Ramset™

WERCS AnkaScrew™

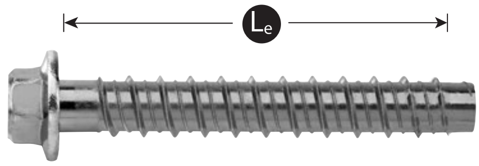
SCREW IN ANCHORS - NON-CRACKED CONCRETE

GENERAL INFORMATION

Performance Related | Material Specification | Installation Related

Product

The WERCS AnkaScrew™ Anchor is a medium duty, rotation setting thread forming anchor.



Benefits, Advantages and Features

Fast and easy to install:
- Simply screws into hole.

Fast and easy to remove:
- Screws out leaving an empty hole with no protruding metal parts to grind off.

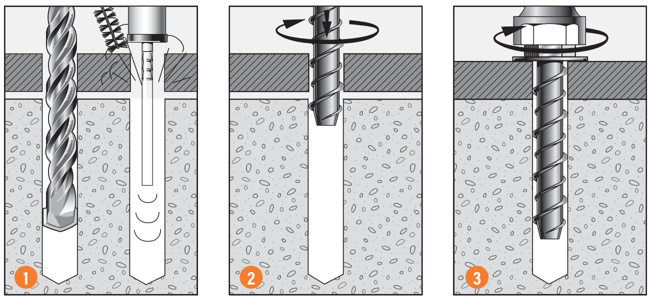
Close to edge and for close anchor spacing:
- Does not expand and burst concrete.

Ramset Design Method:
- Uses technical data validated from testing in ANZ concrete substrates

Principal Applications

- Pallet racking
- Temporary safety barriers
- Conveyors
- Pipe brackets
- Gate hinges into brickwork
- Temporary hand rails
- Bottom plates

Installation



1. Drill hole to correct diameter and depth. Clean thoroughly with brush. Remove debris by way of vacuum or hand pump, compressed air etc.
2. Using a socket wrench, screw the WERCS AnkaScrew™ into the hole using slight pressure until the self tapping action starts.
3. Tighten the WERCS AnkaScrew™ until flush with fixture. If resistance is experienced when tightening, unscrew anchor one turn and re-tighten. Ensure not to over tighten.

Material Specifications

Anchor part	Zn Zinc Plated	MGAL Mechanically Galvanised
Anchor body	Heat treated carbon steel	Heat treated carbon steel
Plating	Electroplated Zinc coating minimum thickness 5 microns	Mechanical Galvanised Coating minimum thickness 42 microns

Ramset™

WERCS AnkaScrew™

SCREW IN ANCHORS - NON-CRACKED CONCRETE

Installation and performance details

Anchor size, d_b (mm)	Installation details				Optimum dimensions*		Reduced Characteristics Capacity			
	Drilled hole diameter, d_h (mm)	Fixture hole diameter, d_f (mm)	Anchor effective depth, h (mm)	Tightening torque, T_r (Nm)	Edge distance, e_c (mm)	Anchor spacing, a_c (mm)	Shear (concrete) ϕV_{uc} (kN)*** f'_c > 20 MPa	Non-Cracked Concrete Tension, ϕN_{uc} (kN)** Concrete compressive strength, f'_c 20 MPa	25 MPa	32 MPa
5	5	7	25	5	15	15	0.9	2.1	2.3	2.5
6	6	8	30	15	60	35	6.8 #	3.7	4.0	4.3
			37				7.5	4.7	5.0	5.5
			45				7.5	5.8	6.3	6.9
8	8	10	40	40	80	45	12.6 #	5.5	5.9	6.4
			50				13.3	7.3	7.9	8.6
			60				13.3	9.3	10.0	10.9
10	10	12	50	55	100	60	20.7	7.9	8.5	9.3
			62				20.7	10.6	11.5	12.5
			75				20.7	13.9	15.0	16.3
12	12	15	60	80	120	70	25 #	11.2	12.1	13.2
			75				28.4 #	15.5	16.8	18.3
			90				29.8	20.3	21.9	23.9
16	16	19	90	-	160	100	53.0	20.7	24.1	28.4
			105				53.0	25.4	29.5	34.8
			120				53.0	30.3	35.2	41.5

* Note: For shear loads acting towards an edge or where these optimum dimensions are not achievable, please use the simplified strength limit state design process to verify capacity.

