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6593 Riverdale St.
San Diego, CA 92120

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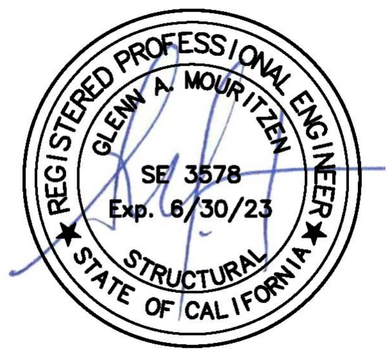
Structural Calculations
for
CBKDSAV28 Curb



Prepared for:

PROVENT

3847 Wabash Drive

Mira Loma, CA 91725

Date: December 19, 2022

Project Number: PV2206

STEEL ATTACHMENT

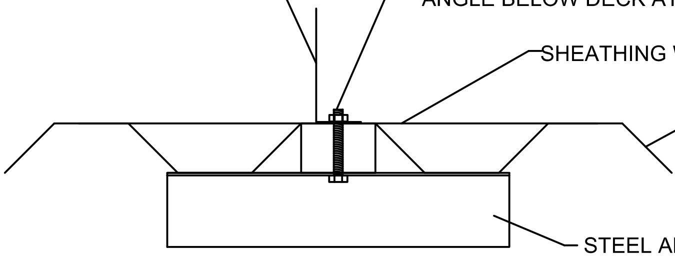
WELDED CURB

CENTER ON CURB FLANGE. SEE TABLE FOR QUANTITY OF EVENLY SPACED 1/2 " (OR 5/8" FOR MIL SERIES ONLY) Ø A307 BOLTS ATTACHED TO STEEL ANGLE BELOW DECK AT EACH CONNECTION POINT.

SHEATHING WHERE OCCURS

METAL DECK

STEEL ANGLE SUPPORT BY OTHERS



	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 @ 39" 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.
SLU180	3 @ 51.38" O.C.	2 @ 71.5" O.C.
SLM1830	3 @ 56.88" O.C	3 @ 35.75" 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
6" MIN THICKNESS
NORMAL WEIGHT CONCRETE

Meets seismic requirements for the following codes:
CBC 2019
IBC 2018

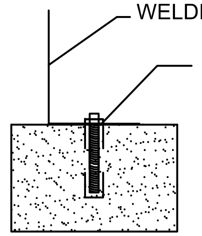
ROOF ANCHORAGE DETAIL	
CBKD Series	**CBWC Series**
LXS	LXS
LXL	LXL
SUN3672	SUN3672
PRD3715	PRD3715
PRS	PRS
PRL	PRL
SLU180	SLU180
SLM1830	SLM1830
SAV1518	SAV1518
SAV2025	SAV2025
SAV28	SAV28

CONCRETE ATTACHMENT

WELDED CURB

CENTER ON CURB FLANGE. SEE TABLE FOR QUANTITY OF EVENLY SPACED 3/4" Ø THREADED ROD IN HILTI HIT-HY 200 EPOXY WITH 4" EMBED

5/8" Ø HAS ROD IN HILTI HIT-HY 200 V3 EPOXY WITH 4-1/2" EMBED MIN. 9-1/8" EDGE DISTANCE (FOR SAV SERIES ONLY)



	NO. OF ANCHORAGE BOLTS REQUIRED	
CURB	**LONG SIDE**	**SHORT SIDE**
LXS	4 @ 11.5" O.C.	3 @ 9.5" O.C.
LXL	4 @ 11.5" O.C.	3 @ 14.5" O.C.
SUN3672	4 @ 20.17" O.C.	3 @ 12.38" O.C.
PRD3715	9 @ 8.61" O.C.	7 @ 6.5" O.C.
PRS	5 @ 14.72" O.C.	4 @ 9.56" O.C.
PRL	6 @ 14.4" O.C.	5 @ 10.38" O.C.
SLU180	8 @ 14.68" O.C.	7 @ 11.92" O.C.
SLM1830	12 @ 10.34" O.C.	10 @ 7.94" 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.

