CITY OF LOS ANGELES
CALIFORNIA

Decon USA Inc.
103 E. Napa St., Suite B
P.O. Box 1486
Sonoma, CA 95476

Attn: Brian Hastings
(800) 363-3266

RESEARCH REPORT: RR 25795-T

Expires: September 1, 2016
Issued Date: September 1, 2014
Code: 2014 LABC

GENERAL APPROVAL – Renewal-Jordahl Carbon and Stainless Steel Anchor Channels and T-Headed Bolts are a connection system embedded in the concrete used as the structural support base.

DETAILS

Jordahl Anchor Channels are a connection system used for transferring external loads to the support base. The system consists of two or more steel anchors factory stamped to a steel channel to create a support base for the external load which is held in place by a steel attaching bolt with washer and hex nut. The Anchor Channels ultimate steel strengths are shown in Table 1. The material specifications are shown in Tables 2, 3 and 4 below.

The approval is subject to the following conditions:

1. Structural calculations and plans shall be prepared by an engineer or architect licensed in the state of California and approved by the structural plan check.

2. Jordahl Carbon and Stainless Steel Anchor Channels and T-Headed Bolts may be installed to exterior concrete decks or walls as permitted by the Los Angeles City Building Code.

3. Installation of anchor channels must comply with ACI 318-11, the approved plans and the manufacturer's instructions.

4. Approved products shall be identified with the name "Jordahl" trademark along with the part number indicated on them.

5. Strength values for Jordahl Carbon and Stainless Steel Anchor Channels and T-Headed Bolts is per table as shown below:

Table 1 – Anchor Channel ultimate steel strengths in Tension and Shear [1),2),3),4)]

Anchor Channel Type	Ultimate Tensile Strength (lbs.)	Ultimate Shear Strength (lbs.)
JTA K28/15	2000	2000
JTA K38/17	4000	4000
JTA W40/22	4500	4500
JTA W50/30	6900	6900
JTA W53/34	12400	12400
JTA W55/42	18000	18000
JTA W72/48	22500	22500

1) The design uses the Load and Resistance Factor Design (LRFD) method where factored material strengths must exceed factored applied loads. The strength reduction factors (ϕ) are taken from ACI318 Appendix D4.4 and the load factors are taken from ACI318 Section 9.2.
2) The design complies with ACI318 Appendix D.
3) The factored strengths shown above are steel strengths. Strength factors must be applied to the above factored steel strengths to account for the following:
   a. Edge and corner distances
   b. Anchor Channel length
   c. Reinforced concrete
   d. Concrete member thickness (or slab thickness)
4) T-bolt design is based on AISC.

6. The effects of the interaction of tensile and shear forces shall be in accordance with section D.7 of ACI 318-11.

Material requirement

Table 2 – Channels

	Profile	Size	Yield strength		Tensile Strength		ASTM	Steel grade
			[N/mm²]	PSI	[N/mm²]	PSI		
Mild steel	JTA	K 28/15	235	34080	360	52210	A 283	C
	JTA	K 38/17	260	37710	360	52210	A 283	C
	JTA	W 40/22	250	36260	380	55110	A 1011	36 Type 1
	JTA	W 50/30	235	34080	360	52210	A 1011	33
	JTA	W 53/34	235	34080	360	52210	A 1011	33
	JTA	W 55/42	275	39890	420	60920	A 1011	40
	JTA	W 72/48	235	34080	390	56560	A 1011	33
Stainless steel	JTA	K 28/15	240	34810	520	75420	A 666	Types 304 & 316
	JTA	K 38/17	260	37710	520	75420	A 666	Types 304 & 316
	JTA	W 40/22	250	36260	520	75420	A 666	Types 304 & 316
	JTA	W 50/30	240	34810	520	75420	A 666	Types 304 & 316
	JTA	W 53/34	240	34810	520	75420	A 666	Types 304 & 316
	JTA	W 72/48	240	34810	520	75420	A 666	Types 304 & 316

Table 3 - Anchors

	Channel	Anchor Name	Yield strength		Tensile Strength		ASTM
			[N/mm²]	PSI	[N/mm²]	PSI	
Mild steel	K 28/15	7x44,5	220	31910	330	47860	A 108
	K 38/17	9x75	270	39160	400	58020	A 108
	W 40/22	8,5x76	240	34810	360	52210	A 108
	W 50/30	9x85	340	49310	500	72520	A 108
	W 53/34	11,5x150	370	53660	550	79770	A 108
	W 55/42	15,5x165	390	56560	580	84120	A 108
	W 72/48	15,5x165	390	56560	580	84120	A 108
Stainless steel Types 304 & 316	K 28/15	7x44,5	220	31910	330	47860	A 108
	K 38/17	9x75	270	39160	400	58020	A 108
	W 40/22	8,5x76	240	34810	360	52210	A 108
	W 50/30	9x85	340	49310	500	72520	A 108
	W 53/34	11,5x150	370	53660	550	79770	A 108
	W 72/48	15,5x165	390	56560	580	84120	A 108

