reid™

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Precast Connection

Application Examples

The following document contains user information with regard to Precast Connection Application Examples

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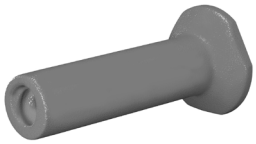
Introduction

RBA16TIS -
16mm ReidBar™
Steel Threaded Insert



ramsetreid™'s continued dedication to industry best practice has supported our latest iteration of innovative testing on common connections systems. The idea here was to better understand the performance of connections when the precast elements are subjected to the loads and forces you would expect during a seismic event.

This document provides examples of installation and performance details of ramsetreid products for a series of applications, including cantilevered wall to slab foundation connections, suspended floor to wall connections, and grouted metal duct connections. NZS3101:2006 A3 Compliance information on the couplers and anchorages is set out below.

NZS3101:2006 A3

The ReidBar couplers and anchorages referred to in this document have been tested and found to comply with the clauses below. The tests were conducted utilising Ramset™ Epcon™ C8 as a filler inside the couplers and anchorages. Refer to the ReidBar Steel Components Specification & Installation Guide for further installation information.

Section 8.7.5.2(b)

"Mechanical connections shall: ..... (b) when tested in tension or compression, as appropriate, to the application, exhibit a change in length at a stress of 0.7fy in the bar, measured over the length of the coupler, of less than twice that of an equal length of unspliced bar." [1]

Section 8.9.1.3(a) - Couplers Only

"For welded splices or mechanical connections to be used in members that are subjected to seismic forces, such splices shall comply with 8.7.4.1 or 8.7.5.2. In addition to the requirements of 8.7.5.2, mechanical splices and anchorages shall satisfy the cyclic load performance requirements specified by ISO 15835-1 and ISO 15835-2 as follows: (a) When tested in accordance with 5.6.2 of ISO 15835-2, the residual elongations after 4 cycles, u4,shall be less than 0.3 mm, and after 8 cycles u8 shall be less than 0.6 mm." [1]

Section 8.6.11.4

"Mechanical anchors for the anchorage of reinforcing steel shall be proven by an appropriate test method to possess resistance to brittle fracture at the service temperatures at which they are intended for use. Where the mechanical anchors and ends of the bars are threaded as the means of achieving the connection between components, and/or the end of the bar is enlarged by cold forging prior to threading, appropriate testing of the processed bar end shall be applied to ensure that the potential for brittle fracture is avoided. Anchors manufactured from cast iron shall not be used." [1]

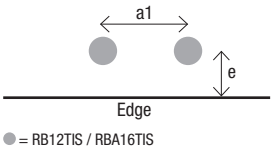
Compliance with Section 8.6.11.4 was demonstrated via. Charpy V Notch Testing to AS1544.2:2003.

Section 8.6.11.1

"For reinforcement complying with AS/NZS 4671, any mechanical device used alone as an anchorage, or used in combination with an embedment length beyond the point of maximum stress in the bar, shall be capable of developing the upper bound breaking strength of the reinforcing bar without damage to the concrete or overall deformation of the anchorage. In addition, when tested with a bar complying with AS/ NZS 4671, the mode of failure of the anchored bar shall be by ductile yielding of the bar, with the bar developing its ultimate tensile strength at a location outside the mechanical anchorage and away from any zone of the bar affected by working (e.g. by cold forging)." [1]

Compliance with Section 8.6.11.1 was achieved with the following product configurations:

Section 8.6.11.1 Product Configuration Table:

Product	Nailing Plate Thickness	Concrete Strength	Edge Distance, e (mm)	Spacing, a1 (mm)	Configuration
RB12TIS	8mm	40MPa	120	300	
RBA16TIS	42mm	40MPa	180	350	

Testing Condition: Uncracked Concrete with products in pairs.