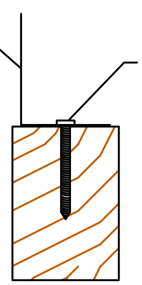
*** SIX INCHES FROM EACH CORNER EVENLY SPACED.**
**** CENTERED.**

WOOD ATTACHMENT

WELDED CURB

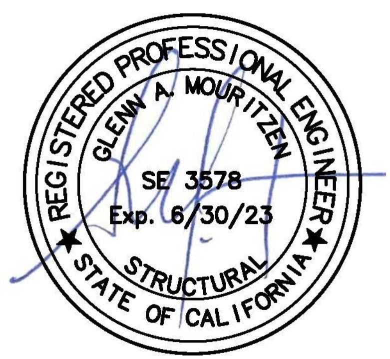
CENTER ON CURB FLANGE. SEE TABLE FOR QUANTITY OF EVENLY SPACED ¼" Ø SIMPSON SDS OR EQUIVALENT SCREWS (3½ " MIN. EMBED. INTO WOOD FRAMING)

1/4" Ø x 3.5" SIMPSON SDS SCREWS W/2.25" THREADED EMBED (FOR SAV SERIES ONLY)



FOUR INCHES FROM EACH CORNER EVENLY SPACED

	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	9 @ 9.11" O.C.	8 @ 6.14" O.C.
PRS	4 @ 20.96" O.C.	3 @ 16.34" O.C.
PRL	5 @ 19" O.C.	4 @ 15.17" O.C.
SLU180	9 @ 13.34" O.C.	7 @ 12.58" O.C.
SLM1830	13 @ 9.81" O.C.	12 @ 6.86" O.C.
SAV1518	5 @ 28.28" O.C.	4 @ 24.04" O.C.
SAV2025	6 @ 25.43" O.C.	5 @ 18.03" O.C.
SAV28	7 @ 23.92" O.C.	5 @ 18.03" O.C.



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:**
11/05/2022	8	FMM

FEATURES

- Roof curb perimeter made of galvanized steel.
- Gasketing package provided.
- Heat treated wood nailer provided.
- Corner flanges are pre-threated for easy bolt on assembly.
- Pitched, adjustable height, welded, different height, isolation and calculated curbs are available.

NOTES

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

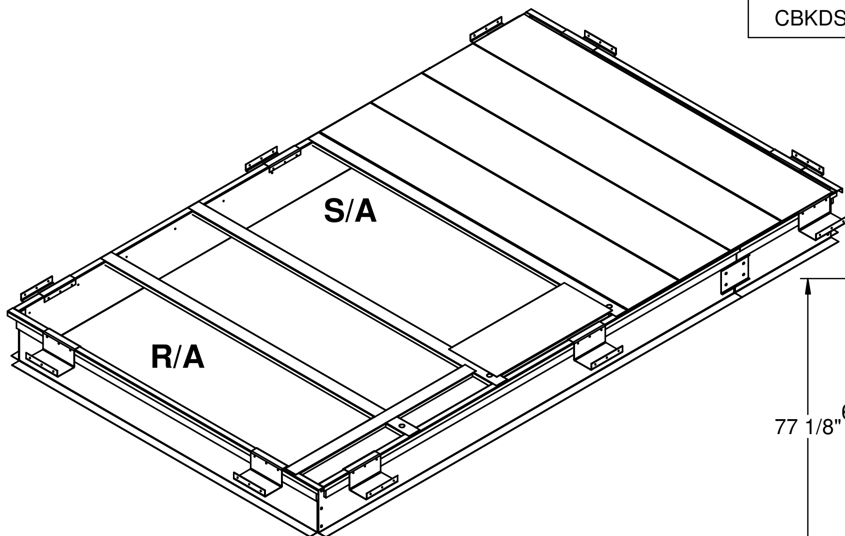
For wood, concrete and steel attachments see Roof Anchorage Detail, Form No. CB-60