**Note: Reduced characteristic ultimate concrete tensile capacity = ϕN_{uc} where ϕ = 0.60 and N_{uc} = Characteristic ultimate concrete tensile capacity.

For conversion to Working Load Limit MULTIPLY ϕN_{uc} x 0.55

*** Note: Values are for shear load direction away from concrete edge - Reduce characteristic ultimate concrete edge shear capacity = ϕV_{uc} where ϕ = 0.6 and V_{uc} = Charecteristic ultimate concrete edge shear capacity.

Note: Values for shear limited by steel - Reduced characteristic ultimate steel shear capacity = ϕV_{us} where ϕ = 0.80 and V_{us} = Characteristic ultimate steel shear capacity.

All data relevant for Non-cracked concrete

DESCRIPTION AND PART NUMBERS

Anchor size, db	Effective length, Le (mm)	Part No. Zn Hex Head	Gal Hex Head
5	28	AS05030	-
6	44	AS06050W100	AS06050WGM100
	69	AS06075W100	AS06075WGM100
	94	AS06100W100	AS06100WGM100
8	54	AS08060W100	AS08060WGM100
	69	AS08075W100	AS08075WGM100
	94	AS08100W100	AS08100WGM100
10	54	AS10060W50	AS10060WGM50
	69	AS10075W50	AS10075WGM50
	94	AS10100W50	AS10100WGM50
12	69	AS12075W50	AS12075WGM50
	94	AS12100W50	AS12100WGM50
	144	AS12150W20	AS12150WGM20
16	115	AS16115	-
	140	AS16140	-
	160	AS16160	-

Effective depth, h (mm)

$h = L_e - t,$

t = total thickness of material(s) being fixed

Substrate thickness, b_m (mm)

b_m = greater of: $1.25 \times h$, $h + (3 \times d_h)$

Drilled hole depth, h_1 (mm)

$h_1 = h + d_h$

h = Effective depth

ENGINEERING PROPERTIES

Anchor size, d_b (mm)	Stress area, A_s (mm²)	Yield strength, f_y (MPa)	UTS, f_u (MPa)
5	15.9	600	800
6	22.9	640	800
8	42.4	640	800
10	69.4	640	800
12	84.1	640	800
16	186.3	640	800

