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6593 Riverdale St.
San Diego, CA 92120
619-727-4800

Structural Calculations

for

CBWC-113 Series

CBWCPRD3715** SERIES

Prepared for:

PROVENT / RRS

3847 Wabash Drive
Mira Loma, CA 91725

Date: September 25, 2023

Project Number: PV2312

For wood,concrete, and steel attachments, see Roof Anchorage Detail, Form No. CB-60.

STRUCTURALLY CALCULATED WELDED ROOF CURBS FOR PREDATOR (SUN PRO) UNITS

ZT, ZH,ZJ,ZR 037-150
ZF, XP, ZB 078-150

PROVENT P/N	A	EST. WEIGHT
CBWCPRD371508	8"	125 Lbs.
CBWCPRD371511	11"	141 Lbs.
CBWCPRD371514	14"	157 Lbs
CBWCPRD371524	24"	208 Lbs.

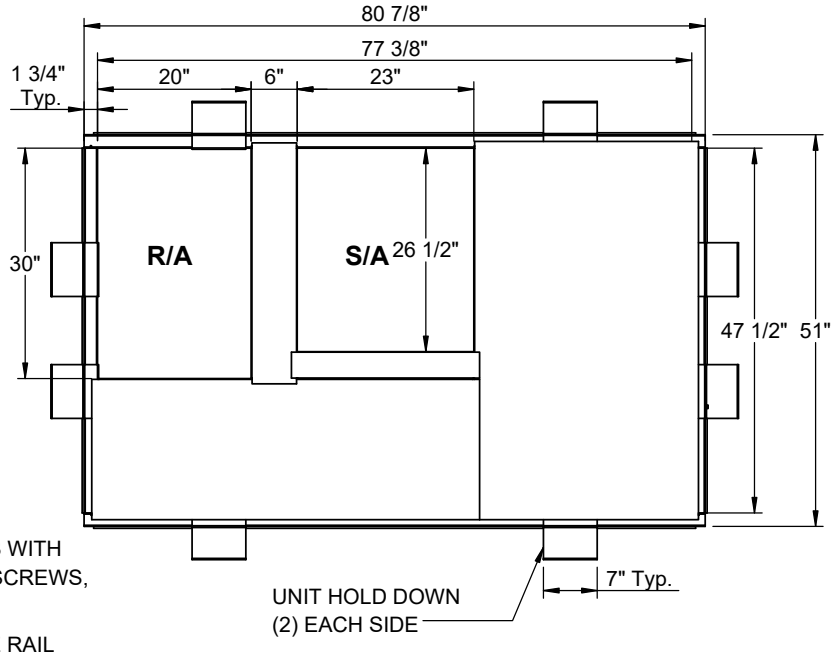
Meets seismic requirements for the following codes:
CBC 2022
IBC 2021

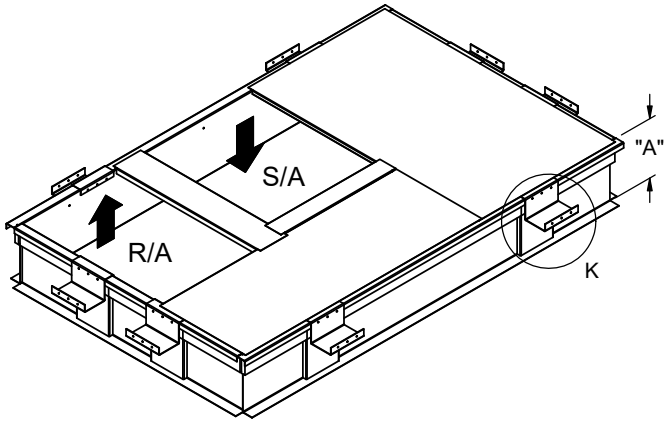
FEATURES

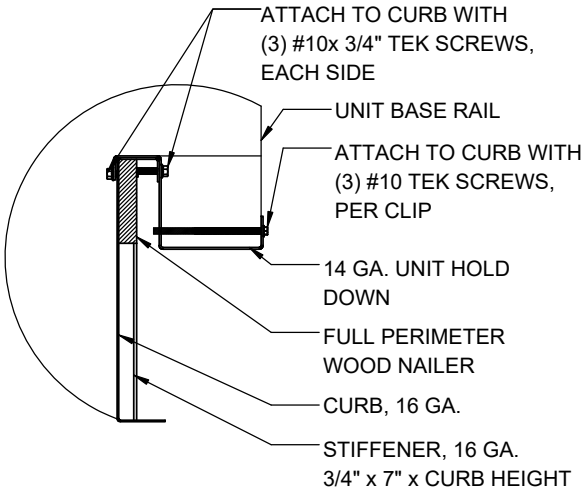
- Roof curb sides and ends are 16 Ga. galvanized steel.
- Gasketing package provided.
- Heat treated wood nailer provided.
- Insulated deck pans provided.
- Pitched curbs and taller curbs are available.

