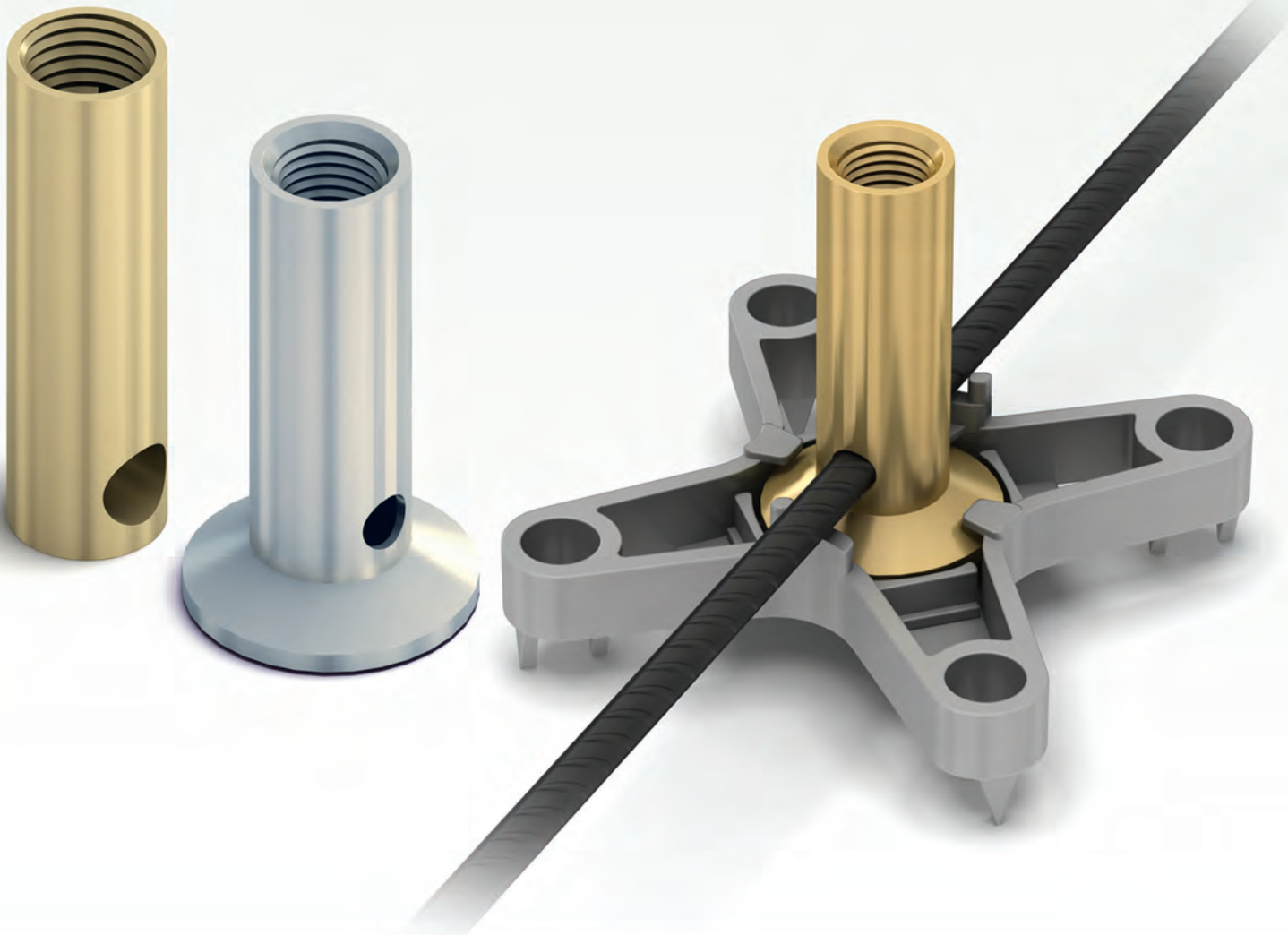


# QwikFoot and QwikFix Threaded Inserts

## Design Guide



**COMPLIANT**  
AS 3850.1:2015



September 2020

**Ancon®**

# Leviat

We imagine, model and make engineered products and innovative construction solutions that help turn architectural visions into reality and enable our construction partners to build better, safer, stronger and faster.

**Leviat is a world leader in connecting, fixing, lifting and anchoring technology.**

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We provide technical design assistance at every stage of a project, from initial planning to installation and beyond.

Our technical support services range from simple product selection through to the development of a fully customised project-specific design solution.

Every promise we make locally, has the commitment and dedication of our global team behind it. We employ almost 3,000 people at 60 locations across North America, Europe and Asia-Pacific, providing an agile and responsive service worldwide.

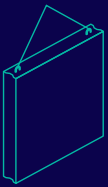




**>3,000**  
People

**60+**  
Locations

**~20**  
Countries

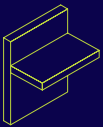


### Lifting & Bracing

Systems for the safe and efficient transportation, lifting and temporary bracing of cast concrete elements and tilt-up panels before permanent structural connections are made.

- Precast Lifting
- Tiltup Lifting
- Bracing & Anchorage

### Other areas of expertise:



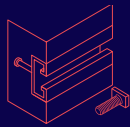
#### Structural Connections

Systems to form robust, efficient connections, and continuity of concrete reinforcement as necessary, between walls, slabs, columns, beams and balconies, providing structural integrity as well as enhanced thermal and acoustic performance.



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Systems for the safe and thermally-efficient fixing of the external building envelope, including brick and natural stone, insulated sandwich panels, curtain walling and suspended concrete façades, and also the repair and strengthening of existing masonry installations.



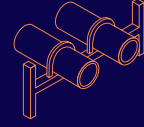
#### Anchoring & Fixing

Systems for fixing secondary fixtures to concrete, including anchor channels, bolts and inserts; also tension rod systems for roofs and canopies.



#### Formwork & Site Accessories

Non-structural accessories that complement our engineered solutions and help keep your construction environment operating safely and efficiently, including moulds for casting standard and special concrete elements and construction essentials such as reinforcing bar spacers.



#### Industrial Technology

Mounting channels, pipe clamps and other versatile framing systems that provide safe fixing in a wide range of industrial applications.

### Leviat product ranges:

Ancon | Aschwanden | Connolly | Halfen | Helifix | Isedio | Meadow Burke | Modersohn | Moment | Plaka | Scaldex | Thermomass

# Threaded Inserts and Accessories



## Ancon QwikFoot and QwikFix Cast-in Inserts (ferrules)

Leviat provides a wide range of Threaded Inserts to be used in precast panels. QwikFoot threaded inserts provide a safe load transfer through a forged head and thus do not require a crossbar to transfer loads. QwikFix inserts are made from solid steel and have a cross hole. The anchorage is provided by a crossbar being fed through this hole. Ferrules are available with metric threads from M10 to M24 and Unicoil threads UC16. The inserts are available in zinc plated or hot-dip galvanized G350 steel and stainless steel grade 316. We provide nailing plates to safely attach the inserts to the formwork and avoid ingress of concrete. Precast Chairs are available to simplify the installation and keep the inserts in place while casting.



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# Applications

Cast-in, threaded inserts are used for two distinct applications in precast concrete elements:

## The attachment of permanent structural fixtures

Metric threaded inserts with M12, M16 and M20 threads are used in combination with Grade 4.6 or 8.8 bolts. For this application the capacities are calculated from the characteristic strength of insert and bolt using capacity reduction factors in accordance with AS 3600 and AS 4100 i.e. the design capacity  $R_d = fR_u$

## The attachment of temporary braces and strongbacks

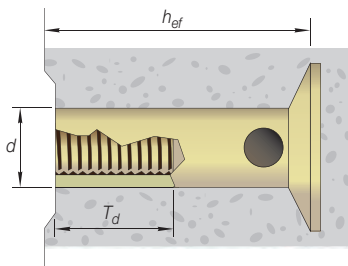
For the erection of precast concrete elements using M20 Grade 4.6 bolts or Unicoil bolts. These applications are designed using the Working Load Limit (WLL) method in accordance with AS 3850:2015 where the WLL is determined from the characteristic strength of the insert and bolt using a Factor of Safety (FoS) not less than 2.25 i.e.  $WLL = R_u / 2.25$



# QwikFoot Threaded Inserts

QwikFoot inserts are heavy duty, hot forged inserts with a large foot for high strength anchorage to concrete.

- Applicable for all structural connections using Grade 4.6 and 8.8 metric bolts
- Available with Unicoil threads for fast connection of braces and strongbacks
- Cross-holed to fit a bar for positive tie-in to reinforcing to prevent movement during concrete pouring and vibration (not to increase the capacity of the insert)
- Easily installed with the click-in QwikFoot Precast Chair, nailing plate or antenna cap according to requirements
- The large diameter foot develops full anchorage capacity without requiring a crossbar
- Develops full strength for 'Puddle-in' applications



## QwikFoot Dimensions and Part Codes

Internal Thread Size	Length L mm	Body Diameter d mm	Eff. Embement Depth * h <sub>ef</sub> mm	Thread Depth T <sub>d</sub> mm	Crosshole Diameter C <sub>d</sub> mm	Crossbar for Tying mm	Foot Diameter F <sub>d</sub> mm	Part Code Zinc Plated	Part Code Galvanised	Part Code T316 Stainless
M10	50	16	55	25	11	R10	35	FF1050Z	FF1050G	FF1050S316
M12	50	20	55	25	11	R10	35	FF1250Z	FF1250G	FF1250S316
M12	70	20	75	30	11	R10	50	FF1270Z	FF1270G	FF1270S316
M12	96	20	101	30	11	R10	50	FF1296Z	FF1296G	FF1296S316
M16	70	25	75	35	11	R10	50	FF1670Z	FF1670G	FF1670S316
M16	96	28	101	35	15	N12	50	FF1696ZH	-	-
M16	96	25	101	40	11	R10	50	-	FF1696G	FF1696S316
M20	70	28	75	30	15	N12	50	FF2070ZH	FF2070G	FF2070S316
M20	96	28	101	50	15	N12	50	FF2096ZH	FF2096G	FF2096S316
M20	120	28	125	50	15	N12	50	FF20120ZH	FF20120G	-
M24	96	36	101	45	15	N12	50	FF2496Z	-	FF2496S316
M24	96	40	101	45	20	N12 / N16	50	-	FF2496G	-
<b>QwikFoot Unicoil Bracing Insert</b>										
UC16	96	28	101	50	15	N12	50	UCQF1696Z	-	-

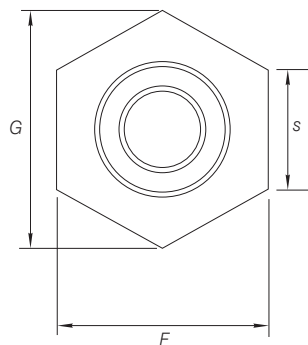
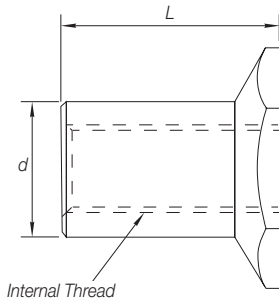
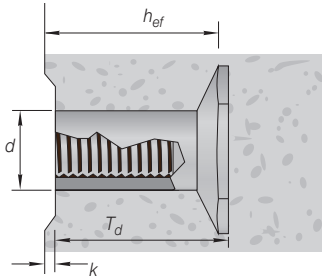
\* Includes 8mm for the nailing plate



## Short QwikFoot Threaded Inserts

Short QwikFoot inserts are heavy duty, hot forged inserts with a large hex foot for high strength anchorage to concrete.

- Applicable for all structural connections using Grade 4.6 and 8.8 metric bolts
- Easily installed with nailing plate or antenna cap according to requirements. Short QwikFoots do not match with QwikFoot Precast Chair.
- The large hex foot develops full anchorage capacity without requiring a crossbar
- Develops full strength for 'Puddle-in' applications



### Short QwikFoot Dimensions and Part Codes

Internal Thread Size	Length L mm	Body Diameter d mm	Eff. Embedment Depth * h <sub>ef</sub> mm	Thread Depth T <sub>d</sub> mm	Max. Foot Width G mm	Min. Foot Width F mm	Hex Side Length s mm	Part Code Galvanised	Part Code T316 Stainless
M12	45	28	50	42	50	43.3	25	FF1245G	FF1245S316
M16	45	28	50	42	50	43.3	25	FF1645G	FF1645S316
M20	45	28	50	42	50	43.3	25	FF2045G	FF2045S316

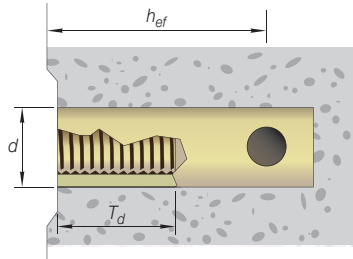
\* Includes 8mm for the nailing plate



## QwikFix Threaded Inserts

QwikFix inserts are medium duty, round bodied inserts, machined and cross-holed from solid G350 steel.

- Popular for medium duty Grade 4.6 metric bolt connections
- Available with Unicoil threads for quick connection of braces and strongbacks
- Cross-holed to fit an N12 bar. This bar should be minimum 300mm long for effective concrete anchorage
- May be installed with a Super Chair, nailing plate or antenna cap according to requirements
- Tension capacity limited by the shear resistance of the inserted N12 crossbar



Double ended ferrule

### QwikFix Dimensions and Part Codes

Internal Thread M Size	Length L mm	Body Diameter d mm	Eff. Embedment Depth * $h_{ef}$ mm	Thread Depth $T_d$ mm	Crosshole Diameter $C_d$ mm	Crossbar for Tying mm	Part Code Zinc Plated	Part Code Galvanised
M12	96	28	89	25	15	N12	FER1296Z	FER1296G
M16	76	28	69	35	15	N12	FER1676Z	-
M16	96	28	89	35	15	N12	FER1696Z	-
M16	96	28	89	55	15	N12	-	FER1696G
M20	76	28	69	35	15	N12	FER2076Z	-
M20	96	28	89	40	15	N12	FER2096Z	-
M20	96	28	89	55	15	N12	-	FER2096G

### Unicoil thread Bracing Insert

UC16	96	28	89	50	15	N12	FERB3496Z	-
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\* Includes 8mm for the nailing plate

### QwikFix Double Ended Inserts Dimensions and Part Codes

M16	140	28	70	40	15	N12	FERD16140Z	-
M16	170	28	85	40	15	N12	FERD16170Z	-
M16	190	28	95	40	15	N12	FERD16190Z	-
M20	140	28	70	40	15	N12	FERD20140Z	-
M20	165	28	82	40	15	N12	FERD20165Z	-
M20	170	28	85	40	15	N12	FERD20170Z	-
M20	190	28	95	40	15	N12	FERD20190Z	-

### Design of QwikFix Double Ended Inserts:

For the design loads and Working Load Limits of Double Ended Inserts please refer to the steel capacities and the concrete capacities for QwikFix Threaded Inserts with similar thread and similar  $h_{ef}$ , (for FERD16140Z refer to FER1676Z, for FERD20190Z refer to FER2096Z).