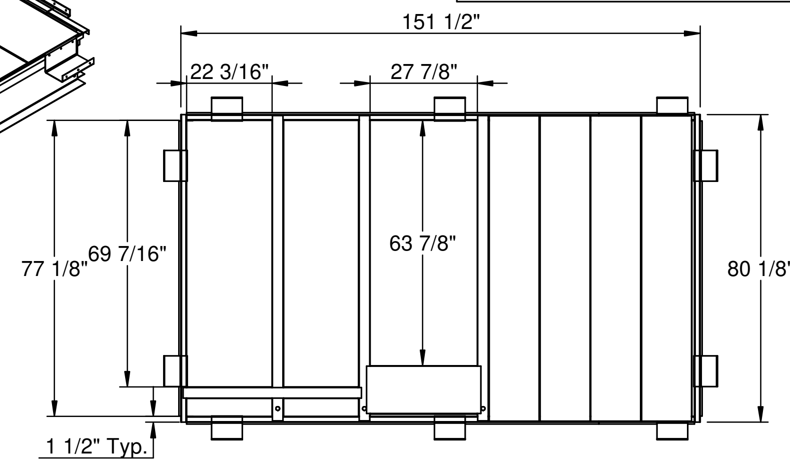
HOLD DOWN CLIPS FOR SUNCHOICE UNITS

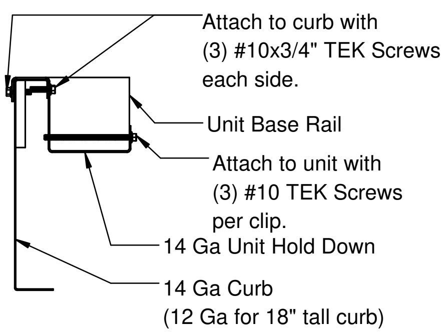
AV28

ProVent P/N	A	Est. Weight	SEISMIC CLIP P/N:	Est. Weight
CBKDSAV2808	8"	260 Lbs.	KDKITSAV28	15 Lbs.
CBKDSAV2811	11"	290 Lbs.		
CBKDSAV2814	14"	320 Lbs.		
CBKDSAV2818	18"	425 Lbs.		

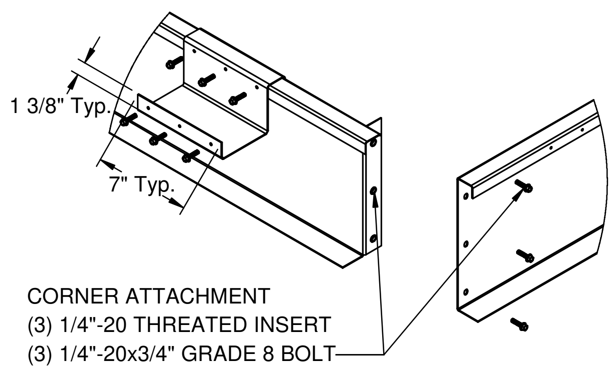
Meets seismic requirements for the following codes:
CBC 2019
IBC 2018







HOLD DOWN DETAIL



CORNER & HOLD DOWN DETAIL

ProVent

3847 WABASH DR.
MIRA LOMA, CA 91752

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

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

PART NUMBER:		
KDKITSAV28		
DATE:	REV:	DRAWN BY:
11/4/2022	-	JG

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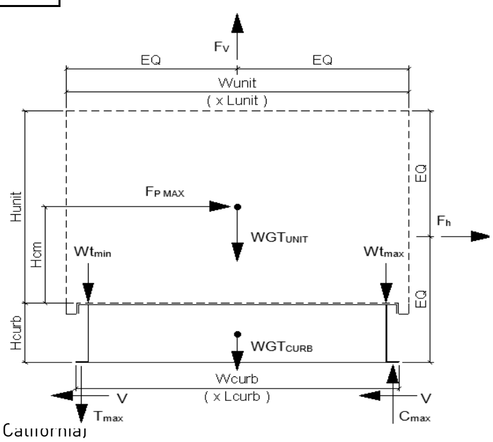
Client:	ProVent PV2206
Description:	CBKDSAV28 18"
Unit:	Sunchoice AV28