NOTES

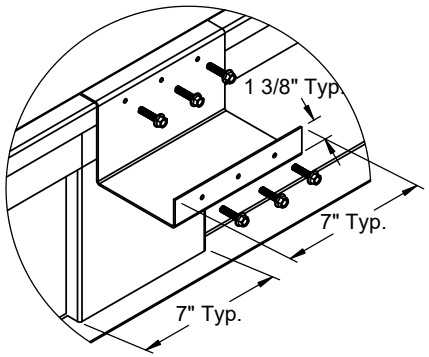
- Attach ductwork to roof curb. Flanges of duct rest on top of curb. Support ductwork below the curb.
- Thru the curbs utilities are available. Contact your York distributor or ProVent directly.



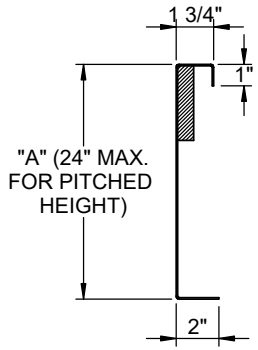




HOLD DOWN DETAIL



DETAIL K



CURB DETAIL

ProVent

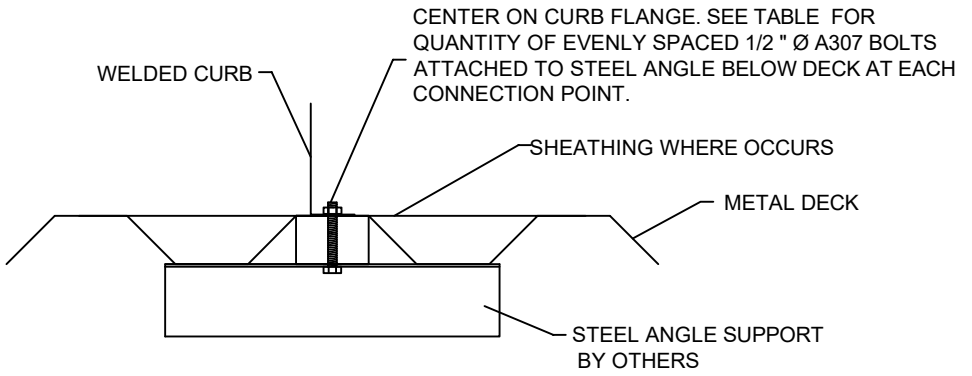
3847 WABASH DR.
MIRA LOMA, CA 91752

PHONE (951) 685-1101
FAX (619) 872-9799

SUBMITED TO: _____
COMPANY: _____
JOB NAME: _____
EQUIPMENT: _____
NOTES: _____

FORM NO:	PART NUMBER:	
CBWC-113	CBWCPRD3715 SERIES	
DATE: 7/27/2023	**REV:** 9	**DRAWN BY:** JG

STEEL ATTACHMENT



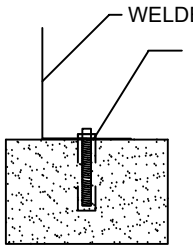
	NO. OF ANCHORAGE BOLTS REQUIRED	
CURB	LONG SIDE	SHORT SIDE
LXS	2 @ 34.5" O.C.	2 @ 19" O.C.
LXL	2 @ 34.5" O.C.	2 @ 29" O.C.
SUN3672	2 @ 60.5" O.C.	2 @ 24.75" O.C.
PRD3715	2 @ 68.88" O.C.	2 @ 39" O.C.
PRS	2 @ 58.88" O.C.	2 @ 28.69" O.C.
PRL	2 @ 72" O.C.	2 @ 41.5" O.C.
SAV1518	3 @ 54.56" O.C	2 @ 68.13" O.C.
SAV2025	3 @ 61.56" O.C	2 @ 68.13" O.C.
SAV28	3 @ 69.75" O.C	2 @ 68.13" O.C.