# Threaded Inserts and Accessories

## Manufacture and Materials

Ancon threaded inserts are manufactured from G350 structural steel or T316 A4 stainless steel. These are ductile steels, ideal for tension, shear and moment carrying structural connections.

### Material Selection

- **Zinc Electroplated** (5 $\mu$  coating thickness) – for use in non-corrosive environment (e.g. interior use)  
Gold passivated: Metric coarse thread  
Silver passivated: Coil thread
- **Hot Dip Galvanised** (50 $\mu$  coating thickness) – for exterior non-marine environments
- **Stainless T316 (A4)** – for all exposed applications including coastal environments

### Testing

Material certificates and breaking strength results are recorded for all manufacturing batches.

Please inform us at the time of order if you require certificates for your project.

### Weldability

All Ancon QwikFoot and QwikFix inserts are fully weldable with no requirement for preheat or post heat treatment.

The zinc coating should be removed from standard and hot dip galvanised inserts by light grinding before welding with low hydrogen welding consumables.

Stainless steel inserts should be cleaned and welded with T316L stainless welding consumables.

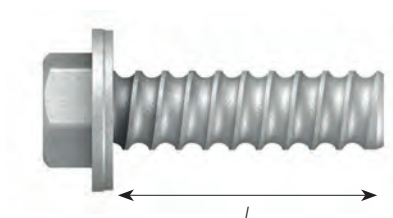
## Bracing Insert Bolt (UC16)

For non-permanent fixings like brace connections, we offer the UniCoil Bracing Insert Bolts BIB.

These bolts are equipped with the UniCoil thread and can be used with Ancon UCQF1696Z

QwikFoot Threaded Inserts and Ancon FERB3496Z QwikFix Threaded Inserts. Unicoil products have smooth rounded threads which resist damage and clogging and are designed to be re-used.

Unicoil Threaded Inserts UCQF16967 and FERB3496Z are designed to exceed the capacity of the BIB bolts.

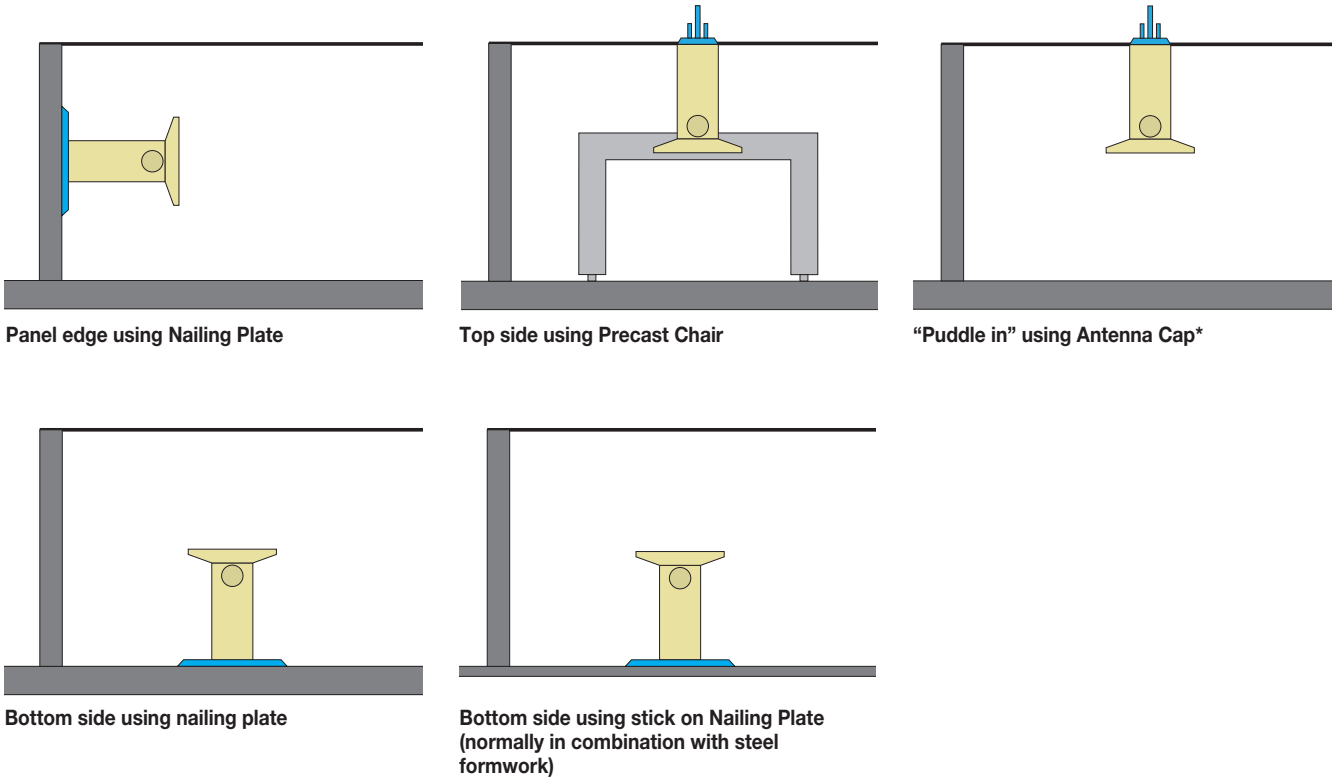


Product Code	Product Description	Length L mm	Spanner size mm	Cross section A mm <sup>2</sup>	Tensile Strength MPa	Tensile Capacity kN
BIB3465Z	Bracing Insert Bolt 3/4 x 65	65	30	198.6	490	97.3
BIB3485Z	Bracing Insert Bolt 3/4 x 85	85	30	198.6	490	97.3

# Installation

## Installation in Concrete

Threaded inserts can be installed using different installation methods depending on the situation and the preferences of the installer.



*\*To achieve consistent results in regards to location and orientation of the insert, we recommend the use of the Precast Chair instead of "puddling in".*  
Check [www.ancon.com.au](http://www.ancon.com.au) for Installation Instructions.

## Installation of the bolts

Ancon QwikFoot and QwikFix Threaded Inserts are designed to exceed the capacity of a grade 4.6 bolt. The bolts should be installed using a calibrated torque wrench with the torque that we recommend. If bolts of a higher grade are installed, the torque must be limited to the installation torque of a grade 4.6 bolt to avoid possible damage to bolt, Threaded Insert and surrounding concrete.

Impact wrenches, so called "rattle guns" should not be used. They can cause serious, uncontrolled overload of bolt and Threaded Insert with unknown consequences.

## Recommended tightening torques in Nm

Thread	Grade 4.6 Dry condition	Grade 4.6 lubricated
M10	18	16
M12	31	27
M16	75	66
M20	150	130
M24	170	150
UC16	100	-

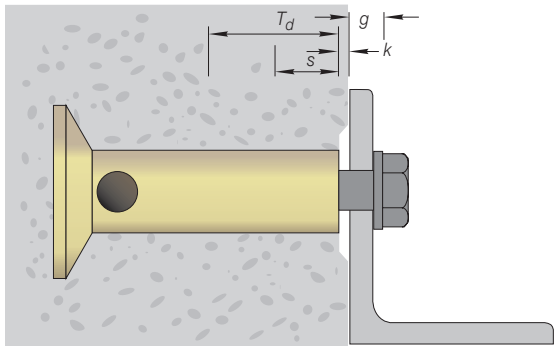
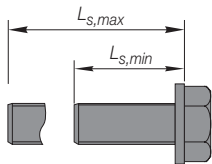
These recommended torque values for new metric bolts are based on a proof stress of 180MPa which relates to 75% of the yield strength for grade 4.6 bolt for diameters M10 to M20 and on 120MPa, which relates to 50% yield for bolts diameter M24.

The torque for the UC 16 bolt is based on testing.

# Threaded Inserts and Accessories

## Determining the Bolt Length

The bolt should be of sufficient length to ensure a minimum thread engagement of 1.5 times bolt diameter.



$$L_{S,max} = T_d + k + g$$

$$L_{S,min} = s + k + g$$

with:

$T_d$  = Thread depth of the insert as shown on page 5, 6 and 7

$s$  = required thread engagement as shown below

$k$  = Recess (8 mm for Ancon Nail Plate)

$g$  = clamp thickness (includes washers)

### Minimum Thread Engagement

Thread	Required Thread Engagement $s$ mm
M10	15
M12	18
M16	24
M20	30
M24	36
UC16	25

## Precast Chairs for QwikFoot

QwikFoot inserts when used with the Precast Chair lock into position which eliminates the costs associated with the repair of lost, misplaced inserts.

- Easy to assemble, fast to install, saves labour costs
- Strong, robust one-piece design
- Positive click together lock between chair and insert
- Designed to fit within the mesh
- Rigidly locates the crossbar providing positive location
- Stable, does not float or move
- One chair fits all QwikFoot inserts
- Available for panel thicknesses from 100 to 200mm

### Precast Chairs

Part Code	For Panel Thickness (mm)	Quantity Per bag
PC125	125	100
PC145	145	100
PC150	150	100
PC170	170	100
PC175	175	100
PC180	180	100
PC195	195	100
PC200	200	100

The panel thickness in the above table is based on 96mm QwikFoot inserts.



## Super Chair for QwikFix

The Super Chair supports the cross bar to ensure that the QwikFix insert is positioned at the correct height. A unique feature of the Super Chair design is that it provides for two different panel thicknesses by simply rotating the chair 90 degrees.

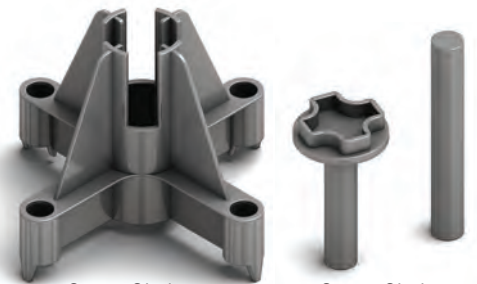
### Super Chairs

Size (mm)	Part Code	Quantity per Bag
125 / 150	SC125150	50
150 / 175	SC150175	50
175 / 200	SC175200	50

### Super Chair Plugs/Dowels

Product	Part Code	Quantity per Bag
Super Chair Plug Short	SCPLUGS	100
Super Chair Plug Long	SCPLUGL	100
Super Chair Dowel 85mm	SCDOWEL	100

For 'tilt-up' applications Super Chair Plugs and Super Chair Dowels are used to accurately position inserts. The plug or the dowel are placed into a drilled hole to avoid movement. One Super Chair plug or two Super Chair dowels should be used with every Super Chair.



Super Chair

Super Chair Plug and Dowel

### Antenna Caps

The use of Antenna Caps is recommended with all ferrules that are installed in the face of a panel. The use of Antenna caps ensures that the ferrules can be found after the concrete is poured.



### Nailing Plates

Typically used for attachment to formwork. Nailing plates are available as threaded nailing plates in diameters M10 to M24 as well as stick-on plates in diameters M12 to M20.



Stick-on Plate



Nailing Plate

# Threaded Inserts and Accessories

## Structural Fixing Design

For the design of QwikFoot and QwikFix Threaded Inserts the following failure modes need to be taken in account:

- Steel failure of the bolt in tension
- Steel failure of the bolt in shear
- Combined Steel failure of the bolt
- Steel Failure of the Threaded Insert in Tension
- Concrete Breakout failure in tension (Concrete cone failure)
- Concrete Pull-out failure\*
- Concrete blow-out failure\*
- Concrete Edge failure in shear
- Concrete pry-out failure
- Combined Concrete failure

\* The concrete pull-out capacity and the concrete blow-out capacity exceed the concrete cone capacity for all Ancon Threaded Inserts and do not need to be checked.

### Applications

Ancon Threaded Inserts, as detailed in this guide, are designed to be used with fixtures fastened with metric bolts following the design principles of AS 5216 and AS 3850.1. Where ductile design is required, check that the concrete capacity provided in the tables exceeds the yield strength of the bolt to be used. The embedment depth of QwikFoot and QwikFix Threaded Inserts is generally too short to develop threaded N class reinforcement bars. Please use Ancon KSN Anchors in conjunction with Ancon BT Threaded Starter Bars where ductile starter bar connections are required, in accordance with AS 3600 or AS 5100. These full-strength connections have been designed for the anchorage of Grade 500 starter bars.

### Bolt Capacities

The table below shows the capacities for structural bolts Grade 4.6 and 8.8.

#### Bolt Strengths and Capacities in kN

Thread	Characteristic Strength kN ISO 898-1:2009 Table 4 $N_{Rk,s}$		Tension Capacity kN AS 4100:1998 Cl. 9.3.2.2 $\phi_s \cdot N_{Rk,s}$		Shear Capacity kN AS 4100:1998 Cl. 9.3.2.1 $\phi_s \cdot V_{Rk,s} = 0.62 \cdot \phi_s \cdot N_{Rk,s}$	
	Grade 4.6	Grade 8.8	Grade 4.6	Grade 8.8	Grade 4.6	Grade 8.8
M10	23.2	46.4	18.6	37.1	11.5	23.0
M12	33.7	67.4	27.0	53.9	16.7	33.4
M16	62.8	125.0	50.2	100.0	31.1	62.0
M20	98.0	203.0	78.4	162.4	48.6	100.7
M24	141.0	293.0	112.8	234.4	69.9	145.3
UC16	76.8	-	not used for permanent structural connections			

Note:  $f_s = 0.8$  (AS 4100:1998 Table 3.4: bolt in tension or shear)

T316 Stainless A4 bolts of strength class A4-50 can be designed using the capacities stated for Grade 4.6 bolts.