Please Note: **This document is intended for use by Professional Structural Engineers, and the examples provided herein do not remove the need for detailed design by these Professionals.**

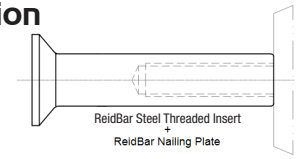
[1] Reference: NZS3101:2006 Amendment 3 2018

Application Examples Summary Table

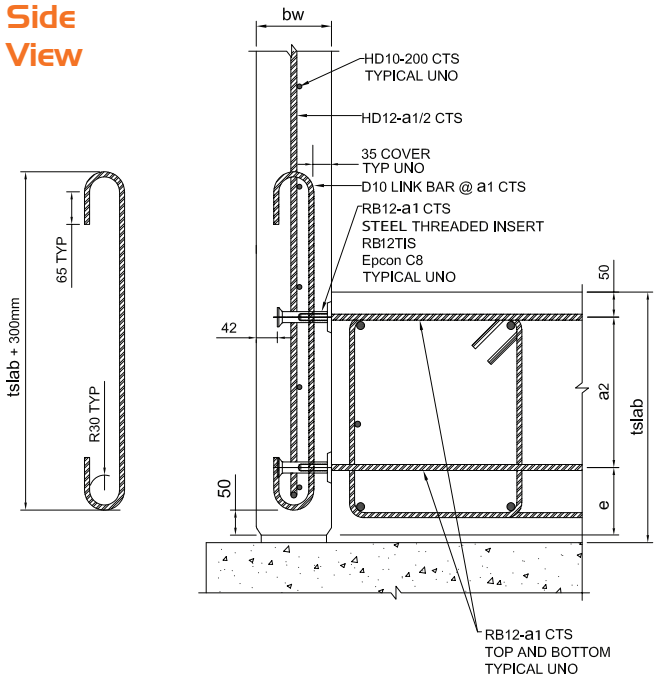
Connection Description	Application	ReidBar™ or Reinforcing Components
Application 1: Cantilevered Connection for Precast Panel 150mm thick	Precast Panel wall to slab connection - Single level concrete structure	**RB12TIS** - 12mm ReidBar Steel Threaded Inserts **RB12NP** - 12mm ReidBar Nailing Plates **RB12 ReidBar Starter Bar** D10 Link Bar to drawing
Application 2: Cantilevered Connection for Precast Panel 200mm thick	Precast Panel wall to slab connection - first level for multilevel concrete structure	**RBA16TIS** - 16mm ReidBar Steel Threaded Inserts **RBA16NP** - 16mm ReidBar Nailing Plates **RBA16 ReidBar Starter Bar** R10 Link Bar to drawing
Application 3: Suspended Floor Connection for Precast Panel 200mm thick	Precast Panel wall to floor connection - for multilevel concrete structures	**RBA16TIS** - 16mm ReidBar Steel Threaded Inserts **RBA16NP** - 16mm ReidBar Nailing Plates **RBA16 ReidBar Starter Bar** R10 Link Bar to drawing
Application 4: Grouted Metal Duct Connection for Precast for 150mm, 175mm and 190mm panel thickness	Precast Panel to Precast Panel /Foundation horizontal structural joint	**HD12** & Ø50mm Drossbach x 650mm long **HD16** & Ø60mm Drossbach x 860mm long **HD20** & Ø60mm Drossbach x 1050mm long **HD20** & Ø70mm Drossbach x 1050mm long Reinforcing Bar Gr500E Ramset Premier Grout MP
Application 5: Grouted Metal Duct Connection for Precast for 200mm 225mm and 250mm panel thickness	Precast Panel to Precast Panel /Foundation horizontal structural joint	**HD16** & Ø60mm Drossbach x 860mm long **HD20** & Ø70mm Drossbach x 1100mm long **HD25** & Ø70mm Drossbach x 1300mm long **HD32** & Ø70mm Drossbach x 1600mm long Reinforcing Bar Gr500E Ramset Premier Grout MP

