TR STUD ANCHOR (STAINLESS STEEL RANGE)

PRODUCT FEATURES

- Through bolt fixing, torque controlled expansion metal anchor.
- Long thread for various embedment depth.
- Wide range of lengths and diameters for installation flexibility.
- Anti-rotation lugs.

MATERIAL SPECIFICATIONS

- Bolt: Cold stamped stainless steel, grade A2, acc. to EN 10088-3.
- Nut: DIN 934; Stainless steel AISI 316 similar acc. to ISO 3506-2.
- Washer: DIN 125, DIN 9021; Stainless steel AISI 316 similar acc. to EN 10088-2.
- Clip: Stainless steel, grade A2, acc. to EN 10088-2.

SUBSTRATES

- RC concrete C20/25 to C50/60 at maximum according to EN 206-1:2000-12.
- Solid stone & other solid masonry.

LOADING ZONES

BASIC LOADING DATA FOR TR-S

- For static and quasi-static loadings.
- For non-cracked concrete only.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm²).
- Loading applicable to stainless steel A2 only.

CHARACTERISTIC RESISTANCE [F_{Rk}]		Standard Anchorage Depth						Reduced Anchorage Depth					
Anchor Size		**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
Effective Depth, h_{ef}	[mm]	40	50	55	65	85	100	30	35	40	50	60	75
Tensile Load, N_{Rk}	[kN]	9.0	12.0	13.4	20.9	29.1	41.7	3.2	7.5	8.3	14.1	17.6	26.0
Shear Load, V_{Rk}	[kN]	6.6	12.0	19.0	27.6	51.5	80.3	6.6	12.0	19.0	27.6	51.5	80.3

DESIGN RESISTANCE [F_{Rd}]		Standard Anchorage Depth						Reduced Anchorage Depth					
Anchor Size		**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
Effective Depth, h_{ef}	[mm]	40	50	55	65	85	100	30	35	40	50	60	75
Tensile Load, N_{Rd}	[kN]	6.0	8.0	8.9	13.9	19.4	27.8	2.1	5.0	5.5	9.4	11.7	17.3
Shear Load, V_{Rd}	[kN]	4.2	7.7	12.2	17.7	33.0	51.5	4.2	7.7	12.2	17.7	33.0	51.5

RECOMMENDED LOAD [F_{Rec}]		Standard Anchorage Depth						Reduced Anchorage Depth					
Anchor Size		**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
Effective Depth, h_{ef}	[mm]	40	50	55	65	85	100	30	35	40	50	60	75
Tensile Load, N_{Rec}	[kN]	4.3	5.7	6.4	9.9	13.9	19.9	1.5	3.6	3.9	6.7	8.4	12.4
Shear Load, V_{Rec}	[kN]	3.0	5.5	8.7	12.6	23.6	36.8	3.0	5.5	8.7	12.6	23.6	36.8

MECHANICAL PROPERTIES

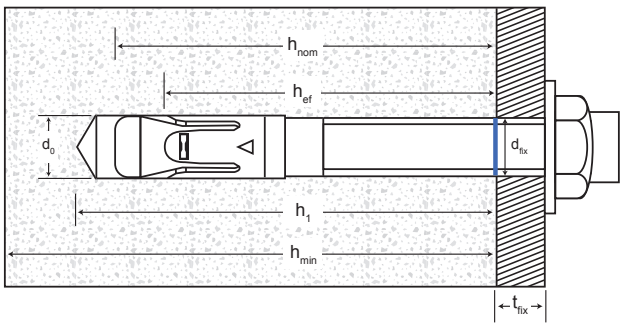
ANCHOR SIZE		M6	M8	M10	M12	M16	M20
Cross Sectional Area, A_s	[mm²]	20.1	36.6	58.0	84.3	157.0	245.0
Nominal Tensile Strength At Thread, f_{uk}	[N/mm²]	600	600	600	600	600	600
Nominal Tensile Strength At Taper, $f_{uk,tp}$	[N/mm²]	700	700	700	700	700	700
Elastic Moment Of Resistance, W_{el}	[mm³]	12.7	31.2	62.3	109.2	277.5	540.9
Design Bending Moment, $M_{Rd,s}$	[Nm]	5.9	14.4	28.8	50.4	128.1	249.6

The design bending moment is derived from $M_{Rd,s} = M_{Rk,s} / \gamma_{Ms,N}$ where the partial safety factor is 1.56 .The recommended bending moment is derived from $M_{Rec,s} = M_{Rd,s} / \gamma_F$ where the partial safety factor is 1.4.