ASSUMES:
CONC SLAB
f'c= 4000PSI MINIMUM
4" MIN THICKNESS
NORMAL WEIGHT CONCRETE
MIN. 7-1/4" EDGE DISTANCE

Meets seismic requirements for the following codes:
CBC 2022
IBC 2021

ROOF ANCHORAGE DETAIL	
CBKD Series	CBWC Series
LXS	LXS
LXL	LXL
SUN3672	SUN3672
PRD3715	PRD3715
PRS	PRS
PRL	PRL
SAV1518	SAV1518
SAV2025	SAV2025
SAV28	SAV28

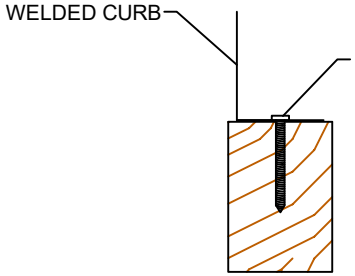
CONCRETE ATTACHMENT



	NO. OF ANCHORAGE BOLTS REQUIRED	
CURB	LONG SIDE	SHORT SIDE
LXS	2 @ 34.5" O.C.	2 @ 19.0" O.C.
LXL	2 @ 34.5" O.C.	2 @ 29" O.C.
SUN3672	2 @ 60.5" O.C.	2 @ 24.75" O.C.
PRD3715	4 @ 22.96" O.C.	2 @ 39" O.C.
PRS	2 @ 58.88" O.C.	2 @ 28.69" O.C.
PRL	3 @ 36" O.C.	2 @ 41.5" O.C.
SAV1518	4 @ 36.38" O.C.	2 @ 68.13" O.C.
SAV2025	4 @ 41.04" O.C.	3 @ 34.06" O.C.
SAV28	5 @ 34.88" O.C.	3 @ 34.06" O.C.

*** SIX INCHES FROM EACH CORNER EVENLY SPACED.**
**** CENTERED.**

WOOD ATTACHMENT



	NO. OF ANCHORAGE SCREWS REQUIRED	
CURB	LONG SIDE	SHORT SIDE
LXS	4 @ 12.83" O.C.	3 @ 11.5" O.C.
LXL	4 @ 12.83" O.C.	3 @ 16.5" O.C.
SUN3672	4 @ 21.5" O.C.	3 @ 14.38" O.C.
PRD3715	7 @ 12.15" O.C.	5 @ 10.75" O.C.
PRS	4 @ 20.96" O.C.	3 @ 16.35" O.C.
PRL	6 @ 15.2" O.C.	4 @ 15.17" O.C.
SAV1518	6 @ 22.63" O.C.	5 @ 18.03" O.C.
SAV2025	7 @ 21.19" O.C.	5 @ 18.03" O.C.
SAV28	8 @ 20.5" O.C.	5 @ 18.03" O.C.

FOUR INCHES FROM EACH CORNER EVENLY SPACED

ProVent

3847 WABASH DRIVE
MIRA LOMA, CA 91725

PHONE (951) 685-1101
FAX (619) 872-9799

SUBMITTED TO: _____
COMPANY: _____
JOB NAME: _____
EQUIPMENT: _____
NOTES: _____

FORM NO: CB-60

DATE:	REV:	DRAWN BY:
8/28/2023	10	FMM

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San Diego, CA 92120
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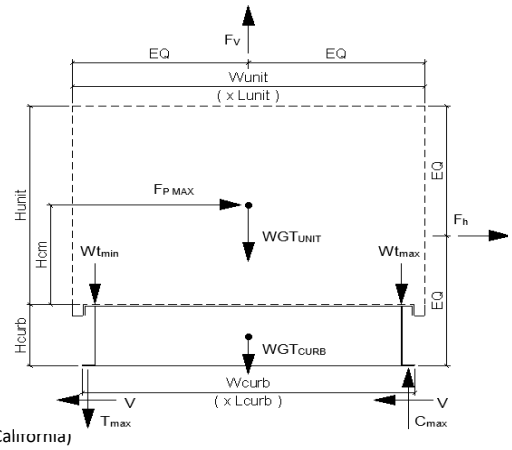
Client:	ProVent PV2312
Description:	CBWC-113 PRD3715
Unit:	ZT, ZH, ZR, ZJ 037-150; ZF, XP, ZB 078-150

Curb Information

Hcurb =	24	in	(Height of curb)
Lcurb =	80.875	in	(Length of curb)
wcurb =	51	in	(Width of curb)
WGTcurb =	208	lbs	(Weight of curb)
# Clips long side =	2		# Clips short side = 2

Unit Information

WGTunit =	1736	lbs	(Oper. Weight of Unit)
Wtmax =	521	lbs	(Maximum corner weight)
Wtmin =	369	lbs	(Minimum corner weight)
Hunit =	50.75	in	(Height of unit above curb)
Hcm =	25.375	in	(Height to center of mass)
Lunit =	89	in	(Length of unit)
Wunit =	59	in	(Width of unit)



