ChemSet™ 101 PLUS

CHEMICAL INJECTION - NON-CRACKED CONCRETE

GENERAL INFORMATION

Performance Related	Installation Related

Product

ChemSet™ Injection 101 PLUS is a marine grade polyester adhesive anchor.

Benefits, Advantages and Features

- Certified Performance European Technical Assessment EAD 330499 - Option 7

Fast installation:

- Load in 50 minutes (at 20°C)
- Easy cold weather dispensing

Versatile:

- Suitable for anchoring into a wide variety of substrates
- Solid concrete, hollow block and brick
- Flooded holes
- Styrene Free
- Cold and temperate climates
- VOC Compliant

Ramset Design Method:

- Uses technical data validated from testing in ANZ concrete

Australian Made

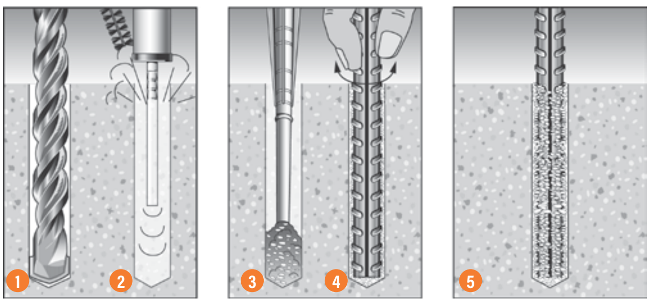
Principal Applications

- **Hollow brick and block**
- **Stadium seating**
- **Starter Bars**
- **Balustrades**

Recommended Installation Temperatures

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

Installation



1. Drill recommended diameter and depth hole.
2. **Important:** Use **Ramset™** Dustless Drilling System to ensure holes are clean. Alternatively, clean dust and debris from hole with stiff wire or nylon brush and blower in the following sequence: blow x 4, brush x 3, blow x 4, brush x 3, blow x 4.
3. Dispense adhesive to waste until colour is uniform light grey (2-3 trigger pulls). Insert mixing nozzle to bottom of hole. Fill hole to 3/4 the hole depth slowly, ensuring no air pockets form.
4. Insert rebar to bottom of hole while turning.
5. ChemSet™ Injection to cure as per setting times.

Service Temperature Limits

-40°C to 80°C

Setting Times

Temperature of base material	Cartridge Temperature	Gel Time	Curing time in dry and wet concrete
5°C	5°C	18 min	145 min
10°C	10°C	10 min	85 min
20°C	20°C	6 min	50 min
25°C	25°C	5 min	40 min
+30°C	+30°C	5 min	35 min
Note: Cartridge temperature minimum +5°C			

ChemSet™ 101 PLUS

CHEMICAL INJECTION - NON-CRACKED CONCRETE

Installation and performance details: ChemSet™ Injection 101 PLUS and Reinforcing Bar

Anchor Size, d_b (mm)	Drilled Hole diam., d_h (mm)	Anchor Effective Depth, h (mm)	Optimum dimensions*			Reduced Characteristic Capacity #				
			Edge* distance, e_c (mm)	Anchor spacing, a_c (mm)	Concrete substrate thickness, b_m (mm)	Gr 500 Rebar - Steel		Non-cracked Concrete		
						Tension, ϕN_{us} (kN)***	Shear, ϕV_{us} (kN)	Tension, ϕN_{uc} (kN)** Concrete compressive strength, f'_c		
								20 MPa	32 MPa	40 MPa
10	14	90	40	60	115	31.4	21.4	7.8	9.8	11.0
12	16	110	50	70	140	45.2	30.8	11.5	14.5	16.2
16	20	125	65	100	160	80.4	54.8	17.3	21.9	24.5
20	25	150	80	120	190	125.6	85.7	26.0	32.9	36.8
		170			215			29.5	37.3	41.7
24	30	180	100	145	240	180.8	123.3	37.5	47.4	53.0
		210			270			43.7	55.3	61.9
25	30	180	100	150	240	196.4	133.9	39.1	49.4	55.3
		210			270			45.6	57.7	64.5
28	35	225	115	170	295	246.4	168.0	54.7	69.2	77.4
		270			340			65.6	83.0	92.8
32	40	240	130	195	320	321.6	219.3	66.7	84.3	94.3
		300			380			83.4	105.4	117.9
36	45	290	145	220	380	408.0	278.3	90.6	114.7	128.2
		330			420			103.2	130.5	145.9
40	50	320	160	240	420	504.0	343.7	111.1	140.6	157.2
		360			460			125.0	158.2	176.8

