RCKW Kneewall Connectors

This product is preferable to similar connectors because of a) easier installation, b) higher loads, c) lower installed cost, or a combination of these features.

The Simpson Strong-Tie® RCKW is a heavy 171 mil (7 ga.) rigid connector that has been developed to resist an overturning moment at the base of exterior kneewalls and parapets as well as interior partial-height walls or overhead ribbon window conditions. These connectors offer a unique small and large anchor-hole pattern that permits anchorage to both concrete and structural steel. The single-anchor RCKW has been redesigned to have all of the same features as the previous model but with an added two-anchor option that accommodates ½"- or ⅜"-diameter concrete anchors. If load requires more capacity, a stiffener, the RCKWS can be added. The RCKWS is a heavy 171 mil (7 ga.) stiffener that nests onto the RCKW clip. The screw holes and anchor holes in the stiffener line up with those in the RCKW clip, making fastener and anchor installation a snap. The RCKW clip and RCKWS stiffener are sold separately.

Features:

- In addition to our RCKW3 and RCKW3S with a large single bolt hole for 3⅝" framing, we have the RCKW3D and RCKW3DS, which have two large holes for anchorage. This provides an option for more capacity in 3⅝"-framed kneewalls.
- Anchorage legs incorporate stiffened flanges, improving overturning moment resistance.
- Large-diameter anchor holes accommodate ½"-diameter concrete screw anchor and wedge anchors, such as the Simpson Strong-Tie Titen HD® heavy-duty screw anchor and the Strong-Bolt® 2 wedge anchor.
- The RCKW5.5 and RCKW7.5 have three large holes for added versatility. The center hole is for a one-anchor solution at the edge or center of slab. The outer holes are for a two-anchor solution that requires higher capacities at the center of slab. In addition, two ⅜" Titen HD screw anchors have been tested in the outer holes for shallow embedment conditions like fluted deck. The RCKW3 and RCKW3S have single large holes in the center, and the RCKW3D and RCKW3DS have two large holes on the outside for increased anchorage capacity.
- The smaller-diameter anchor holes enable attachment to structural steel with #12 self-drilling screws.
- Attachment to CMU can be achieved with Titen HD or Titen Turbo™ concrete and masonry screws.
- For the RCKWS: 171 mil (7 ga.) stiffeners are secured to the RCKW clip with screws, optimizing overturning moment resistance and stiffness.

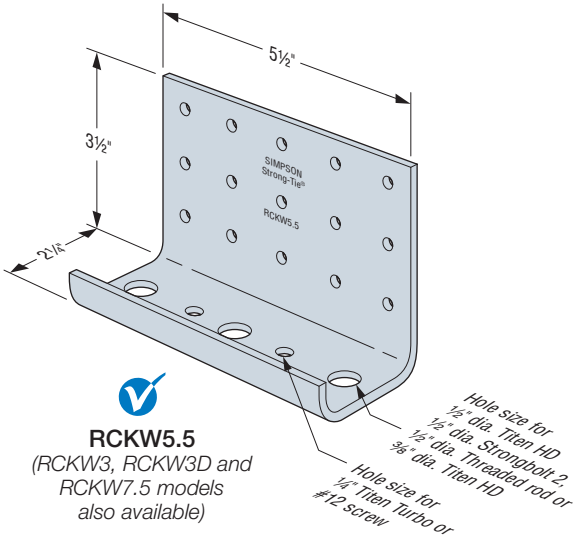
Material: RCKW and RCKWS — 171 mil (7 ga.), 33 ksi

Coating: Galvanized (G90)

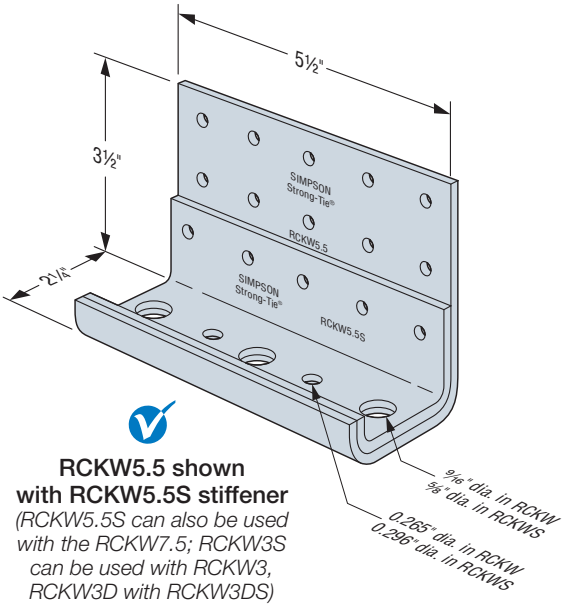
Installation:

- Use all specified screw fasteners. To achieve tabulated load values, use #12–14 screws according to the fastener patterns on p. 121.
- When using the RCKWS, secure the stiffener to the clip with the specified screw fasteners. Screws must be at least 1" long and extend through the connection with a minimum of three exposed threads.
- Use all specified anchors. To achieve tabulated stiffness values, the installation torque for concrete anchors shall be at least 17 ft.-lb. or the torque requirements of the anchor, whichever is greater.
- When using the larger-diameter anchor holes, the bottom track must be predrilled or punched with a ¾"-diameter hole.

Codes: See p. 13 for Code Reference Key Chart



RCKW5.5
(RCKW3, RCKW3D and RCKW7.5 models also available)



RCKW5.5 shown with RCKW5.5S stiffener
(RCKW5.5S can also be used with the RCKW7.5; RCKW3S can be used with RCKW3, RCKW3D with RCKW3DS)

US Patent: 9,938,709

RCKW Kneewall Connectors

Ordering Information

Model No.	Ordering SKU	Package Quantity
RCKW3	RCKW3-R10	10 RCKW3 clips
RCKW3D	RCKW3D-R10	10 RCKW3D clips
RCKW5.5	RCKW5.5-R10	10 RCKW5.5 clips
RCKW7.5	RCKW7.5-R10	10 RCKW7.5 clips
RCKW3S	RCKW3S-R10	10 RCKW3S stiffeners
RCKW3DS	RCKW3DS-R10	10 RCKW3DS stiffeners
RCKW5.5S	RCKW5.5S-R10	10 RCKW5.5S stiffeners

RCKW assembly test with member failure.

Ease of Specification

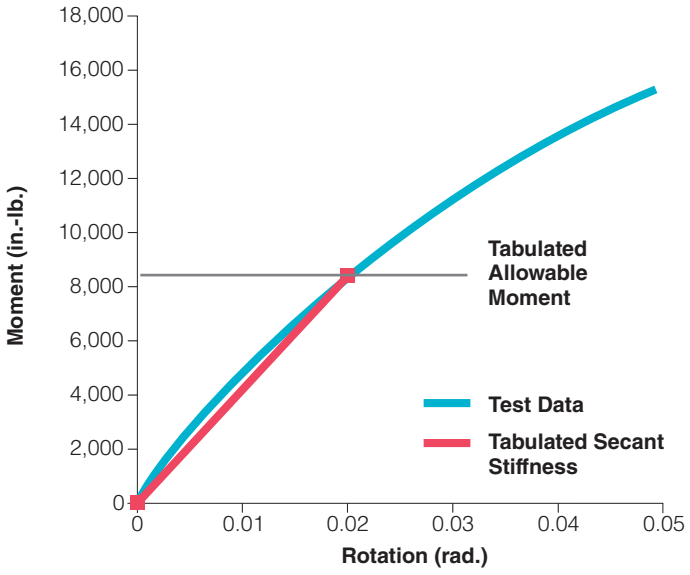
Many cold-formed steel connector manufacturers provide limited technical data for their products. As a result, designers often rely on detailed and time-consuming hand calculations for CFS connection design. This often involves assumptions regarding connection eccentricity, prying and connection stiffness.

Simpson Strong-Tie strives for ease of specification by providing comprehensive load tables based on tests that simulate real-world conditions. These load tables ensure that tabulated values reflect not only the strength of the connector, but also the strength of the fasteners, the anchorage, the member near the connection, and the overall stiffness. The photo to the right is an example of member failure near the connection. Such failures are reflected in our tabulated loads because of our assembly testing.

