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

Structural Calculations

for

CBWC-121 Series

CBWCSAV1518** 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 Nos. CB-60

STRUCTURALLY CALCULATED WELDED ROOF CURBS FOR SUNCHOICE UNITS

AV 15-18, AD 15-18, AH 15, AL 15, HV 13

PROVENT P/N	A	EST. WEIGHT
CBWCSAV151808	08"	230 Lbs.
CBWCSAV151811	11"	265 Lbs.
CBWCSAV151814	14"	300 Lbs.
CBWCSAV151824	24"	415 Lbs.

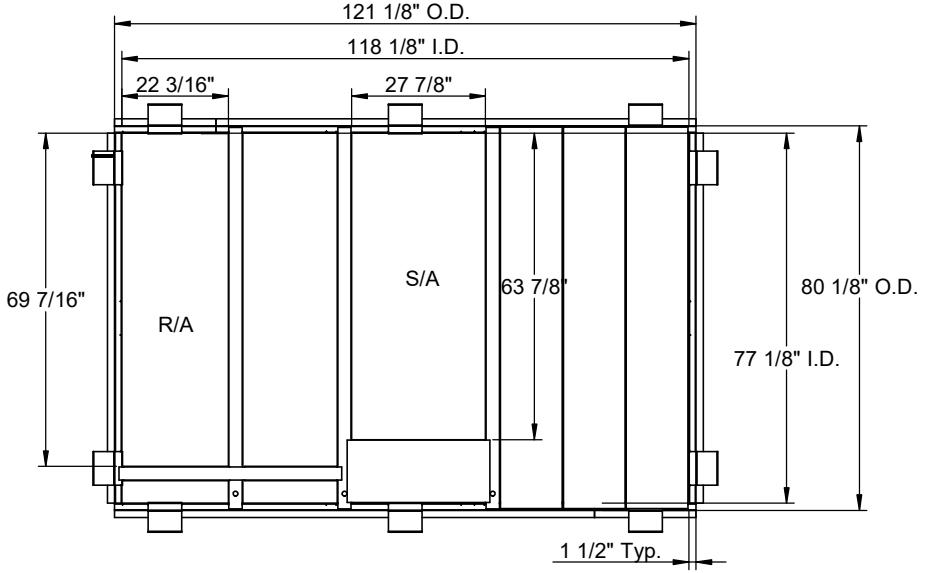
Meets seismic requirements for the following codes:
CBC 2022
IBC 2021

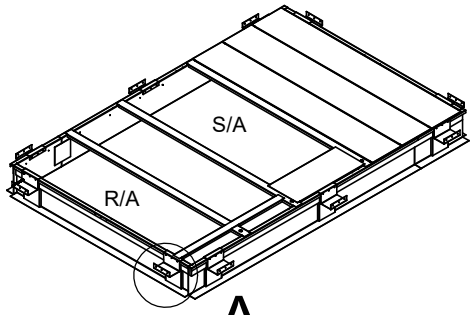
FEATURES

- Roof curb sides and ends are 14 Ga. galvanized steel.
- Gasketing package provided.
- Heat treated wood nailer provided.
- Insulated sloped deck pans provided.
- Pitched curbs and taller curbs are available.

Notes

Attached ductwork to roof curb. Flanges of duct rest on top of curb. Support ductwork below the curb.





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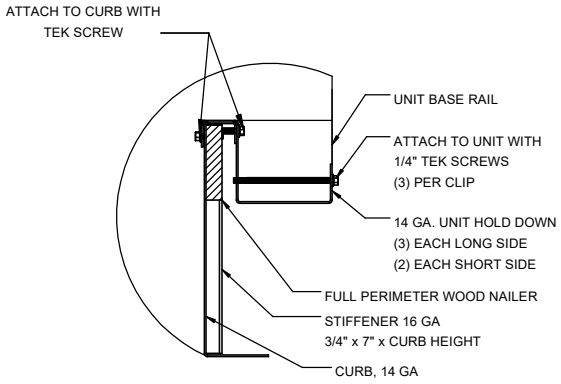
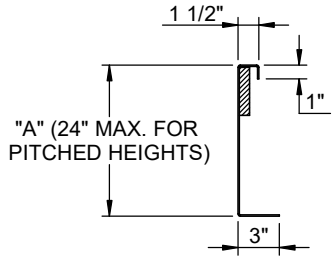
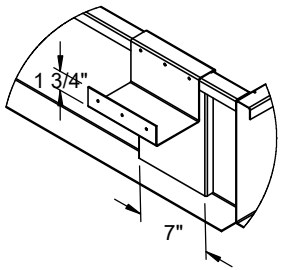