WERCS AnkaScrew™

STRENGTH LIMIT STATE DESIGN

STEP 1 Select anchor to be evaluated

Table 1a Indicative combined loading - interaction diagram

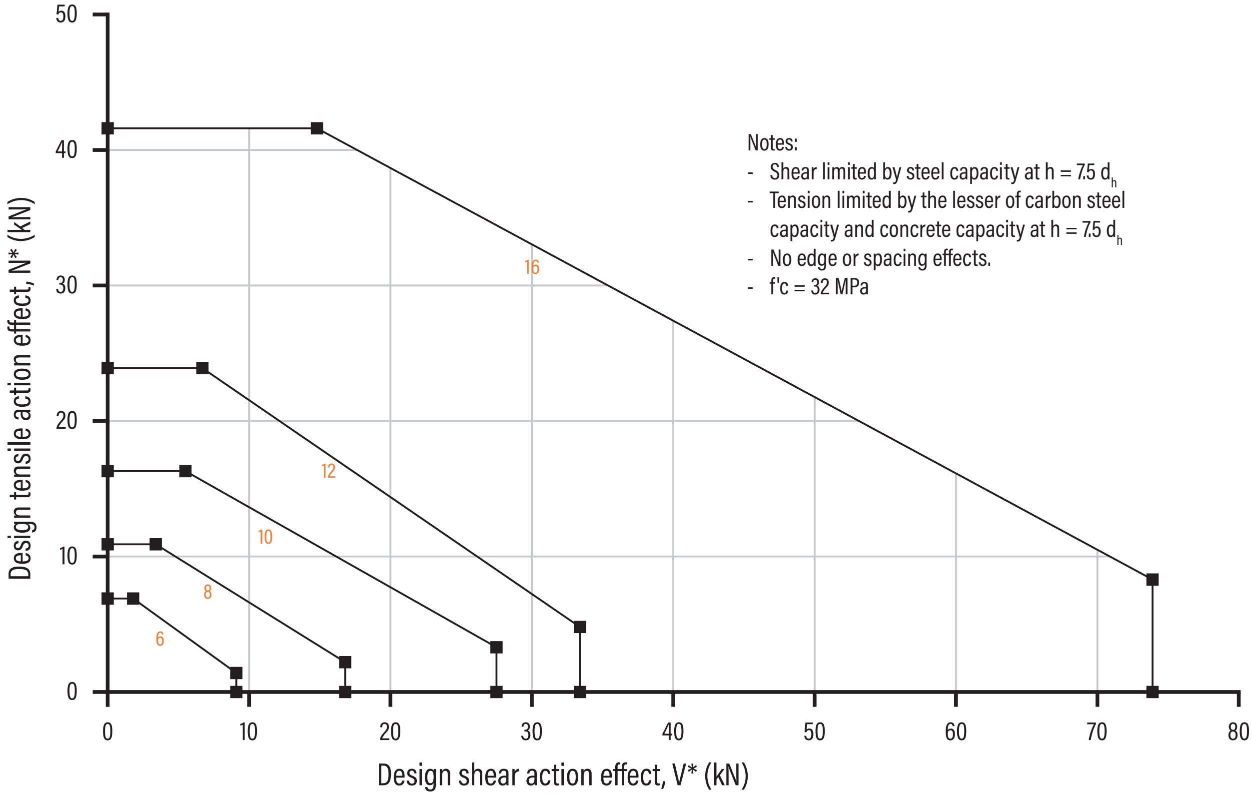


Table 1b Absolute minimum edge distance and anchor spacing values, e_m and a_m (mm)

Anchor Size, d_b (mm)	6	8	10	12	16
e_m, a_m	20	25	30	35	50

Step 1c Calculate anchor effective depth, h (mm)

Refer to "Description and Part Numbers" table on the previous page.

Effective depth, h (mm)

$h = L_e - t,$

t = total thickness of material(s) being fixed

Checkpoint 1 Anchor size determined, absolute minima compliance achieved, effective depth (h) calculated.

WERCS AnkaScrew™

STRENGTH LIMIT STATE DESIGN

STEP 2 Verify concrete tensile capacity - per anchor

Table 2a Reduced characteristic ultimate concrete tensile capacity, ϕN_{uc} (kN), ϕ_c = 0.6, f'$_c$ = 32 MPa

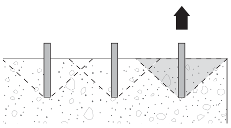
Anchor Size, d_b	6	8	10	12	16
Drilled Hole Dia, d_h (mm)	6	8	10	12	16
Effective Depth, h (mm)					
30	4.3				
35	5.1				
40	6.0	6.4			
45	6.9	7.5			
50		8.6	9.3		
55		9.8	10.6		
60		10.9	12.0	13.2	
75			16.3	18.3	22.3
90				23.9	28.4
105					34.8
120					41.6

All data relevant for Non-cracked concrete

Table 2b Concrete compressive strength effect, tension, X_{nc}

f'$_c$ (MPa)	20	25	32	40
X_{nc} - Anchor size d_b = 6-12	0.85	0.92	1	1.08
X_{nc} - Anchor size d_b = 16 only	0.73	0.85	1	1.16

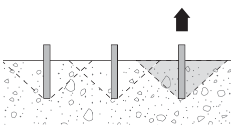
Table 2c Edge distance effect, tension, X_{ne}



Anchor Size, d_b	6	8	10	12	16
Edge Distance e, (mm)					
20	0.53				
25	0.59	0.52			
30	0.65	0.56	0.51		
35	0.71	0.61	0.55	0.50	
40	0.77	0.65	0.58	0.53	
50	0.88	0.74	0.65	0.59	0.51
60	1.00	0.83	0.72	0.65	0.55
70		0.91	0.79	0.71	0.60
80		1.00	0.86	0.77	0.64
90			0.93	0.83	0.69
100			1.00	0.88	0.73
110				0.94	0.78
120				1.00	0.82
145					0.93
160					1.00