Application 1: Cantilevered Connection

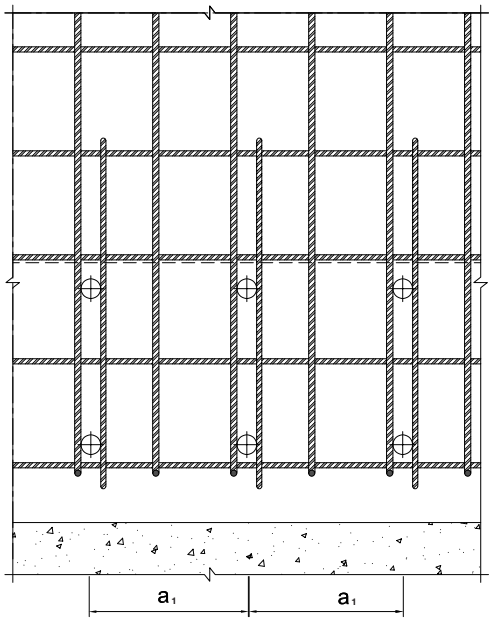
12mm ReidBar™ Steel Threaded Insert (RB12TIS) Detail for 150mm thick precast panel



Side View



Front View



Installation and performance details (out of plane actions - per anchor)

ReidBar Threaded Insert Size	Anchor Effective Depth, h (mm)	Anchor Spacing		Edge distance, e (mm)	Concrete Slab thickness, t_{SLAB} (mm)	Min. Precast Concrete Panel thickness, b_w (mm)	Reduced Characteristic Capacity#		
							Gr500E Steel		Concrete
		a_1 (mm)	a_2 (mm)				Shear, $ØV_{us}$ (kN)*	Tension, $ØN_{us}$ (kN)***	Tension, $ØN_{uc}$ (kN)** Conc. Strength 40 MPa
RB12TIS + 8mm thick Nailing Plate & EPCON C8	104	300	300	120	470	150	25.3	42.4	44.9##
		300	300	150	500				51.8
		350	300	150	500				54.4

Please Note:

*Note: Reduced characteristic ultimate steel shear capacity = $ØV_{us}$ where Ø = 0.65 and V_{us} = characteristic minimum ultimate steel shear capacity. Concrete Shear capacities can be derived by calculation in accordance with Chapter 17 of NZS3101:Part 1: 2006 A3.

**Note: Reduced characteristic ultimate concrete tensile capacity = $ØN_{uc}$ where Ø = 0.65 and N_{uc} = Characteristic ultimate concrete tensile capacity.

***Note: Reduced characteristic ultimate steel tensile capacity = $ØN_{us}$ = $Øf_{sy}$ where Ø = 0.75 and f_{sy} = characteristic yield steel tensile capacity

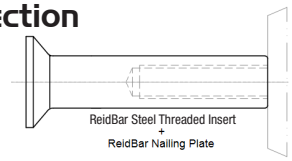
#Note: Design Tensile Capacity $ØN_{ur}$ = minimum of $ØN_{uc}$ and $ØN_{us}$

##Note: This data has been derived through testing at ramsetreid facility, independently witnessed by Melbourne Testing Services, a NATA accredited laboratory. All other data is derived by calculation in accordance with Chapter 17 of NZS3101:Part 1:2006 A3.

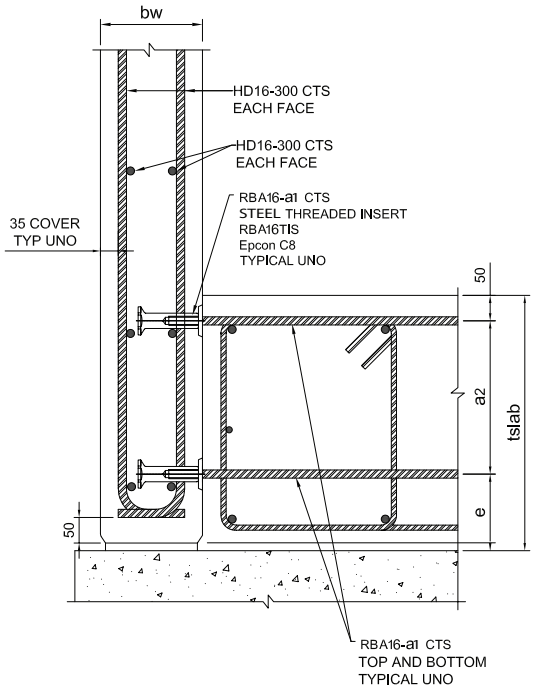
General Note: All data is based on uncracked concrete. For cracked concrete performance, multiply $ØN_{uc}$ x 0.79