* 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 = 0.6 and N_{UC} = Characteristic ultimate concrete tensile capacity. **For conversion to Working Load Limit MULTIPLY ϕN_{UC} x 0.55

***Note: Reduced characteristic ultimate steel tensile capacity = ϕN_{US} where ϕ = 0.8 and N_{US} = Characteristic ultimate steel tensile capacity. **For conversion to Working Load Limit MULTIPLY ϕN_{US} x 0.56**

#Note: Design Tensile Capacity ϕN_{ur} = minimum of ϕN_{UC} and ϕN_{US}

WET HOLES: Multiply ϕN_{UC} x 1 All data relevant for Non-Cracked Concrete

For optimised performance data, please use Ramset iExpert Anchoring Software.

DESCRIPTION AND PART NUMBERS

Description	Cartridge Size	Part No.
ChemSet™ 101 PLUS Cartridge	380 ml	C101C
ChemSet™ 101 PLUS Jumbo Cartridge	750 ml	C101J
ChemSet™ 101 PLUS Kit	2 x 380 ml	ISKP
Mixer Nozzle for 101 PLUS	-	ISNP

Substrate thickness, b_m (mm)

b_m = greater of: 1.25 x h, h + (2 x d_h)

Drilled hole depth, h_1 (mm)
h_1 = h
h = Effective depth

TYPICAL ENGINEERING PROPERTIES OF GRADE 500 REINFORCING BAR

Rebar Size	10	12	16	20	24	25	28	32	36	40
Drilled Hole Dia, d_h (mm)	14	16	20	25	30	30	35	40	45	50
Stress Area, A_s (mm^2)	78.5	113	201	314	452	491	616	804	1020	1260
Yield Stress, f_{sy} (MPa)	500	500	500	500	500	500	500	500	500	500
Tensile Steel Yield Capacity N_{sy}, (KN)	39.3	56.5	100.5	157.0	226.0	245.5	308.0	402.0	510.0	630.0

For further information refer to reinforcing bar manufacturer's published information and current revision of **AS/NZS 4671**

