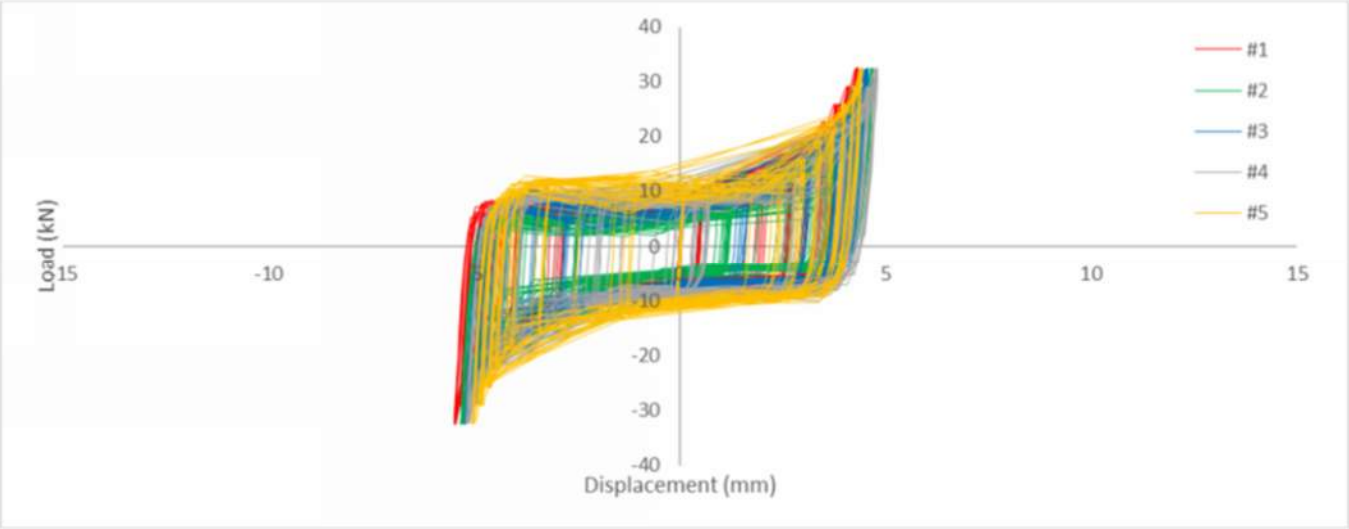
Cyclic Loading for ORB2020PIAGH Longitudinal Vertically aligned upwards bolt central 32mm plate thickness, M20 ChemSet Anchor Stud



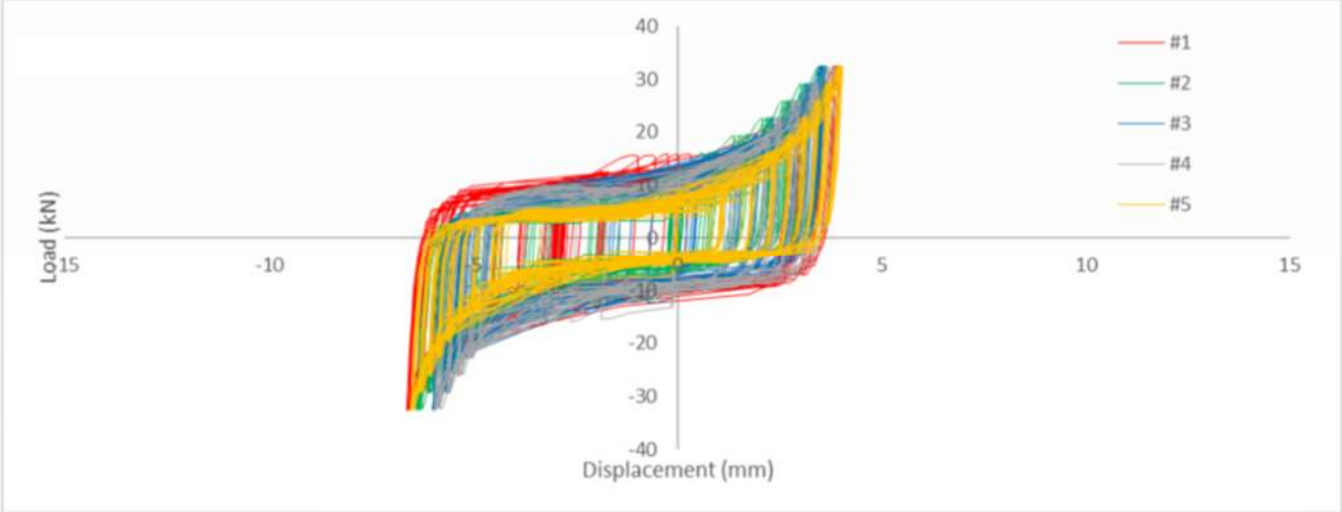
OrbiPlate™ Post-Installed Connection System (Steel Shear)	
Performances: Shear under seismic force (Graph) According to AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Cat.C2	**Annex C6**

Graph C6: Rotational & Longitudinal Seismic C2 Steel Shear Performance

Cyclic Loading for ORB2020PIAGH Rotational Horizontally aligned and bolt at extremity of slot 6mm plate thickness, M20 ChemSet Anchor Stud