Application 2: Cantilevered Connection

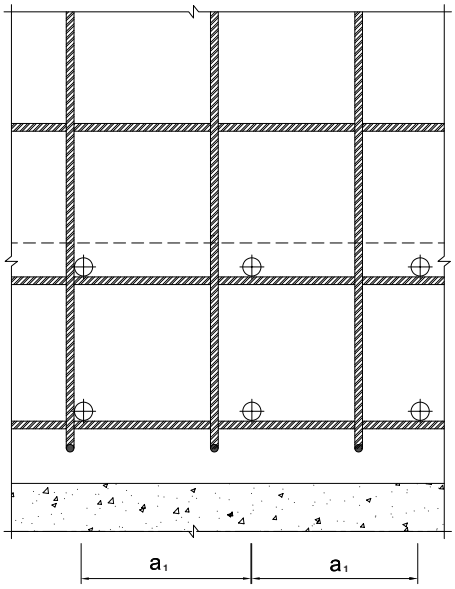
16mm ReidBar™ Steel Threaded Insert (RBA16TIS)
Detail for 200mm thick precast panel



Side View



Front View



Installation and performance details (out of plane actions - per anchor)

ReidBar Threaded Insert Size	Anchor Effective Depth, h (mm)	Anchor Spacing		Edge distance, e (mm)	Concrete Slab thickness, t_{SLAB} (mm)	Min. Precast Concrete Panel thickness, b_w (mm)	Reduced Characteristic Capacity#		
							Gr500E Steel		Concrete
		a_1 (mm)	a_2 (mm)				Shear, $ØV_{us}$ (kN)*	Tension, $ØN_{us}$ (kN)***	Tension, $ØN_{uc}$ (kN)** Conc. Strength 40 MPa
RBA16TIS + 8mm thick Nailing Plate & EPCON C8	121	350	300	180	530	200	45.1	75.4	73.5##

Please Note:

*Note: Reduced characteristic ultimate steel shear capacity = $ØV_{us}$ where Ø = 0.65 and V_{us} = characteristic minimum ultimate steel shear capacity. Concrete Shear capacities can be derived by calculation in accordance with Chapter 17 of NZS3101:Part 1: 2006 A3.

**Note: Reduced characteristic ultimate concrete tensile capacity = $ØN_{uc}$ where Ø = 0.65 and N_{uc} = Characteristic ultimate concrete tensile capacity.

***Note: Reduced characteristic ultimate steel tensile capacity = $ØN_{us}$ = $Øf_{sy}$ where Ø = 0.75 and f_{sy} = characteristic yield steel tensile capacity

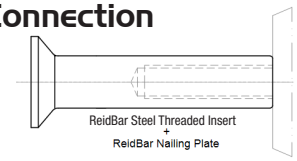
#Note: Design Tensile Capacity $ØN_{ur}$ = minimum of $ØN_{uc}$ and $ØN_{us}$

##Note: This data has been derived through testing at ramsetreid facility, independently witnessed by Melbourne Testing Services, a NATA accredited laboratory.

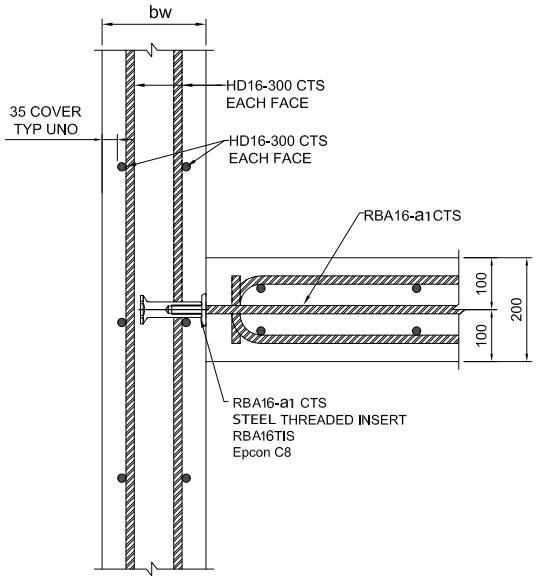
General Note: All data is based on uncracked concrete. For cracked concrete performance, multiply $ØN_{uc}$ x 0.63