ChemSet™ 101 PLUS

STRENGTH LIMIT STATE DESIGN

STEP 1 Select anchor to be evaluated

Table 1a Indicative combined loading – interaction diagram

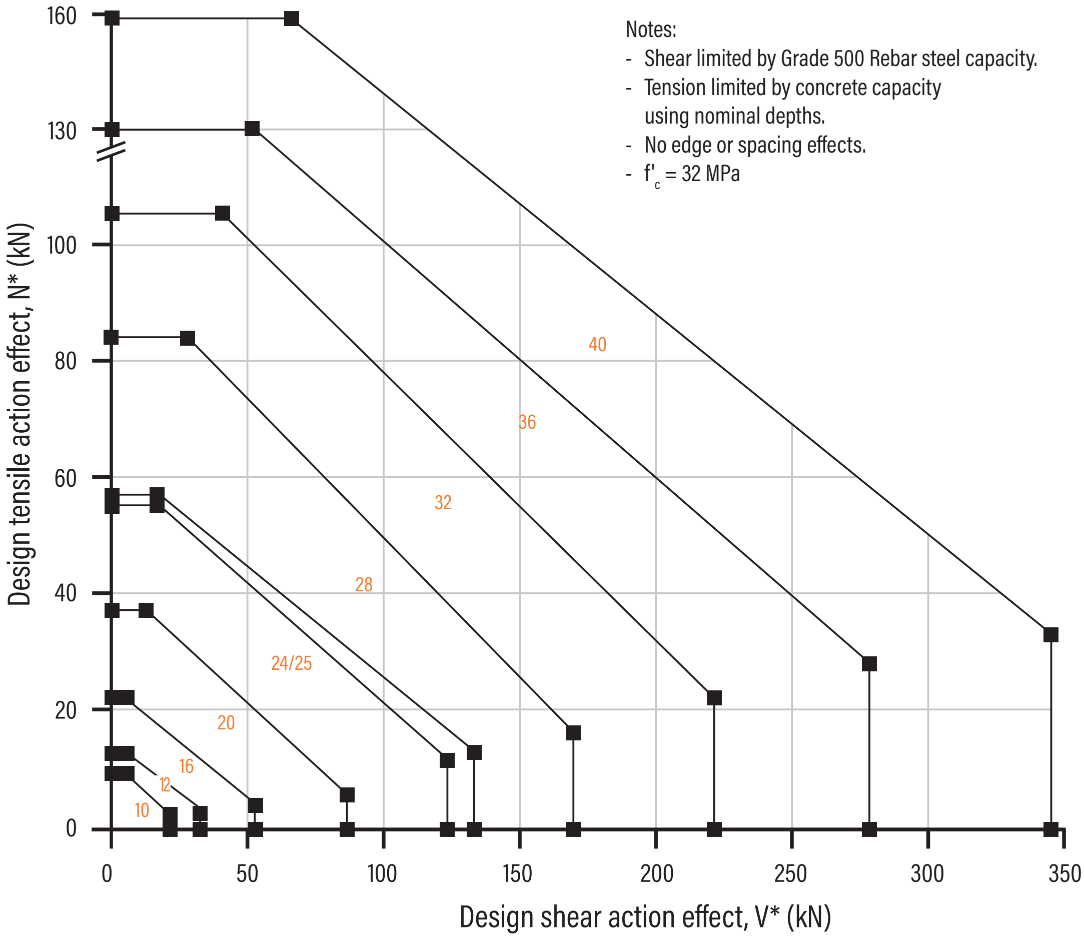


Table 1b Absolute minimum edge distance and anchor spacing values, e_m and a_m (mm)

Anchor size, d_b	10	12	16	20	24	25	28	32	36	40
e_m, a_m	30	36	48	60	72	75	84	96	108	120

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

Refer to nominal recommended effective depths, h, listed in installation and performance details table on previous page.

Effective depth, h (mm)

Preferred h = h_n otherwise

$h = L_e - t$,

t = total thickness of material(s) being fixed

Substrate thickness, b_m (mm)

b_m = greater of: 1.25 x h,
$h + (2 \times d_h)$

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

ChemSet™ 101 PLUS

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

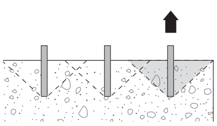
Anchor size, d_b	10	12	16	20	24	25	28	32	36	40
Drilled Hole Dia, d_h (mm)	14	16	20	25	30	30	35	40	45	50
Effective Depth, h (mm)										
85	9.3									
90	**9.8**									
95	10.4									
100	10.9	13.1								
105	11.5	13.8								
110	12.0	**14.5**								
115	12.6	15.1								
125	13.7	16.4	**21.9**							
140	15.3	18.4	24.6							
150	16.4	19.7	26.3	32.9						
170		22.4	29.8	**37.3**						
180		23.7	31.6	39.5	47.4	49.4				
210			36.9	46.1	**55.3**	**57.7**	64.5			
240			42.2	52.7	63.3	65.9	73.8	84.3		
270				59.3	71.1	74.1	**83.0**	94.8	106.7	
300				65.9	79.0	82.4	92.2	**105.4**	118.6	131.7
320				70.2	84.3	87.9	98.4	112.4	126.5	140.5
330					86.9	90.6	101.4	115.9	**130.4**	144.9
360					94.8	98.8	110.7	126.5	142.3	**158.1**
420						115.3	129.1	147.6	166.0	184.5
460								161.7	181.8	202.0
500								175.7	197.6	219.6
550									217.4	241.6
600										263.5
625										274.5

Bold values are at ChemSet™ Anchor Stud nominal depths.
WET HOLES: Multiply ϕN_{uc} x 1
All data relevant for Non-Cracked Concrete. For optimised performance data, please use Ramset iExpert Anchoring Software.