Simplified Stiffness Calculations

Some manufacturers tabulate stiffness values only for the connector. It's often unknown or unclear if their stiffness includes the screw fastener slip and how this varies with the thickness of the stud. Additionally, with some manufacturers, the deflection of the stud must be added to the deflection from the rotation of the connector in order to arrive at the final deflection for design.

Because we have tested the entire assembly, Simpson Strong-Tie tabulates stiffness that includes connector deflection, fastener slip and stud deflection for walls up to 38" in height. Our stiffness also takes into account the thickness of the stud, making it simple for the designer to calculate deflections: Simply divide the required moment by the tabulated stiffness, and then multiply the result by the stud length (Ref. Example #1 on p. 123). For walls over 38", a different approach is required (Ref. Example #2 on pp. 124–125).



RCKW Kneewall Connectors

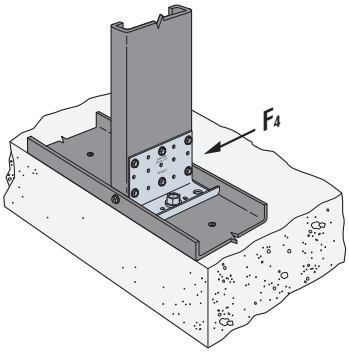


Figure A
F_4 Loading
(one anchor shown)

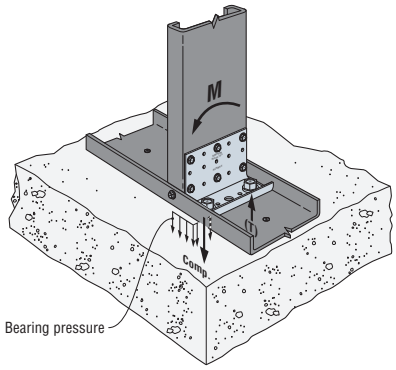


Figure B
Anchor Tension, T, Created from Moment
(two anchors shown)

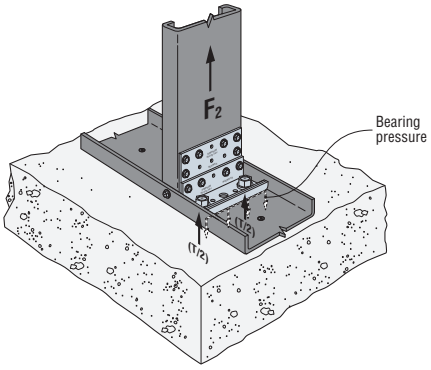


Figure C
Anchor Tension, T, Created from F_2
(two anchors shown)

Table 1: RCKW Allowable Loads (lb.) — Concrete Applications

Model No.	Fastener Pattern No.	Anchor Bolt Diameter (in.)	Fasteners to Stud	Framing Members Thickness mil (ga.)	Assembly Rotational Stiffness β_c (in.-kip / rad.)	Connector Rotational Stiffness β_c (in.-kip / rad.)	Allowable Load			Anchor Tension, T				Code Ref.
							Moment M (in.-lb.)	Tension F_2 (lb.)	Shear F_4 (lb.)	At Allowable Moment, M (lb.)		At Allowable Tension Load, F_2 (lb.)		
										f'_c = 3,000 psi	f'_c = 4,000 psi	f'_c = 3,000 psi	f'_c = 4,000 psi	
RCKW3	1	(1) ½	(4) #12	33 (20)	87	93	2,425	860	620	1,870	1,790	1,080	1,055	IBC, LA
				43 (18)	113	115	3,080	1,340	755	2,510	2,355	1,780	1,705	
				54 (16)	128	137	4,330	1,850	1,120	4,120	3,590	2,645	2,470	
				68 (14)	141	153	5,150	1,850	1,120	6,530[15]	4,570[15]	2,645	2,470	
RCKW3D	1B	(2) ½	(4) #12	33 (20)	109	119	2,770	860	620	1,165	1,150	1,080	1,055	—
				43 (18)	126	136	3,860	1,340	755	1,665	1,630	1,780	1,705	
				54 (16)	165	180	5,530	1,850	1,120	2,480	2,400	2,645	2,470	
				68 (14)	302	343	6,280	1,850	1,120	2,870	2,760	2,645	2,470	
RCKW3 and RCKW3S (Stiffener)	2	(1) ½	(9) #12	33 (20)	164	175	3,335	1,310	620	2,790	2,590	1,730	1,665	IBC, LA
				43 (18)	164	175	4,215	1,710	795	3,935	3,465	2,390	2,250	
				54 (16)	164	175	5,160	2,220	1,120	6,700[15]	4,585[15]	3,410	3,085	
				68 (14)	164	175	5,160	2,410	1,415	6,700[15]	4,585[15]	3,875	3,425	
RCKW3D and RCKW3DS (Stiffener)	2B	(2) ½	(9) #12	33 (20)	205	224	3,815	1,310	620	1,645	1,610	1,730	1,665	—
				43 (18)	303	371	5,215	1,710	795	2,320	2,250	2,390	2,250	
				54 (16)	341	410	7,930	2,220	1,120	3,800	3,595	3,410	3,085	
				68 (14)	341	410	7,930	2,410	1,415	3,800	3,595	3,875	3,425	

See footnotes on p. 120.

RCKW Kneewall Connectors

Table 1: RCKW Allowable Loads (lb.) — Concrete Applications (cont.)