#### Combined loading in tension and shear for bolts

If bolts are subject to combined tension and shear the design should be done using the following formula:

$$\left( \frac{N^*}{f_s \cdot N_{Rk,s}} \right)^2 + \left( \frac{V^*}{f_s \cdot V_{Rk,s}} \right)^2 \leq 1$$

with

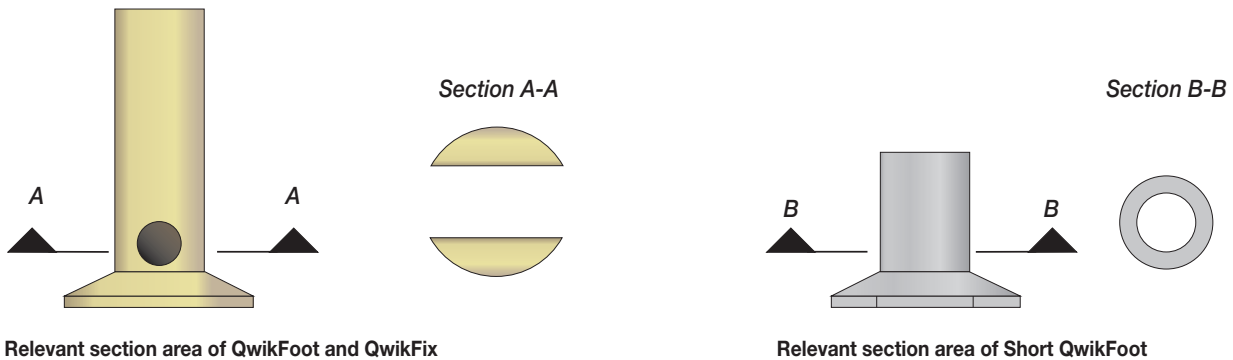
$N^*$  = Design load in tension

$V^*$  = Design load in shear

When Threaded Inserts are installed with a recess, shear loads will create bending in the bolt that will have to be taken into consideration!

## Tension Capacities of the Threaded Insert

The tension capacity of the threaded insert is defined by the steel capacity  $N_{Rk,s}$  of the section at the cross hole of the Threaded Insert:



The table below shows the tension capacities for Ancon Threaded Inserts type QwikFix and QwikFoot:

Product Code	Char. Tensile Capacity $N_{Rk,s}$ kN	WLL according to AS 3850:2015 ( $N_{Rd,s} = N_{Rk,s} / 2.25$ ) kN	Tension capacity AS 4100:1998 ( $N_{Rd,s} = 0.8 \cdot N_{Rk,s}$ ) kN
FF1050	30.6	13.6	24.5
FF1050S316	33.8	15.0	27.1
FF1245G	236.2	104.9	188.9
FF1250, FF1270, FF1296	49.7	22.1	39.8
FF1250S316, FF1270S316, FF1296S316	55.0	24.5	44.0
FF1645G	194.9	86.2	155.9
FF1670, FF1696G	105.8	47.0	84.6
FF1670S316, FF1696S316	130.5	58.0	104.4
FF2045G	141.7	62.9	113.4
FF2070, FF2096, FF20120	101.9	45.3	81.5
FF2096S316	112.7	50.1	90.2
FF2496G	230.9	102.6	184.8
FF2496Z	232.1	103.2	185.7
FF2496S316	256.8	114.2	205.5
FF1696ZH	101.9	45.3	81.5
FER1296*, FER1676*, FER1696*, FER2076*, FER2096*, FERB3496*	101.9 (70.1*)	45.3 (33.7)	81.5 (56.1)

\* The tension capacity of the QwikFix Threaded Inserts is limited by shear capacity of the N12 cross bar (70.1kN) which provides the anchorage in concrete unless anchorage is achieved by structural welding to the reinforcement.

# Threaded Inserts and Accessories

## Tension Capacity of the Concrete

### Concrete Capacity Design (CCD)

AS 3600:2018 Cl 19.3.3 requires cast-in fixings to be designed in accordance with the Concrete Capacity Design (CCD) method as per AS 3850.1, Appendix B.

The design strength is calculated by multiplying the ultimate capacity from AS 3850.1 Appendix B with a reduction factor of  $f = 0.6$  in accordance with table 2.2.2 of AS 3600:2018.

This design is also in line with AS 5216:2018 (formally known as SA TS 101) "Design of post-installed and cast-in fastenings in concrete", and which does not include Threaded Inserts.

The capacities in this guide have been calculated in accordance with the CCD design method as described in AS 3850.1:2015 for anchors installed in uncracked concrete with  $k_{cr} = 13$ .

For more detailed design and load configurations other than those in this guide, refer to AS 3850.1:2015.

#### Anchors Loaded in Tension Concrete breakout (cone) failure

$$N_{Rk,c} = N_{Rk,c}^0 (A_{c,N}/A_{c,N}^0) \psi_{s,N}$$

where

$N_{Rk,c}$  = Characteristic concrete cone failure resistance of an insert

$N_{Rk,c}^0$  = Characteristic cone failure resistance of an insert located well away from the edges of the concrete member or adjacent inserts

$A_{c,N}$  = Actual projected area of the idealised concrete cone developed by the insert at the concrete surface. It is limited by overlapping concrete cones of adjoining inserts ( $s < s_{cr,N}$ ) as well as by edges of the concrete member ( $c < c_{cr,N}$ ) (refer to figures on page 14)

$A_{c,N}^0$  = Area of the idealised concrete breakout cone at the surface, of an individual insert located well away from the edges of the concrete member or adjacent inserts. The cone is idealised as a pyramid with a height equal to  $h_{ef}$  and a base length equal to  $s_{cr,N}$  (refer to figure on page 15)

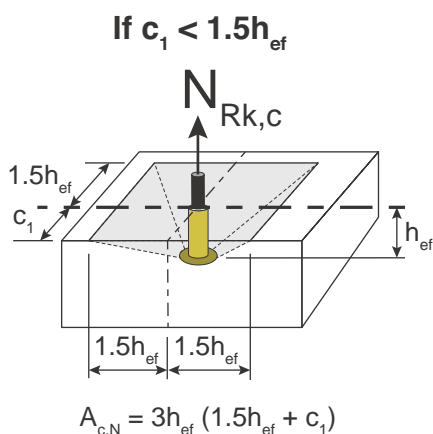
$\psi_{s,N}$  = Stress disturbance factor dependant on the proximity of edges

#### Stress disturbance factor

$$\psi_{s,N} = 0.7 + 0.3 \cdot \left( \frac{c_1}{1.5 \cdot h_{ef}} \right) \leq 1$$

with

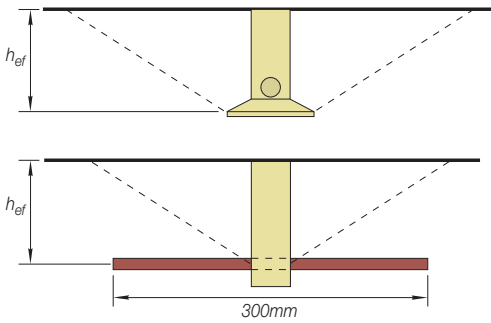
$c_1$  = smallest edge distance



### Characteristic tension resistance of a single insert

The characteristic resistance to concrete cone failure for a single insert, placed at a minimum distance  $1.5h_{ef}$  from any edge is -

$N_{Rk,c}^0$	$= k_{cr} \cdot \sqrt{f'_c} \cdot h_{ef}^{1.5}$
with	
$k_{cr}$	$= 13$ for inserts in uncracked concrete $= 10$ for inserts in cracked concrete
<b>Note:</b> The capacity tables in the back of this brochure show the values for anchors in uncracked concrete, when inserts are located in tension zones where cracks may be expected, the loads in the tables should be reduced by 25%	
$f'_c$	$=$ Characteristic compressive strength of the concrete (MPa)
$h_{ef}$	$=$ Effective embedment depth of the insert (mm)

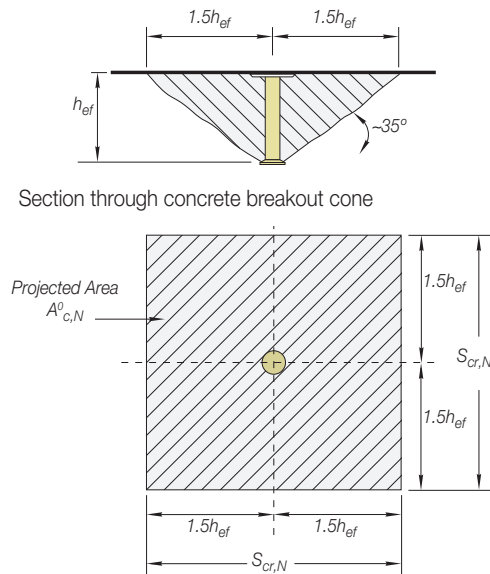
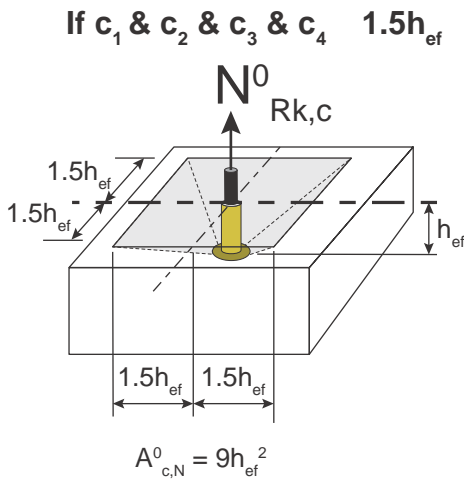


Effective embedment depth  $h_{ef}$

### Effect of insert spacing and edge distance

The geometric effect of insert spacing and edge distances is determined by the ratio  $A_{c,N}/A_{c,N}^0$ , where -

$A_{c,N}$	$=$ Actual projected area, limited by overlapping concrete cones of adjacent inserts ( $s < s_{cr,N}$ ) as well as by edges of the concrete member ( $c < c_{cr,N}$ ) (refer to Figure).
$A_{c,N}^0$	$=$ Reference projected area of a single insert
	$= s_{cr,N} \cdot s_{cr,N}$
$s_{cr,N}$	$= 2c_{cr,N}$
$c_{cr,N}$	$= 1.5h_{ef}$
$A_{c,N}^0$	$= 9h_{ef}^2$



# Threaded Inserts and Accessories

## Anchors loaded in shear - concrete breakout toward an edge

$V_{Rk,c}$	$= V_{Rk,c}^0 \cdot \frac{A_{c,V}}{A_{c,V}^0} \cdot \psi_{s,V} \cdot \psi_{h,V} \cdot \psi_{re,V}$
where	
$V_{Rk,c}$	= Characteristic resistance of a single insert in shear
$V_{Rk,c}^0$	= Characteristic resistance of an insert loaded perpendicular to the edge in cracked concrete
$A_{c,V}$	= Projected area of the idealised concrete breakout area of an insert toward an edge
$A_{c,V}^0$	= Area of the idealised concrete breakout cone at the lateral concrete surface, of an insert located well away from edges parallel to the loading direction, or adjacent inserts, with a thickness greater than the embedment depth of the insert with the shape of the fracture area idealised as a half pyramid with a height equal to $c_1$ and a base-length of $1.5c_1$ and $3c_1$ .
$\psi_{s,V}$	= Factor which accounts for the disturbance of the distribution of stresses
$\psi_{h,V}$	= Stress disturbance factor dependant on the proximity of edges.
$\psi_{re,V}$	= Factor to account for reinforcing and state of concrete: 1.4 for uncracked concrete 1.0 for cracked concrete

## Characteristic shear resistance of a single insert

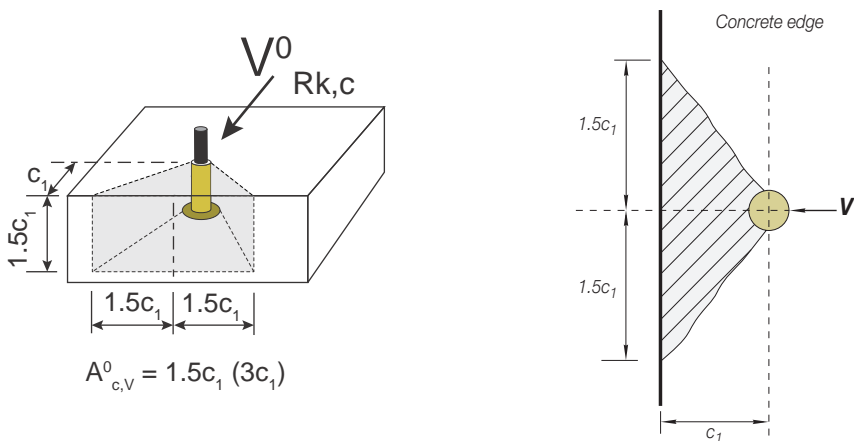
The characteristic resistance of an insert loaded perpendicular to the edge is -

$V_{Rk,c}^0$	$= 1.8 \cdot d_{nom}^\alpha \cdot l_f^\beta \cdot \sqrt{f_c} \cdot c_1^{1.5}$
with	
$\alpha$	$= 0.1 \left( \frac{l_f}{c_1} \right)^{0.5}$
$\beta$	$= 0.1 \left( \frac{d_{nom}}{c_1} \right)^{0.2}$
$d_{nom}$	= Outside diameter of insert $\leq 60$ mm
$l_f$	= $h_{ef}$ for inserts with a uniform diameter $\leq 8 \cdot d_{nom}$ (mm)
$f_c$	= Characteristic compressive strength of the concrete (MPa)
$c_1$	= Edge distance in the direction of the shear load (mm)

## Effect of insert spacing, edge distance and member thickness

The geometrical effect of spacing as well as of further edge distances and the effect of thickness of the concrete member on the characteristic resistance is taken into account by the ratio  $A_{c,V}/A_{c,V}^0$ , where -

$A_{c,V}^0$	= Reference projected area as shown in Figure. $= 4.5c_1^2$
$A_{c,V}$	= Area of the idealised concrete break-out cone, limited by the overlapping cones of adjacent inserts ( $s \leq 3c_1$ ) as well as by edges parallel to the loading direction ( $c_2 \leq 1.5c_1$ ) and by member thickness ( $h \leq 1.5c_1$ ).

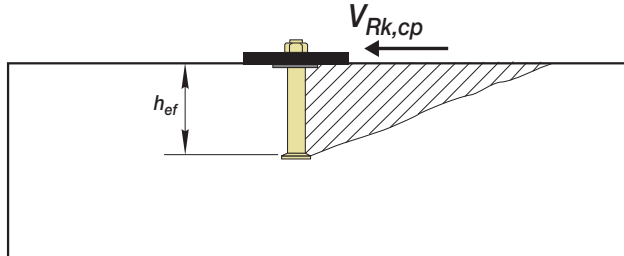


$$A_{c,V}^0 = 4.5c_1^2$$

Idealised concrete break-out area  $A_{c,V}^0$  for a single insert.