Seismic Loading - 2021 IBC/2022 CBC

Ss =	2.85		(Worst case for majority of California)
Fa =	1.20		(Default Site Class D - Table 11.4-1 ASCE 7-16)
Ip =	1.50		(Importance Factor Category III Building)
Sms =	3.420		(Fa*Ss)
Sds =	2.280		(2/3*Sms) ap = 2.5
Fpmax =	1.710	Wp	(0.4*ap*Sds*Ip)*Wp*3/Rp <=1.6*Sds*Ip*Wp Rp = 6
FpmaxASD =	2078	lbs	(0.7*Fpmax) FpmaxASD = 2327 lbs
	(unit only)		(unit and curb)

Wind Loading - 2021 IBC/2022 CBC

Kz =	1.13		(For 60 ft roof height, Exposure C - Table 26.10-1 ACSE 7-16)
Kzt =	1.0		(No topographic effects assumed for rooftop mounted units)
Kd =	0.85		(Directionality factor Table 26.6-1 ASCE 7-16)
V =	115		(Wind velocity, mph for Occupancy Cat III-IV bldgs Exp. Cat C, Fig 25.5-1D, ASCE7-16)
$GCr_{(horiz)}$ =	1.9		(Refer Sect 29.4.1 ASCE 7-16)
$GCr_{(vert)}$ =	1.5		(Refer Sect 29.4.1 ASCE 7-16)
qz	32.5	psf	= 0.00256*Kz*Kzt*Kd*V^2 (Eq. 26.10-1 ASCE 7-16)
$F_{h\ ASD\ trans}$ =	1713	lbs	= 0.6*qz*GCr*Lunit*(Hunit+Hcurb) (Eq. 29.4-2)
$F_{h\ ASD\ long}$ =	1135	lbs	= 0.6*qz*GCr*Wunit*(Hunit+Hcurb)
$F_{vert\ ASD}$ =	1067	lbs	= 0.6*qz*GCr*Lunit*Wunit (Eq. 29.4-3)

Curb Loading

Transverse:

$Compression_{SEISMIC}$ =	2408	lbs	=[FpmaxASD*Hcm+2*(1+0.14S_{DS})*Wtmax*wcurb]/wcurb
$Tension_{SEISMIC}$ =	827	lbs	=[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*wcurb]/wcurb
$Compression_{WIND}$ =	943	lbs	=[$F_{h\ ASD\ trans}$*Hcm+2*0.6*Wtmax*wcurb-$F_{vert\ ASD}$*wcurb/2]/wcurb
$Tension_{WIND}$ =	943	lbs	=[$F_{h\ ASD\ trans}$*Hcm-2*0.6*Wtmin*wcurb+$F_{vertASD}$*wcurb/2]/wcurb

---> Negative values indicate opposite load.

Longitudinal:

$Compression_{SEISMIC}$ =	2737	lbs	=[FpmaxASD*Hcm+2*(1+0.14*S_{DS})*Wtmax*Lcurb]/(Lcurb-2*10.5in)
$Tension_{SEISMIC}$ =	601	lbs	=[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*Lcurb]/(Lcurb-21in)
$Compression_{WIND}$ =	605	lbs	=[$F_{h\ ASD\ long}$*Hcm+2*0.6*Wtmax*Lcurb-$F_{vertASD}$*Lcurb/2]/(Lcurb-21in)
$Tension_{WIND}$ =	604	lbs	=[$F_{h\ ASD\ long}$*Hcm-2*0.6*Wtmin*Lcurb+$F_{vertASD}$*Lcurb/2]/(Lcurb-21in)

---> Negative values indicate opposite load.

Governing Reactions:

Transverse:	$Comp_{MAX}$ =	2408	lbs	---> Along long edge of curb.
(on long edge)	$Tens_{MAX}$ =	943	lbs	---> Along long edge of curb.
Longitudinal:	$Comp_{MAX}$ =	2737	lbs	---> Along short edge of curb.
(on short edge)	$Tens_{MAX}$ =	604	lbs	---> Along short edge of curb.

---> Negative values indicate opposite load.