Model No.	Fastener Pattern No.	Anchor Bolt Diameter (in.)	Fasteners to Stud	Framing Members Thickness mil (ga.)	Assembly Rotational Stiffness β_c (in.-kip / rad.)	Connector Rotational Stiffness β_c (in.-kip / rad.)	Allowable Load			Anchor Tension, T				Code Ref.
							Moment M (in.-lb.)	Tension F_2 (lb.)	Shear F_4 (lb.)	At Allowable Moment, M (lb.)		At Allowable Tension Load, F_2 (lb.)		
										f'_c = 3,000 psi	f'_c = 4,000 psi	f'_c = 3,000 psi	f'_c = 4,000 psi	
RCKW5.5	3	(1) ½	(6) #12	30 (20 DW)[5,6]	258	280	3,775	1,030	600	1,455	1,435	1,250	1,235	IBC, LA
				33 (20 STR)[6]	260	281	4,670	1,140	665	1,830	1,795	1,395	1,375	
				33 (20)	304	328	4,670	1,140	665	1,830	1,795	1,395	1,375	
				43 (18)	320	338	6,245	1,440	1,035	2,525	2,450	1,790	1,755	
				54 (16)	320	338	8,225	2,455	1,390	3,465	3,320	3,255	3,125	
				68 (14)	417	438	9,375	2,455	1,390	4,065	3,850	3,255	3,125	
	3A	(2) ⅜	(6) #12	30 (20 DW)[5,6]	258	280	3,775	1,030	600	770	765	1,250	1,235	
				33 (20 STR)[6]	260	281	4,670	1,140	665	955	950	1,395	1,375	
				33 (20)	304	328	4,670	1,140	665	955	950	1,395	1,375	
				43 (18)	333	355	6,245	1,440	1,035	1,285	1,275	1,790	1,755	
				54 (16)	412	439	8,865	2,455	1,390	1,845	1,830	3,255	3,125	
				68 (14)	489	519	11,620	2,455	1,390	2,455[16]	2,420[16]	3,255	3,125	
	3B	(2) ½	(6) #12	30 (20 DW)[5,6]	258	280	3,775	1,030	600	770	765	1,250	1,235	
				33 (20 STR)[6]	260	281	4,670	1,140	665	955	950	1,395	1,375	
				33 (20)	304	328	4,670	1,140	665	955	950	1,395	1,375	
				43 (18)	333	355	6,245	1,440	1,035	1,285	1,275	1,790	1,755	
				54 (16)	593	651	9,995	2,455	1,390	2,095	2,070	3,255	3,125	
				68 (14)	674	734	11,630	2,455	1,390	2,460	2,420	3,255	3,125	
RCKW5.5 and RCKW5.5S (Stiffener)	4	(1) ½	(10) #12	33 (20)	256	272	4,855	1,660	665	1,910	1,870	2,090	2,040	
				43 (18)	450	490	8,445	2,165	1,035	3,580	3,420	2,815	2,720	
				54 (16)	467	502	11,575	2,980	1,390	5,340[15]	4,930[15]	4,115	3,895	
				68 (14)	511	513	14,040	2,980	1,830	7,105[15]	6,275[15]	4,115	3,895	
	4A	(2) ⅜	(10) #12	33 (20)	256	272	4,855	1,660	665	990	985	2,090	2,040	
				43 (18)	450	490	8,445	2,165	1,035	1,755	1,740	2,815	2,720	
				54 (16)	530	576	12,920	2,980	1,390	2,705[16]	2,705[16]	4,115	3,895	
				68 (14)	626	678	14,300	2,980	1,830	3,065[16]	3,010[16]	4,115	3,895	
	4B	(2) ½	(10) #12	33 (20)	256	272	4,855	1,660	665	990	985	2,090	2,040	
				43 (18)	450	490	8,445	2,165	1,035	1,755	1,740	2,815	2,720	
				54 (16)	669	742	13,455	2,980	1,390	2,870	2,820	4,115	3,895	
				68 (14)	867	966	16,515	2,980	1,830	3,585	3,505	4,115	3,895	
RCKW7.5	5	(1) ½	(6) #12	33 (20)	389	402	6,445	1,095	795	1,815	1,790	1,315	1,300	
				43 (18)	510	536	8,200	1,280	1,200	2,345	2,300	1,550	1,530	
				54 (16)	554	571	11,400	2,165	1,695	3,370	3,275	2,715	2,655	
				68 (14)	605	628	13,895	2,165	1,695	4,225	4,065	2,715	2,655	
	5A	(2) ⅜	(6) #12	33 (20)	389	402	6,445	1,095	795	1,095	1,090	1,315	1,300	
				43 (18)	510	536	8,200	1,280	1,200	1,400	1,395	1,550	1,530	
				54 (16)	820	868	12,840	2,165	1,695	2,230[16]	2,205[16]	2,715	2,655	
				68 (14)	912	965	14,920	2,165	1,695	2,610[16]	2,575[16]	2,715	2,655	
	5B	(2) ½	(6) #12	33 (20)	389	402	6,445	1,095	795	1,095	1,090	1,315	1,300	
				43 (18)	510	536	8,200	1,280	1,200	1,400	1,395	1,550	1,530	
				54 (16)	867	927	13,255	2,165	1,695	2,305	2,280	2,715	2,655	
				68 (14)	912	965	15,640	2,165	1,695	2,745	2,705	2,715	2,655	

See footnotes on p. 120.

RCKW Kneewall Connectors

Table 1: RCKW Allowable Loads (lb.) — Concrete Applications (cont.)

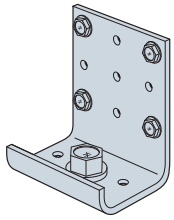
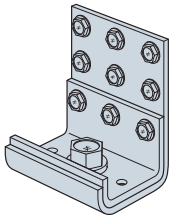
Model No.	Fastener Pattern No.	Anchor Bolt Diameter (in.)	Fasteners to Stud	Framing Members Thickness mil (ga.)	Assembly Rotational Stiffness β_C (in.-kip / rad.)	Connector Rotational Stiffness β_C (in.-kip / rad.)	Allowable Load			Anchor Tension, T				Code Ref.
							Moment M (in.-lb.)	Tension F_2 (lb.)	Shear F_4 (lb.)	At Allowable Moment, M (lb.)		At Allowable Tension Load, F_2 (lb.)		
										f'_c = 3,000 psi	f'_c = 4,000 psi	f'_c = 3,000 psi	f'_c = 4,000 psi	
RCKW7.5 and RCKW5.5S (Stiffener)	6	(1) ½	(10) #12	33 (20)	495	517	8,705	1,730	795	2,505	2,450	2,130	2,095	IBC, LA
				43 (18)	591	623	10,915	2,255	1,200	3,210	3,125	2,840	2,775	
				54 (16)	689	720	14,045	2,625	1,695	4,275	4,115	3,360	3,265	
				68 (14)	689	720	16,670	2,665	2,065	5,254[15]	4,985[15]	3,420	3,320	
	6A	(2) ⅜	(10) #12	33 (20)	495	517	8,705	1,730	795	1,490	1,480	2,130	2,095	
				43 (18)	591	623	10,915	2,255	1,200	1,885	1,865	2,840	2,775	
				54 (16)	873	930	17,175	2,625	1,695	3,030[16]	2,985[16]	3,360	3,265	
				68 (14)	959	1,011	18,370	2,665	2,065	3,255[16]	3,200[16]	3,420	3,320	
	6B	(2) ½	(10) #12	33 (20)	495	517	8,705	1,730	795	1,490	1,480	2,130	2,095	
				43 (18)	591	623	10,915	2,255	1,200	1,885	1,865	2,840	2,775	
				54 (16)	923	991	19,940	2,625	1,695	3,550	3,490	3,360	3,265	
				68 (14)	1,040	1,107	22,555	2,665	2,065	4,060	3,975	3,420	3,320	

1. For additional important information, see General Information and Notes on p. 26.
2. The designer is responsible for anchorage design.
3. See illustrations for fastener pattern placement.
4. Tabulated values are based on framing members with track and stud of the same thickness and (1) #10 screw into each stud flange unless otherwise noted.
5. Tabulated values may be used for framing members with track and stud of thickness 20 mil, F_y = 57 ksi (20 EQ).
6. Tabulated values are applicable for framing members with CFS track of thickness 20 mil, F_y = 57 ksi (20 EQ).
7. EQ — equivalent, DW — drywall, STR — structural.
8. Tabulated moment values correspond to maximum connector strength without consideration of serviceability. Designer must check out-of-plane deflections using tabulated Rotational Stiffness.
9. Tabulated Assembly Rotational Stiffness is applicable for walls at 38" tall with corresponding framing member depth and thickness. Reference Example #1 on p. 123.
10. Tabulated Connector Rotational Stiffness may be used for any wall heights; the designer must consider member deflection due to bending in the stud member. Reference Example #2 on pp. 124–125.
11. Per IBC 2012 and later Table 1604.3 footnote f, wind load is permitted to be taken as 0.42 times “component and cladding loads” for deflection checks. For IBC 2009 and earlier, the factor is 0.7 instead of 0.42. Tabulated values have not been adjusted.
12. Anchor tension, T, is the force in the anchor, or both anchors for two-anchor solutions, at maximum allowable, M, or maximum allowable tension, F_2.
13. Tabulated values for anchor tension, T, at allowable tension load, F_2, are provided for total anchor tension for (1) anchor and (2) anchors. See p. 126 for anchorage design tables and illustrations.
14. Anchor tension is calculated using AISC Steel Design Guide 1. The ‘Anchor Bolt Design’ illustration (Figure B) shows the anchor tension, T, based on an applied moment, M. An illustration for the anchor tension, T, based on a vertical tension load, F_2, shown in Figure C.
15. Tabulated allowable tension loads for the connectors with ½"-diameter anchor bolts require ASTM F3125, Grade A325 or ASTM A449 high-strength bolts. For A307 Grade A bolt, anchor tension load is limited to 4,410 lb.
16. Tabulated allowable tension loads for the connectors with ⅜"-diameter anchor bolts require ASTM F3125, Grade A325 or ASTM A449 high-strength bolts. For A307 Grade A bolt, anchor tension load is limited to 2,200 lb.
17. Anchor tension, T, may be interpolated. See footnotes on p. 128.