## Concrete pry-out failure

Shear loaded inserts may fail by concrete pry-out where the insert is located well away from an edge. This type of failure can occur with short inserts, low concrete strengths and high strength bolts. The characteristic resistance to pry-out  $V_{Rk,cp}$  may be calculated as follows:



$$V_{Rk,cp} = k \cdot N_{Rk,c}$$

with  
 $k=1$  for  $h_{ef} < 60\text{mm}$   
 $k=2$  for  $h_{ef} \geq 60\text{mm}$

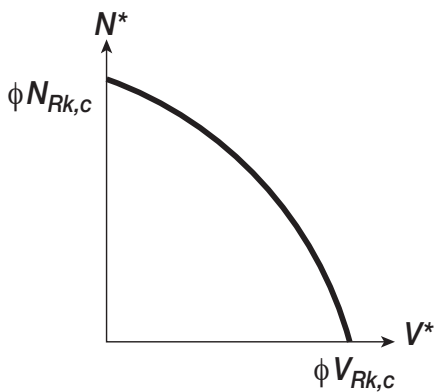
## Threaded inserts subject to combined tension and shear loads

Inserts subject to combined tension and shear loads may be designed using the following equation:

$$\left( \frac{N^*}{\phi \cdot N_{Rk,c}} \right)^{1.5} + \left( \frac{V^*}{\phi \cdot V_{Rk,c}} \right)^{1.5} \leq 1.0$$

Where

- $N^*$  is tension component of the applied load
- $V^*$  is shear component of the applied load
- $\phi \cdot N_{Rk,c}$  is design tensile capacity
- $\phi \cdot V_{Rk,c}$  is design shear capacity



# Threaded Inserts and Accessories

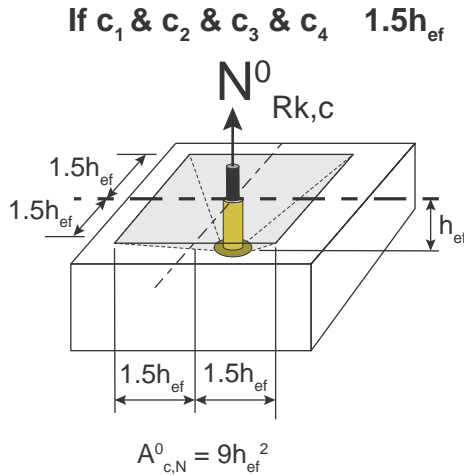
## QwikFoot Design for Structural Fixings

The following values are based on the CCD method as described in AS 3850.1:2015

Inserts located in elements with a minimum edge distance,  $\min c_1 \geq 1.5h_{ef}$

Minimum edge distance  $c_1$  and insert spacing  $s_1$  to reach full concrete cone capacity

Insert Length (mm)	50	70	96
min $c_1$ (mm)	85	115	155
min $s_1$ (mm)	165	225	305



Cone breakout (tension) capacity of a QwikFoot Threaded Insert located with minimum edge distance and insert spacing

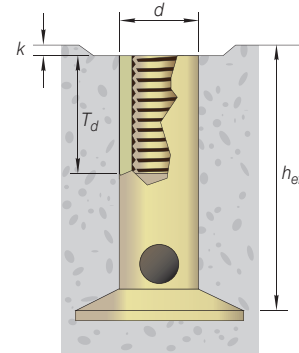
Concrete Cone Breakout Capacity ( $\phi_c N_{Rk,c}$ ); kN

QwikFoot Part Code	Concrete Compressive Strength MPa					
	15	20	25	32	40	50
FF1245G, FF1645G, FF2045G	10.6	12.3	13.7	15.6	17.4	19.5
FF1050, FF1250	12.3	14.2	15.9	18.0	20.1	22.5
FF1270, FF1670, FF2070	19.4	22.4	25.1	28.4	31.7	35.5
FF1296, FF1696, FF2096, FF2496	30.4	35.1	39.3	44.5	49.7	55.6
FF20120	42.0	48.5	54.2	61.3	68.5	76.6

**Note:** QwikFoot inserts do not require a crossbar to achieve the capacities shown in this table.

All capacities assume that a nailing plate is used to increase  $h_{ef}$  by 8mm.

All design values calculated using a reduction factor  $f_c = 0.6$  according to table 2.2.2 of AS 3600:2018



### Concrete capacities of inserts located close to edges or each other

The design tables on pages 21-25 provide tension and shear capacities based on steel failure or concrete breakout, whichever is the minimum.

There are three cases considered:

- close to one edge
- close to two edges at right angles to each other
- a group of two inserts at close spacing

For more complicated configurations please refer either to AS 3850.1:2015 or contact us.

In each table, the loads are colour coded to show the load range for each bolt size M10-M24 and grades G4.6 and 8.8.

## Design Method

### Sample Calculation 1

Fix a bearing plate with a Grade 4.6 bolt using a single QwikFoot Threaded Insert in 50MPa concrete with the nearest edge at 300mm. The factored tension load  $N^* = 15\text{kN}$  and factored shear load  $V^* = 30\text{kN}$ .

Check steel capacity for the bolt (see page 12)

$N^* \leq 18.6\text{kN} \rightarrow$  minimum bolt diameter for tension is M10

$16.7\text{kN}$  (M12 G4.6 bolt)  $< V^* \leq 31.1\text{kN}$  (M16 G4.6 bolt)  $\rightarrow$  minimum bolt diameter for shear is M16

$$\left(\frac{15}{50.2}\right)^2 + \left(\frac{30}{31.1}\right)^2 = 1.02 > 1.0 \rightarrow \text{An M20 bolt is required for combined load.}$$

Check concrete capacity for the threaded inserts:

For M20 bolt, inserts with length of 45, 70 and 96mm are available.

For FF2045 from first table on page 21,

$$\phi_c N_{Rk,c} = 19.5 > N^* \text{ and } \phi_c V_{Rk,c} = 19.5 < V^* \rightarrow \text{not OK, check FF2070}$$

For FF2070 from first table on page 23,

$$\phi_c N_{Rk,c} = 35.5 > N^* \text{ and } \phi_c V_{Rk,c} = 48.6 > V^* \rightarrow \text{OK check combined loading}$$

$$\left(\frac{15}{35.5}\right)^{1.5} + \left(\frac{30}{48.6}\right)^{1.5} = 0.76 < 1.0 \rightarrow \text{FF2070 is OK}$$

### Sample Calculation 2

Same application as Example 1 however the insert is located at a distance of 150mm from one edge.

Try the FF2070 as above:

From first table on page 23,

$$\phi_c N_{Rk,c} = 35.5 > N^* \text{ and } \phi_c V_{Rk,c} = 33.8 > V^* \rightarrow \text{OK check combined loading}$$

$$\left(\frac{15}{35.5}\right)^{1.5} + \left(\frac{30}{33.8}\right)^{1.5} = 1.11 > 1.0 \rightarrow \text{not OK, check FF2096}$$

From first table on page 24,

$$\phi_c N_{Rk,c} = 55.3 > N^* \text{ and } \phi_c V_{Rk,c} = 36.2 > V^* \rightarrow \text{OK check combined loading}$$

$$\left(\frac{15}{55.3}\right)^{1.5} + \left(\frac{30}{36.2}\right)^{1.5} = 0.89 < 1.0 \rightarrow \text{FF2096 is OK}$$

## How to find capacity values in tables

Table on page 23

Single Edge Distance $c_1$	Tensile Capacity kN						Shear Capacity kN					
	Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
	Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
	15	20	25	32	40	50	15	20	25	32	40	50
50	11.7	13.5	15.1	17.1	19.2	21.4	4.3	4.9	5.5	6.2	7.0	7.8
75	14.6	16.9	18.9	21.4	23.9	26.7	7.1	8.2	9.2	10.4	11.7	13.0
100	17.8	20.6	23.0	26.0	29.1	32.5	10.4	12.0	13.4	15.1	17.5	19.6
125	19.4	22.4	25.1	28.4	31.7	35.5	13.9	16.1	18.5	20.9	23.4	26.2
150	19.4	22.4	25.1	28.4	31.7	35.5	18.2	21.1	23.6	26.6	29.8	33.8
175	19.4	22.4	25.1	28.4	31.7	35.5	22.4	25.9	28.9	33.5	37.4	41.8

Table on page 24

Single Edge Distance $c_1$	Tensile Capacity kN						Shear Capacity kN					
	Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
	Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
	15	20	25	32	40	50	15	20	25	32	40	50
50	16.2	18.7	20.9	23.7	26.5	29.6	4.6	5.4	6.0	6.8	7.6	8.5
75	19.4	22.3	25.0	28.3	31.6	35.3	7.7	8.9	9.9	11.2	12.5	14.0
100	22.8	26.3	29.4	33.2	37.2	41.5	11.0	12.8	14.3	16.1	18.7	20.9
125	26.4	30.5	34.1	38.6	43.1	48.2	14.7	17.6	19.7	22.3	24.9	27.9
150	30.3	35.0	39.1	44.3	49.5	55.3	19.3	22.3	24.9	28.2	32.4	36.2
175	30.4	35.1	39.3	44.5	49.7	55.6	24.0	27.7	31.0	35.4	39.6	44.3

# Threaded Inserts and Accessories

## Break-out areas of inserts near edges or other inserts

**QwikFoot insert located near to one edge**

Tensile Capacity - kN:  $\phi_c \cdot N_{Rk,c}$

If  $c_1 < 1.5h_{ef}$

$A_{c,N} = 3h_{ef} (1.5h_{ef} + c_1)$

Shear Capacity - kN:  $\phi_c \cdot V_{Rk,c}$

$A_{c,V}^0 = 1.5c_1 (3c_1)$

**QwikFoot insert located near two edges at right angles to each other**

Tensile Capacity - kN:  $\phi_c \cdot N_{Rk,c}$

If  $c_1 \text{ \& } c_2 < 1.5h_{ef}$

$A_{c,N} = (1.5h_{ef} + c_1) (1.5h_{ef} + c_2)$

Shear Capacity - kN:  $\phi_c \cdot V_{Rk,c}$

If  $c_2 < 1.5c_1$

$A_{c,V} = 1.5c_1 (1.5c_1 + c_2)$

**A group of two QwikFoot inserts located near to one edge**

Tensile Capacity - kN:  $\phi_c \cdot N_{Rk,c}$

If  $c_1 < 1.5h_{ef} \text{ \& } s_1 < 3h_{ef}$

$A_{c,N} = (3h_{ef} + s_1) (1.5h_{ef} + c_1)$

Shear Capacity - kN:  $\phi_c \cdot V_{Rk,c}$

If  $c_2 \geq 1.5c_1 \text{ \& } s_1 < 3c_1$

$A_{c,V} = 1.5c_1 (3c_1 + s_1)$



### Short QwikFoot 45mm long - Single insert located near one edge

Design capacity in combination with G4.6 Bolts: M12 Green, M16 Purple

Single Edge Distance $c_1$	Tensile Capacity kN						Shear Capacity kN					
	Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
	Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
	15	20	25	32	40	50	15	20	25	32	40	50
50	8.0	9.2	10.3	11.7	13.1	14.6	4.1	4.7	5.3	6.0	6.7	7.5
75	10.7	12.3	13.8	15.6	17.4	19.5	6.9	7.9	8.9	10.1	11.2	12.6
100	10.7	12.3	13.8	15.6	17.4	19.5	10.0	11.6	13.0	14.7	16.4	18.3
125	10.7	12.3	13.8	15.6	17.4	19.5	10.7	12.3	13.8	15.6	17.4	19.5
150	10.7	12.3	13.8	15.6	17.4	19.5	10.7	12.3	13.8	15.6	17.4	19.5

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

### Short QwikFoot 45mm long - Single insert located near two edges at right angles to each other

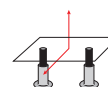
Design capacity in combination with G4.6 Bolts: M12 Green, M16 Purple

Single Edge Distance $c_1$	Second Edge Distance $c_2$	Concrete or Steel Tensile Capacity						Concrete or Steel Shear Capacity					
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
		Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	50	6.7	7.7	8.6	9.8	10.9	12.2	3.1	3.5	4.0	4.5	5.0	5.6
50	100	8.0	9.2	10.3	11.7	13.1	14.6	4.1	4.7	5.3	6.0	6.7	7.5
100	100	10.7	12.3	13.8	15.6	17.4	19.5	7.5	8.7	9.7	11.0	12.3	13.7
100	150	10.7	12.3	13.8	15.6	17.4	19.5	10.0	11.6	13.0	14.7	16.4	18.3
150	150	10.7	12.3	13.8	15.6	17.4	19.5	10.7	12.3	13.8	15.6	17.4	19.5
200	150	10.7	12.3	13.8	15.6	17.4	19.5	10.7	12.3	13.8	15.6	17.4	19.5

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

### A group of TWO Short QwikFoot 50mm long - Threaded inserts located near one edge at various insert spacings

Design capacity in combination with G4.6 Bolts: M12 Green, M16 Purple



Single Edge Distance $c_1$	Spacing $s_1$	Concrete or Steel Tensile Capacity for a PAIR of Threaded Inserts						Concrete or Steel Shear Capacity for a PAIR of Threaded Inserts					
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
		Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	100	13.4	15.4	17.2	19.5	21.8	24.4	6.8	7.9	8.8	10.0	11.1	12.5
100	100	17.8	20.6	23.0	26.0	29.1	32.5	13.4	15.5	17.3	19.5	21.9	24.4
200	100	17.8	20.6	23.0	26.0	29.1	32.5	17.8	20.6	23.0	26.0	29.1	32.5
50	200	16.0	18.5	20.7	23.4	26.2	29.3	8.2	9.5	10.6	12.0	13.4	14.9
100	200	21.4	24.7	27.6	31.2	34.9	39.0	16.7	19.3	21.6	24.4	27.3	30.5
200	200	21.4	24.7	27.6	31.2	34.9	39.0	21.4	24.7	27.6	31.2	34.9	39.0
50	300	16.0	18.5	20.7	23.4	26.2	29.3	8.2	9.5	10.6	12.0	13.4	14.9
100	300	21.4	24.7	27.6	31.2	34.9	39.0	20.1	23.2	25.9	29.3	32.8	36.7
200	300	21.4	24.7	27.6	31.2	34.9	39.0	21.4	24.7	27.6	31.2	34.9	39.0
50	400	16.0	18.5	20.7	23.4	26.2	29.3	8.2	9.5	10.6	12.0	13.4	14.9
100	400	21.4	24.7	27.6	31.2	34.9	39.0	20.1	23.2	25.9	29.3	32.8	36.7
200	400	21.4	24.7	27.6	31.2	34.9	39.0	21.4	24.7	27.6	31.2	34.9	39.0