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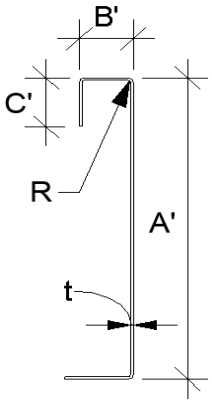
Curb Design

Fy =	50 ksi		Fu =	65 ksi	
E =	29500 ksi		t =	0.0566	16 Gauge



Calculate Section Properties of Curb

A'=	24.000	in	a =	23.717	in	= A'-(2r+t)
B'=	1.750	in	a'=	23.943	in	= A'-t
C'=	0.000	in (0 if no lips)	b =	1.609	in	= B'-[r+t/2+α(r+t/2)]
α =	0.000	(0 - no Lip; 1 w/ lip)	b'=	1.722	in	= B'-(t/2+αt/2)
R =	0.0849	(Inside bend radius)	c =	0.000	in	= α[C'-(r+t/2)]
t =	0.0566	in	c'=	0.000	in	= α(C'-t/2)
r'=	0.113	in = R+t/2	u =	0.178	in	= πr/2
x =	0.109	in (Distance between centroid and web centerline)				
Ix =	91.935	in^4	rx =	7.71	in	
Iy =	0.174	in^4	ry =	0.336	in	
A =	1.54	in^2	rmin =	0.336	in	

Axial Compression

Pu =	1.039 k	(Max Axial Comp)	Ωc =	1.80
Pn/Ωc =	17.105 k			
Fe =	22.76 ksi			
λc =	1.48			
Fn =	19.93 ksi			
Ly =	48 in	Lateral unbraced length		
k_yL_y/r_y =	113	(assume k=0.8)		

$$\frac{P_n}{\Omega_c}=\frac{F_nA}{\Omega_c} \qquad If\ \lambda_c \le 1.5;\ F_n=\left(0.658^{\lambda_c{}^2}\right)F_y \qquad If\ \lambda_c > 1.5;\ F_n=\frac{0.877}{\lambda_c{}^2}F_y \qquad \lambda_c=\sqrt{\frac{F_y}{F_e}} \qquad F_e=\frac{\pi^2E}{\left(kl/r\right)^2}$$

Compression Check = O.K.

Check Web Crippling

h =	24 in	-- Check limits:		C =	4.00
t =	0.0566 in	h/t =	424.03 ≤ 260	C_R =	0.14
N =	7.00	N/t =	123.67 ≤ 210	C_N =	0.35
Ω_w =	1.75	N/h =	0.291667 ≤ 2.0	C_h =	0.02
P_n =	1.366 k	R/t =	1.50 ≤ 9.0		
P_n/Ω_w =	0.780 k				
Long side: Pu_{Trans} =	1.204 k	**web stiffener REQ'D**	# clips = 2		
Short side: Pu_{Long} =	1.368 k	**web stiffener REQ'D**	# clips = 2		

(See table C3.4.1-2, fastened to support, one flange, end loading)

$$P_n = Ct^2F_y\sin(90)\left(1-C_R\sqrt{\frac{R}{t}}\right)\left(1+C_N\sqrt{\frac{N}{t}}\right)\left(1-C_h\sqrt{\frac{h}{t}}\right)$$

*****h/t > 260; use web stiffeners**

Check Web Stiffener 16Ga x 3/4" x 6" (C-channel)

width of stiffener =	6.000 in		ts =	0.0566	16 Gauge
web of stiff. w =	5.717 in		Rs =	0.0849 in	
***Check w/ts ≤ 1.28√E/Fys			Ωc =	1.70	
w/ts =	101.007				
1.28√(E/Fys) =	31.091	--> w/ts over limit	Use C3.7.2		

$$P_n = 0.7\left(P_{wc}+A_eF_y\right) \ge P_{wc}$$

Pwc =	1.366 k		Ae =	0.324	in^2
Pn =	12.281 k		Pn/Ω =	7.224 k	
			O.K.		

Corner Connections **1/4" ϕ SAE Grade 8 bolts w/ 1/4-20-UNC Threaded inserts**

Tcrnmax =	582 lbs	Max($F_{pmaxASD}$/4 -OR- $Fh_{ASDtrans}$/4 corner connections)				
Vcrnmax =	1368 lbs	Max(Tens/2 -OR- Comp/2 corner connections per side)				
Bolt:	Tall =	2480	lbs	Vall =	1208	lbs
Threaded Insert:	Tall =	2860	lbs	Vall =	1536	lbs

# of Bolts required for Tension = 0.2

# of Bolts required for Shear = 1.1

# of Bolts Used = 3.0

Check Combined Stress in Bolts & Inserts: 0.456 **O.K.**

Check 1/8" welded connection <--- USE WELD Ω = 2.35

Assume L/t > 25: 25*t =	1.415 in				
Lreq'd =	1.165 in				

$$P_n/\Omega = \frac{1}{\Omega}0.75tLF_u \ge V_{req} \qquad L_{req'd}=\frac{V_{req}\Omega}{0.75tF_u}$$