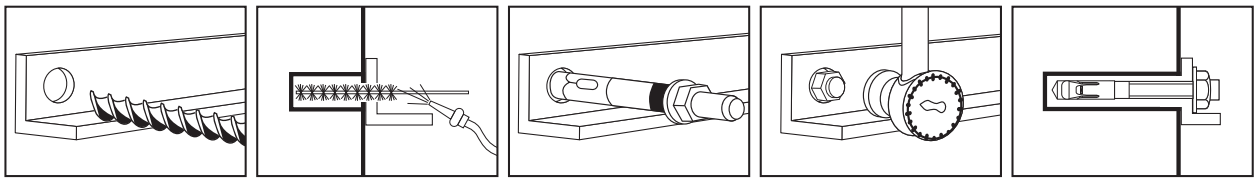
SETTING DETAILS

ANCHOR SIZE		M6	M8	M10	M12	M16	M20
Drilled Hole Diameter, d_0	[mm]	6	8	10	12	16	20
Recommended Torque, T_{inst}	[Nm]	7	20	35	60	120	240
Fixture Hole Diameter, d_{fix}	[mm]	7	9	12	14	18	22
Wrench Size, W		10	13	17	19	24	30
Standard Anchorage Depth							
Minimum Hole Depth, h_1	[mm]	55	70	80	90	120	145
Embedment Depth, h_{nom}	[mm]	50	60	65	75	100	125
Standard Effective Anchorage Depth, $h_{ef,std}$	[mm]	40	50	55	65	85	100
Minimum Concrete Thickness, h_{min}	[mm]	75	90	100	115	160	190
Maximum Fixture Thickness, t_{fix}	[mm]	L - 55	L - 70	L - 80	L - 90	L - 120	L - 145
Critical Anchor Spacing, $s_{cr,N}$	[mm]	120	150	165	195	255	300
Minimum Anchor Spacing, s_{min}	[mm]	40	50	55	65	85	100
Critical Edge Distance, $c_{cr,N}$	[mm]	60	75	85	100	130	150
Minimum Edge Distance, c_{min}	[mm]	40	50	55	65	85	100
Reduced Anchorage Depth							
Minimum Hole Depth, h_1	[mm]	40	45	55	70	80	110
Embedment Depth, h_{nom}	[mm]	35	40	50	60	75	95
Reduced Effective Anchorage Depth, $h_{ef,red}$	[mm]	30	35	40	50	60	75
Minimum Concrete Thickness, h_{min}	[mm]	75	90	100	115	160	190
Maximum Fixture Thickness, t_{fix}	[mm]	L - 40	L - 45	L - 55	L - 70	L - 80	L - 110
Critical Anchor Spacing, $s_{cr,N}$	[mm]	90	105	120	150	180	225
Minimum Anchor Spacing, s_{min}	[mm]	30	35	40	50	60	75
Critical Edge Distance, $c_{cr,N}$	[mm]	45	55	60	75	90	115
Minimum Edge Distance, c_{min}	[mm]	30	35	40	50	60	75

SETTING DIAGRAM



INSTALLATION PROCEDURES



1. Examine the concrete base is well compact and porosity is insignificant. Drill a hole through the pre-drilled hole fixture into concrete at right angle to the substrate surface, to the specified diameter and depth.
2. Clean the drilled hole by using air pump or brush prior inserting the anchor.
3. Insert the anchor into the drilled hole by tapping lightly with a hammer until the fixing depth is reached. The installation could be done through the fixture hole.
4. Tighten the anchor according to the recommended torque.

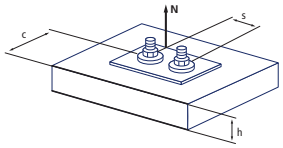
TENSION LOAD [N_{Rd}]

Design Tensile Resistance, N_{Rd}: lower value of [$N_{Rd,s}$; $N_{Rd,p}$; $N_{Rd,c}$]

Design Steel Tensile Resistance: $N_{Rd,s}$

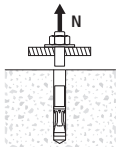
Design Pull-Out Resistance: $N_{Rd,p} = N^0_{Rd,p} * \Psi_{h,N} * \Psi_{\beta,N}$

Design Concrete Cone Resistance: $N_{Rd,c} = N^0_{Rd,c} * \Psi_{h,N} * \Psi_{\beta,N} * \Psi_{s,N} * \Psi_{c,N}$



STEEL TENSILE RESISTANCE [$N_{Rd,s}$]

- For static and quasi-static loadings.
- Only a single anchor is considered.
- For non-cracked concrete only.
- Loading applicable to stainless steel A2 only.