Table 4 - T-Bolts

	Steel grade	Yield strength		Tensile Strength		ASTM
		[N/mm²]	PSI	[N/mm²]	PSI	
Steel	4.6	240	34810	400	58020	F 568
	8.8	640	92820	800	116030	F 568
Stainless steel	A4-50	210	30460	500	72520	F 738
	A4-70, FA-70	450	65270	700	101530	F 738

DISCUSSION

Condition number 6 was added to correct the method of consideration of the interaction of tensile and shear forces in the anchor design. Page 9 of the design example was removed as it did not conform to the ACI 318-11 provisions.

The report has been renewed on a temporary basis until the Anchor Channels have been evaluated in accordance with the Acceptance Criteria For Anchor Channels in Concrete Elements AC232 that was approved in June 2013 published by ICC Evaluation Services.

The report is in compliance with the 2014 Los Angeles Building Code.

The approval is based on tests static load tests in accordance with ASTM E 488-96.

Addressee to whom this Research Report is issued is responsible for providing copies of it, complete with any attachments indicated, to architects, engineers and builders using items approved herein in design or construction which must be approved by Department of Building and Safety Engineers and Inspectors.

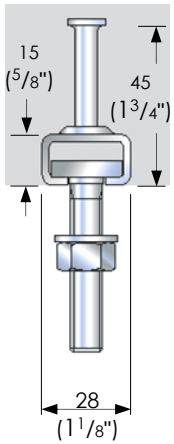
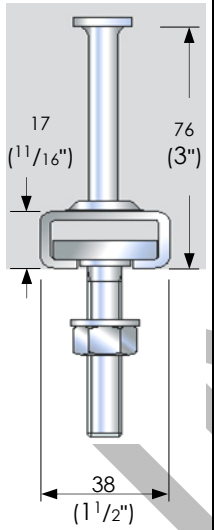
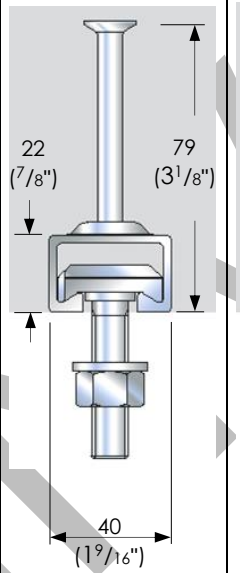
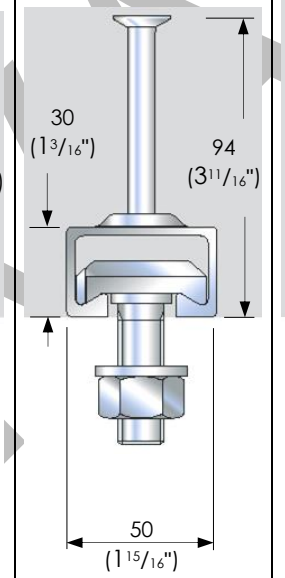
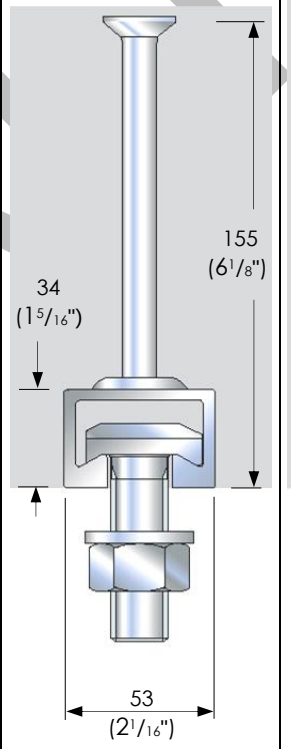
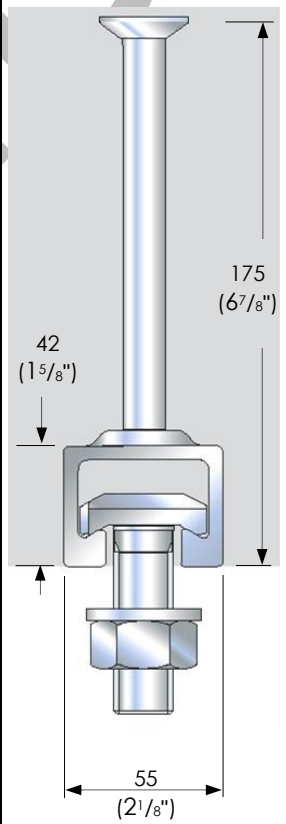
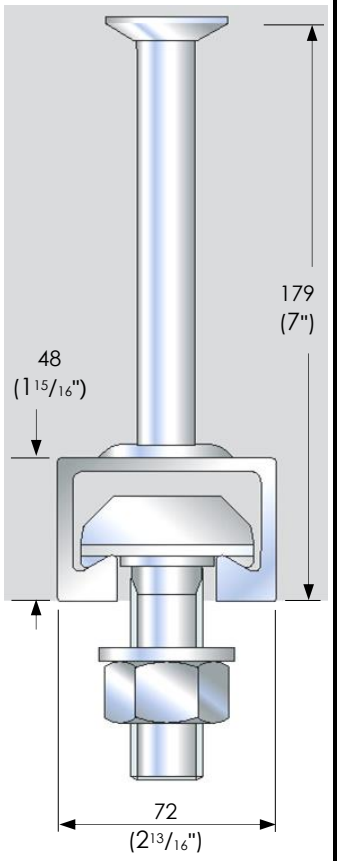
This general approval of an equivalent alternate to the Code is only valid where an engineer and/or inspector of this Department has determined that all conditions of this Approval have been met in the project in which it is to be used.