Application 3: Suspended Floor Connection

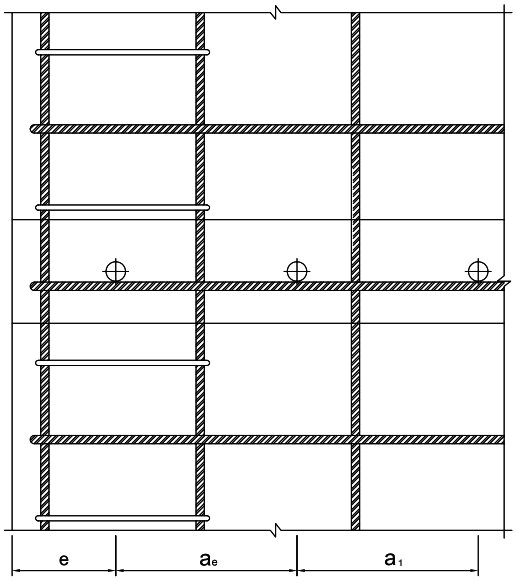
16mm ReidBar™ Steel Threaded Insert (RBA16TIS)
Detail for 200mm thick precast panel



Side View



Front View



Installation and performance details (out of plane actions - per anchor)

ReidBar Threaded Insert Size	Anchor Effective Depth, h (mm)	Anchor Spacing		Edge distance, e (mm)	Min. Precast Concrete Panel thickness, b_w (mm)	Reduced Characteristic Capacity#		
						Gr500E Steel		Concrete
		a_e (mm)	a_1 (mm)			Shear, $ØV_{us}$ (kN)*	Tension, $ØN_{us}$ (kN)***	Tension, $ØN_{uc}$ (kN)** Conc. Strength 40 MPa
RBA16TIS + 8mm thick Nailing Plate & EPCON C8	121	350	350	180	200	45.1	75.4	73.5##

Please Note:

*Note: Reduced characteristic ultimate steel shear capacity = $ØV_{us}$ where Ø = 0.65 and V_{us} = characteristic minimum ultimate steel shear capacity. Concrete Shear capacities can be derived by calculation in accordance with Chapter 17 of NZS3101:Part 1: 2006 A3.

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***Note: Reduced characteristic ultimate steel tensile capacity = $ØN_{us}$ = $Øf_{sy}$ where Ø = 0.75 and f_{sy} = characteristic yield steel tensile capacity

#Note: Design Tensile Capacity $ØN_{ur}$ = minimum of $ØN_{uc}$ and $ØN_{us}$

##Note: This data has been derived through testing at ramsetreid facility, independently witnessed by Melbourne Testing Services, a NATA accredited laboratory.

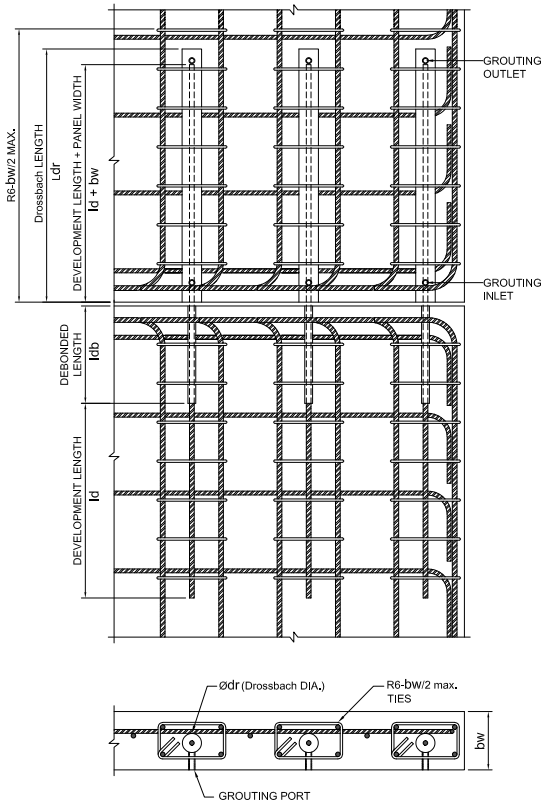
General Note: All data is based on uncracked concrete. For cracked concrete performance, multiply $ØN_{uc}$ x 0.63