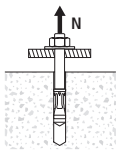


		Standard Anchorage Depth						Reduced Anchorage Depth					
ANCHOR SIZE		**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
h_{ef}	[mm]	40	50	55	65	85	100	30	35	40	50	60	75
$N_{Rd,s}$	[kN]	6.4	11.7	18.6	27.0	50.4	78.6	6.4	11.7	18.6	27.0	50.4	78.6

The design steel tensile resistance is derived from $N_{Rd,s} = N_{Rk,s} / \gamma_{Ms,N}$ where the partial safety factor is 1.87. The recommended load is derived from $N_{Rec,s} = N_{Rd,s} / \gamma_F$ where the partial safety factor is 1.4.

PULL-OUT RESISTANCE [$N_{Rd,p}$]

- For static and quasi-static loadings.
- For non-cracked concrete only.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm²).
- Loading applicable to stainless steel A2 only.

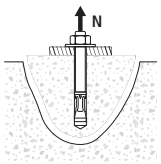


		Standard Anchorage Depth						Reduced Anchorage Depth					
ANCHOR SIZE		**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
h_{ef}	[mm]	40	50	55	65	85	100	30	35	40	50	60	75
$N^0_{Rd,p}$	[kN]	6.0	8.0	8.9	13.9	19.4	27.8	2.1	5.0	5.5	9.4	11.7	17.3

The design pull-out resistance is derived from $N^0_{Rd,p} = N^0_{Rk,p} / \gamma_{Mc,N}$ where partial of safety factor varies for different sizes. The recommended load is derived from $N^0_{Rec,p} = N^0_{Rd,p} / \gamma_F$ where the partial safety factor is 1.4.

CONCRETE CONE RESISTANCE [$N_{Rd,c}$]

- For static and quasi-static loadings.
- For non-cracked concrete only.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm²).
- Loading applicable to stainless steel A2 only.



		Standard Anchorage Depth						Reduced Anchorage Depth					
ANCHOR SIZE		**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
h_{ef}	[mm]	40	50	55	65	85	100	30	35	40	50	60	75
$N^0_{Rd,c}$	[kN]	8.5	11.9	13.7	17.6	26.4	33.7	5.5	7.0	8.5	11.9	15.6	21.9

The design concrete cone resistance is derived from $N^0_{Rd,c} = N^0_{Rk,c} / \gamma_{Mc,N}$ where the partial safety factor is 1.5. The recommended load is derived from $N^0_{Rec,c} = N^0_{Rd,c} / \gamma_F$ where the partial safety factor is 1.4.

TR STUD ANCHOR (STAINLESS STEEL RANGE)

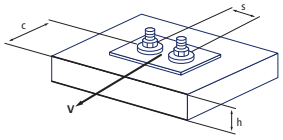
SHEAR LOAD [V_{Rd}]

Design Shear Resistance, V_{Rd}: lower value of [$V_{Rd,s}$; $V_{Rd,c}$; $V_{Rd,cp}$]

Design Steel Shear Resistance: $V_{Rd,s}$

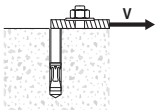
Design Concrete Edge Shear Resistance: $V_{Rd,c} = V^0_{Rd,c} * \Psi_{\beta,V} * \Psi_{\alpha,V} * \Psi_{sc,V}$

Design Concrete Pry-Out Resistance: $V_{Rd,cp} = V^0_{Rd,cp} * \Psi_{\beta,V} * \Psi_{s,N} * \Psi_{c,N}$



STEEL SHEAR RESISTANCE [$V_{Rd,s}$]

- For static and quasi-static loadings.
- Only a single anchor is considered.
- For non-cracked concrete only.
- Loading applicable to stainless steel A2 only.

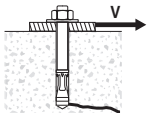


		Standard Anchorage Depth						Reduced Anchorage Depth					
ANCHOR SIZE		M6	M8	M10	M12	M16	M20	M6	M8	M10	M12	M16	M20
h_{ef}	[mm]	40	50	55	65	85	100	30	35	40	50	60	75
$V_{Rd,s}$	[kN]	4.2	7.7	12.2	17.7	33.0	51.5	4.2	7.7	12.2	17.7	33.0	51.5

The design steel shear resistance is derived from $V_{Rd,s} = V_{Rk,s} / \gamma_{Ms,v}$ where the partial safety factor is 1.56. The recommended load is derived from $V_{Rec,s} = V_{Rd,s} / \gamma_F$ where the partial safety factor is 1.4.