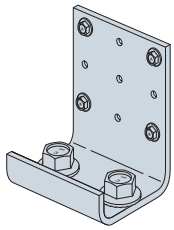
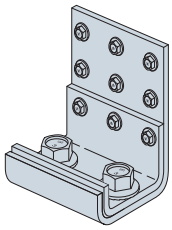
RCKW Kneewall Connectors

RCKW Fastener Patterns

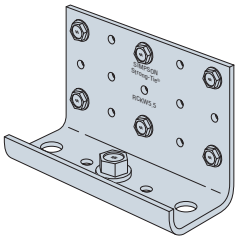
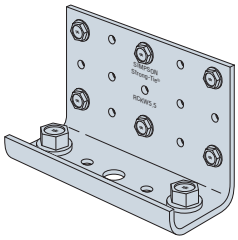
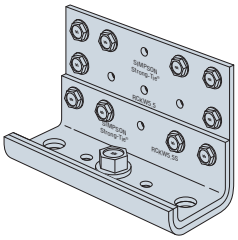
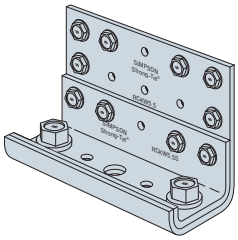
RCKW3 and RCKW3S Options

RCKW3 Fastener Pattern 1	RCKW3 with RCKW3S Fastener Pattern 2
	

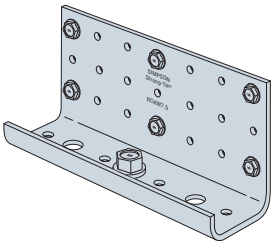
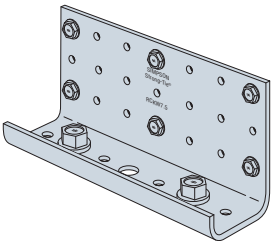
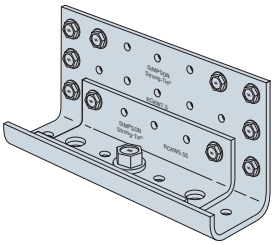
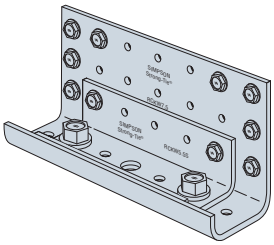
RCKW3D and RCKW3DS Options

RCKW3D Fastener Pattern 1A, 1B	RCKW3D with RCKW3DS Fastener Pattern 2A, 2B
	

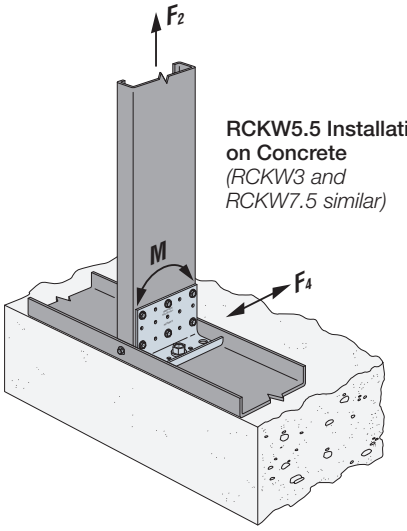
RCKW5.5 and RCKW5.5S Options

RCKW5.5 Fastener Pattern 3	RCKW5.5 Fastener Pattern 3A, 3B	RCKW5.5 with RCKW5.5S Fastener Pattern 4	RCKW5.5 with RCKW5.5S Fastener Pattern 4A, 4B
			

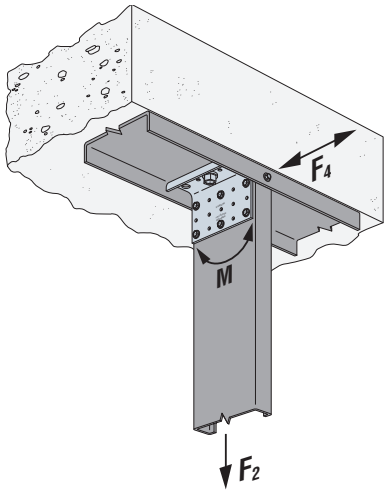
RCKW7.5 and RCKW5.5S Options

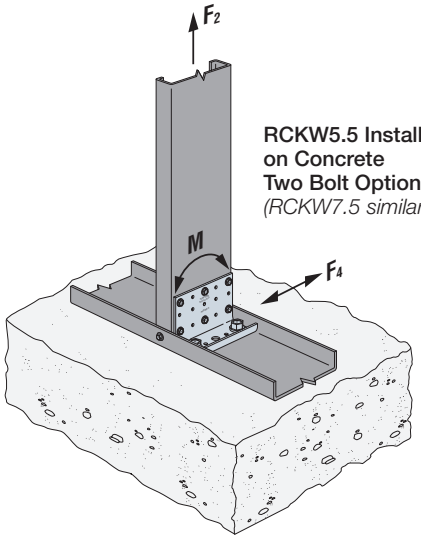
RCKW7.5 Fastener Pattern 5	RCKW7.5 Fastener Pattern 5A, 5B	RCKW7.5 with RCKW5.5S Fastener Pattern 6	RCKW7.5 with RCKW5.5S Fastener Pattern 6A, 6B
			

RCKW Kneewall Connectors

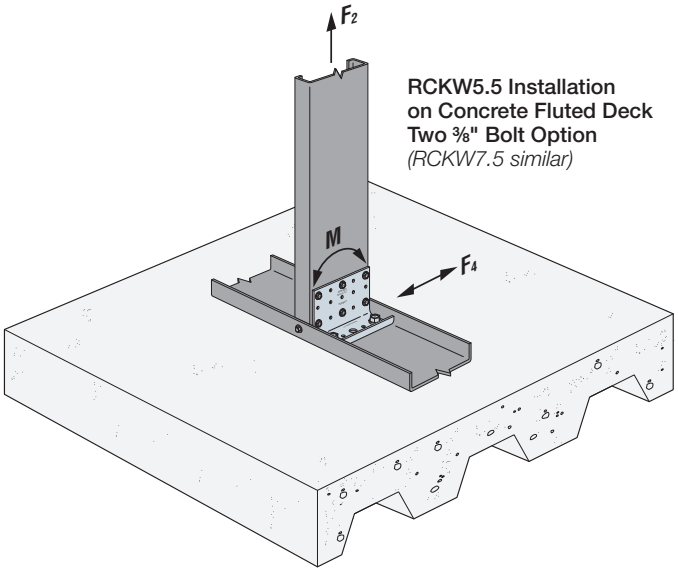


RCKW5.5 Installation on Concrete
(RCKW3 and RCKW7.5 similar)

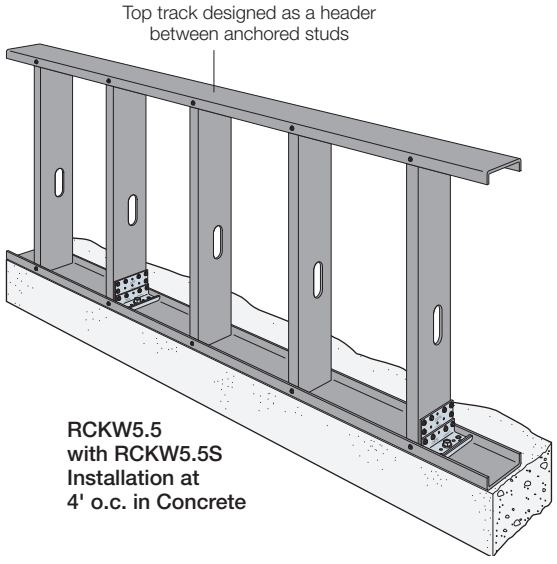




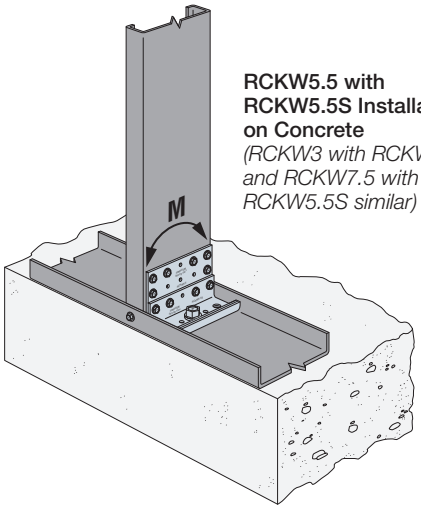
RCKW5.5 Installation on Concrete Two Bolt Option
(RCKW7.5 similar)