ALLEN PEERY, Chief
Engineering Research Section
201 N. Figueroa St., Room 880
Los Angeles, CA 90012
Phone - 213-202-9812
Fax - 213-202-9943

AP
RR25795/MSWord2010
R09/22/2014
5D2/2002

Decon USA Inc.
RE: Jordahl Carbon and Stainless Steel Anchor Channels and T-Headed Bolts.

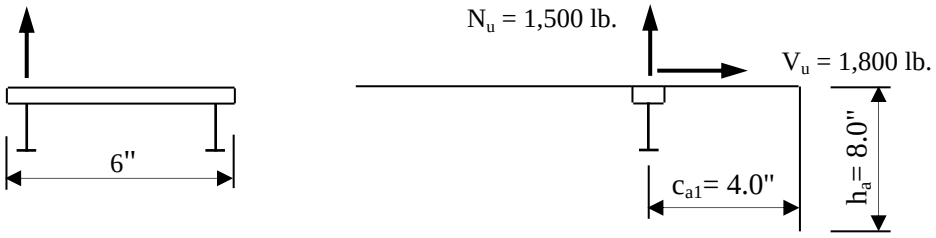
Anchor Channel Dimensions *

	Cold – rolled profiles		Hot – rolled profiles				
	K 28/15	K 38/17	W 40/22	W 50/30	W 53/34	W 55/42	W 72/48
mm (in.)							

* Dimensions shown are nominal

Sample calculation according to ACI 318 Appendix D

Given:



- Concrete strength 4,000 psi, cracked, unreinforced
- Channel W40/22-150 with 2 anchors, length 150mm (~6")
- Ultimate steel strength in tension and shear is 4,500 lb.
- Edge distance c_{a1} = 4", no corner influence
- Slab-thickness h_a = 8"
- Factored loads with load factors acc. ACI-318, chapter 9.2:

N_u = 1,500 lb. V_u = 1,800 lb.
decisive load position over anchor

Check possible failure modes in tension and shear.

Tension:

1) Anchor:

ϕ	= 0.75	(ACI D.4.4)
f_{ya}	= 240 N/mm² $\rightarrow$ 34,810 psi	
f_{uta}	= 360 N/mm² $\rightarrow$ 52,214 psi < 1.9 ∗ 34,810 psi	
diameter Ø	= 0.335 inch $\rightarrow$ Area = 0.088 inch²	
N_{sa}	$= nA_{se,N}f_{uta}$	(D – 3)
N_{sa}	= 0.088 inch² ∗ 52,214 psi = 4,595 lb.	
ϕN_{sa}	= 0.75 ∗ 4,595 lb. = 3,446 lb. > 1,500 lb.	

2) Concrete breakout strength / tension:

h_{ef}	= 3.11 inch	
A_{Nco}	$= 9h_{ef}^2$	(D – 6)
A_{Nco}	= 9 ∗ (3.11 inch)² = 87.0 inch²	
N_b	$= k_c\lambda\sqrt{f'_c}\, h_{ef}^{1.5}$	(D – 7)
N_b	$= 24 * 1 * \sqrt{4{,}000\text{psi}} * (3.11\text{ inch})^{1.5}$ = 8,325 lb.	
A_{Nc}	$= (c_{a1}+1.5h_{ef})(2*1.5h_{ef})$	(D.5.2.1)
A_{Nc}	= (4.0 inch + 1.5 ∗ 3.11 inch) (2 ∗ 1.5 ∗ 3.11 inch)	
	= 80.84 inch²	
$\Psi_{ed,N}$	$= 0.7+0.3\,\frac{Ca,\min}{1.5h_{ef}}$	(D – 11)