Table 2d Anchor spacing effect, end of a row, tension, X_{nae}

Note: For single anchor designs, X_{nae} = 1.0



Anchor Size, d_b	6	8	10	12	16
Anchor Spacing a, (mm)					
20	0.78				
25	0.85	0.76			
30	0.92	0.81	0.75		
35	1.00	0.86	0.79	0.78	
40		0.92	0.83	0.81	
45		1.00	0.88	0.81	
50			0.92	0.85	0.76
55			0.96	0.88	0.79
60			1.00	0.92	0.81
70				1.00	0.86
80					0.92
90					0.97
100					1.00

WERCS AnkaScrew™

STRENGTH LIMIT STATE DESIGN

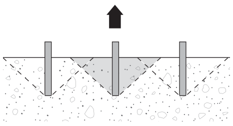


Table 2e Anchor spacing effect, internal to a row, tension, X_{nai}

Note: For single anchor designs, X_{nai} = 1.0

Anchor Size, d_b	6	8	10	12	16
Anchor Spacing a, (mm)					
20	0.56				
25	0.69	0.52			
30	0.83	0.63	0.50		
35	1.00	0.73	0.58	0.49	
40		0.83	0.67	0.56	
45		0.94	0.75	0.63	
50		1.00	0.83	0.69	0.52
55			0.92	0.76	0.57
60			1.00	0.83	0.63
70				1.00	0.73
80					0.83
90					0.94
100					1.00

Checkpoint 2

Design reduced ultimate concrete tensile capacity, $ØN_{urc}$

$$\phi N_{urc} = \phi N_{uc} * X_{nc} * X_{ne} * (X_{nae} \text{ or } X_{nai})$$

STEP 3 Verify anchor tensile capacity - per anchor

Table 3a Reduced characteristic ultimate steel tensile capacity, ϕN_{us} (kN), ϕ_n = 0.8

Anchor size, d_b (mm)	6	8	10	12	16
Heat Treated Carbon Steel	14.6	27.1	44.4	53.8	119.2

Checkpoint 3

Design reduced ultimate tensile capacity, ϕN_{ur}

$$\phi N_{ur} = \text{minimum of } \phi N_{urc}, \phi N_{us}$$

Check $N^* / \phi N_{ur} \leq 1$,

if not satisfied return to step 1

Tensile performance conversion table

Performance Required	Concrete Tensile Performance		Steel Tensile Performance	
	Notation	Concrete Tension Capacity	Notation	Carbon Steel Tension Capacity
Strength Limit State	ϕN_{urc}	MULTIPLY ϕN_{urc} x 1.00	ϕN_{us}	MULTIPLY ϕN_{us} x 1.00
Working Load Limit	N_{ac}	MULTIPLY ϕN_{urc} x 0.55	N_{as}	MULTIPLY ϕN_{us} x 0.56
Cyclic Loading	N_{yc}	MULITPLY ϕN_{urc} x 0.55	N_{ys}	MULITPLY ϕN_{us} x 0.56
Fire Resistance	$N_{Rk,c,fi,t}$	Refer to Fire Rated Anchors	$N_{Rk,s,fi,t}$	Refer to Fire Rated Anchors
Seismic	$N^0_{Rd,p,sis}$	Refer to Seismic Anchors	$N_{Rd,s,sis}$	Refer to Seismic Anchors

NOTE: Design Tensile Capacity is the minimum of Concrete Tension and Steel Tension Capacities

WERCS AnkaScrew™

STRENGTH LIMIT STATE DESIGN

STEP 4 Verify concrete shear capacity - per anchor

Table 4a Reduced characteristic ultimate concrete edge shear capacity, ϕV_{uc} (kN), ϕ_q = 0.6, f'_c = 32 MPa

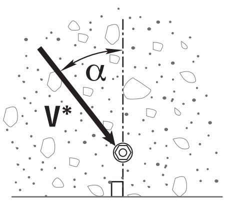
Anchor Size, d_b	6	8	10	12	16
Edge Distance e, (mm)					
20	0.9				
25	1.3	1.5			
30	1.7	1.9	2.2		
35	2.1	2.4	2.7	3.0	
50	3.6	4.1	4.6	5.1	5.9
75	6.6	7.6	8.5	9.3	10.8
100	10.1	11.7	13.1	14.3	16.6
150	18.6	21.5	24.1	26.4	30.4
200	28.7	33.1	37.0	40.6	46.8
250		46.3	51.8	56.7	65.5
300			68.0	74.5	86.1
400				114.8	132.5
500					185.2