Curb Information

Hcurb =	18	in	(Height of curb)
Lcurb =	151.5	in	(Length of curb)
wcurb =	80.125	in	(Width of curb)
WGTcurb =	440	lbs	(Weight of curb)
# Clips long side =	3		# Clips short side = 2

Unit Information

WGTunit =	2720	lbs	(Oper. Weight of Unit)
Wtmax =	748	lbs	(Maximum corner weight)
Wtmin =	578	lbs	(Minimum corner weight)
Hunit =	57.22	in	(Height of unit above curb)
Hcm =	28.61	in	(Height to center of mass)
Lunit =	160.06	in	(Length of unit)
Wunit =	88.75	in	(Width of unit)

Seismic Loading - 2018 IBC/2019 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)	ap =	2.5
Sds =	2.280		(2/3*Sms)	Rp =	6
Fpmax =	1.710	Wp	(0.4*ap*Sds*Ip)*Wp*3/Rp <=1.6*Sds*Ip*Wp		
FpmaxASD =	3256	lbs	(0.7*Fpmax)	FpmaxASD =	3783 lbs
	(unit only)				(unit and curb)

Wind Loading - 2018 IBC/2019 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 =	110		(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	29.8	psf	$= 0.00256*Kz*Kzt*Kd*V^2$ (Eq. 26.10-1 ASCE 7-16)
$F_{h\ ASD\ trans}$ =	2836	lbs	= 0.6*qz*GCr*Lunit*(Hunit+Hcurb) (Eq. 29.4-2)
$F_{h\ ASD\ long}$ =	1572	lbs	= 0.6*qz*GCr*Wunit*(Hunit+Hcurb)
$F_{vert\ ASD}$ =	2642	lbs	= 0.6*qz*GCr*Lunit*Wunit (Eq. 29.4-3)

Curb Loading

Transverse:

$Compression_{SEISMIC}$ =	3136	lbs	$=[FpmaxASD*Hcm+2*(1+0.14S_{DS})*Wtmax*wcurb]/wcurb$
$Tension_{SEISMIC}$ =	838	lbs	$=[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*wcurb]/wcurb$
$Compression_{WIND}$ =	589	lbs	$=[F_{h\ ASD\ trans}*Hcm+2*0.6*Wtmax*wcurb-F_{vert\ ASD}*wcurb/2]/wcurb$
$Tension_{WIND}$ =	1640	lbs	$=[F_{h\ ASD\ trans}*Hcm-2*0.6*Wtmin*wcurb+F_{vertASD}*wcurb/2]/wcurb$

---> Negative values indicate opposite load.

Longitudinal:

$Compression_{SEISMIC}$ =	2588	lbs	$=[FpmaxASD*Hcm+2*(1+0.14*S_{DS})*Wtmax*Lcurb]/Lcurb$
$Tension_{SEISMIC}$ =	290	lbs	$=[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*Lcurb]/Lcurb$
$Compression_{WIND}$ =	-126	lbs	$=[F_{h\ ASD\ long}*Hcm+2*0.6*Wtmax*Lcurb-F_{vertASD}*Lcurb/2]/Lcurb$
$Tension_{WIND}$ =	924	lbs	$=[F_{h\ ASD\ long}*Hcm-2*0.6*Wtmin*Lcurb+F_{vertASD}*Lcurb/2]/Lcurb$

---> Negative values indicate opposite load.

Governing Reactions:

Transverse:	$Comp_{MAX}$ =	3136	lbs	---> Along long edge of curb.
(on long edge)	$Tens_{MAX}$ =	1640	lbs	---> Along long edge of curb.
Longitudinal:	$Comp_{MAX}$ =	2588	lbs	---> Along short edge of curb.
(on short edge)	$Tens_{MAX}$ =	924	lbs	---> Along short edge of curb.