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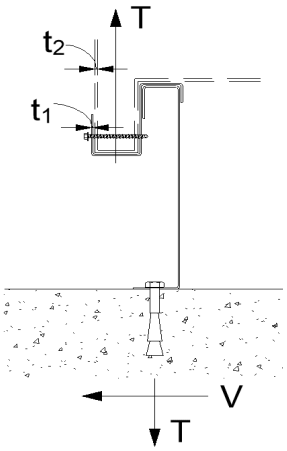
Connection Unit to Curb Clip | #10 SMS screw | Ω = 3.0

t1 = 0.0566 in | Fu1 = 65 ksi
t2 = 0.1017 in (unit base rail thickness) | Fu2 = 65 ksi
d = 0.190 in (screw diameter) | dw = 0.375 in (nom. washer diameter)
t2/t1 = 1.8



For t2/t1 ≤ 1.0: | Pns = 1887 # | For t2/t1 ≥ 2.5: | Pns = 1887 #

Shear: $P_{ns} = 4.2F_{u2}\sqrt{t_2^3 d}$ = 3.86 k | $P_{ns} = 2.7t_1 dF_{u1}$ = 1.89 k | $P_{ns} = 2.7t_2 dF_{u2}$ = 3.39 k

$P_{ns} = 2.7t_1 dF_{u1}$ = 1.89 k
$P_{ns} = 2.7t_2 dF_{u2}$ = 3.39 k

Pns/Ω = 629 #
Pss/Ω = 540 # <- Controls

Tension: Pnot = 1.068 k (screw pull-out strength)
Pnov = 2.069 k (screw pull-over strength)

$P_{not} = 0.85t_c dF_{u2})$
$t_c = \min(t_1, t_2)$
$P_{nov} = 1.5t_1 d_w F_{u1}$

Pts/Ω = 356 # <- Controls
Pts/Ω = 820 # (full tensile screw capacity)

	Shear (k)	# clips	V_{clip} (k)	V_{allow}(lb)	# screws	spacing
Long side:	2.078	2	1.04	540 #	2	6.00 in
Short side:	2.078	2	1.04	540 #	2	6.00 in

clip width (in) = 7.00 | clip height = 1.4 in
min spacing = 0.57 in | edge distance = 0.5 in (min. 1.5d)

Check Block shear rupture: O.K. | thinnest part = 0.0566 AISI BSR applies
Fy = 50 ksi | Ω = 2.22 bolt/screw connection
Agv = 0.368 in^2 | Anv = 0.352 in^2 | Ant = 0.034 in^2
Rn/Ω = 5.954 k

$R_n = 0.6F_y A_{gv} + F_u A_{nt} \leq 0.6F_u A_{nv} + F_u A_{nt}$

BSR O.K. (AISI Sect. E5.3)

Connection of Curb to Supporting Structure

Roof Loading SEISMIC: $(0.6\text{-}0.14S_{DS})D + 0.7E$ WIND: 0.6D + W

Transverse: $Uplift_{MAX}$ = 1980 lbs | $Shear_{MAX}$ = 1163 lbs

$Compression_{SEISMIC}$ = 3535 lbs =[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb
$Tension_{SEISMIC}$ = 1980 lbs =[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb
$Compression_{WIND}$ = 1708 lbs =[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*wcurb/2-$F_{vert\ ASD}$*wcurb/2]/wcurb
$Tension_{WIND}$ = 1609 lbs =[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)-0.6*$WGT_{unit+curb}$*wcurb/2+$F_{vertASD}$*wcurb/2]/wcurb

Longitudinal: $Uplift_{MAX}$ = 1148 lbs | $Shear_{MAX}$ = 1163 lbs

$Compression_{SEISMIC}$ = 2703 lbs =[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb
$Tension_{SEISMIC}$ = 1148 lbs =[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb
$Compression_{WIND}$ = 743 lbs =[$F_{h\ ASD\ long}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*Lcurb/2-$F_{vert\ ASD}$*Lcurb/2]/Lcurb
$Tension_{WIND}$ = 644 lbs =[$F_{h\ ASD\ long}$*(Hcm+Hcurb)-0.6*$WGT_{unit+curb}$*Lcurb/2+$F_{vertASD}$*Lcurb/2]/Lcurb

Wood Attachment: **1/4"ϕ x 3.5" Simpson SDS screws w/ 2.25" threaded emb** (SGmin = 0.43)