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

# Threaded Inserts and Accessories



## QwikFoot 50mm long - Single insert located near one edge

Design capacity in combination with G4.6 Bolts: M10 Orange, M12 Green

Single Edge Distance $c_1$	Tensile Capacity kN						Shear Capacity kN					
	Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
	Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
	15	20	25	32	40	50	15	20	25	32	40	50
50	8.7	10.1	11.3	12.7	14.2	15.9	3.8	4.4	4.9	5.6	6.2	7.0
75	11.4	13.2	14.8	16.7	18.7	20.9	6.5	7.5	8.4	9.5	10.6	12.2
100	12.3	14.2	15.9	18.0	20.1	22.5	9.5	11.0	12.6	14.3	16.0	16.7
125	12.3	14.2	15.9	18.0	20.1	22.5	12.3	14.2	15.9	16.7	16.7	16.7
150	12.3	14.2	15.9	18.0	20.1	22.5	12.3	14.2	15.9	16.7	16.7	16.7

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$



## QwikFoot 50mm long - Single insert located near two edges at right angles to each other

Design capacity in combination with G4.6 Bolts: M10 Orange, M12 Green

Single Edge Distance $c_1$	Second Edge Distance $c_2$	Concrete or Steel Tensile Capacity						Concrete or Steel Shear Capacity					
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
		Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	50	7.0	8.1	9.0	10.2	11.4	12.8	2.9	3.3	3.7	4.2	4.7	5.2
50	100	8.7	10.1	11.3	12.7	14.2	15.9	3.8	4.4	4.9	5.6	6.2	7.0
100	100	12.3	14.2	15.9	18.0	20.1	22.5	7.1	8.2	9.2	10.4	12.0	13.4
100	150	12.3	14.2	15.9	18.0	20.1	22.5	9.5	11.0	12.6	14.3	16.0	16.7
150	150	12.3	14.2	15.9	18.0	20.1	22.5	12.3	14.2	15.9	16.7	16.7	16.7
200	150	12.3	14.2	15.9	18.0	20.1	22.5	12.3	14.2	15.9	16.7	16.7	16.7

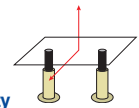
The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

## A Group of TWO QwikFoot 50mm long - Threaded Inserts located near one edge at various insert spacings

Design capacity in combination with G4.6 Bolts: M10 Orange, M12 Green

Single Edge Distance $c_1$	Spacing $s_1$	Concrete or Steel Tensile Capacity for a PAIR of Threaded Inserts						Concrete or Steel Shear Capacity for a PAIR of Threaded Inserts					
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
		Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	100	14.0	16.2	18.1	20.5	22.9	25.6	6.3	7.3	8.2	9.3	10.4	11.6
100	100	19.8	22.9	25.5	28.9	32.3	36.1	12.7	14.6	16.3	18.5	20.7	23.8
200	100	19.8	22.9	25.5	28.9	32.3	36.1	19.8	22.9	25.5	28.9	32.3	33.4
50	200	17.5	20.2	22.5	25.5	28.5	31.9	7.6	8.8	9.8	11.1	12.4	13.9
100	200	24.6	28.5	31.8	36.0	40.2	45.0	15.8	18.3	20.4	23.8	26.6	29.8
200	200	24.6	28.5	31.8	36.0	40.2	45.0	24.6	28.5	31.8	33.4	33.4	33.4
50	300	17.5	20.2	22.5	25.5	28.5	31.9	7.6	8.8	9.8	11.1	12.4	13.9
100	300	24.6	28.5	31.8	36.0	40.2	45.0	19.0	21.9	25.2	28.6	31.9	33.4
200	300	24.6	28.5	31.8	36.0	40.2	45.0	24.6	28.5	31.8	33.4	33.4	33.4
50	400	17.5	20.2	22.5	25.5	28.5	31.9	7.6	8.8	9.8	11.1	12.4	13.9
100	400	24.6	28.5	31.8	36.0	40.2	45.0	19.0	21.9	25.2	28.6	31.9	33.4
200	400	24.6	28.5	31.8	36.0	40.2	45.0	24.6	28.5	31.8	33.4	33.4	33.4

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$





### QwikFoot 70mm long - Single insert located near one edge

Design capacity in combination with G4.6 Bolts: M12 Green, M16 Purple, M20 Red

Single Edge Distance $c_1$	Tensile Capacity kN						Shear Capacity kN					
	Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
	Concrete Compressive Strength $f'_c$ - MPa						Concrete Compressive Strength $f'_c$ - MPa					
	15	20	25	32	40	50	15	20	25	32	40	50
50	11.7	13.5	15.1	17.1	19.2	21.4	4.3	4.9	5.5	6.2	7.0	7.8
75	14.6	16.9	18.9	21.4	23.9	26.7	7.1	8.2	9.2	10.4	11.7	13.0
100	17.8	20.6	23.0	26.0	29.1	32.5	10.4	12.0	13.4	15.1	17.5	19.6
125	19.4	22.4	25.1	28.4	31.7	35.5	13.9	16.1	18.5	20.9	23.4	26.2
150	19.4	22.4	25.1	28.4	31.7	35.5	18.2	21.1	23.6	26.6	29.8	33.8
175	19.4	22.4	25.1	28.4	31.7	35.5	22.4	25.9	28.9	33.2	37.1	41.5
200	19.4	22.4	25.1	28.4	31.7	35.5	26.8	30.9	35.1	39.7	44.3	48.6
225	19.4	22.4	25.1	28.4	31.7	35.5	31.8	36.7	41.1	46.5	48.6	48.6
250	19.4	22.4	25.1	28.4	31.7	35.5	36.7	42.3	47.3	48.6	48.6	48.6
275	19.4	22.4	25.1	28.4	31.7	35.5	38.9	44.9	48.6	48.6	48.6	48.6
300	19.4	22.4	25.1	28.4	31.7	35.5	38.9	44.9	48.6	48.6	48.6	48.6

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

### QwikFoot 70mm long - Single insert located near two edges at right angles to each other

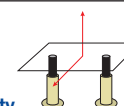
Design capacity in combination with G4.6 Bolts: M12 Green, M16 Purple, M20 Red

Single Edge Distance $c_1$	Second Edge Distance $c_2$	Tensile Capacity kN						Shear Capacity kN					
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
		Concrete Compressive Strength $f'_c$ - MPa						Concrete Compressive Strength $f'_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	50	8.5	9.8	11.0	12.4	13.9	15.5	3.2	3.7	4.1	4.7	5.2	5.9
50	100	11.1	12.8	14.3	16.2	18.1	20.3	4.3	4.9	5.5	6.2	7.0	7.8
100	100	16.9	19.5	21.8	24.7	27.6	30.8	7.8	9.0	10.0	11.4	12.7	14.2
100	150	17.8	20.6	23.0	26.0	29.1	32.5	10.4	12.0	13.4	15.1	17.5	19.6
150	150	19.4	22.4	25.1	28.4	31.7	35.5	13.3	15.3	17.7	20.0	22.3	25.0
200	150	19.4	22.4	25.1	28.4	31.7	35.5	17.1	19.7	22.0	24.9	27.9	31.6
200	200	19.4	22.4	25.1	28.4	31.7	35.5	20.1	23.2	25.9	29.3	33.3	37.2
300	150	19.4	22.4	25.1	28.4	31.7	35.5	24.8	28.6	32.3	36.6	40.9	45.7
300	200	19.4	22.4	25.1	28.4	31.7	35.5	27.9	32.6	36.5	41.3	46.2	48.6
300	300	19.4	22.4	25.1	28.4	31.7	35.5	35.2	40.7	45.5	48.6	48.6	48.6

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

### A Group of TWO QwikFoot 70mm long - Threaded Inserts located near one edge at various insert spacings

Design capacity in combination with G4.6 Bolts: M12 Green, M16 Purple, M20 Red



Single Edge Distance $c_1$	Spacing $s_1$	Concrete or Steel Tensile Capacity for a PAIR of Threaded Inserts						Concrete or Steel Shear Capacity for a PAIR of Threaded Inserts					
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
		Concrete Compressive Strength $f'_c$ - MPa						Concrete Compressive Strength $f'_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	100	17.0	19.6	21.9	24.8	27.7	31.0	7.1	8.2	9.2	10.4	11.6	13.0
100	100	25.8	29.8	33.3	37.7	42.1	47.1	13.8	16.0	17.8	20.2	22.6	25.2
200	100	28.1	32.5	36.3	41.1	45.9	51.3	30.5	36.1	40.4	45.7	51.0	57.1
300	100	28.1	32.5	36.3	41.1	45.9	51.3	51.6	59.6	67.4	76.2	85.2	95.3
50	200	22.2	25.7	28.7	32.5	36.3	40.6	8.5	9.9	11.0	12.5	14.0	15.6
100	200	33.8	39.0	43.6	49.3	55.2	61.7	17.3	19.9	22.3	25.2	28.2	31.5
200	200	36.8	42.5	47.5	53.8	60.1	67.2	35.7	41.2	46.1	52.2	58.3	66.1
300	200	36.8	42.5	47.5	53.8	60.1	67.2	56.8	66.3	74.1	83.9	93.8	97.2
50	300	23.5	27.1	30.3	34.3	38.3	42.8	8.5	9.9	11.0	12.5	14.0	15.6
100	300	35.6	41.2	46.0	52.1	58.2	65.1	20.7	23.9	26.8	30.3	35.0	39.1
200	300	38.9	44.9	50.2	56.7	63.4	70.9	40.2	46.4	51.9	58.7	66.5	74.4
300	300	38.9	44.9	50.2	56.7	63.4	70.9	61.9	72.3	80.9	91.5	97.2	97.2
50	400	23.5	27.1	30.3	34.3	38.3	42.8	8.5	9.9	11.0	12.5	14.0	15.6
100	400	35.6	41.2	46.0	52.1	58.2	65.1	20.7	23.9	26.8	30.3	35.0	39.1
200	400	38.9	44.9	50.2	56.7	63.4	70.9	44.7	51.6	57.6	66.1	73.9	82.6
300	400	38.9	44.9	50.2	56.7	63.4	70.9	67.9	78.4	87.6	97.2	97.2	97.2

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

# Threaded Inserts and Accessories



## QwikFoot 96mm long - Single insert located near one edge

Design capacity in combination with G4.6 Bolts: M12 Green, M16 Purple, M20 Red, M24 Blue.

Single Edge Distance $c_1$	Tensile Capacity kN						Shear Capacity kN					
	Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
	Concrete Compressive Strength $f'_c$ - MPa						Concrete Compressive Strength $f'_c$ - MPa					
	15	20	25	32	40	50	15	20	25	32	40	50
50	16.2	18.7	20.9	23.7	26.5	29.6	4.6	5.4	6.0	6.8	7.6	8.5
75	19.4	22.3	25.0	28.3	31.6	35.3	7.7	8.9	9.9	11.2	12.5	14.0
100	22.8	26.3	29.4	33.2	37.2	41.5	11.0	12.8	14.3	16.1	18.7	20.9
125	26.4	30.5	34.1	38.6	43.1	48.2	14.7	17.6	19.7	22.3	24.9	27.9
150	30.3	35.0	39.1	44.3	49.5	55.3	19.3	22.3	24.9	28.2	32.4	36.2
175	30.4	35.1	39.3	44.5	49.7	55.6	24.0	27.7	31.0	35.4	39.6	44.3
200	30.4	35.1	39.3	44.5	49.7	55.6	28.2	33.4	37.3	42.2	47.2	54.1
225	30.4	35.1	39.3	44.5	49.7	55.6	33.8	35.1	43.6	50.5	56.4	63.1
250	30.4	35.1	39.3	44.5	49.7	55.6	38.8	44.8	51.3	58.0	64.9	69.9
275	30.4	35.1	39.3	44.5	49.7	55.6	44.1	52.1	58.2	65.8	69.9	69.9
300	30.4	35.1	39.3	44.5	49.7	55.6	50.6	58.5	65.4	69.9	69.9	69.9

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

## QwikFoot 96mm long - Single insert located near two edges at right angles to each other

Design capacity in combination with G4.6 Bolts: M12 Green, M16 Purple, M20 Red, M24 Blue.

Single Edge Distance $c_1$	Second Edge Distance $c_2$	Tensile Capacity kN						Shear Capacity kN					
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
		Concrete Compressive Strength $f'_c$ - MPa						Concrete Compressive Strength $f'_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	50	10.8	12.5	13.9	15.8	17.6	19.7	3.5	4.0	4.5	5.1	5.7	6.4
50	100	13.5	15.6	17.4	19.7	22.0	24.6	4.6	5.4	6.0	6.8	7.6	8.5
100	100	18.9	21.9	24.4	27.6	30.9	34.6	8.3	9.6	10.7	12.1	13.5	15.1
100	150	22.7	26.2	29.3	33.2	37.1	41.4	11.0	12.8	14.3	16.1	18.7	20.9
150	150	30.2	34.9	39.0	44.2	49.4	55.2	14.0	16.2	18.7	21.2	23.7	26.5
200	150	30.3	35.0	39.1	44.3	49.5	55.3	18.0	20.8	23.2	26.3	29.4	33.6
200	200	30.4	35.1	39.3	44.5	49.7	55.6	21.2	24.4	27.3	30.9	35.4	36.9
300	150	30.3	35.0	39.1	44.3	49.5	55.3	25.9	29.9	34.1	38.6	43.2	48.3
300	200	30.4	35.1	39.3	44.5	49.7	55.6	29.9	34.4	38.5	43.2	49.8	55.6
300	300	30.4	35.1	39.3	44.5	49.7	55.6	37.2	42.9	48.0	55.5	62.0	69.3
500	500	30.4	35.1	39.3	44.5	49.7	55.6	69.9	69.9	69.9	69.9	69.9	69.9

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

## A Group of TWO QwikFoot 96mm long - Threaded Inserts located near one edge at various insert spacings

Design capacity in combination with G4.6 Bolts: M12 Green, M16 Purple, M20 Red, M24 Blue.