HOLD DOWN DETAIL



CURB DETAIL



DETAIL A

ProVent

3847 WABASH DRIVE
MIRA LOMA, CA 91752

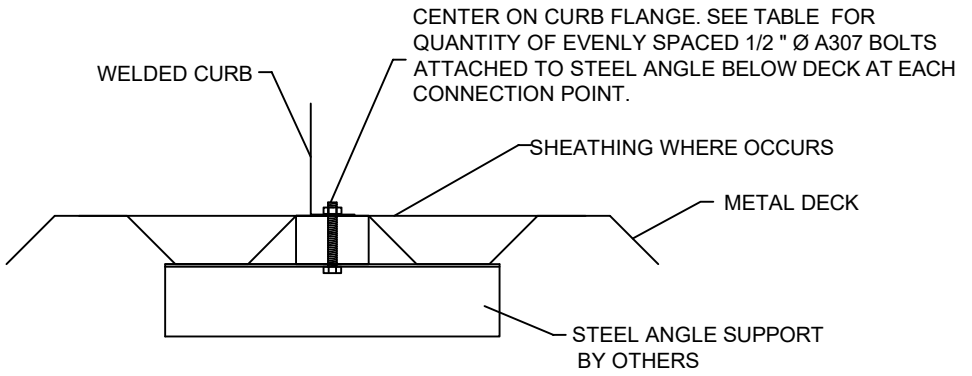
PHONE (951) 685-1101
FAX (619) 872-9799

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

FORM NO:	PART NUMBER:
CBWC-121	CBWCSAV1518 SERIES

DATE:	REV:	DRAWN BY:
8/28/2023	1	FMM

STEEL ATTACHMENT



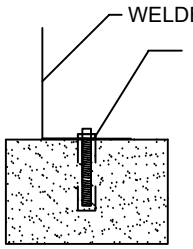
	NO. OF ANCHORAGE BOLTS REQUIRED	
CURB	LONG SIDE	SHORT SIDE
LXS	2 @ 34.5" O.C.	2 @ 19" O.C.
LXL	2 @ 34.5" O.C.	2 @ 29" O.C.
SUN3672	2 @ 60.5" O.C.	2 @ 24.75" O.C.
PRD3715	2 @ 68.88" O.C.	2 @ 39" O.C.
PRS	2 @ 58.88" O.C.	2 @ 28.69" O.C.
PRL	2 @ 72" O.C.	2 @ 41.5" O.C.
SAV1518	3 @ 54.56" O.C	2 @ 68.13"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

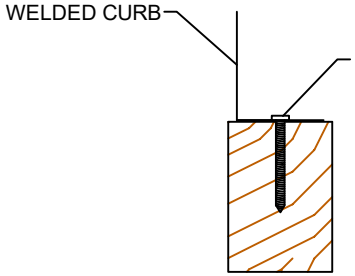
CONCRETE ATTACHMENT



	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

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SUBMITTED TO: _____
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8/28/2023	10	FMM

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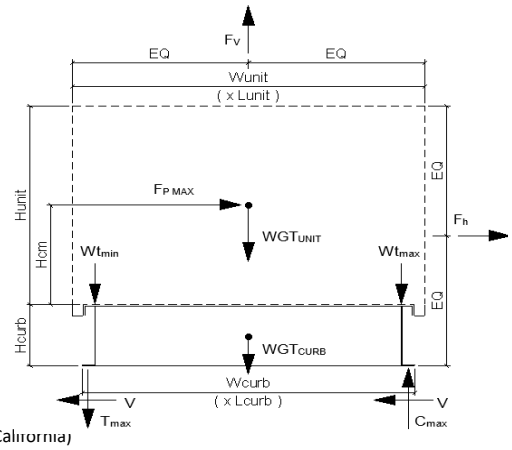
Client:	ProVent PV2312
Description:	CBWC-121 SAV1518
Unit:	AV 15-18; AD 15-18; AH/AL 15; HV 13

Curb Information

Hcurb =	24	in	(Height of curb)
Lcurb =	121.125	in	(Length of curb)
wcurb =	80.125	in	(Width of curb)
WGTcurb =	420	lbs	(Weight of curb)
# Clips long side =	3		# Clips short side = 2