Note: Effective depth, h must be ≥ 3.5 x Anchor size, d_h for anchor to achieve tabled shear capacities

All data relevant for Non-cracked concrete

Table 4b Concrete compressive strength effect, concrete edge shear, X_{vc}

f'_c (MPa)	20	25	32	40
X_{vc}	0.79	0.88	1.00	1.12



Load direction effect, conc. edge shear, X_{vd}

Table 4c Load direction effect, concrete edge shear, X_{vd}

Angle, α°	0	10	20	30	40	50	60	70	80	90 - 180
X_{vd}	1.00	1.04	1.16	1.32	1.50	1.66	1.80	1.91	1.98	2.00

Table 4d Anchor spacing effect, concrete edge shear, X_{va}

Note: For single anchor designs, X_{va} = 1.0

Edge distance, e (mm)	20	25	30	35	50	75	100	150	200	250	300	400	500
Anchor spacing, a (mm)													
20	0.70	0.66	0.63	0.61	0.58	0.55	0.54	0.53	0.52				
25	0.75	0.70	0.67	0.64	0.60	0.57	0.55	0.53	0.53	0.52			
30	0.80	0.74	0.70	0.67	0.62	0.58	0.56	0.54	0.53	0.52	0.52		
35	0.85	0.78	0.73	0.70	0.64	0.59	0.57	0.55	0.54	0.53	0.52	0.52	
40	0.90	0.82	0.77	0.73	0.66	0.61	0.58	0.55	0.54	0.53	0.53	0.52	0.52
50	1.00	0.90	0.83	0.79	0.70	0.63	0.60	0.57	0.55	0.54	0.53	0.53	0.52
65		1.00	0.93	0.87	0.76	0.67	0.63	0.59	0.57	0.55	0.54	0.53	0.53
80			1.00	0.96	0.82	0.71	0.66	0.61	0.58	0.56	0.55	0.54	0.53
100				1.00	0.90	0.77	0.70	0.63	0.60	0.58	0.57	0.55	0.54
125					1.00	0.83	0.75	0.67	0.63	0.60	0.58	0.56	0.55
150						0.90	0.80	0.70	0.65	0.62	0.60	0.58	0.56
200						1.00	0.90	0.77	0.70	0.66	0.63	0.60	0.58
250							1.00	0.83	0.75	0.70	0.67	0.63	0.60
300								0.90	0.80	0.74	0.70	0.65	0.62
450								1.00	0.95	0.86	0.80	0.73	0.68
600									1.00	0.98	0.90	0.80	0.74
1000										1.00	1.00	1.00	0.90
1250													1.00

WERCS AnkaScrew™

STRENGTH LIMIT STATE DESIGN

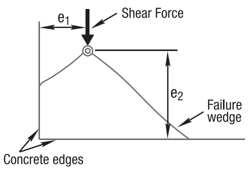
Table 4e Multiple anchors effect, concrete edge shear, X_{vn}

Note: For single anchor designs, X_{vn} = 1.0

Anchor spacing / Edge distance, a / e	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60	1.80	2.00	2.25	2.50
Number of anchors, n												
2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	0.72	0.76	0.80	0.83	0.86	0.88	0.91	0.93	0.95	0.96	0.98	1.00
4	0.57	0.64	0.69	0.74	0.79	0.82	0.86	0.89	0.92	0.94	0.97	1.00
5	0.49	0.57	0.63	0.69	0.74	0.79	0.83	0.87	0.90	0.93	0.97	1.00
6	0.43	0.52	0.59	0.66	0.71	0.77	0.81	0.85	0.89	0.93	0.96	1.00
7	0.39	0.48	0.56	0.63	0.69	0.75	0.80	0.84	0.88	0.92	0.96	1.00
8	0.36	0.46	0.54	0.61	0.68	0.74	0.79	0.84	0.88	0.92	0.96	1.00
9	0.34	0.44	0.52	0.60	0.67	0.73	0.78	0.83	0.87	0.91	0.96	1.00
10	0.32	0.42	0.51	0.59	0.66	0.72	0.77	0.82	0.87	0.91	0.96	1.00
15	0.26	0.37	0.47	0.55	0.63	0.70	0.76	0.81	0.86	0.90	0.95	1.00
20	0.23	0.35	0.45	0.54	0.61	0.68	0.75	0.80	0.85	0.90	0.95	1.00