---> Negative values indicate opposite load.

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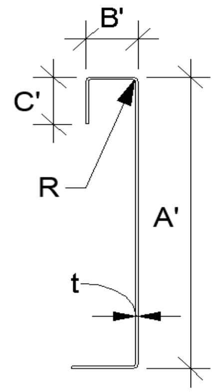

Curb Design

Fy =	50 ksi	Fu =	65 ksi
E =	29500 ksi	t =	0.1017 12 Gauge

Calculate Section Properties of Curb

A'=	18.000 in	a =	17.492 in = A'-(2r+t)
B'=	1.500 in	a'=	17.898 in = A'-t
C'=	0.000 in (0 if no lips)	b =	1.246 in = B'-[r+t/2+α(r+t/2)]
α =	0.000 (0 - no Lip; 1 w/ lip)	b'=	1.449 in = B'-(t/2+αt/2)
R =	0.1525 (Inside bend radius)	c =	0.000 in = α(C'-(r+t/2))
t =	0.1017 in	c'=	0.000 in = α(C'-t/2)
r'=	0.203 in = R+t/2	u =	0.319 in = πr/2
x =	0.102 in (Distance between centroid and web centerline)		
Ix =	70.803 in^4	rx =	5.81 in
Iy =	0.185 in^4	ry =	0.297 in
A =	2.10 in^2	rmin =	0.297 in

Axial Compression

Pu =	1.628 k	(Max Axial Comp)
Pn/Ωc =	6.875 k	
Fe =	6.73 ksi	
λc =	2.73	
Fn =	5.90 ksi	
Ly =	77 in	Lateral unbraced length
k_yL_y/r_y =	208	(assume k=0.8)

Ωc = 1.80

$$\frac{P_n}{\Omega_c} = \frac{F_n A}{\Omega_c} \qquad If\ \lambda_c \le 1.5;\ F_n = \left(0.658^{\lambda_c^2}\right) F_y \qquad If\ \lambda_c > 1.5;\ F_n = \frac{0.877}{\lambda_c^2} F_y$$

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

Compression Check = O.K.

Check Web Crippling

h =	18 in	-- Check limits:	
t =	0.1017 in	h/t =	176.99 ≤ 200
N =	7.00	N/t =	68.83 ≤ 210
Ω_w =	1.75	N/h =	0.388889 ≤ 2.0
P_n =	4.390 k	R/t =	1.50 ≤ 9.0
P_n/Ω_w =	2.509 k		
Long side: Pu_{Trans} =	1.045 k	O.K.	# clips = 3
Short side: Pu_{Long} =	1.294 k	O.K.	# clips = 2

C = 4.00; C_R = 0.14; C_N = 0.35; C_h = 0.02 (See table C3.4.1-2, fastened to support, one flange, end loading)

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

Check Web Stiffener 16Ga x 3/4" x 7" (C-channel)

width of stiffener =	7.000 in	ts =	0.0566 16 Gauge
web of stiff. w =	6.717 in	Rs =	0.0849 in
***Check w/ts ≤ 1.28√E/Fys		Ωc =	1.70
w/ts =	118.675		
1.28√(E/Fys) =	31.091	--> w/ts over limit	Use C3.7.2

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

Pwc =	4.390 k	Ae =	0.380 in^2
Pn =	16.379 k	Pn/Ω =	9.635 k

O.K.

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

Tcrnmax =	946 lbs	Max($F_{pmaxASD}$/4 -OR- $Fh_{ASDtrans}$/4 corner connections)
Vcrnmax =	1568 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 = 0.4
# of Bolts required for Shear = 1.3
# of Bolts Used = 3.0
Check Combined Stress in Bolts & Inserts: 0.560 O.K.