Unit Information

WGTunit =	2385	lbs	(Oper. Weight of Unit)
Wtmax =	716	lbs	(Maximum corner weight)
Wtmin =	507	lbs	(Minimum corner weight)
Hunit =	49.25	in	(Height of unit above curb)
Hcm =	24.625	in	(Height to center of mass)
Lunit =	129.75	in	(Length of unit)
Wunit =	88.75	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 =	2855	lbs	(0.7*Fpmax) FpmaxASD = 3358 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)
$F_{h\ ASD\ trans}$ =	2447	lbs	= 0.6*qz*GCr*Lunit*(Hunit+Hcurb) (Eq. 29.4-2)
$F_{h\ ASD\ long}$ =	1674	lbs	= 0.6*qz*GCr*Wunit*(Hunit+Hcurb)
$F_{vert\ ASD}$ =	2340	lbs	= 0.6*qz*GCr*Lunit*Wunit (Eq. 29.4-3)

Curb Loading

Transverse:

$Compression_{SEISMIC}$ =	2765	lbs	=[FpmaxASD*Hcm+2*(1+0.14S_{DS})*Wtmax*wcurb]/wcurb
$Tension_{SEISMIC}$ =	593	lbs	=[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*wcurb]/wcurb
$Compression_{WIND}$ =	440	lbs	=[$F_{h\ ASD\ trans}$*Hcm+2*0.6*Wtmax*wcurb-$F_{vert\ ASD}$*wcurb/2]/wcurb
$Tension_{WIND}$ =	1314	lbs	=[$F_{h\ ASD\ trans}$*Hcm-2*0.6*Wtmin*wcurb+$F_{vertASD}$*wcurb/2]/wcurb

---> Negative values indicate opposite load.

Longitudinal:

$Compression_{SEISMIC}$ =	2468	lbs	=[FpmaxASD*Hcm+2*(1+0.14*S_{DS})*Wtmax*Lcurb]/Lcurb
$Tension_{SEISMIC}$ =	296	lbs	=[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*Lcurb]/Lcurb
$Compression_{WIND}$ =	29	lbs	=[$F_{h\ ASD\ long}$*Hcm+2*0.6*Wtmax*Lcurb-$F_{vertASD}$*Lcurb/2]/Lcurb
$Tension_{WIND}$ =	902	lbs	=[$F_{h\ ASD\ long}$*Hcm-2*0.6*Wtmin*Lcurb+$F_{vertASD}$*Lcurb/2]/Lcurb

---> Negative values indicate opposite load.

Governing Reactions:

Transverse:	$Comp_{MAX}$ =	2765	lbs	---> Along long edge of curb.
(on long edge)	$Tens_{MAX}$ =	1314	lbs	---> Along long edge of curb.
Longitudinal:	$Comp_{MAX}$ =	2468	lbs	---> Along short edge of curb.
(on short edge)	$Tens_{MAX}$ =	902	lbs	---> Along short edge of curb.

---> Negative values indicate opposite load.

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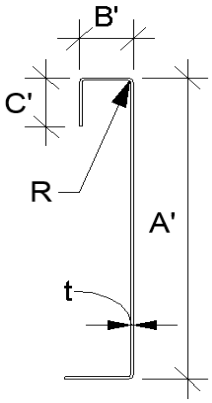
Curb Design

Fy =	50	ksi	Fu =	65	ksi
E =	29500	ksi	t =	0.0713	14 Gauge



Calculate Section Properties of Curb

A'=	24.000	in	a =	23.644	in	= A'-(2r+t)
B'=	1.500	in	a'=	23.929	in	= A'-t
C'=	0.000	in (0 if no lips)	b =	1.322	in	= B'-[r+t/2+α(r+t/2)]
α =	0.000	(0 - no Lip; 1 w/ lip)	b'=	1.464	in	= B'-(t/2+αt/2)
R =	0.1069	(Inside bend radius)	c =	0.000	in	= α[C'-(r+t/2)]
t =	0.0713	in	c'=	0.000	in	= α(C'-t/2)
r'=	0.143	in = R+t/2	u =	0.224	in	= πr/2
x =	0.080	in (Distance between centroid and web centerline)				
Ix =	110.108	in^4	rx =	7.60	in	
Iy =	0.137	in^4	ry =	0.268	in	
A =	1.91	in^2	rmin =	0.268	in	

Axial Compression

Pu =	1.427	k	(Max Axial Comp)	Ωc = 1.80
Pn/Ωc =	5.104	k		
Fe =	5.50	ksi	$\frac{P_n}{\Omega_c}=\frac{F_n A}{\Omega_c}$	If $\lambda_c \le 1.5$; $F_n=\left(0.658^{\lambda_c{}^2}\right)F_y$
λc =	3.02			If $\lambda_c > 1.5$; $F_n=\frac{0.877}{\lambda_c{}^2}F_y$
Fn =	4.82	ksi		
Ly =	77.125	in	Lateral unbraced length	
k_yL_y/r_y =	230		(assume k=0.8)	

$\lambda_c=\sqrt{\frac{F_y}{F_e}}$ $\quad F_e=\frac{\pi^2 E}{\left(kl/r\right)^2}$

Compression Check = O.K.