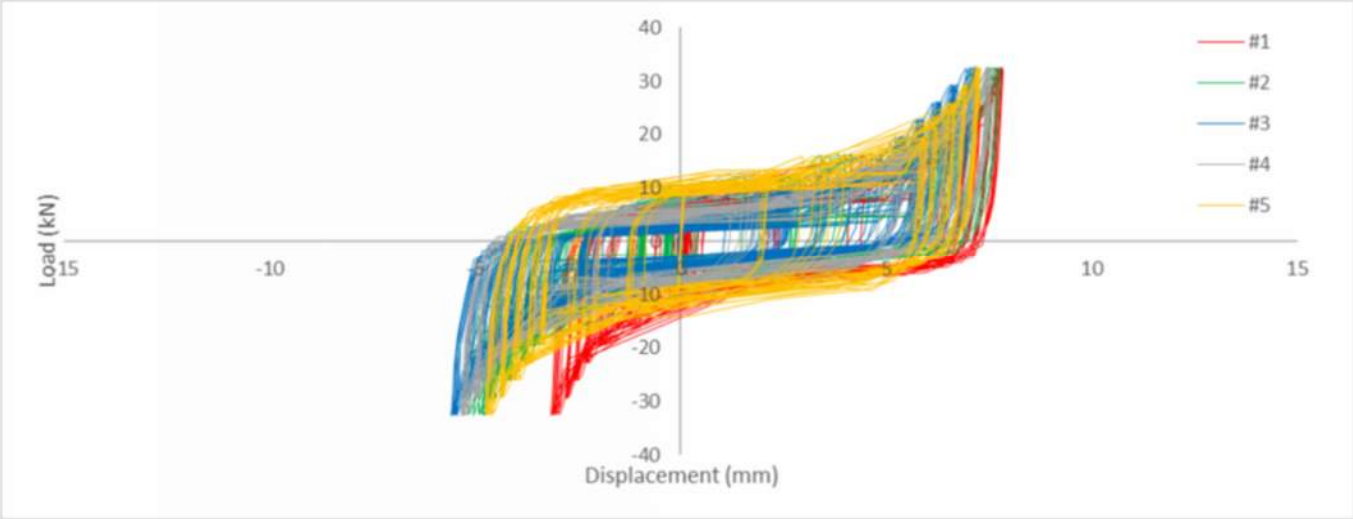


Cyclic Loading for ORB2020PIAGH Rotational Horizontally aligned and bolt at extremity of slot 16mm plate thickness, M20 ChemSet Anchor Stud



Graph C6: Rotational & Longitudinal Seismic C2 Steel Shear Performance

Cyclic Loading for ORB2020PIAGH Rotational Horizontally aligned and bolt at extremity of slot, 32mm plate thickness, M20 ChemSet Anchor Stud



OrbiPlate™ Post-Installed Connection System (Steel Shear)	**Annex C6**
Performances: Shear under seismic force (Graph) According to AS 4100:2020 (A1), NZS 3404.1:1997, EOTA TR 049: 2016-08 Cat.C2	

Table C7: Tensile Performance

Concrete

OrbiPlate Post-Installed System Part No.	ChemSet Reo 502 Xtrem Part No.	Effective Depth h_{ef} [mm]	Anchor Stud Size & Length [mm]	Capacity[2] Reduction Factor ϕ	Characteristic Ultimate Tensile Resistance[1, 4] in concrete where f'c = 20 MPa				
					Uncracked Concrete[3]		Cracked Concrete Seismic[3]		
					Bond N_{ucp} [kN]	Concrete Cone N_{ucc} [kN]	Category C1 Bond $N_{ucp,seis}$ [kN]	Category C2 Bond $N_{ucp,seis}$ [kN]	Category C1 & C2 Concrete Cone $N_{ucc,seis}$ [kN]
ORB2020PIAGH	CREO502X	100	M20 x 240	0.67	89.2	49.2	57.8	23.9	29.3
		150			133.8	90.4	86.7	35.8	53.8
		170			151.7	109.0	98.3	40.6	64.9

Notes:

1) *Characteristic Ultimate Tensile Resistance derived from European Technical assessment ETA 25/0648 of 03/03/2026 and AS 5216 or EN 1992-4*
2) *Capacity Reduction Factor needs to be applied to the Characteristic Ultimate Tensile Resistance to derive Design Capacity*
3) *The minimum of Bond and Concrete Cone Resistance should be used when deciding Design Capacity*
4) *All data is based on a single anchor configuration. For multiple anchor configurations, refer to AS 5216 or EN 1992-4*

Steel

OrbiPlate Post-Installed System Part No.	Anchor Stud Size & Length (mm)	Capacity[2] Reduction Factor ϕ	Characteristic Ultimate Tensile[1] Resistance	
			Static	Seismic C1 & C2
			Steel N_{us} [kN]	Steel N_{us} [kN]
ORB2020PIAGH	M20 x 240	0.67	122.5	122.5

Notes:

1) *Characteristic Ultimate Tensile Resistance taken from European Technical assessment ETA 25/0648 of 03/03/2026*
2) *Capacity Reduction Factor needs to be applied to the Characteristic Ultimate Tensile Resistance to derive Design Capacity*

General

- The resultant tensile performance is the minimum of the Steel and Concrete Resistances in the tables above
- The above tables do not take into consideration the concrete splitting resistance which will vary depending on the concrete element thickness