$Tall_{metal}$ = 797 lbs | $Vall_{metal}$ = 876 lbs
Transverse: $Tall_{wood}$ = 616 lbs | $Vall_{wood}$ = 400 lbs

# of Screws Req'd for Uplift = 3.21 | COMBINED LOADING: 0.875 O.K.
# of Screws Req'd for Shear = 2.91 | Screw Spacing = 12.1 in o.c.
Total # of screws Required = 7

1/4"ϕ x 3.5" Simpson SDS screws @ 12.1 in o.c. along long side of curb w/ 2.25" threaded embed

Longitudinal:

# of Screws Req'd for Uplift = 1.9 | COMBINED LOADING: 0.954 O.K.
# of Screws Req'd for Shear = 2.9 | Screw Spacing = 10.8 in o.c.
Total # of screws Required = 5

1/4"ϕ x 3.5" Simpson SDS screws @ 10.8 in o.c. along short side of curb w/ 2.25" threaded embed

Steel Deck Attachment: **1/2" ϕ A307 Bolts to steel angle below deck**

$Tall_{bolt}$ = 3927 lbs | $Vall_{bolt}$ = 2209 lbs
Transverse: $Tall_{metal}$ = 1656 lbs | $Vall_{metal}$ = 1756 lbs

# of Bolts Req'd for Uplift = 1.20 | COMBINED LOADING: 0.583 O.K.
# of Bolts Req'd for Shear = 0.66 | Bolt Spacing = 68.9 in o.c.
Total # of Bolts Required = 2

1/2" ϕ A307 Bolts to steel angle below deck @ 68.9 in o.c. along long side of curb

Longitudinal:

# of Bolts Req'd for Uplift = 0.69 | COMBINED LOADING: 0.330 O.K.
# of Bolts Req'd for Shear = 0.66 | Req'd Min Spacing = 39.0 in o.c.
Total # of Bolts Required = 2

1/2" ϕ A307 Bolts to steel angle below deck @ 39 in o.c. along short side of curb

MOUR GROUP
ENGINEERING + DESIGN

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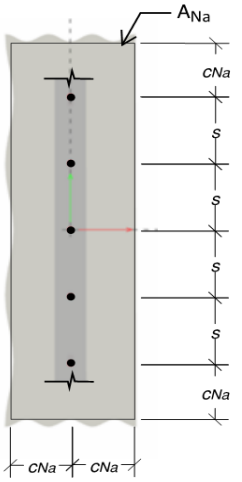
For Concrete anchorage: SEISMIC $(0.6\text{-}0.14S_{DS})D + 0.7\Omega_o E$ Ωo = 2.0

Concrete Attachment: 1/2"ϕ HAS rods in Hilti HIT-HY 200 V3 epoxy w/ 2.75in embed

Epoxy: Hilti HIT-HY 200 V3 (ICC ESR 4868)



f'c =	3000	psi		
h =	4	in (concrete thickness, t_min = h_ef + 2do)	O.K.	
h_ef =	2.75	in (effective embedment)		
da =	0.5	in (anchor diameter)	do = 0.625	in (hole diameter)
n =	2	(number of dummy anchors to check capacity with spacing effect)		
s =	16.9	in (initial spacing estimate)		
τk,cr / uncr =	1135	2220 psi (from ESR 4868, Table 14, Temp range B)		
τk,cr / uncr =	1156	2261 psi	If $f'_c > 2500$,	$multiply\ by\ (f'_c/2500)^{0.1}$
c_Na=	7.15	in (min. edge distance for full capacity);	$c_{Na} = 10d_a\sqrt{\frac{\tau_{uncr}}{1100}}$	

Tension:

Bond strength

$$N_{ag} = \frac{A_{Na}}{A_{Nao}}\varphi_{ec,Na}\varphi_{ed,Na}\varphi_{cp,Na}N_{ba} \quad \text{(ACI318-14, 17.4.5.1b)}$$

$$\varphi_{ec,Na}\varphi_{ed,Na}\varphi_{cp,Na} = 1.0$$

***Bond strength will govern over concrete breakout

A_{Na}=	408.98	in^2		
A_{Nao}=	204.49	in^2		
N_{ba} =	4943	lbs	$N_{ba} = \lambda_a\tau_{cr}\pi d_a h_{ef}\alpha_{n,seismic}$	$\alpha_{n,seismic} = 0.99$
N_{ag} =	9886	lbs (group)		λ_a =1.0
øN_{ag} =	4820	lbs (group)	CONTROLS	λ_a =1.0 for normal weight conc; 0.6 for lightv