Single Edge Distance $c_1$	Spacing $s_1$	Concrete or Steel Tensile Capacity for a PAIR of Threaded Inserts						Concrete or Steel Shear Capacity for a PAIR of Threaded Inserts					
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
		Concrete Compressive Strength $f'_c$ - MPa						Concrete Compressive Strength $f'_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	100	21.6	24.9	27.9	31.5	35.2	39.4	7.7	8.9	10.0	11.3	12.6	14.1
100	100	30.3	35.0	39.1	44.3	49.5	55.3	14.7	17.0	19.0	21.5	24.0	26.9
200	100	40.5	46.8	52.3	59.2	66.2	74.0	32.0	38.0	42.5	48.1	53.7	60.1
300	100	40.5	46.8	52.3	59.2	66.2	74.0	53.9	63.6	71.1	80.4	89.9	102.7
50	200	27.0	31.1	34.8	39.4	44.0	49.2	9.3	10.7	12.0	13.6	15.2	17.0
100	200	37.9	43.7	48.9	55.3	61.8	69.1	18.4	21.3	23.8	26.9	30.1	34.9
200	200	50.6	58.5	65.4	73.9	82.7	92.4	37.6	43.4	48.6	54.9	61.4	70.3
300	200	50.6	58.5	65.4	73.9	82.7	92.4	59.3	69.9	78.2	88.5	101.1	113.0
50	300	32.3	37.3	41.7	47.2	52.8	59.0	9.3	10.7	12.0	13.6	15.2	17.0
100	300	45.4	52.4	58.6	66.3	74.1	82.9	22.1	25.5	28.5	32.3	37.5	41.9
200	300	60.7	70.1	78.4	88.7	99.2	110.9	42.3	48.9	54.6	61.8	70.8	79.1
300	300	60.7	70.1	78.4	88.7	99.2	110.9	66.1	76.3	85.3	96.5	110.2	123.2
50	400	32.4	37.4	41.8	47.3	52.9	59.2	9.3	10.7	12.0	13.6	15.2	17.0
100	400	45.5	52.6	58.8	66.5	74.3	83.1	22.1	25.5	28.5	32.3	37.5	41.9
200	400	60.9	70.3	78.6	88.9	99.4	111.1	47.0	54.3	60.7	70.3	78.6	87.9
300	400	60.9	70.3	78.6	88.9	99.4	111.1	71.6	82.7	92.4	106.8	119.4	133.5

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$



### QwikFoot 120mm long - Single insert located near one edge

Design capacity in combination with M20 G4.6 Bolts

Single Edge Distance $c_1$	Tensile Capacity kN						Shear Capacity kN					
	Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
	Concrete Compressive Strength $f'_c$ - MPa						Concrete Compressive Strength $f'_c$ - MPa					
	15	20	25	32	40	50	15	20	25	32	40	50
50	20.8	24.0	26.8	30.3	33.9	37.9	5.4	6.2	6.9	7.9	8.8	9.8
75	24.1	27.9	31.2	35.2	39.4	44.1	8.7	10.0	11.2	12.7	14.2	15.9
100	27.7	32.0	35.8	40.5	39.4	44.1	12.3	14.3	15.9	18.0	14.2	15.9
125	31.6	36.4	40.7	46.1	51.5	57.6	16.3	18.8	21.1	23.8	26.5	29.8
150	35.6	41.1	46.0	52.0	58.1	65.0	20.6	23.8	26.6	30.1	33.6	37.6
175	39.9	46.0	51.5	58.2	65.1	72.8	25.1	29.0	32.4	36.6	41.0	45.8
200	42.0	48.5	54.2	61.3	68.5	76.6	29.8	34.4	38.5	43.6	48.6	48.6
225	42.0	48.5	54.2	61.3	68.5	76.6	34.8	40.2	44.9	48.6	48.6	48.6
250	42.0	48.5	54.2	61.3	68.5	76.6	40.0	46.2	48.6	48.6	48.6	48.6
275	42.0	48.5	54.2	61.3	68.5	76.6	45.4	48.6	48.6	48.6	48.6	48.6
300	42.0	48.5	54.2	61.3	68.5	76.6	48.6	48.6	48.6	48.6	48.6	48.6

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

### QwikFoot 120mm long - Single insert located near two edges at right angles to each other

Design capacity in combination with M20 G4.6 Bolts

Single Edge Distance $c_1$	Second Edge Distance $c_2$	Tensile Capacity kN						Shear Capacity kN					
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
		Concrete Compressive Strength $f'_c$ - MPa						Concrete Compressive Strength $f'_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	50	13.2	15.2	17.0	19.2	21.5	24.0	4.0	4.7	5.2	5.9	6.6	7.4
50	100	15.9	18.4	20.6	23.3	26.0	29.1	5.4	6.2	6.9	7.9	8.8	8.8
100	100	21.3	24.6	27.5	31.1	34.8	38.9	9.3	10.7	12.0	13.5	15.1	16.9
100	150	25.0	28.9	32.3	36.5	40.8	45.6	12.3	14.3	15.9	18.0	20.2	22.5
150	150	32.1	37.1	41.4	46.9	52.4	58.6	15.4	17.8	19.9	22.5	25.2	28.2
200	150	35.6	41.1	46.0	52.0	58.1	65.0	19.0	22.0	24.6	27.8	31.1	34.7
200	200	42.0	48.5	54.2	61.3	68.5	76.6	22.4	25.8	28.9	32.7	36.5	40.9
300	150	35.6	41.1	46.0	52.0	58.1	65.0	27.2	31.4	35.1	39.1	44.3	48.6
300	200	42.0	48.5	54.2	61.3	68.5	76.6	30.6	35.4	36.9	44.8	48.6	48.6
300	300	42.0	48.5	54.2	61.3	68.5	76.6	38.2	44.1	48.6	48.6	48.6	48.6
500	500	42.0	48.5	54.2	61.3	68.5	76.6	48.6	48.6	48.6	48.6	48.6	48.6

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

### QwikFoot 120mm long - Threaded Inserts located near one edge at various insert spacings

Design capacity in combination with M20 G4.6 Bolts

Single Edge Distance $c_1$	Spacing $s_1$	Concrete or Steel Tensile Capacity for a PAIR of Threaded Inserts						Concrete or Steel Shear Capacity for a PAIR of Threaded Inserts					
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
		Concrete Compressive Strength $f'_c$ - MPa						Concrete Compressive Strength $f'_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	100	26.3	30.4	34.0	38.4	43.0	48.0	9.0	10.4	11.6	13.1	14.6	16.4
100	100	35.2	40.6	45.4	51.3	57.4	64.2	16.5	19.0	21.2	24.0	26.9	30.1
200	100	53.2	61.4	68.7	77.7	86.9	97.1	34.8	40.2	44.9	50.8	56.8	63.5
300	100	53.2	61.4	68.7	77.7	86.9	97.1	56.6	65.3	73.0	82.6	92.4	97.2
50	200	31.9	36.8	41.1	46.6	52.0	58.2	10.8	12.4	13.9	15.7	17.6	19.7
100	200	42.6	49.2	55.0	62.2	69.5	77.7	20.6	23.8	26.6	30.1	33.6	37.6
200	200	64.4	74.4	83.2	94.1	105.2	117.6	39.8	45.9	51.4	58.1	65.0	72.6
300	200	64.4	74.4	83.2	94.1	105.2	117.6	62.2	71.9	80.3	90.1	97.2	97.2
50	300	18.7	43.2	48.3	54.7	61.1	68.3	5.4	12.4	13.9	15.7	17.6	19.7
100	300	50.0	57.7	64.6	73.0	81.7	91.3	24.7	28.5	31.9	36.1	40.3	45.1
200	300	75.7	87.4	97.7	110.5	123.6	138.2	44.8	51.7	57.8	65.4	73.1	81.7
300	300	75.7	87.4	97.7	110.5	123.6	138.2	67.9	78.4	87.7	97.2	97.2	97.2
50	400	41.5	47.9	53.6	60.6	67.8	75.8	10.8	12.4	13.9	15.7	17.6	19.7
100	400	55.5	64.0	71.6	81.0	90.6	101.3	24.7	28.5	31.9	36.1	40.3	45.1
200	400	83.9	96.9	108.4	122.6	137.1	153.2	49.7	57.4	64.2	72.6	81.2	90.8
300	400	83.9	96.9	108.4	122.6	137.1	153.2	73.9	84.9	95.0	97.2	97.2	97.2

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

# Threaded Inserts and Accessories

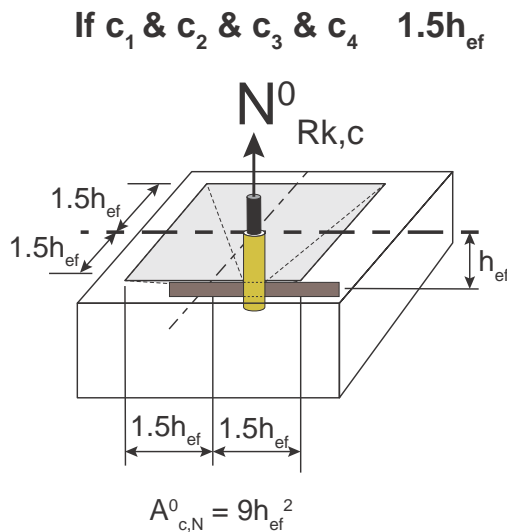
## QwikFix Round Insert Design for Structural Fixings

The following values are based on the CCD method as described in AS 3850.1:2015.

Minimum Edge Distance,  $\min c_1 = 1.5h_{ef}$

**Minimum edge distance  $c_1$  and insert spacing  $s_1$  to reach full concrete cone capacity**

Insert Length (mm)	76	96
min $c_1$ (mm)	105	135
min $s_1$ (mm)	205	270



**Cone breakout (tension) capacity ( $\phi_c N_{Rk,c}$ ) of a QwikFix insert located with minimum edge distance and insert spacing; kN**

Part Code	Concrete Compressive Strength $f_c$ - MPa					
	15	20	25	32	40	50
FER1676, FER2076	17.1	19.8	22.1	25.0	28.0	31.3
FER1296, FER1696, FER2096	25.2	29.0	32.5	36.7	37.9	37.9

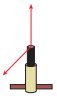
**Note:** QwikFix inserts require an N12x300 long crossbar which has a maximum shear capacity 37.9kN.

### Design Method

#### How to use the tables

- Determine the factored load and required capacities in accordance with AS 3600
- Determine the design compressive strength of the concrete.
- Check the edge distance and spacing of the insert. If the edge distances and insert spacing exceed the minimum, check the concrete breakout (tension) capacity in the table above
- Choose the size and grade of bolt to be used and its steel capacity from the table above
- If the insert is closer to one or more edges or to another insert, refer to the following tables for insert capacity.

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$



### QwikFix 76mm long - Single insert located near one edge

Design capacity in combination with G4.6 Bolts: M16 Purple, M20 Red

Single Edge Distance $c_1$	Tensile Capacity kN						Shear Capacity kN					
	Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
	Concrete Compressive Strength $f'_c$ - MPa						Concrete Compressive Strength $f'_c$ - MPa					
	15	20	25	32	40	50	15	20	25	32	40	50
50	10.8	12.5	14.0	15.8	17.7	19.8	4.5	5.2	5.8	6.5	7.3	8.2
75	13.7	15.8	17.7	20.0	22.4	25.0	7.4	8.6	9.6	10.8	12.1	13.5
100	16.8	19.5	21.8	24.6	27.5	30.8	10.7	12.4	13.8	15.7	17.5	19.6
125	17.3	20.0	22.4	25.3	28.3	31.6	14.3	16.6	18.5	21.0	23.4	26.2
150	17.3	20.0	22.4	25.3	28.3	31.6	18.3	21.1	23.6	26.7	29.8	33.3
175	17.3	20.0	22.4	25.3	28.3	31.6	22.4	25.9	28.9	32.7	36.6	40.9
200	17.3	20.0	22.4	25.3	28.3	31.6	26.8	31.0	34.6	39.2	43.8	48.6
225	17.3	20.0	22.4	25.3	28.3	31.6	31.4	36.3	40.6	45.9	48.6	48.6
250	17.3	20.0	22.4	25.3	28.3	31.6	34.6	40.0	44.7	48.6	48.6	48.6
275	17.3	20.0	22.4	25.3	28.3	31.6	34.6	40.0	44.7	48.6	48.6	48.6
300	17.3	20.0	22.4	25.3	28.3	31.6	34.6	40.0	44.7	48.6	48.6	48.6
400	17.3	20.0	22.4	25.3	28.3	31.6	34.6	40.0	44.7	48.6	48.6	48.6

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

### QwikFix 76mm long - Single insert located near two edges at right angles to each other

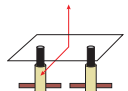
Design capacity in combination with G4.6 Bolts: M16 Purple, M20 Red

Single Edge Distance $c_1$	Second Edge Distance $c_2$	Tensile Capacity kN					Shear Capacity kN						
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$					Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$						
		Concrete Compressive Strength $f'_c$ - MPa					Concrete Compressive Strength $f'_c$ - MPa						
		15	20	25	32	40	50	15	20	25	32	40	50
50	50	8.0	9.3	10.4	11.8	13.1	14.7	3.3	3.9	4.3	4.9	5.5	6.1
50	100	10.7	12.3	13.8	15.6	17.4	19.5	4.5	5.2	5.8	6.6	7.3	8.2
100	100	16.6	19.1	21.4	24.2	27.0	30.2	8.0	9.3	10.4	11.7	13.1	14.7
100	150	16.8	19.5	21.8	24.6	27.5	30.8	10.7	12.4	13.8	15.7	17.5	19.6
150	150	17.3	20.2	22.4	25.3	28.3	31.6	13.7	15.8	17.7	20.0	22.4	25.0
200	150	17.3	20.2	22.4	25.3	28.3	31.6	17.1	19.7	22.1	25.2	27.9	31.2
200	200	17.3	20.2	22.4	25.3	28.3	31.6	20.1	23.2	26.0	29.4	32.8	36.7
300	100	16.8	19.5	21.8	24.6	27.5	30.8	21.8	25.5	28.1	31.8	35.5	39.7
300	200	17.3	20.2	22.4	25.3	28.3	31.6	28.0	32.3	36.1	40.8	45.7	48.6
300	300	17.3	20.2	22.4	25.3	28.3	31.6	34.6	40.0	44.7	48.6	48.6	48.6
300	300	17.3	20.2	22.4	25.3	28.3	31.6	34.6	40.0	44.7	48.6	48.6	48.6