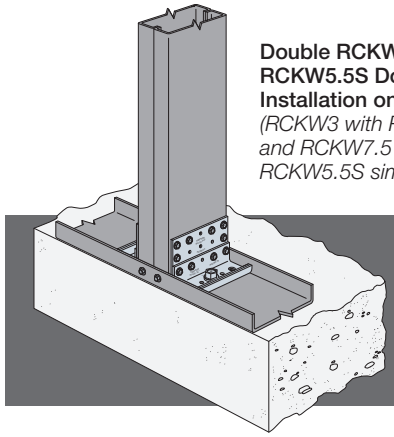
RCKW5.5 Installation on Concrete Fluted Deck Two ⅜" Bolt Option
(RCKW7.5 similar)



RCKW5.5 with RCKW5.5S Installation at 4' o.c. in Concrete



RCKW5.5 with RCKW5.5S Installation on Concrete
(RCKW3 with RCKW3S and RCKW7.5 with RCKW5.5S similar)



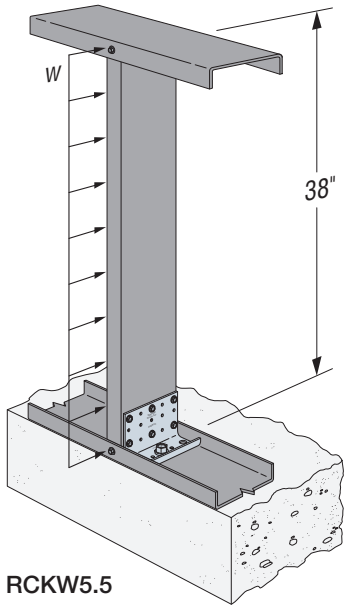
Double RCKW5.5 with RCKW5.5S Double-Stud Installation on Concrete
(RCKW3 with RCKW3S and RCKW7.5 with RCKW5.5S similar)

Need to replace a prefabricated post, or having trouble with concrete anchorage? Consider using this detail.

Example #1: Exterior Parapet Stud

Given:

- 2021 IBC (ASCE 7-16 and AISI S100-16)
- 600S162-33 (33 ksi) studs @ 16" o.c. supported at the base
- Parapet height, L = 38"-tall studs
- Wind design pressure = 49.67 psf (LRFD)
- Deflection Limits, Δ_{allow} = L/240 (Ref. IBC Table 1604.3)
- 3,000 psi concrete, cracked, SDC A&B, 3" anchor edge



RCKW5.5

Calculations:

Determine ASD wind pressure:

$p = (0.6)(49.67\ psf) = 29.8\ psf$

Note: 2021 IBC load combinations for ASD include a factor of 0.6 for wind loads.

$$w = (29.8\ psf)\frac{16\ in.}{12\ in.} = 39.7\ plf$$

Determine Required Moment:

$$M_{req} = \frac{wL^2}{2} = \frac{(39.7\ plf)(38\ in.)^2}{2\left(12\frac{in.}{ft.}\right)} = 2{,}389\ in.\text{-}lb.$$

From Table 1 (p. 118–120) for 600S162-33, 6"-deep 33-mil stud:

- Select RCKW5.5 connector, fastener pattern 3, with ½" anchor diameter and (6) #12 self-drilling screws, attaching to each stud @ 16" o.c.
- Allowable Moment = 4,670 in.-lb. > 2,389 in.-lb. **OK**
- Assembly Rotational Stiffness, β = 304,000 in.-lb./rad. for RCKW5.5 connector at 38" wall height

Check Deflection at Required Moment:

$$\Delta_{req} = \left(\frac{(0.7)(M_{req})}{\beta}\right)L = \left(\frac{(0.7)(2{,}389\ in.\text{-}lb.)}{304{,}000\frac{in.\text{-}lb.}{rad.}}\right)38\ in. = 0.209\ in.$$

Note: Per IBC Table 1604.3 footnote f, 0.42 factor can be used to calculate deflections for components and cladding wind loads for LRFD loads. ASD load conversion is 0.7.

Allowable Deflection:

$$\Delta_{allow} = \frac{2L}{240} = \frac{2(38\ in.)}{240} = 0.317\ in. > 0.209\ in.$$ **OK**

Computer-Assisted Design Note:
Please use kneewall module in Simpson Strong-Tie® CFS Designer™.

Select Anchorage:

Normal weight concrete with f'_c = 3,000 psi
Table 2 (p. 126–127) — Cracked Concrete, Wind and Seismic in SDC A&B

(1) Titen HD® with 3¼" embedment and 3" edge

F_{4req} = 39.7*38/12 = 125.7 lb.

M_{req} = 2,389 in.-lb.

F_{4all} = 930*0.86 = 799.8 lb.

M_{all} = 3,525*0.86 = 3,031 in.-lb.

***Note:** 0.86 comes from note 11, Table 2 (p. 128) (3,000 psi concrete)

F_{4req}/F_{4all} = 125.7/799.8 = 0.16 < 1 **OK**

M_{req}/M_{all} = 2,389/3,031 = 0.79 < 1 **OK**

Interaction = 0.16 + 0.79 = 0.95 < 1.2 **OK**

Example #2: High Interior Half-Wall — Concrete Slab, No Edge, Two Anchor

Given:

- 2021 IBC (ASCE 7-16 and AISI S100-16)
- The top track 600T125-54 (50 ksi) spans between 600S162-54 (50 ksi) studs @ spacing, S = 32" o.c. supported at the base
- 6" drywall studs at 16" o.c. as infill between the bottom and top track
- Wall height, L = 48"-tall studs
- Design Load: w = 50 plf or P = 200 lb. concentrated load for guard or handrail applications in accordance with Section 4.5.1 of ASCE (Ref. IBC 1607.9.1 and 1607.9.1.1)
- Deflection Limit, Δ_{allow} = L/120 (Ref. IBC Table 1604.3)
- 4,000 psi NWC, uncracked A&B, no edge, 5" concrete thickness

Calculations:

Design criteria #1 for linear load of 50 lb./ft.

Determine Required Concentrated Load, P_{req}:

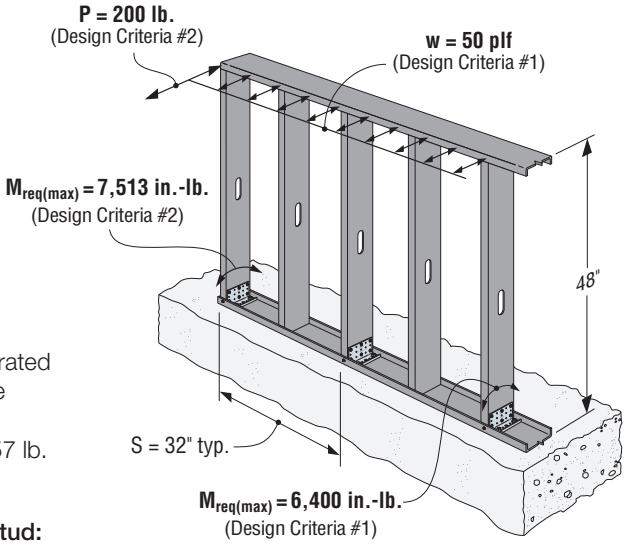
$$P = (w)(S) = (50\ plf)(32\ in.)\left(\frac{1\ ft.}{12\ in.}\right) = 133.3\ lb.$$

Determine Required Moment, M_{req}:

$$M_{req} = (P_{req})(L) = (133.3\ lb.)(48\ in.) = 6{,}400\ in.\text{-}lb.$$

Design criteria #2 for concentrated load of 200 lb.

Note: From a 3D structural analysis with the 200 lb. concentrated load at the end stud, a continuous top track distributes some load to adjacent studs so that the worst-case moment is $M_{req(max)}$ = 7,513 in.-lb. and maximum shear is $V_{req(max)}$ = 157 lb. as indicated in the illustration.