Application 4: Grouted Metal Duct Connection

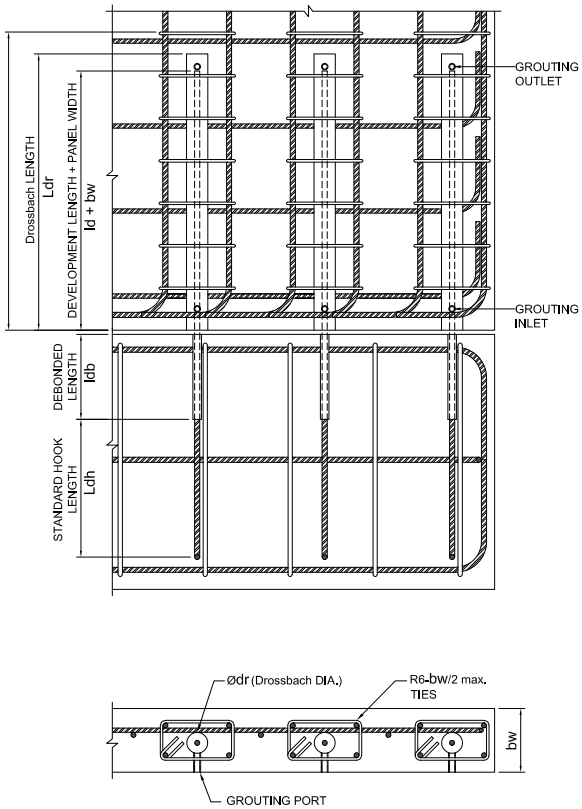
Drossbach Detail for 150mm, 175mm & 190mm thick precast panel

Drossbach 

Panel to Panel



Panel to Slab/Foundation



Installation and performance details (per anchor)

Panel Thickness b_w (mm)	Reinforcing Bar Details Concrete Strength f'c = 40 MPa			Drossbach Details	
	Rebar Diameter d_b (mm)	Reinforcing Bar development length l_d (mm)*	Gr500E Reinforcing Bar Yield Strength f_{sy} (kN)	Drossbach Diameter $Ø_{dr}$ (mm)	Drossbach Length L_{dr} (mm)
150	12	474	56.5	50	650
150	16	632	100.5	50	830
175	16	632	100.5	60	860
175	20	790	157.0	60	1050
190	16	632	100.5	60	860

Note:

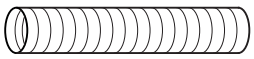
1. Reinforcement detailing as per SESOC Interim Design Guidance (Version No. 9 - 26 March 2013) [2]
2. *"It is recommended that the minimum grout strength be 10 MPa greater than that of the surrounding concrete"* [3]