Check Web Crippling

h =	24	in	-- Check limits:		C = 4.00
t =	0.0713	in	h/t =	336.61 ≤ 260	C_R = 0.14
N =	7.00		N/t =	98.18 ≤ 210	C_N = 0.35
Ω_w =	1.75		N/h =	0.291667 ≤ 2.0	C_h = 0.02
P_n =	2.130	k	R/t =	1.50 ≤ 9.0	
P_n/Ω_w =	1.217	k			
Long side: Pu_{Trans} =	0.922	k	**O.K.**	# clips = 3	
Short side: Pu_{Long} =	1.234	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 =	2.130	k	Ae =	0.324	in^2
Pn =	12.817	k	Pn/Ω =	7.539	k

O.K.

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

Tcrnmax =	839	lbs	Max($F_{pmaxASD}$/4 -OR- $Fh_{ASDtrans}$/4 corner connections)			
Vcrnmax =	1383	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 = 0.3

# of Bolts required for Shear = 1.1

# of Bolts Used = 3.0

Check Combined Stress in Bolts & Inserts: 0.494 **O.K.**

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

Assume L/t > 25: 25*t =	1.783	in
Lreq'd =	0.935	in

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

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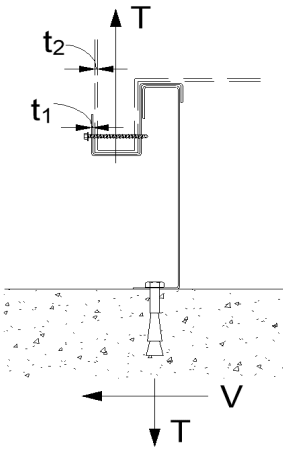
Connection Unit to Curb Clip | #10 SMS screw | Ω = 3.0

t1 = 0.0713 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 = 1.4



For t2/t1 ≤ 1.0:

Shear: $P_{ns} = 4.2F_{u2}\sqrt{t_2^3 d}$ Pns = 2377 # | 3.86 k

$P_{ns} = 2.7t_1 dF_{u1}$ 2.38 k

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

Pns/Ω = 792 #
Pss/Ω = 540 # <- Controls

For t2/t1 ≥ 2.5:

Pns = 2377 #

$P_{ns} = 2.7t_1 dF_{u1}$ 2.38 k

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

Tension:

Pnot = 1.068 k (screw pull-out strength)
Pnov = 2.607 k (screw pull-over strength)
Pts/Ω = 356 # <- Controls
Pts/Ω = 820 # (full tensile screw capacity)

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

	Shear (k)	# clips	V_{clip} (k)	V_{allow}(lb)	# screws	spacing
Long side:	2.855	3	0.95	540 #	2	6.00 in
Short side:	2.855	2	1.43	540 #	3	3.00 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 = 0.0713 AISI BSR applies
Fy = 50 ksi | Ω = 2.22 bolt/screw connection
Agv = 0.463 in^2 | Anv = 0.430 in^2 | Ant = 0.042 in^2
Rn/Ω = 7.500 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:	$Uplift_{MAX}$ =	1814 lbs		$Shear_{MAX}$ =	1679 lbs
$Compression_{SEISMIC}$ =	3888 lbs	=[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb			
$Tension_{SEISMIC}$ =	1644 lbs	=[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb			
$Compression_{WIND}$ =	1156 lbs	=[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*wcurb/2-$F_{vert\ ASD}$*wcurb/2]/wcurb			
$Tension_{WIND}$ =	1814 lbs	=[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)-0.6*$WGT_{unit+curb}$*wcurb/2+$F_{vertASD}$*wcurb/2]/wcurb			
Longitudinal:	$Uplift_{MAX}$ =	1001 lbs		$Shear_{MAX}$ =	1679 lbs
$Compression_{SEISMIC}$ =	3198 lbs	=[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb			
$Tension_{SEISMIC}$ =	954 lbs	=[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb			
$Compression_{WIND}$ =	343 lbs	=[$F_{h\ ASD\ long}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*Lcurb/2-$F_{vert\ ASD}$*Lcurb/2]/Lcurb			
$Tension_{WIND}$ =	1001 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)

	$Tall_{metal}$ =	997 lbs	$Vall_{metal}$ =	1097 lbs
Transverse:	$Tall_{wood}$ =	616 lbs	$Vall_{wood}$ =	672 lbs