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

### A Group of TWO QwikFix 76 mm long - Threaded Inserts located near one edge at various insert spacings

Design capacity in combination with G4.6 Bolts: M16 Purple, M20 Red



Single Edge Distance $c_1$	Spacing $s_1$	Tensile Capacity for a PAIR of Threaded Inserts						Shear Capacity for a PAIR of Threaded Inserts					
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
		Concrete Compressive Strength $f'_c$ - MPa						Concrete Compressive Strength $f'_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	100	16.1	18.6	20.8	23.5	26.3	29.4	7.4	8.6	9.6	10.9	12.2	13.5
100	100	25.0	28.9	32.3	36.5	40.8	45.6	14.3	16.5	18.5	20.9	23.3	26.1
200	100	25.7	29.7	33.2	37.5	41.9	46.9	31.3	36.1	40.4	45.7	51.1	57.1
300	100	25.7	29.7	33.2	37.5	41.9	46.9	51.4	59.3	66.3	75.0	84.9	95.9
50	200	21.3	24.6	27.5	31.2	34.8	38.9	8.9	10.3	11.5	13.0	14.6	16.3
100	200	33.1	38.3	42.8	48.4	54.1	60.5	17.9	20.6	23.1	26.1	29.2	32.6
200	200	34.0	39.3	44.0	49.7	55.6	62.2	35.7	41.3	46.1	52.2	58.4	65.3
300	200	34.0	39.3	44.0	49.7	55.6	62.2	56.8	65.6	73.3	82.9	92.7	97.2
50	300	21.7	25.1	28.0	31.7	35.4	39.6	8.9	10.3	11.5	13.0	14.6	16.3
100	300	33.7	38.9	43.5	49.2	55.0	61.5	21.4	24.8	27.7	31.3	35.0	39.2
200	300	34.6	40.0	44.7	50.6	56.5	63.2	40.2	46.4	52.7	59.5	66.7	73.4
300	300	34.6	40.0	44.7	50.6	56.5	63.2	62.0	71.5	80.0	90.5	97.2	97.2
50	400	21.7	25.1	28.0	31.7	35.4	39.6	8.9	10.3	11.5	13.0	14.6	16.3
100	400	33.7	38.9	43.5	49.2	55.0	61.5	21.4	24.8	27.7	31.3	35.0	39.2
200	400	34.6	40.0	44.7	50.6	56.5	63.2	40.2	46.4	52.7	59.5	66.7	73.4
300	400	34.6	40.0	44.7	50.6	56.5	63.2	62.0	71.5	80.0	90.5	97.2	97.2

# Threaded Inserts and Accessories



## QwikFix 96mm long - Single insert located near one edge

Design capacity in combination with G4.6 Bolts: M12 Green, M16 Purple, M20 Red

Single Edge Distance $c_1$	Tensile Capacity kN						Shear Capacity kN					
	Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
	Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
	15	20	25	32	40	50	15	20	25	32	40	50
50	14.2	16.4	18.3	20.7	23.1	25.9	4.8	5.6	6.2	7.0	7.9	8.8
75	17.2	19.9	22.2	25.1	28.1	31.4	7.9	9.1	10.2	11.5	12.9	14.4
100	20.5	23.7	26.5	30.0	33.5	37.4	11.4	13.1	14.7	16.6	18.5	20.7
125	24.1	27.8	31.1	35.2	39.3	44.0	15.1	17.5	19.5	22.1	24.7	27.6
150	25.4	29.3	32.7	37.0	41.4	46.3	19.2	22.1	24.7	28.0	31.1	35.0
175	25.4	29.3	32.7	37.0	41.4	46.3	23.5	27.1	30.3	34.3	38.3	42.8
200	25.4	29.3	32.7	37.0	41.4	46.3	28.0	32.3	36.2	40.9	45.7	48.6
225	25.4	29.3	32.7	37.0	41.4	46.3	32.8	37.8	42.3	47.9	48.6	48.6
250	25.4	29.3	32.7	37.0	41.4	46.3	37.7	43.6	48.6	48.6	48.6	48.6
275	25.4	29.3	32.7	37.0	41.4	46.3	37.7	43.6	48.6	48.6	48.6	48.6
300	25.4	29.3	32.7	37.0	41.4	46.3	48.2	48.6	48.6	48.6	48.6	48.6

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

## QwikFix 96mm long - Single insert located near two edges at right angles to each other

Design capacity in combination with G4.6 Bolts: M12 Green, M16 Purple, M20 Red

Single Edge Distance $c_1$	Second Edge Distance $c_2$	Tensile Capacity kN						Shear Capacity kN					
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
		Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	50	9.7	11.2	12.6	14.2	15.9	17.8	3.6	4.2	4.7	5.3	5.9	6.6
50	100	12.4	14.3	16.0	18.1	20.2	22.6	4.8	5.6	6.2	7.0	7.9	8.8
100	100	17.9	20.7	23.2	26.2	29.3	32.8	8.5	9.8	11.0	12.4	13.9	15.6
100	150	20.5	23.7	26.5	30.0	33.5	37.4	11.4	13.1	14.7	16.6	18.5	20.7
150	150	25.4	29.3	32.7	37.0	41.4	46.3	14.4	16.6	18.6	21.0	23.5	26.2
200	150	25.4	29.3	32.7	37.0	41.4	46.3	17.9	20.6	23.0	26.1	29.2	32.6
200	200	25.4	29.3	32.7	37.0	41.4	46.3	21.0	24.3	27.1	30.7	34.3	38.3
300	100	20.5	23.7	26.5	30.0	33.5	37.4	22.6	26.1	29.2	33.0	36.9	41.3
300	200	25.4	29.3	32.7	37.0	41.4	46.3	29.0	33.5	37.5	42.4	47.4	48.6
300	300	25.4	29.3	32.7	37.0	41.4	46.3	36.2	41.8	46.7	48.6	48.6	48.6

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

## A Group of TWO QwikFix 96mm long - Threaded Inserts located near one edge at various insert spacings

Design capacity in combination with G4.6 Bolts: M12 Green, M16 Purple, M20 Red

Single Edge Distance $c_1$	Spacing $s_1$	Tensile Capacity for a PAIR of Threaded Inserts						Shear Capacity for a PAIR of Threaded Inserts					
		Capacity limited by either $f_c \cdot N_{Rk,c}$ or $f_s \cdot N_{Rk,s}$						Capacity limited by either $f_c \cdot V_{Rk,c}$ or $f_s \cdot V_{Rk,s}$					
		Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	100	19.5	22.5	25.1	28.4	31.8	35.5	8.0	9.3	10.4	11.7	13.1	14.7
100	100	28.2	32.6	36.4	41.2	46.0	51.5	15.1	17.5	19.5	22.1	24.7	27.6
200	100	34.9	40.3	45.0	50.9	56.9	63.7	32.7	37.7	42.2	47.7	53.4	59.7
300	100	34.9	40.3	45.0	50.9	56.9	63.7	53.6	61.9	69.2	78.3	87.5	97.2
50	200	24.8	28.6	32.0	36.2	40.4	45.2	9.6	11.1	12.4	14.1	15.7	17.6
100	200	35.9	41.4	46.3	52.4	58.6	65.5	18.9	21.9	24.4	27.6	30.9	34.6
200	200	44.4	51.2	57.3	64.8	72.4	81.0	37.3	43.1	48.2	54.5	61.0	68.2
300	200	44.4	51.2	57.3	64.8	72.4	81.0	59.0	68.1	76.1	86.1	96.3	97.2
50	300	28.3	32.7	36.3	41.4	46.3	51.7	9.6	11.1	12.4	14.1	15.7	17.6
100	300	41.0	47.4	53.0	59.9	67.0	74.9	22.7	26.2	29.3	33.2	37.1	41.5
200	300	50.7	58.6	65.5	74.1	82.8	92.6	42.0	48.5	54.2	61.4	68.6	76.7
300	300	50.7	58.6	65.5	74.1	82.8	92.6	64.3	74.3	83.0	93.9	97.2	97.2
50	400	28.3	32.7	36.6	41.4	46.3	51.7	9.6	11.1	12.4	14.1	15.7	17.6
100	400	41.0	47.4	53.0	59.9	67.0	74.9	22.7	26.2	29.3	33.2	37.1	41.5
200	400	50.7	58.6	65.5	74.1	82.8	92.6	46.7	53.9	60.3	68.2	76.2	85.2
300	400	50.7	58.6	65.5	74.1	82.8	92.6	96.7	80.5	90.0	97.2	97.2	97.2

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

# Working Load Limit (WLL) Design of Brace and Strongback Inserts in accordance with AS 3850.1:2015

Inserts which are used to fasten braces and strongbacks for the erection of precast concrete elements are designed with working load limits which are determined by dividing the characteristic strength of either the steel or the concrete by a factor of safety (FoS) of 2.25.

## Steel WLL

The following table provides the WLL for Unicoil 16 and M20 G4.6 bolts

### AS 3850.1 Working Load Limit

Bolt	WLL Tension Grade 4.6	WLL Shear
UC16	34.1	21.2
M20	43.6	27.0

## Concrete WLL

The characteristic strengths for tension  $N_{Rk,c}$  and shear  $V_{Rk,c}$  are determined by the CCD design method.

Minimum Edge Distance,  $\min c_1 = 1.5h_{ef}$

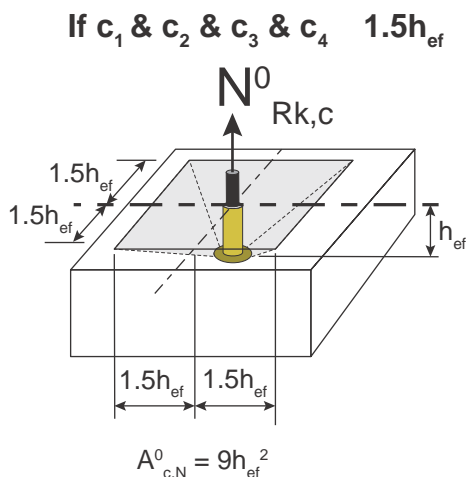
### Minimum edge and spacing

Insert Type	FF2096/ UCQF1696	FER2096/ FERB3496Z
min $c_1$	155	135
min $s_1$	305	270

## WLL of a QwikFoot insert located with minimum edge and insert spacing

### FF2096 and UCQF1696 Bracing Ferrule

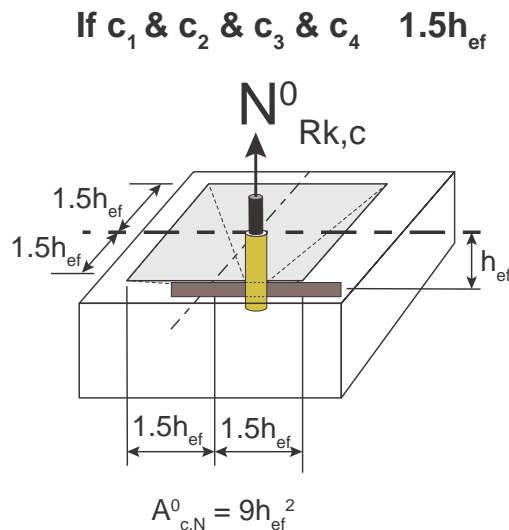
Concrete Compressive Strength $f_c$ - MPa			
15	20	25	32
WLL - kN: $N_{Rk,c} / 2.25$			
23.7	27.4	30.6	34.7



## WLL of a QwikFix round insert fitted with a N12 Crossbar 300mm long located with minimum edge and insert spacing

### FER2096 and FERB3496Z Bracing Ferrule

Concrete Compressive Strength $f_c$ - MPa			
15	20	25	32
WLL - kN: $N_{Rk,c} / 2.25$			
18.6	21.5	24.1	27.2



**Note:** QwikFix inserts require an N12x300 long crossbar which has a maximum WLL limited by shear of 38kN.

# Threaded Inserts and Accessories

## WLL of inserts located close to edges or close to each other

The following design tables provide working loads limited either by the WLL of the Bolts (steel) or concrete breakout whichever is the minimum.

There are three cases considered:

- close to one edge
- close to two edges at right angles to each other
- a group of two inserts at close spacings

For more complicated configurations please refer either to AS 3850.1 Appendix B or Leviai.

In each table, the loads are limited by either the concrete or the steel WLL and colour coded to show the load range for each bolt type (Unicoil 16 & M20 G4.6).

## Design Method

### How to use the tables

- Determine the factored load and required capacities in accordance with AS 3850.
- Determine the compressive strength of the concrete at the time of loading.
- Check the edge distance and spacing of the insert. If the edge distances and insert spacing exceed the minimum, check the Concrete WLL in the table above.
- Choose the type of bolt to be used, either Unicoil 16 or G4.6 and it's WLL from the table above.
- If the insert is closer to one or more edges or to another insert, refer to the following tables for insert capacity.

### Example 1

A QwikFoot insert is required to fix a wind brace with an applied load of 25kN in tension in a footing which is designed to provide  $f_{cm}=20\text{MPa}$  at the time of erection and where the closest edge distance is 300mm.

The applied load is less than the WLL of either the UCQF1696 in combination with a Unicoil bolt (34.1 kN) or FF2096 in combination with a M20 bolt (43.6kN) so either may be used.

The edge distance is greater than the minimum edge distance required to reach the full concrete cone capacity (160 mm). The WLL at 20MPa is 27.4kN; see table on page 29 so design OK.

**Note:** A QwikFix insert has a lower WLL (21.7kN at 20MPa) and could only be used if the concrete strength exceeded 32MPa.

### Example 2

A QwikFoot insert is located at an edge distance 125mm from one edge. Refer to the first table on page 31.

The capacity in the table at 20MPa is 22.6kN, i.e. not sufficient.

A concrete strength of 25MPa is required. If the concrete strength can be increased either a Unicoil16 (purple) or M20 G4.6bolt (red) is OK.

### Example 3

An insert is to be located 200mm from two adjacent edges at right angles with an applied load of 34kN. Refer to the second table on page 31.

The minimum required concrete strength to develop a WLL of at least 34kN is 40MPa (WLL=36.8kN). Use a Unicoil insert and bolt with a WLL of 34.1kN or an M20 G4.6 (red).

## Code Compliance with AS 3850.1:2015

Ancon QwikFoot and QwikFix Threaded Inserts are manufactured from ductile materials. When designed in accordance with the design method described in this document QwikFoot and QwikFix Threaded Inserts comply with clause 2.2, 2.5.1 and 2.5.4 of AS 3850.1:2015.