Breakout strength

$$N_{cbg} = \frac{A_{Nc}}{A_{Nco}}\varphi_{ec,N}\varphi_{ed,N}\varphi_{cp,N}N_b \qquad N_b = \lambda_a k_c\sqrt{f'_c}h_{ef}^{1.5}$$

A_{Nc} =	207.4875	in^2	N_b = 4246	lbs	$ø_{conc}$ =	0.75
A_{Nco} =	68.0625	in^2	kc = 17		$ø_{bond}$ =	0.65
N_{cbg} =	12945	lbs (group)			$ø_{seis}$ =	0.75
øN_{cbg} =	7281	lbs (group)			$ø_{steel}$ =	0.65

Shear:

Steel strength

Vsa,eq =	4940	(from ESR4868, Table 11)			$\alpha_{v,seismic}$ =	0.6
øVsa,eq =	1927					
$Tall_{LRFD}$ =	2410	lbs (anchor)	$Vall_{LRFD}$ =	3067 lbs	$\propto = (1 + 0.2SDS)D + 2.5E$	
$Tall_{ASD} = Tall_{LRFD}/\alpha$ =	1411	lbs	$Vall_{ASD} = Vall_{LRFD}/\alpha$ =	1796 lbs	D =0.758 E =0.242	$\propto$ =1.709

Transverse:				
	$Uplift_{MAX}$ =	4233 lbs	$Shear_{MAX}$ =	2327 lbs

$Compression_{SEISMIC}$ = 5788 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb

$Tension_{SEISMIC}$ = 4233 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb

$Shear_{SEISMIC}$ = 2327 lbs =Ωo*FpmaxASD/2

Min Bolts Req'd Uplift =	3.00	spacing =	22.96	in o.c.	Tapplied =	1058.2 lbs
Min Bolts Req'd Shear =	2.00	spacing =	68.88	in o.c.	Vapplied =	387.8 lbs

Try using 4 bolts spaced at 22.96 in o.c.

COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{apllied}}{V_{allow,ASD}} \le 1.2$ = 0.97 O.K.

Use 4 - 1/2"ϕ HAS rods in Hilti HIT-HY 200 V3 epoxy @ 23 in o.c. max. along long side of curb w/ 2.75in embed

Longitudinal:				
	$Uplift_{MAX}$ =	2568 lbs	$Shear_{MAX}$ =	2327 lbs

$Compression_{SEISMIC}$ = 4124 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb

$Tension_{SEISMIC}$ = 2568 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb

$Shear_{SEISMIC}$ = 2327 lbs =Ωo*FpmaxASD/2

Min Bolts Req'd Uplift =	1.82	spacing =	19.50	in o.c.	Tapplied =	1284.2 lbs
Min Bolts Req'd Shear =	2.00	spacing =	39.00	in o.c.	Vapplied =	387.8 lbs

Try using 2 bolts spaced at 39.00 in o.c.

COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{apllied}}{V_{allow,ASD}} \le 1.2$ = 1.13 O.K.

Use 2 - 1/2"ϕ HAS rods in Hilti HIT-HY 200 V3 epoxy @ 39 in o.c. max. along short side of curb w/ 2.75in embed

CURB DESIGN SUMMARY:	CBWC-113	PRD3715	**Unit:** ZT, ZH, ZR, ZJ 037-150; ZF, XP, ZB 078-150
CURB RAIL THICKNESS:	0.0566 in	16 Gauge	
UNIT CLIP THICKNESS:	0.0566 in	16 Gauge	
# OF CLIPS (LONG SIDE) -	2 clips with 2 - #10 SMS screws each clip		
WEB STIFFENER:	16Ga x 3/4" x 6" (C-channel) stiffener at each clip		
# OF CLIPS (SHORT SIDE) -	2 clips with 2 - #10 SMS screws each clip		
WEB STIFFENER:	16Ga x 3/4" x 6" (C-channel) stiffener at each clip		
CORNER CONNECTION:	Use 3 - 1/4" ϕ SAE Grade 8 bolts w/ 1/4-20-UNC Threaded inserts		

CURB ANCHORAGE	WOOD	STEEL	CONCRETE
	1/4"ϕ x 3.5" Simpson SDS screws w/ 2.25" threaded embed	1/2" ϕ A307 Bolts to steel angle below deck	1/2"ϕ HAS rods in Hilti HIT-HY 200 V3 epoxy w/ 2.75in embed
LONG DIRECTION	7 @ 12.15 in o.c.	2 @ 68.88 in o.c.	4 @ 22.96 in o.c.
SHORT DIRECTION	5 @ 10.75 in o.c.	2 @ 39 in o.c.	2 @ 39 in o.c.