# of Screws Req'd for Uplift = 2.94 | COMBINED LOADING: 0.907 O.K.
# of Screws Req'd for Shear = 2.50 | Screw Spacing = 22.6 in o.c.
Total # of screws Required = 6

1/4"ϕ x 3.5" Simpson SDS screws @ 22.6 in o.c. along long side of curb w/ 2.25" threaded embed

Longitudinal:

# of Screws Req'd for Uplift = 1.6 | COMBINED LOADING: 0.824 O.K.
# of Screws Req'd for Shear = 2.5 | Screw Spacing = 18.0 in o.c.
Total # of screws Required = 5

1/4"ϕ x 3.5" Simpson SDS screws @ 18 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:	$Tall_{metal}$ =	2086 lbs	$Vall_{metal}$ =	2192 lbs

# of Bolts Req'd for Uplift = 0.87 | COMBINED LOADING: 0.230 O.K.
# of Bolts Req'd for Shear = 0.77 | Bolt Spacing = 54.6 in o.c.
Total # of Bolts Required = 3

1/2" ϕ A307 Bolts to steel angle below deck @ 54.6 in o.c. along long side of curb

Longitudinal:

# of Bolts Req'd for Uplift = 0.48 | COMBINED LOADING: 0.295 O.K.
# of Bolts Req'd for Shear = 0.77 | Req'd Min Spacing = 68.1 in o.c.
Total # of Bolts Required = 2

1/2" ϕ A307 Bolts to steel angle below deck @ 68.1 in o.c. along short side of curb

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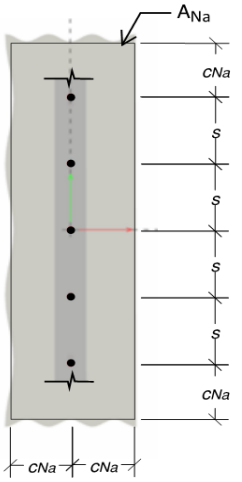
(619)727-4800

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$_{MAX}$ =	3681 lbs	Shear$_{MAX}$ =	3358 lbs

Compression$_{SEISMIC}$ = 5925 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb

Tension$_{SEISMIC}$ = 3681 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb

Shear$_{SEISMIC}$ = 3358 lbs =Ωo*FpmaxASD/2

Min Bolts Req'd Uplift =	2.61	spacing =	54.56	in o.c.	Tapplied =	920.3 lbs
Min Bolts Req'd Shear =	2.00	spacing =	109.13	in o.c.	Vapplied =	559.6 lbs

Try using	4	bolts
spaced at	36.38	in o.c.

COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{apllied}}{V_{allow,ASD}} \le 1.2$ = 0.96 O.K.

Use 4 - 1/2"ϕ HAS rods in Hilti HIT-HY 200 V3 epoxy @ 36.4 in o.c. max. along long side of curb w/ 2.75in embed

Longitudinal:	Uplift$_{MAX}$ =	2302 lbs	Shear$_{MAX}$ =	3358 lbs

Compression$_{SEISMIC}$ = 4546 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb

Tension$_{SEISMIC}$ = 2302 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb

Shear$_{SEISMIC}$ = 3358 lbs =Ωo*FpmaxASD/2

Min Bolts Req'd Uplift =	1.63	spacing =	34.06	in o.c.	Tapplied =	1151.0 lbs
Min Bolts Req'd Shear =	2.00	spacing =	68.13	in o.c.	Vapplied =	559.6 lbs

Try using	2	bolts
spaced at	68.13	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 @ 68.1 in o.c. max. along short side of curb w/ 2.75in embed

CURB DESIGN SUMMARY:	CBWC-121	SAV1518	**Unit:**	AV 15-18; AD 15-18; AH/AL 15; HV 13
CURB RAIL THICKNESS:	0.0713 in	14 Gauge		
UNIT CLIP THICKNESS:	0.0713 in	14 Gauge		
# OF CLIPS (LONG SIDE) -	3 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 3 - #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 1/4"ϕ x 3.5" Simpson SDS screws w/ 2.25" threaded embed	STEEL 1/2" ϕ A307 Bolts to steel angle below deck	CONCRETE 1/2"ϕ HAS rods in Hilti HIT-HY 200 V3 epoxy w/ 2.75in embed
LONG DIRECTION	6 @ 22.63 in o.c.	3 @ 54.56 in o.c.	4 @ 36.38 in o.c.
SHORT DIRECTION	5 @ 18.03 in o.c.	2 @ 68.13 in o.c.	2 @ 68.13 in o.c.