### QwikFoot 96mm long - Single insert located near one edge

Working Load Limit of Unicoil Bolts Purple, G4.6 M20 Red

Single Edge Distance $c_1$	WLL in Tension kN						WLL in Shear kN					
	WLL limited by either $N_{Rk,c} / 2.25$ or $N_{Rk,s} / 2.25$						WLL limited by either $V_{Rk,c} / 2.25$ or $V_{Rk,s} / 2.25$					
	Concrete Compressive Strength $f'_c$ - MPa						Concrete Compressive Strength $f'_c$ - MPa					
	15	20	25	32	40	50	15	20	25	32	40	50
50	12.0	13.9	15.5	17.5	19.6	21.9	3.7	4.3	4.8	5.4	6.1	6.8
75	14.3	16.6	18.5	20.9	23.4	26.2	6.1	7.0	7.8	8.8	9.9	11.0
100	16.9	19.5	21.8	24.6	27.5	30.8	8.7	10.0	11.2	12.6	14.1	15.8
125	19.6	22.6	25.3	28.6	31.9	35.3	11.5	13.3	14.9	16.8	18.8	21.0
150	22.5	25.9	29.0	32.8	36.7	41.0	14.6	16.8	18.8	21.3	23.8	26.6
175	22.5	26.0	29.1	32.9	36.8	41.2	17.8	20.5	23.0	26.0	27.0	27.0
200	22.5	26.0	29.1	32.9	36.8	41.2	21.2	24.5	27.0	27.0	27.0	27.0
225	22.5	26.0	29.1	32.9	36.8	41.2	24.8	27.0	27.0	27.0	27.0	27.0
250	22.5	26.0	29.1	32.9	36.8	41.2	27.0	27.0	27.0	27.0	27.0	27.0
275	22.5	26.0	29.1	32.9	36.8	41.2	27.0	27.0	27.0	27.0	27.0	27.0
300	22.5	26.0	29.1	32.9	36.8	41.2	27.0	27.0	27.0	27.0	27.0	27.0

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

### QwikFix 96mm long - Single insert located near two edges at right angles to each other

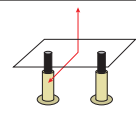
Working Load Limit of Unicoil Bolts Purple, G4.6 M20 Red

Single Edge Distance $c_1$	Second Edge Distance $c_2$	WLL in Tension kN					WLL in Shear kN						
		WLL limited by either $N_{Rk,c} / 2.25$ or $N_{Rk,s} / 2.25$					WLL limited by either $V_{Rk,c} / 2.25$ or $V_{Rk,s} / 2.25$						
		Concrete Compressive Strength $f'_c$ - MPa					Concrete Compressive Strength $f'_c$ - MPa						
		15	20	25	32	40	50	15	20	25	32	40	50
50	50	8.0	9.2	10.3	11.7	13.0	14.6	2.8	3.2	3.6	4.1	4.5	5.1
50	100	10.0	11.5	12.9	14.6	16.3	18.2	3.7	4.3	4.8	5.4	6.1	6.8
100	100	14.0	16.2	18.1	20.5	22.9	25.6	6.5	7.5	8.4	9.5	10.6	11.9
100	150	16.8	19.4	21.7	24.6	27.5	30.7	8.7	10.0	11.2	12.6	14.1	15.8
150	150	22.4	25.9	28.9	32.7	36.6	40.9	10.9	12.6	14.1	15.9	17.8	19.9
200	150	22.5	25.9	29.0	32.8	36.7	41.0	13.5	15.6	17.5	19.7	22.1	24.7
200	200	22.5	26.0	29.1	32.9	36.8	41.2	15.9	18.4	20.5	23.2	26.0	27.0
300	150	22.5	25.9	29.0	32.8	36.7	41.0	19.4	22.4	25.1	27.0	27.0	27.0
300	200	22.5	26.0	29.1	32.9	36.8	41.2	21.9	25.3	27.0	27.0	27.0	27.0

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

### A Group of TWO QwikFoot 96mm long - Threaded Inserts located near one edge at various insert spacings

Working Load Limit of Unicoil Bolts Purple, G4.6 M20 Red



Single Edge Distance $c_1$	Spacing $s_1$	WLL in Tension for a PAIR of Threaded Inserts					WLL in Shear for a PAIR of Threaded Inserts						
		WLL limited by either $N_{Rk,c} / 2.25$ or $N_{Rk,s} / 2.25$					WLL limited by either $V_{Rk,c} / 2.25$ or $V_{Rk,s} / 2.25$						
		Concrete Compressive Strength $f'_c$ - MPa					Concrete Compressive Strength $f'_c$ - MPa						
		15	20	25	32	40	50	15	20	25	32	40	50
50	100	16.0	18.5	20.6	23.3	26.1	29.2	6.2	7.1	8.0	9.0	10.1	11.3
100	100	22.4	25.9	29.0	32.8	36.7	41.0	11.5	13.3	14.9	16.9	18.9	21.1
200	100	30.0	34.7	38.8	43.9	49.0	54.8	24.7	28.6	31.9	36.1	40.4	45.2
300	100	30.0	34.7	38.8	43.9	49.0	54.8	40.5	46.7	52.2	54.0	54.0	54.0
50	200	20.0	23.1	25.8	29.2	32.6	36.4	20.0	8.6	9.6	10.8	12.1	13.5
100	200	28.0	32.4	36.2	41.0	45.8	51.2	14.4	16.7	18.6	21.1	23.6	26.4
200	200	37.5	43.3	48.4	54.8	61.2	68.5	28.3	32.7	36.5	41.3	46.2	51.6
300	200	37.5	43.3	48.4	54.8	61.2	68.5	44.5	51.4	54.0	54.0	54.0	54.0
50	300	23.9	27.6	30.9	35.0	39.1	43.7	7.4	8.6	9.6	10.8	12.1	13.5
100	300	33.6	38.8	43.4	49.1	54.9	61.4	17.3	20.0	22.4	25.3	28.3	31.6
200	300	45.0	51.9	58.1	65.7	73.4	82.1	31.8	36.7	41.1	46.5	52.0	54.0
300	300	45.0	51.9	58.1	65.7	73.4	82.1	48.6	54.0	54.0	54.0	54.0	54.0
50	400	24.0	27.7	31.0	35.1	39.2	43.8	7.4	8.6	9.6	10.8	12.1	13.5
100	400	33.7	38.9	43.5	49.2	55.1	61.4	17.3	20.0	22.4	25.3	28.3	31.6
200	400	45.1	52.1	58.2	65.9	73.6	82.3	35.3	40.8	45.6	51.6	54.0	54.0
300	400	45.1	52.1	58.2	65.9	73.6	82.3	52.6	54.0	54.0	54.0	54.0	54.0

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

# Threaded Inserts and Accessories



## QwikFix 96mm long - Single insert located near one edge

Working Load Limit of Unicoil Bolts Purple, G4.6 M20 Red

Single Edge Distance $c_1$	WLL in Tension kN						WLL in Shear kN					
	WLL limited by either $N_{Rk,c} / 2.25$ or $N_{Rk,s} / 2.25$						WLL limited by either $V_{Rk,c} / 2.25$ or $V_{Rk,s} / 2.25$					
	Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
	15	20	25	32	40	50	15	20	25	32	40	50
50	10.5	12.1	13.5	15.3	17.1	19.2	3.6	4.1	4.6	5.2	5.8	6.5
75	12.7	14.7	16.5	18.6	20.8	23.3	5.9	6.8	7.6	8.6	9.6	10.7
100	15.2	17.5	19.6	22.2	24.8	27.7	8.4	9.7	10.9	12.3	13.7	15.4
125	17.8	20.6	23.0	26.1	29.1	32.6	11.2	12.9	14.5	16.4	18.3	20.5
150	18.8	21.7	24.3	27.4	30.7	34.3	14.2	16.4	18.3	20.7	23.2	25.9
175	18.8	21.7	24.3	27.4	30.7	34.3	17.4	20.1	22.4	25.4	27.0	27.0
200	18.8	21.7	24.3	27.4	30.7	34.3	20.7	24.0	26.8	27.0	27.0	27.0
225	18.8	21.7	24.3	27.4	30.7	34.3	24.3	27.0	27.0	27.0	27.0	27.0
250	18.8	21.7	24.3	27.4	30.7	34.3	27.0	27.0	27.0	27.0	27.0	27.0
275	18.8	21.7	24.3	27.4	30.7	34.3	27.0	27.0	27.0	27.0	27.0	27.0
300	18.8	21.7	24.3	27.4	30.7	34.3	27.0	27.0	27.0	27.0	27.0	27.0

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

## QwikFix 96mm long - Single insert located near two edges at right angles to each other

Working Load Limit of Unicoil Bolts Purple, G4.6 M20 Red

Single Edge Distance $c_1$	Second Edge Distance $c_2$	WLL in Tension kN						WLL in Shear kN					
		WLL limited by either $N_{Rk,c} / 2.25$ or $N_{Rk,s} / 2.25$						WLL limited by either $V_{Rk,c} / 2.25$ or $V_{Rk,s} / 2.25$					
		Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	50	7.2	8.3	9.3	10.5	11.8	13.2	2.7	3.1	3.5	3.9	4.4	4.9
50	100	9.2	10.6	11.8	13.4	15.0	16.7	3.6	4.1	4.6	5.2	5.8	6.5
100	100	13.3	15.3	17.2	19.4	21.7	24.3	6.3	7.3	8.1	9.2	10.3	11.5
100	150	15.2	17.5	19.6	22.2	24.8	27.7	8.4	9.7	10.9	12.3	13.7	15.4
150	150	18.8	21.7	24.3	27.4	30.7	34.3	10.6	12.3	13.7	15.6	17.4	19.4
200	150	18.8	21.7	24.3	27.4	30.7	34.3	13.2	15.3	17.1	19.3	21.6	24.1
200	200	18.8	21.7	24.3	27.4	30.7	34.3	15.6	18.0	20.1	22.7	25.4	27.0
300	100	15.2	17.5	19.6	22.2	24.8	27.7	16.7	19.3	21.6	24.5	27.0	27.0
300	200	18.8	21.7	24.3	27.4	30.7	34.3	21.5	24.8	27.0	27.0	27.0	27.0
300	300	18.8	21.7	24.3	27.4	30.7	34.3	27.0	27.0	27.0	27.0	27.0	27.0

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$

## A Group of TWO QwikFix 96mm long - Threaded Inserts located near one edge at various insert spacings

Working Load Limit of Unicoil Bolts Purple, G4.6 M20 Red

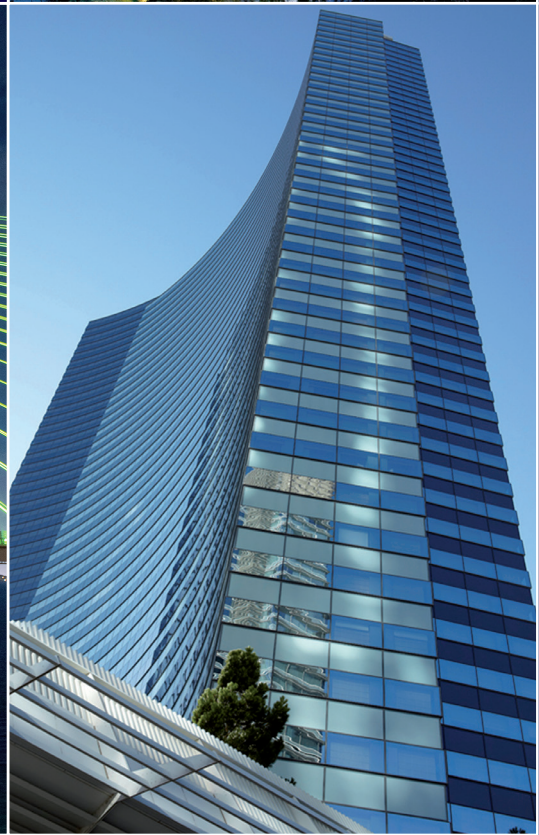
Single Edge Distance $c_1$	Spacing $s_1$	WLL in Tension for a PAIR of Threaded Inserts						WLL in Shear for a PAIR of Threaded Inserts					
		WLL limited by either $N_{Rk,c} / 2.25$ or $N_{Rk,s} / 2.25$						WLL limited by either $V_{Rk,c} / 2.25$ or $V_{Rk,s} / 2.25$					
		Concrete Compressive Strength $f_c$ - MPa						Concrete Compressive Strength $f_c$ - MPa					
		15	20	25	32	40	50	15	20	25	32	40	50
50	100	14.4	16.6	18.6	21.1	23.5	26.3	5.9	6.9	7.7	8.7	9.7	10.9
100	100	20.9	24.1	27.0	30.5	34.1	38.1	11.2	13.0	14.5	16.4	18.3	20.5
200	100	25.8	29.8	33.3	37.7	42.2	47.2	24.2	27.9	31.2	35.3	39.5	44.2
300	100	25.8	29.8	33.3	37.7	42.2	47.2	39.7	45.8	51.3	54.0	54.0	54.0
50	200	18.3	21.2	23.7	26.8	30.0	33.5	7.1	8.2	9.2	10.4	11.7	13.0
100	200	26.6	30.7	34.3	38.8	43.4	48.5	14.0	16.2	18.1	20.5	22.9	25.6
200	200	32.9	37.9	42.4	48.0	53.7	60.0	27.7	31.9	35.7	40.0	45.2	50.5
300	200	32.9	37.9	42.4	48.0	53.7	60.0	43.7	50.4	54.0	54.0	54.0	54.0
50	300	21.0	24.2	27.1	30.6	34.3	38.3	7.1	8.2	9.2	10.4	11.7	13.0
100	300	30.4	35.1	39.2	44.4	49.6	55.5	16.8	19.4	21.7	24.6	27.5	30.7
200	300	37.6	43.4	48.5	54.9	61.4	68.6	31.1	35.9	40.2	45.4	50.8	54.0
300	300	37.6	43.4	48.5	54.9	61.4	68.6	47.6	54.0	54.0	54.0	54.0	54.0
50	400	21.0	24.2	27.1	30.6	34.3	38.3	7.1	8.2	9.2	10.4	11.7	13.0
100	400	30.4	35.1	39.2	44.4	49.6	55.5	16.8	19.4	21.7	24.6	27.5	30.7
200	400	37.6	43.4	48.5	54.9	61.4	68.6	34.6	39.9	44.6	50.5	54.0	54.0
300	400	37.6	43.4	48.5	54.9	61.4	68.6	51.6	54.0	54.0	54.0	54.0	54.0

The full shear capacity can only be reached for slab thicknesses bigger than  $1.5 \cdot c_1$



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