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

Assume L/t > 25: 25*t =	2.543 in
Lreq'd =	0.743 in

$$P_n/_{\Omega} = \frac{1}{\Omega} 0.75 t L F_u \ge V_{req} \qquad L_{req'd} = \frac{V_{req}\Omega}{0.75 t F_u}$$

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

t1 = 0.1017 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 = 1.0

For t2/t1 ≤ 1.0: Pns = 3391 # For t2/t1 ≥ 2.5:

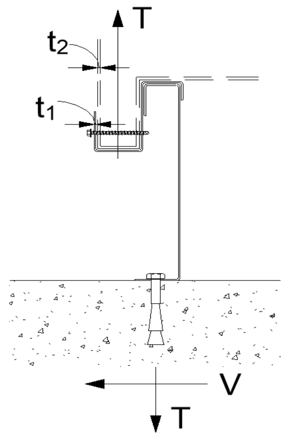
Shear: $P_{ns} = 4.2F_{u2}\sqrt{t_2^3 d}$ 3.86 k Pns = 3391 #
$P_{ns} = 2.7t_1dF_{u1}$ 3.39 k $P_{ns} = 2.7t_1dF_{u1}$ 3.39 k
$P_{ns} = 2.7t_2dF_{u2}$ 3.39 k $P_{ns} = 2.7t_2dF_{u2}$ 3.39 k
Pns/Ω = 1130 #
Pss/Ω = 540 # <- Controls

Tension: Pnot = 1.068 k (screw pull-out strength) $P_{not} = 0.85t_cdF_{u2}$
Pnov = 3.718 k (screw pull-over strength) $t_c = \min(t_1, t_2)$ $P_{nov} = 1.5t_1d_wF_{u1}$
Pts/Ω = 356 # <- Controls
Pts/Ω = 820 # (full tensile screw capacity)

	Shear (k)	# clips	V_{clip} (k)	V_{allow}(lb)	# screws	spacing
Long side:	3.256	3	1.09	540 #	3	3.00 in
Short side:	3.256	2	1.63	540 #	4	2.00 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 = 0.1017 AISI BSR applies
Fy = 50 ksi Ω = 2.22 bolt/screw connection
Agv = 0.661 in^2 Anv = 0.593 in^2 Ant = 0.060 in^2
Rn/Ω = 10.697 k $R_n = 0.6F_yA_{gv} + F_uA_{nt} \leq 0.6F_uA_{nv} + F_uA_{nt}$
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: $Uplift_{MAX}$ = 2022 lbs $Shear_{MAX}$ = 1891 lbs
$Compression_{SEISMIC}$ = 4285 lbs =[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb
$Tension_{SEISMIC}$ = 1757 lbs =[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb
$Compression_{WIND}$ = 1277 lbs =[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*wcurb/2-$F_{vert\ ASD}$*wcurb/2]/wcurb
$Tension_{WIND}$ = 2022 lbs =[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)-0.6*$WGT_{unit+curb}$*wcurb/2+$F_{vertASD}$*wcurb/2]/wcurb

Longitudinal: $Uplift_{MAX}$ = 857 lbs $Shear_{MAX}$ = 1891 lbs
$Compression_{SEISMIC}$ = 3248 lbs =[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb
$Tension_{SEISMIC}$ = 720 lbs =[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb
$Compression_{WIND}$ = 111 lbs =[$F_{h\ ASD\ long}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*Lcurb/2-$F_{vert\ ASD}$*Lcurb/2]/Lcurb
$Tension_{WIND}$ = 857 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 = 3.28 COMBINED LOADING: 0.871 O.K.
# of Screws Req'd for Shear = 2.81 Screw Spacing = 23.9 in o.c.
Total # of screws Required = 7
1/4"φ x 3.5" Simpson SDS screws @ 23.9 in o.c. along long side of curb w/ 2.25" threaded embed

Longitudinal:
# of Screws Req'd for Uplift = 1.4 COMBINED LOADING: 0.841 O.K.
# of Screws Req'd for Shear = 2.8 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 = 0.97 COMBINED LOADING: 0.278 O.K.
# of Bolts Req'd for Shear = 0.86 Bolt Spacing = 69.8 in o.c.
Total # of Bolts Required = 3
1/2" φ A307 Bolts to steel angle below deck @ 69.8 in o.c. along long side of curb