RCKW5.5 Installation on Concrete

From Table 1 (p. 118–120) for 600S162-54, 6"-deep, 54-mil stud:

- Select a RCKW5.5 connector, screw pattern 3B with (6) #12 self-drilling screws and (2) ½"-diameter anchors
- Allowable Moment = 9,995 in.-lb. > 6,400 in.-lb. (for linear load) **OK**
- Allowable Moment = 9,995 in.-lb. > 7,513 in.-lb. (for concentrated load) **OK**
- Connector Rotational Stiffness β_c = 651,000 in.-lb. / rad.

Check Deflection for Design Criteria #1 at Required Load:

Determine Stud Deflection, Δ_s, at P_{req} = 133.3 lb.

$$\Delta_s = \frac{P_{req}L^3}{3EI_{xe}} = \left(\frac{(133.3\ lb.)(48\ in.)^3}{3(29{,}500{,}000\ psi)(2.86\ in.^4)}\right) = 0.058\ in.$$

Note: Effective moment of inertia for a 600S162-54 stud is I_{xe} = 2.86 in.^{4}

Determine Connector Deflection, Δ_c, at M_{req} = 6,400 in.-lb. by utilizing the Connector Rotational Stiffness, β_c = 651,000 in.-lb. / rad. for RCKW5.5.

$$\Delta_c = \frac{M_{req}}{\beta_c}L = \frac{6{,}400\ in.\text{-}lb.}{651{,}000\ \frac{in.\text{-}lb.}{rad.}}(48\ in.) = 0.472\ in.$$

Note: The Connector Rotational Stiffness may be used for any wall height; the designer must consider member deflection due to bending in the stud member. See footnote 10 of Table 1 (p. 120).

Example #2: High Interior Half-Wall — Concrete Slab, No Edge, Two Anchor (cont.)

Total Deflection is the sum of the Stud Deflection and the Connector Deflection.

$$\Delta_{total} = \Delta_S + \Delta_C = 0.058\ in. + 0.472\ in. = 0.53\ in.$$

Allowable Deflection:

$$\Delta_{allow} = \frac{2L}{120} = \frac{(2)(48\ in.)}{120} = 0.800\ in. > 0.53\ in.$$ **OK**

Check Deflection for Design Criteria #2 at Required Load:

Determine Stud Deflection, Δ_S, at $M_{req(max)}$ = 7,513 in.-lb. from concentrated load.

$$\Delta_S = \frac{M_{req}L^2}{3EI_{xe}} = \left(\frac{(7{,}513\ in.\text{-}lb.)(48\ in.)^2}{3(29{,}500{,}000\ psi)(2.86\ in.^4)}\right) = 0.068\ in.$$

Determine Connector Deflection, Δ_C, at $M_{req(max)}$ = 7,513 in.-lb. by utilizing the Connector Rotational Stiffness, β_C = 651,000 in.-lb. / rad. for RCKW5.5.

$$\Delta_C = \frac{M_{req(max)}}{\beta_C} L = \frac{7{,}513\ in.\text{-}lb.}{651{,}000\ \frac{in.\text{-}lb.}{rad.}} (48\ in.) = 0.554\ in.$$

Total Deflection is the sum of Stud Deflection and Connector Deflection.

$$\Delta_{total} = \Delta_S + \Delta_C = 0.068\ in. + 0.554\ in. = 0.622\ in.$$

Allowable Deflection:

$$\Delta_{allow} = \frac{2L}{120} = \frac{(2)(48\ in.)}{120} = 0.800\ in. > 0.622\ in.$$ **OK**

Select Anchorage:

Normal-weight concrete with f'_c = 4,000 psi
Table 2 (p. 126–127) — Uncracked Concrete Wind and Seismic in SDC A&B (2) ½"-diameter Titen HD® with 3¼" embedment
F_{4req} = 157 lb.
F_{4all} = 3,765 lb. Table 2 (p. 126–127) two anchors assumed to act in shear with no edge condition
F_{4req}/F_{4all} = 157 lb./3,765 lb. = 0.04 < 1 **OK**
$M_{req(max)}$ = 7,513 in.-lb.
M_{req} = 10,800 in.-lb. Table 2 (p. 126–127)
$M_{req(max)}/M_{all}$ = 7,513 in.-lb. / 10,280 in.-lb. = 0.73 < 1 **OK**
Interaction = 0.04 + 0.73 = 0.77 < 1.2 **OK**

Note: Per ASCE Section 4.5.1, for handrail and guardrail systems, there is no need to apply the 50 plf linear load and the 200 lb. concentrated load concurrently. Example #2 demonstrates the design for both loading cases, and the outermost anchored stud governs when using the 200 lb. concentrated load.

Computer-Assisted Design Note:
Please use kneewall module in Simpson Strong-Tie® CFS Designer™.

RCKW Kneewall Connectors

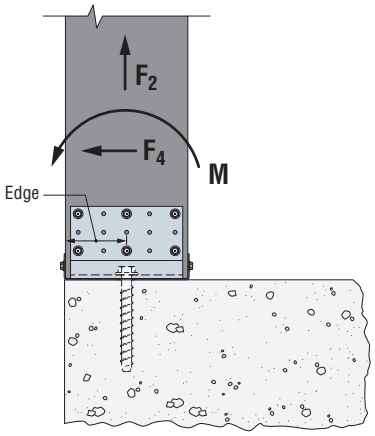


Figure 1
One Anchor

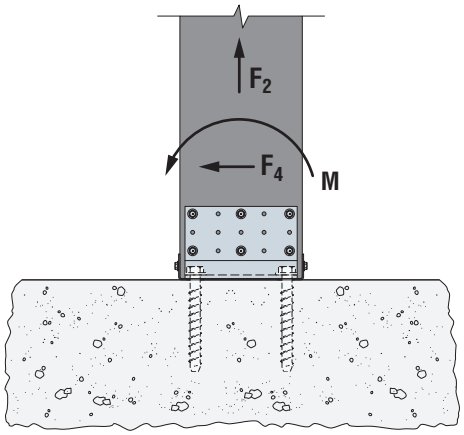


Figure 2
Two Anchors

Table 2: RCKW Allowable Anchorage Loads (lb.)

Model No.	Min. Anchor Edge Distance (in.)	Type of Concrete	Anchor Type	Nominal Embedment Depth, h_{nom} (in.)	Minimum Concrete Thickness, h_{min} (in.)	Uncracked 4,000 psi Concrete			Cracked 4,000 psi Concrete					
						Wind and Seismic in SDC A and B			Wind and Seismic in SDC A and B			Seismic in SDC C and D		
						Allowable			Allowable			Allowable		
						Moment M (in.-lb.)	Tension F_2 (lb.)	Shear F_4 (lb.)	Moment M (in.-lb.)	Tension F_2 (lb.)	Shear F_4 (lb.)	Moment M (in.-lb.)	Tension F_2 (lb.)	Shear F_4 (lb.)
RCKW3	1⅞	SLWC	(1) ½"-dia. Titen HD®	3¼	5	1,170	670	410	850	490	295	305	175	135
				3¾	6	1,295	745	425	935	535	305	335	190	140
		NWC	(1) ½"-dia. Titen HD	3¼	5	1,680	965	605	1,230	705	430	445	255	200
				3¾	6	1,865	1,070	625	1,350	775	445	495	285	210
	No edge	SLWC	(1) ½"-dia. Titen HD	3¼	5	2,005	1,150	1,560	1,450	835	1,105	530	305	515
				3¾	6	2,515	1,445	2,685	1,840	1,055	2,465	680	390	805
			(1) ½"-dia. Strong-Bolt® 2	3⅞	6	2,395	1,375	2,820	1,755	1,010	2,820	645	370	1,185
		NWC	(1) ½"-dia. Titen HD	3¼	5	2,825	1,625	2,295	2,080	1,195	1,625	770	445	760
				3¾	6	3,500	2,010	2,685	2,610	1,500	2,685	980	565	805
			(1) ½"-dia. Strong-Bolt 2	3⅞	6	3,340	1,920	2,820	2,490	1,430	2,820	935	535	1,185
RCKW3D	6	NWC	(2) ½"-dia. Titen HD	3¼	5	6,230	2,005	2,060	4,540	1,495	1,470	4,005	1,325	1,715
				3¼	6	6,230	2,005	2,260	4,540	1,495	1,615	4,005	1,325	1,880
	No edge	NWC	(2) ½"-dia. Titen HD	3¼	5	6,230	2,005	2,950	4,540	1,495	2,090	4,005	1,325	2,435
				3¾	6	6,230	2,005	2,950	4,540	1,495	2,090	4,005	1,325	2,435

Table continued on next page.