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

f'_c (MPa)	20	25	32	40	50
X_{nc}	0.79	0.88	1.00	1.12	1.25

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



Anchor size, d_b	10	12	16	20	24	25	28	32	36	40
Edge Distance, e (mm)										
30	0.83									
35	0.91	0.81								
40	1.00	0.88								
50		1.00	0.85							
65			1.00	0.87						
80				1.00	0.88	0.86				
95					1.00	0.97	0.89	0.82		
100						1.00	0.93	0.85		
110							1.00	0.90	0.83	
130								1.00	0.93	0.87
145									1.00	0.93
160										1.00

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STRENGTH LIMIT STATE DESIGN

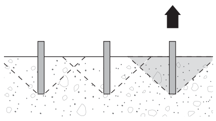


Table 2d Anchor spacing effect, end of a row, tension, X_{nae}

For single anchor design, X_{nae} = 1.0

Anchor size, d_b	10	12	16	20	24	25	28	32	36	40
Anchor Spacing, a (mm)										
30	0.75									
35	0.79	0.74								
40	0.83	0.78								
50	0.92	0.85	0.76							
60	1.00	0.92	0.81	0.75						
75		1.00	0.89	0.81	0.76	0.75				
95			1.00	0.90	0.83	0.82	0.78			
120				1.00	0.92	0.90	0.86	0.81	0.78	0.75
140					1.00	0.97	0.92	0.86	0.82	0.79
150						1.00	0.95	0.89	0.85	0.81
170							1.00	0.94	0.89	0.85
195								1.00	0.95	0.91
220									1.00	0.96
240										1.00

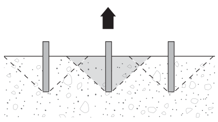


Table 2e Anchor spacing effect, internal to a row, tension, X_{nai}

For single anchor design, X_{nai} = 1.0

Anchor size, d_b	10	12	16	20	24	25	28	32	36	40
Anchor Spacing, a (mm)										
30	0.50									
35	0.58	0.49								
40	0.67	0.56								
50	0.83	0.69	0.52							
60	1.00	0.83	0.63	0.50						
75		1.00	0.78	0.63	0.52	0.50				
95			1.00	0.79	0.66	0.63	0.57	0.49		
120				1.00	0.83	0.80	0.71	0.63	0.56	0.50
150					1.00	1.00	0.89	0.78	0.69	0.63
170							1.00	0.89	0.79	0.71
195								1.00	0.90	0.81
215									1.00	0.90
240										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	10	12	16	20	24	25	28	32	36	40
e_m, a_m	31.4	45.2	80.4	125.6	180.8	196.4	246.4	321.6	408.8	504.0

ChemSet™ 101 PLUS

STRENGTH LIMIT STATE DESIGN

Checkpoint 3

Design reduced ultimate tensile capacity, $ØN_{ur}$

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

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 $ØN_{urc}$ x 1.00	ϕN_{us}	MULTIPLY ϕN_{us} x 1.00
Working Load Limit	N_{ac}	MULTIPLY $ØN_{urc}$ x 0.55	N_{as}	MULTIPLY ϕN_{us} x 0.56
Cyclic Loading	N_{yc}	Refer to page 40 for suitable anchor	N_{ys}	Refer to page 40 for suitable anchor
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

STEP 4

Verify concrete shear capacity - per anchor

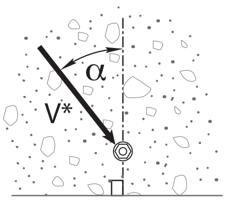
Table 4a Reduced characteristic ultimate concrete edge shear capacity, ϕV_{uc} (kN), ϕ_q = 0.6, f'_c = 32 MPa