CONCRETE EDGE SHEAR RESISTANCE [$V_{Rd,c}$]

- For static and quasi-static loadings.
- For non-cracked concrete only.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm^2).
- Loading applicable to stainless steel A2 only.

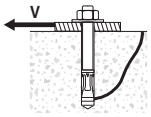


		Standard Anchorage Depth						Reduced Anchorage Depth					
ANCHOR SIZE		M6	M8	M10	M12	M16	M20	M6	M8	M10	M12	M16	M20
h_{ef}	[mm]	40	50	55	65	85	100	30	35	40	50	60	75
c_{min}	[mm]	40	50	55	65	85	100	30	35	40	50	60	75
$V^o_{Rd,c}$	[kN]	2.8	4.5	5.8	8.2	14.2	20.3	1.8	2.7	3.6	5.6	8.4	13.2

The design concrete edge shear resistance is derived from $V^o_{Rd,c} = V^o_{Rk,c} / \gamma_{Mc,V}$ where the partial safety factor is 1.5. The recommended load is derived from $V^o_{Rec,c} = V^o_{Rd,c} / \gamma_F$ where the partial safety factor is 1.4.

CONCRETE PRY-OUT RESISTANCE [$V_{Rd,cp}$]

- For static and quasi-static loadings.
- For non-cracked concrete only.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm^2).
- Loading applicable to stainless steel A2 only.



		Standard Anchorage Depth						Reduced Anchorage Depth					
ANCHOR SIZE		M6	M8	M10	M12	M16	M20	M6	M8	M10	M12	M16	M20
h_{ef}	[mm]	40	50	55	65	85	100	30	35	40	50	60	75
$V^o_{Rd,cp}$	[kN]	8.5	11.9	13.7	35.3	52.8	67.3	5.5	7.0	8.5	11.9	31.3	43.7

The design concrete pry-out resistance is derived from $V^o_{Rd,cp} = V^o_{Rk,cp} / \gamma_{Mp,v}$ where the partial safety factor is 1.5. The recommended load is derived from $V^o_{Rec,cp} = V^o_{Rd,cp} / \gamma_F$ where the partial safety factor is 1.4.

COMBINED TENSION & SHEAR

Combined Tension & Shear: $\frac{N_{Sd}}{N_{Rd}} + \frac{V_{Sd}}{V_{Rd}} \leq 1.2$

The resultant force must be satisfied to the above conditions. The designer must cross check the loading conditions, types of applied loads and substrate to ensure the recommended anchor is applicable to the actual site applications. This would avoid any design faults which commonly caused by inconclusive load requirements with respective to actual site conditions.

INFLUENCING FACTORS - TENSION

INFLUENCE OF ANCHORAGE DEPTH [$\Psi_{h,N}$]

$$\Psi_{h,N} = \left(\frac{h_{act}}{h_{ef}}\right)^{1.5}$$

Limits: $h_{ef,red} \leq h_{act} \leq h_{ef,std}$

INFLUENCE OF CONCRETE STRENGTH ON PULL-OUT AND CONCRETE CONE RESISTANCE [$\Psi_{\beta,N}$]

$$\Psi_{\beta,N} = \sqrt{\frac{f_{ck,cube}}{25}}$$

Limits: 25 MPa $\leq f_{ck,cube} \leq$ 60 MPa

Concrete Strength Designation (ENV 206)		C 20/25	C 25/30	C 30/37	C 35/45	C 40/50	C 50/60
Concrete Cylinder Strength, $f_{ck,cyl}$	[MPa]	20	25	30	35	40	50
Concrete Cube Strength, $f_{ck,cube}$	[MPa]	25	30	37	45	50	60
Concrete Strength Factor, $\Psi_{\beta,N}$		1.00	1.10	1.22	1.34	1.41	1.55

INFLUENCE OF ANCHOR SPACING [$\Psi_{s,N}$]