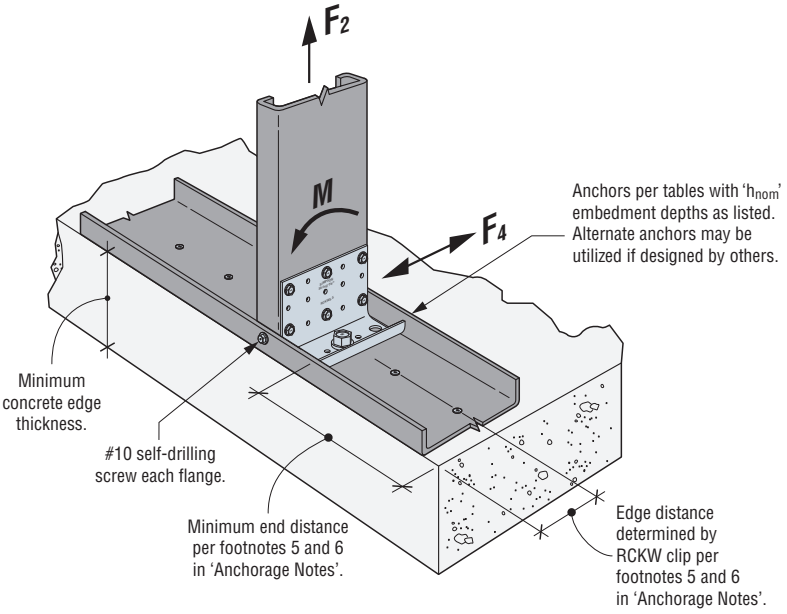
Table 2: RCKW Allowable Anchorage Loads (lb.) (cont.)

Model No.	Min. Anchor Edge Distance (in.)	Type of Concrete	Anchor Type	Nominal Embedment Depth, h_{nom} (in.)	Minimum Concrete Thickness, h_{min} (in.)	Uncracked 4,000 psi Concrete			Cracked 4,000 psi Concrete					
						Wind and Seismic in SDC A and B			Wind and Seismic in SDC A and B			Seismic in SDC C and D		
						Allowable			Allowable			Allowable		
						Moment M (in.-lb.)	Tension F_2 (lb.)	Shear F_4 (lb.)	Moment M (in.-lb.)	Tension F_2 (lb.)	Shear F_4 (lb.)	Moment M (in.-lb.)	Tension F_2 (lb.)	Shear F_4 (lb.)
RCKW5.5	3	SLWC	(1) ½"-dia. Titen HD®	3¼	5	3,360	1,055	815	2,435	765	635	870	275	295
				3¾	6	3,855	1,210	915	2,770	870	655	995	310	305
		NWC	(1) ½"-dia. Titen HD	3¼	5	4,845	1,520	1,305	3,525	1,105	930	1,275	400	435
				3¾	6	5,535	1,735	1,350	4,015	1,260	965	1,450	455	450
	No edge	SLWC	(1) ½"-dia. Titen HD	3¼	5	3,815	1,195	1,560	2,735	855	1,105	980	305	515
				3¾	6	4,845	1,520	2,685	3,490	1,095	2,465	1,260	395	805
			(1) ½"-dia. Strong-Bolt 2	3⅞	6	4,600	1,440	2,820	3,325	1,040	2,820	1,195	375	1,185
		NWC	(1) ½"-dia. Titen HD	3¼	5	5,485	1,720	2,295	3,965	1,245	1,625	1,435	450	760
				3¾	6	6,935	2,175	2,685	5,040	1,580	2,685	1,830	575	805
			(1) ½"-dia. Strong-Bolt 2	3⅞	6	6,585	2,065	2,820	4,795	1,505	2,820	1,740	545	1,185
		SLWC	(2) ⅜"-dia. Titen HD	2½	4" slab and 3¼" top of metal deck	4,460	1,430	1,020	2,060	700	725	725	250	335
			(2) ⅜"-dia. Strong-Bolt 2	2¼	4	4,360	1,440	700	3,070	1,035	700	1,095	370	330
		NWC	(2) ⅜"-dia. Titen HD	2½	4" slab and 3¼" top of metal deck	6,505	2,050	1,500	3,020	1,015	1,065	1,070	360	480
			(2) ⅜"-dia. Strong-Bolt 2	2¼	4	6,360	2,065	700	4,505	1,490	700	1,590	540	330
		SLWC	(2) ½"-dia. Titen HD	3¼	5	7,080	1,900	2,560	5,040	1,380	1,815	1,790	500	845
				3¾	6	9,040	2,265	5,370	6,460	1,650	4,380	2,305	600	1,610
			(2) ½"-dia. Strong-Bolt 2	3⅞	6	8,570	2,720	5,645	6,145	2,000	5,500	2,185	735	2,225
		NWC	(2) ½"-dia. Titen HD	3¼	5	10,280	2,700	3,765	7,365	1,975	2,665	2,625	725	1,245
				3¾	6	13,110	3,185	5,370	9,415	2,350	5,370	3,360	875	1,610
			(2) ½"-dia. Strong-Bolt 2	3⅞	6	12,425	3,780	5,645	8,945	2,830	5,645	3,190	1,070	2,370
RCKW7.5	4	SLWC	(1) ½"-dia. Titen HD	3¼	5	5,265	1,210	1,245	3,760	865	890	1,340	310	415
				3¾	6	6,485	1,490	1,410	4,665	1,070	1,010	1,670	385	470
			(1) ½"-dia. Strong-Bolt 2	3⅞	6	5,145	1,180	1,465	4,580	1,050	1,050	1,635	375	490
		NWC	(1) ½"-dia. Titen HD	3¼	5	7,615	1,750	1,830	5,475	1,260	1,310	1,965	450	610
				3¾	6	9,345	2,150	2,075	6,760	1,555	1,485	2,440	560	690
			(1) ½"-dia. Strong-Bolt 2	3⅞	6	7,445	1,710	2,160	6,640	1,525	1,540	2,385	550	720
	No edge	SLWC	(1) ½"-dia. Titen HD	3¼	5	5,265	1,210	1,560	3,760	865	1,105	1,340	310	515
				3¾	6	6,710	1,540	2,685	4,810	1,105	2,465	1,725	395	805
			(1) ½"-dia. Strong-Bolt 2	3⅞	6	6,365	1,460	2,820	4,580	1,050	2,820	1,635	375	1,185
		NWC	(1) ½"-dia. Titen HD	3¼	5	7,615	1,750	2,295	5,475	1,260	1,625	1,965	450	760
				3¾	6	9,680	2,225	2,685	6,985	1,605	2,685	2,510	575	805
			(1) ½"-dia. Strong-Bolt 2	3⅞	6	9,180	2,110	2,820	6,640	1,525	2,820	2,385	550	1,185
		SLWC	(2) ⅜"-dia. Titen HD	2½	4" slab and 3¼" top of metal deck	5,365	1,450	1,020	2,475	700	725	870	250	335
			(2) ⅜"-dia. Strong-Bolt 2	2¼	4	5,245	1,460	700	3,690	1,045	700	1,315	370	330
		NWC	(2) ⅜"-dia. Titen HD	2½	4" slab and 3¼" top of metal deck	7,835	2,095	1,500	3,630	1,025	1,065	1,285	365	480
			(2) ⅜"-dia. Strong-Bolt 2	2¼	4	7,660	2,110	700	5,420	1,515	700	1,910	545	330
		SLWC	(2) ½"-dia. Titen HD	3¼	5	8,530	1,940	2,560	6,065	1,400	1,815	2,150	500	845
				3¾	6	10,905	2,320	5,370	7,780	1,675	4,380	2,770	600	1,610
			(2) ½"-dia. Strong-Bolt 2	3⅞	6	10,335	2,805	5,645	7,400	2,040	5,500	2,625	740	2,225
		NWC	(2) ½"-dia. Titen HD	3¼	5	12,410	2,780	3,765	8,875	2,020	2,665	3,155	730	1,245
				3¾	6	15,855	3,305	5,370	11,360	2,410	5,370	4,040	880	1,610
			(2) ½"-dia. Strong-Bolt 2	3⅞	6	15,020	3,965	5,645	10,790	2,920	5,645	3,835	1,080	2,370

See footnotes on p. 128.