$\Psi_{ed,N}$ $= 0.7 + 0.3 * \frac{4.0\,\text{inch}}{1.5 * 3.11\,\text{inch}} = 0.957$

$\Psi_{c,N}$ $= 1.0$ (cracked concrete) (D.5.2.6)

$\Psi_{cp,N}$ $= 1.0$ (cast in anchor) (D.5.2.7)

$N_{cb} = \frac{A_{Nc}}{A_{Nco}} * \Psi_{ed,N} * \Psi_{c,N} * \Psi_{cp,N} * N_b$ (D – 4)

$N_{cb} = \frac{80.84\,\text{inch}^2}{87.00\,\text{inch}^2} * 0.957 * 1 * 1 * 8{,}325\ \text{lb.}$

$= 7{,}403$ lb.

$\phi N_{cb} = 0.7 * 7{,}403$ lb. $= 5{,}182$ lb. $> 1{,}500$ lb.

3) Pull out:

$\Psi_{c,p}$ $= 1.0$ (cracked concrete) (D.5.3.6)

$A_{brg} = \frac{(0.59\text{inch})^2 * \pi}{4} - \frac{(0.33\text{inch})^2 * \pi}{4} = 0.187\,\text{inch}^2$

$N_p = 8 A_{brg} f'_c$ (D-15)

$N_p = 8 * 0.187\ \text{inch}^2 * 4{,}000$ psi $= 5{,}984$ lb.

$\phi N_p = 0.7 * 5{,}984$ lb. $= 4{,}188$ lb. $> 1{,}500$ lb.

4) Side face blow-out:

$h_{ef} < 2.5\, c_{a1} \rightarrow$ not relevant (D.5.4.1)

Shear:

5) Anchor:

$\phi = 0.65$

$A = 0.088\ \text{inch}^2$

$f_{uta} = 52{,}214$ psi

$\phi V_{sa} = \phi n A_{se,V} f_{uta}$ (D-19)

$\phi V_{sa} = 0.65 * 0.088\ \text{inch}^2 * 52{,}214$ lb. $= 2{,}987$ lb. $> 1{,}800$ lb.

6) Concrete breakout shear:

A_{Vco} $= 4.5\ (c_{a1})^2$ (D – 23)

A_{Vco} $= 4.5 * (4.0\ \text{inch})^2 = 72.0\ \text{inch}^2$

A_{Vc} $= A_{Vco} = 4.5\ (c_{a1})^2$ (Fig. RD.6.2.1(a))

A_{Vc} $= 4.5 * (4.0\ \text{inch})^2$

$= 72.0\ \text{inch}^2$

l_e $= h_{ef} = 3.11$ inch

d_a $= 0.335$ inch

λ $= 1$

V_b $= \left(7\left(\frac{l_e}{d_a}\right)^{0.2} * \sqrt{d_a}\ \right) * \lambda \sqrt{f'_c} * (c_{a1})^{1.5}$ (D – 24)

V_b $= 7\left(\frac{3.11\,\text{inch}}{0.335\,\text{inch}}\right)^{0.2} * \sqrt{0.335\,\text{inch}} * \sqrt{4{,}000\,\text{psi}} * (4.0\,\text{inch})^{1.5}$

$= 3{,}200$ lb.

$\Psi_{ed,V}$ $= 1.0$ (D – 27)

$\Psi_{c,V}$ $= 1.0$ (cracked concrete, no reinforcement) (D.6.2.7)

$\Psi_{h,V}$ $= 1.0$ ($h_a = 8.0$ inch $> 1.5 * c_{a1} = 6.0$ inch) (D.6.2.8)

V_{cb} $= \frac{A_{Vc}}{A_{Vco}} \Psi_{ed,V} * \Psi_{c,V} * \Psi_{h,V} * V_b$ (D – 21)

V_{cb} $= \frac{72}{72} * 1.0 * 1.0 * 1.0 * 3{,}200$ lb. $= 3{,}200$ lb.

ϕV_{cb} $= 0.7 * 3{,}200$ lb. $= 2{,}240$ lb. $> 1{,}800$ lb.

7) Pry out:

h_{ef} $= 3.11$ inch > 2.5 inch $\rightarrow k_{cp} = 2.0$

N_{cb} $= 7{,}403$ lb. (see page - 6 -)

V_{cp} $= k_{cp}N_{cp}$ (D – 30)

V_{cp} $= 2 * 7{,}403$ lb. $= 14{,}806$ lb.

ϕV_{cp} $= 0.7 * 14{,}806$ lb. $= 10{,}364$ lb. $> 1{,}800$ lb.