Table 4f Anchor at a corner effect, concrete edge shear, X_{vs}

Note: For e_1/e_2 > 1.25, X_{vs} = 1.0



ANCHOR AT A CORNER

Edge distance, e_2 (mm)	25	30	35	50	60	75	125	200	300	400	600	900
Edge dustance, e_1 (mm)												
25	0.86	0.77	0.70	0.58	0.53	0.49	0.41	0.37	0.35	0.34	0.32	0.32
30	0.97	0.86	0.78	0.64	0.58	0.52	0.43	0.38	0.36	0.34	0.33	0.32
35	1.00	0.95	0.86	0.69	0.63	0.56	0.46	0.40	0.37	0.35	0.33	0.32
50	1.00	1.00	1.00	0.86	0.77	0.67	0.52	0.44	0.39	0.37	0.35	0.33
60	1.00	1.00	1.00	0.97	0.86	0.75	0.57	0.47	0.41	0.38	0.36	0.34
75	1.00	1.00	1.00	1.00	1.00	0.86	0.64	0.51	0.44	0.41	0.37	0.35
125	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.65	0.53	0.48	0.42	0.38
200	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.67	0.58	0.49	0.42
300	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.72	0.58	0.49
400	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.67	0.55
500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.77	0.61
600	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.67
900	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86

Checkpoint 4

Design reduced ultimate concrete edge shear capacity, ϕV_{urc}

$$\phi V_{urc} = \phi V_{uc} * X_{vc} * X_{vd} * X_{va} * X_{vn} * X_{vs}$$

STEP 5 Verify anchor shear capacity - per anchor

Table 5a Reduced characteristic ultimate steel shear capacity, ϕV_{us} (kN), ϕ_v = 0.8

Anchor size, d_b (mm)	6	8	10	12	16
$h \geq 5 \times d_h$	6.8	12.6	20.7	25.0	55.4
$h \geq 6 \times d_h$	7.7	14.3	23.4	28.4	62.8
$h \geq 7 \times d_h$	8.6	16.0	26.2	31.7	70.2
$h \geq 7.5 \times d_h$	9.1	16.8	27.5	33.4	73.9

WERCS AnkaScrew™

STRENGTH LIMIT STATE DESIGN

Checkpoint 5

Design reduced ultimate shear capacity, ϕV_{ur}

ϕV_{ur} = minimum of ϕV_{urc}, ϕV_{us}

Check $V^* / \phi V_{ur} \leq 1$,

if not satisfied return to step 1

Shear performance conversion table

Performance Required	Concrete Shear Performance		Steel Shear Performance	
	Notation	Concrete Shear Capacity	Notation	Carbon Steel Shear Capacity
Strength Limit State	ϕV_{uc}	MULTIPLY ϕV_{uc} x 1.00	ϕV_{us}	MULTIPLY ϕV_{us} x 1.00
Working Load Limit	V_{ac}	MULTIPLY ϕV_{uc} x 0.55	V_{as}	MULTIPLY ϕV_{us} x 0.50
Cyclic Loading	V_{yc}	MULITPLY ϕV_{uc} x 0.55	V_{ys}	MULITPLY ϕV_{us} x 0.50
Fire Resistance	$V_{Rk,c,fi,t}$	Refer to Fire Rated Anchors	$V_{Rk,s,fi,t}$	Refer to Fire Rated Anchors
Seismic	$V^0_{Rd,c,sis}$	Refer to Seismic Anchors	$V^0_{Rd,s,sis}$	Refer to Seismic Anchors

NOTE: Design Shear Capacity is the minimum of Concrete Shear and Steel Shear Capacities

STEP 6 Combined loading and specification

Checkpoint 6

Check

$N^*/\phi N_{ur} + V^*/\phi V_{ur} \leq 1.2$,

if not satisfied return to step 1

Specify

Ramset™ WERCS AnkaScrew™ Anchor,
(Anchor Size) ((Part Number).
Maximum fixed thickness to be (t) mm.

Example

Ramset™ WERCS AnkaScrew™ Anchor,
12 mm (AS12100W50).
Maximum fixed thickness to be 40 mm.
To be installed in accordance to Ramset™
Installation Instructions.