Anchor size, d_b / Edge Distance, e (mm)	10	12	16	20	24	25	28	32	36	40
30	2.5									
35	3.2									
40	3.9	4.2								
50	5.5	5.9	6.5							
60	7.2	7.7	8.6	9.6						
75	10.1	10.8	12.0	13.4	14.7	14.7				
95	14.3	15.3	17.1	19.2	21.0	21.0	22.7			
120	20.4	21.8	24.3	27.2	29.8	29.8	32.2	34.4	36.5	38.5
200	43.8	46.8	52.4	58.6	64.1	64.1	69.3	74.1	78.6	82.8
300	80.5	86.1	96.2	107.6	117.8	117.8	127.3	136.1	144.3	152.1
400	123.9	132.5	148.1	165.6	181.4	181.4	196.0	209.5	222.2	234.2
500	173.2	185.2	207.0	231.5	253.6	253.6	273.9	292.8	310.6	327.4
600	227.7	243.4	272.2	304.3	333.3	333.3	360.0	384.9	408.2	430.3

Note: Effective depth, h must be ≥ 6 x drilled hole diameter, d_h for anchor to achieve tabled shear capacities.

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

f'_c (MPa)	20	25	32	40	50
X_{vc}	0.79	0.88	1.00	1.12	1.25



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

ChemSet™ 101 PLUS

STRENGTH LIMIT STATE DESIGN

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

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

Edge distance, e (mm)	25	30	35	50	60	75	125	200	300	400	500	600
Anchor spacing, a (mm)												
25	0.70	0.67	0.64	0.60	0.58	0.57	0.54					
30	0.74	0.70	0.67	0.62	0.60	0.58	0.55	0.53				
35	0.78	0.73	0.70	0.64	0.62	0.59	0.56	0.54	0.52			
50	0.90	0.83	0.79	0.70	0.67	0.63	0.58	0.55	0.53	0.53		
60	0.98	0.90	0.84	0.74	0.70	0.66	0.60	0.56	0.54	0.53	0.52	
75	1.00	1.00	0.93	0.80	0.75	0.70	0.62	0.58	0.55	0.54	0.53	0.53
150			1.00	1.00	1.00	0.90	0.74	0.65	0.60	0.58	0.56	0.55
200						1.00	0.82	0.70	0.63	0.60	0.58	0.57
300							0.98	0.80	0.70	0.65	0.62	0.60
400							1.00	0.90	0.77	0.70	0.66	0.63
500								1.00	0.83	0.75	0.70	0.67
625									0.92	0.81	0.75	0.71
750									1.00	0.88	0.80	0.75
875										0.94	0.85	0.79
1000										1.00	0.90	0.83
1250											1.00	0.92
1500												1.00

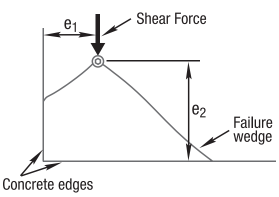
Table 4e Multiple anchors effect, concrete edge shear, X_{vn}

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

ChemSet™ 101 PLUS

STRENGTH LIMIT STATE DESIGN

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	10	12	16	20	24	25	28	32	36	40
Grade 500 Rebar	21.4	30.8	54.8	85.7	123.3	133.9	168.0	219.3	278.3	343.7

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 0.45
Cyclic Loading	V_{yc}	Refer to page 40 for suitable anchor	V_{ys}	Refer to page 40 for suitable anchor
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 - Reinforcing Bar Anchorage

Ramset™ ChemSet™ 101 PLUS with (Anchor Size) grade 500 Rebar.
Drilled hole depth to be (h) mm.

Example

Ramset™ ChemSet™ 101 PLUS with N20 grade 500 Rebar
Drilled hole depth to be 160 mm.
To be installed in accordance with Ramset™ Installation Instructions.