Table 2 Footnotes:

1. Anchor Allowable Loads have been determined using ACI 318-14 Chapter 17 anchorage calculations with the minimum concrete compressive strength, f'_c, and slab thickness listed. Sand-Lightweight Concrete is abbreviated as 'SLWC', Normal Weight Concrete is abbreviated as 'NWC'.
2. Load values are for anchor based on ACI 318-14, condition B, load factors from ACI 318 Section 5.3, no supplemental edge reinforcement, $\Psi_{c,V}$ = 1.0 for cracked concrete and periodic special inspection. Reference ICC-ES or IAPMO-UES evaluation reports for further information.
3. Load values are based on short-term temperature range of 160°F and 180°F for SET-3G™ and AT-XP® adhesives, respectively. Long-term temperature range is assumed to be 110°F for SET-3G and AT-XP adhesives.
4. Allowable Stress Design (ASD) values were determined by multiplying calculated Strength Design values by a conversion factor, Alpha (α), of 0.7 for seismic loads and 0.6 for wind loads. ASD values for other load combinations may be determined using alternate conversion factors.
5. End distances are assumed as 1.5 x Min. Edge Distance in one direction and 'N/A' in the other direction. See figure on this page.
6. Edge and end distances are assumed as 'N/A' in all directions at locations for (No Edge).
7. Tabulated anchorage capacities for RCKW models shown are applied to the same model size with stiffener. For example, a value for model RCKW3 is equivalent to model RCKW3 and RCKW3S.
8. Tabulated allowable ASD loads for Wind and Seismic in SDC A and B are based on using wind conversion factors and may be increased by 1.17 for seismic SDC A and B only.
9. Allowable loads have been divided by an Omega (Ω) seismic factor of 2.5 for brittle failure as required by ACI 318-14 Chapter 17, unless steel failure governs.
10. Tabulated capacities are based on maximum allowable anchorage loads only. The capacity of the connection system shall be the minimum of the tabulated value and the RCKW allowable load value listed on p. 118–120.
11. Tabulated loads in Table 2 are based on f'_c = 4,000 psi. For f'_c = 3,000 psi, use an adjustment factor of 0.86 for the blue shaded values and 1.0 for all other values.
12. For anchor subjected to both tension and shear loads, it shall be designed to satisfy following:
    – For $N_a / N_{al} \leq 0.2$, the full allowable load in shear is permitted.
    – For $V_a / V_{al} \leq 0.2$, the full allowable load in tension is permitted.
    – For all other cases: $N_a / N_{al} + V_a / V_{al} \leq 1.2$.
    where:
    N_a = Applied ASD tension load
    N_{al} = Allowable tension load from Table 2
    V_a = Applied ASD shear load
    V_{al} = Allowable shear load from Table 2.

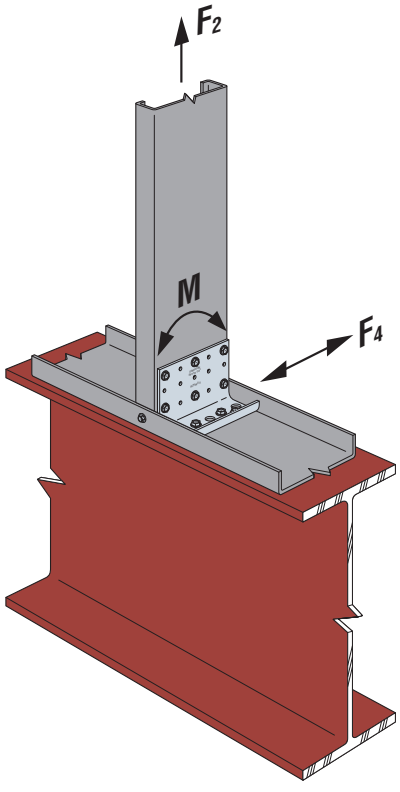


RCKW Kneewall Connectors

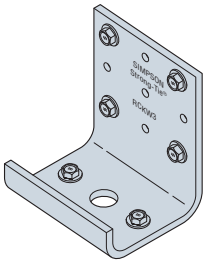
Table 3: RCKW Allowable Loads — Steel Applications with Anchorage

Model No.	Framing Member Depth (in.)	Fastener to Structural Steel[2]	Fastener to Stud[3]	Framing Member Thickness mil (ga.)	Assembly Rotational Stiffness[6,8] β (in.-lb./rad)	Connector Rotational Stiffness[7,8] βc (in.-lb./rad)	Allowable Load			Code Ref.
							Moment[4,5] M (in.-lb.)	Tension F_2 (lb.)	Shear F_4 (lb.)	
RCKW3	3.625	(2) #12	(4) #12	33 (20)	55,500	58,000	2,105	850	455	—
				43 (18)	73,300	76,700	2,570	1,225	745	
				54 (16)	87,260	91,200	2,690	1,115	1,115	
RCKW5.5	6.00	(4) #12	(6) #12	33 (20)	199,200	209,200	5,165	1,245	650	
				43 (18)	272,600	287,100	6,370	1,900	1,060	
				54 (16)	255,900	266,100	6,430	2,000	1,295	
RCKW7.5	8.00	(6) #12	(6) #12	33 (20)	456,700	483,200	7,030	965	655	
				43 (18)	571,600	603,600	9,595	1,950	1,135	
				54 (16)	693,600	731,600	11,320	2,185	1,710	

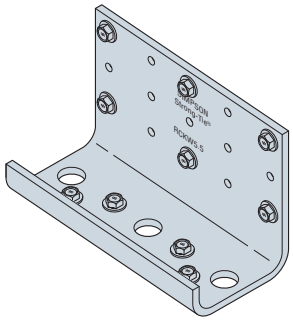
1. For additional important information, see General Information and Notes on p. 26.
2. Designer is responsible for structural steel design.
3. See illustrations for fastener patterns.
4. Tabulated values are based on framing members with track and stud of the same thickness and #10 screws into each stud flange.
5. Tabulated moment values correspond to the maximum connector strength without consideration of serviceability. Designer must check out-of-plane deflections using tabulated Rotational Stiffness.
6. Tabulated Assembly Rotational Stiffness is for walls at 38" tall.
7. The tabulated Connector Rotational Stiffness is for any wall heights. The designer must consider member deflection due to bending in the stud.
8. Per IBC 2015 Table 1604.3 footnote f, wind load is permitted to be taken as 0.42 times "component and cladding loads" for deflection checks. For IBC 2009 and earlier, the factor is 0.7 instead of 0.42.



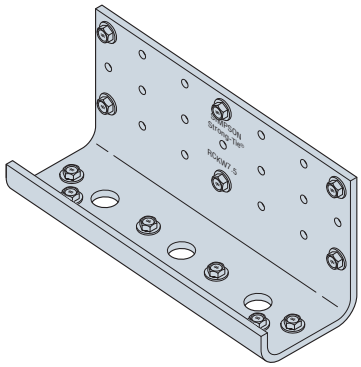
RCKW5.5 Installation on Structural Steel
(RCKW3 and RCKW7.5 similar)



RCKW3 Screw Pattern for Steel Anchorage



RCKW5.5 Screw Pattern for Steel Anchorage



RCKW7.5 Screw Pattern for Steel Anchorage