Standard Anchorage Depth

Anchor Spacing 's' [mm]	M6	M8	M10	M12	M16	M20
40	0.67					
50	0.71	0.67				
55	0.73	0.68	0.67			
65	0.77	0.72	0.70	0.67		
85	0.85	0.78	0.76	0.72	0.67	
100	0.92	0.83	0.80	0.76	0.70	0.67
120	1.00	0.90	0.86	0.81	0.74	0.70
150		1.00	0.95	0.88	0.79	0.75
165			1.00	0.92	0.82	0.78
195				1.00	0.88	0.83
255					1.00	0.93
300						1.00
Critical Spacing 's_{cr}' [mm]	120	150	165	195	255	300
Minimum Spacing 's_{min}' [mm]	40	50	55	65	85	100

Reduced Anchorage Depth

Anchor Spacing 's' [mm]	M6	M8	M10	M12	M16	M20
30	0.67					
35	0.69	0.67				
40	0.72	0.69	0.67			
50	0.78	0.74	0.71	0.67		
60	0.83	0.79	0.75	0.70	0.67	
75	0.92	0.86	0.81	0.75	0.71	0.67
90	1.00	0.93	0.88	0.80	0.75	0.70
105		1.00	0.94	0.85	0.79	0.73
120			1.00	0.90	0.83	0.77
150				1.00	0.92	0.83
180					1.00	0.90
225						1.00
Critical Spacing 's_{cr}' [mm]	90	105	120	150	180	225
Minimum Spacing 's_{min}' [mm]	30	35	40	50	60	75

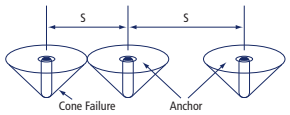
$$\Psi_{s,N} = 0.5 + \frac{s}{6 * h_{ef}}$$

Limits:

$s_{min} \leq s \leq s_{cr}$

$s_{min} = 1.0 * h_{ef}$

$s_{cr} = 3.0 * h_{ef}$



INFLUENCE OF EDGE DISTANCE [$\Psi_{c,N}$]

Standard Anchorage Depth

Edge Distance 'c' [mm]	M6	M8	M10	M12	M16	M20
40	0.76					
50	0.88	0.76				
55	0.94	0.81	0.76			
65	1.00	0.90	0.85	0.76		
75		1.00	0.93	0.83		
85			1.00	0.90	0.76	
100				1.00	0.84	0.76
130					1.00	0.90
150						1.00
Critical Edge Distance 'c_{cr}' [mm]	60	75	85	100	130	150
Minimum Edge Distance 'c_{min}' [mm]	40	50	55	65	85	100

Reduced Anchorage Depth

Edge Distance 'c' [mm]	M6	M8	M10	M12	M16	M20
30	0.76					
35	0.84	0.76				
40	0.92	0.83	0.76			
45	1.00	0.89	0.82			
50		0.96	0.88	0.76		
55		1.00	0.94	0.81		
60			1.00	0.85	0.76	
75				1.00	0.88	0.76
90					1.00	0.85
115						1.00
Critical Edge Distance 'c_{cr}' [mm]	45	55	60	75	90	115
Minimum Edge Distance 'c_{min}' [mm]	30	35	40	50	60	75

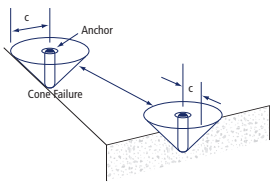
$$\Psi_{c,N} = 0.29 + 0.47 * \frac{c}{h_{ef}}$$

Limits:

$c_{min} \leq c \leq c_{cr}$

$c_{min} = 1.0 * h_{ef}$

$c_{cr} = 1.5 * h_{ef}$



INFLUENCING FACTORS - SHEAR

INFLUENCE OF CONCRETE STRENGTH ON CONCRETE EDGE SHEAR AND CONCRETE PRY-OUT RESISTANCE [$\Psi_{\beta,V}$]

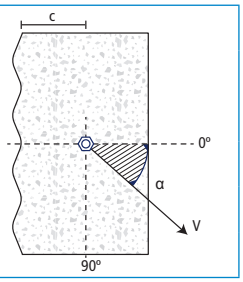
$$\Psi_{\beta,V} = \sqrt{\frac{f_{ck,cube}}{25}}$$

Limits: 25 MPa $\leq f_{ck,cube} \leq$ 60 MPa

Concrete Strength Designation (ENV 206)		C 20/25	C 25/30	C 30/37	C 35/45	C 40/50	C 50/60
Concrete Cylinder Strength, $f_{ck,cyl}$	[MPa]	20	25	30	35	40	50
Concrete Cube Strength, $f_{ck,cube}$	[MPa]	25	30	37	45	50	60
Concrete Strength Factor, $\Psi_{\beta,V}$		1.00	1.10	1.22	1.34	1.41	1.55