*l_d as per Section 8.6.3.2 of NZS3101:Part 1: 2006 A3

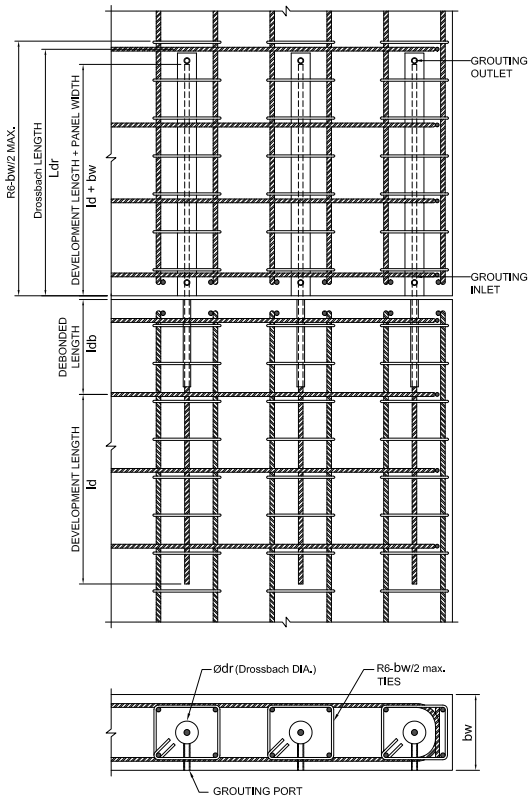
[2] **Reference:** SESOC Interim Design Guidance (Version No. 9 -26 March 2013). [3] **Reference:** Guidelines for the Use of Structural Precast Concrete in Buildings (Second Edition December 1999)

Application 5: Grouted Metal Duct Connection

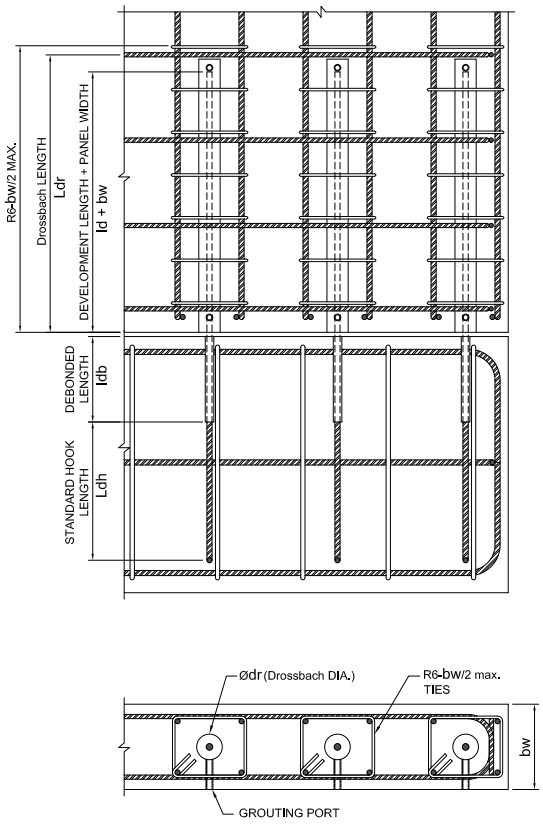
Drossbach Detail for 200mm, 225mm & 250mm thick precast panel

Drossbach 

Panel to Panel



Panel to Slab/Foundation



Installation and performance details (per anchor)

Panel Thickness b_w (mm)	Reinforcing Bar Details Concrete Strength f'c = 40 MPa			Drossbach Details	
	Rebar Diameter d_b (mm)	Reinforcing Bar development length l_d (mm)*	Gr500E Reinforcing Bar Yield Strength f_{sy} (kN)	Drossbach Diameter $Ø_{dr}$ (mm)	Drossbach Length L_{dr} (mm)
200	16	632	100.5	60	860
200	20	790	157.0	70	1050
225	16	632	100.5	60	860
225	20	790	157.0	70	1100
250	25	988	245.5	70	1300
250	32	1265	308.0	70	1600

Note:

1. Reinforcement detailing as per SESOC Interim Design Guidance (Version No. 9 - 26 March 2013) [2]
2. *"It is recommended that the minimum grout strength be 10 MPa greater than that of the surrounding concrete"* [3]

*l_d as per Section 8.6.3.2 of NZS3101:Part 1: 2006 A3

[2] **Reference:** SESOC Interim Design Guidance (Version No. 9 -26 March 2013). [3] **Reference:** Guidelines for the Use of Structural Precast Concrete in Buildings (Second Edition December 1999)

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