INFLUENCE OF SHEAR LOAD DIRECTION [$\Psi_{\alpha,V}$]

Load Type	Angle, α [°]	$\Psi_{\alpha,V}$
Oblique 0°	0° < α ≤ 15°	1.00
Oblique 30°	15° < α ≤ 37.5°	1.14
Oblique 45°	37.5° < α ≤ 52.5°	1.35
Oblique 60°	52.5° < α ≤ 67.5°	1.71
Oblique 90°	67.5° < α ≤ 90°	2.00

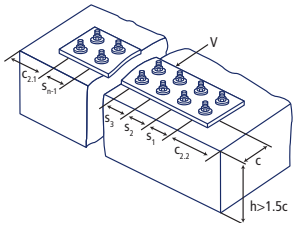


INFLUENCE OF ANCHOR SPACING AND EDGE DISTANCE ON CONCRETE EDGE SHEAR RESISTANCE [$\Psi_{sc,V}$]

$$\Psi_{sc,V} = \frac{c}{c_{min}} * \sqrt{\frac{c}{c_{min}}}$$ for single anchor towards a concrete edge

$$\Psi_{sc,V} = \frac{3c + s}{6c_{min}} * \sqrt{\frac{c}{c_{min}}}$$ for two anchors when $s \leq 3c$

$$\Psi_{sc,V} = \frac{3c + s_1 + s_2 + s_{n-1}}{3nc_{min}} * \sqrt{\frac{c}{c_{min}}}$$ for multiple anchors when s_1 to $s_{n-1} \leq 3c$ and $c_2 \geq 1.5c$



$\Psi_{sc,V}$		c / c_{min} 1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0
Edge influence with single anchor		1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72	6.27	6.83	7.41	8.00
s / c_{min}	1.0	0.67	0.84	1.03	1.22	1.43	1.65	1.88	2.12	2.36	2.62	2.89	3.16	3.44	3.73	4.03	4.33
	1.5	0.75	0.93	1.12	1.33	1.54	1.77	2.00	2.25	2.50	2.76	3.03	3.31	3.60	3.89	4.19	4.50
	2.0	0.83	1.02	1.22	1.43	1.65	1.89	2.13	2.38	2.63	2.90	3.18	3.46	3.75	4.05	4.35	4.67
	2.5	0.92	1.11	1.32	1.54	1.77	2.00	2.25	2.50	2.77	3.04	3.32	3.61	3.90	4.21	4.52	4.83
	3.0	1.00	1.20	1.42	1.64	1.88	2.12	2.37	2.63	2.90	3.18	3.46	3.76	4.06	4.36	4.68	5.00
	3.5		1.30	1.52	1.75	1.99	2.24	2.50	2.76	3.04	3.32	3.61	3.91	4.21	4.52	4.84	5.17
	4.0			1.62	1.86	2.10	2.36	2.62	2.89	3.17	3.46	3.75	4.05	4.36	4.68	5.00	5.33
	4.5				1.96	2.21	2.47	2.74	3.02	3.31	3.60	3.90	4.20	4.52	4.84	5.17	5.50
	5.0					2.33	2.59	2.87	3.15	3.44	3.74	4.04	4.35	4.67	5.00	5.33	5.67
	5.5						2.71	2.99	3.28	3.57	3.88	4.19	4.50	4.82	5.15	5.49	5.83
	6.0						2.83	3.11	3.41	3.71	4.02	4.33	4.65	4.98	5.31	5.65	6.00
	6.5							3.24	3.53	3.84	4.16	4.47	4.80	5.13	5.47	5.82	6.17
	7.0								3.67	3.98	4.29	4.62	4.95	5.29	5.63	5.98	6.33
	7.5									4.11	4.43	4.76	5.10	5.44	5.79	6.14	6.50
	8.0										4.57	4.91	5.25	5.59	5.95	6.30	6.67
	8.5											5.05	5.40	5.75	6.10	6.47	6.83
	9.0											5.20	5.55	5.90	6.26	6.63	7.00
	9.5												5.69	6.05	6.42	6.79	7.17
	10.0													6.21	6.58	6.95	7.33
	10.5														6.74	7.12	7.50
	11.0															7.28	7.67
	11.5																7.83
	12.0																8.00