Longitudinal:
# of Bolts Req'd for Uplift = 0.41 COMBINED LOADING: 0.318 O.K.
# of Bolts Req'd for Shear = 0.86 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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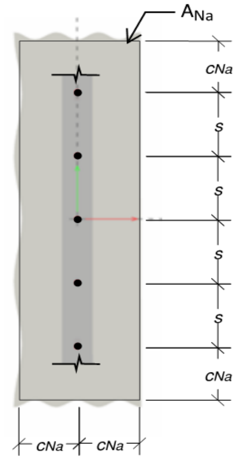
For Concrete anchorage: SEISMIC $(0.6-0.14S_{DS})D + 0.7\Omega_o E$ Ωo = 2.0

Concrete Attachment: 5/8"φ HAS rods in Hilti HIT-HY 200 V3 epoxy w/ 4.5in embed

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



f'c = 4000 psi
h = 6 in (concrete thickness, t_min = h_ef + 2do) O.K.
h_ef = 4.5 in (effective embedment)
da = 0.625 in (anchor diameter) do = 0.75 in (hole diameter)
n = 3 (number of dummy anchors to check capacity with spacing effect)
s = 20 in (initial spacing estimate)
τk,cr / uncr = 1170 2220 psi (from ESR 4868, Table 14, Temp range B)
τk,cr / uncr = 1226 2327 psi If $f'_c > 2500$, *multiply by* $(f'_c/2500)^{0.1}$
c_{Na} = 9.0625 in (min. edge distance for full capacity); $c_{Na} = 10d_a\sqrt{\frac{\tau_{uncr}}{1100}}$

Tension:
Bond strength

$$N_{ag} = \frac{A_{Na}}{A_{Nao}}\varphi_{ec,Na}\varphi_{ed,Na}\varphi_{cp,Na}N_{ba}$$ (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} = 985.55 in^2
A_{Nao} = 328.52 in^2
N_{ba} = 10727 lbs $N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef} \alpha_{n,seismic}$ $\alpha_{n,seismic} = 0.99$
N_{ag} = 32181 lbs (group) $\lambda_a = 1.0$
øN_{ag} = 15688 lbs (group) CONTROLS λ_a = 1.0 for normal weight conc; 0.6 for lightweig

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} = 722.25 in^2 N_b = 10264 lbs ϕ_{conc} = 0.75
A_{Nco} = 182.25 in^2 kc = 17 ϕ_{bond} = 0.65
N_{cbg} = 40674 lbs (group) ϕ_{seis} = 0.75
øN_{cbg} = 22879 lbs (group) ϕ_{steel} = 0.65

Shear: Vsa,eq = 7865 (from ESR4868, Table 11) $\alpha_{v,seismic}$ = 0.6
Steel strength øVsa,eq = 3067
$Tall_{LRFD}$ = 5229 lbs (anchor) $Vall_{LRFD}$ = 3067 lbs $\propto = (1 + 0.2SDS)D + 2.5E$ = 1.708
$Tall_{ASD} = Tall_{LRFD}/\alpha$ = 3062 lbs $Vall_{ASD} = Vall_{LRFD}/\alpha$ = 1796 lbs $(D = 0.758, E = 0.242)$

Transverse: $Uplift_{MAX}$ = 3957 lbs $Shear_{MAX}$ = 3783 lbs

$Compression_{SEISMIC}$ = 6485 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb
$Tension_{SEISMIC}$ = 3957 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb
$Shear_{SEISMIC}$ = 3783 lbs =Ωo*FpmaxASD/2
Min Bolts Req'd Uplift = 1.29 spacing = 69.75 in o.c. Tapplied = 1319.0 lbs
Min Bolts Req'd Shear = 2.11 spacing = 69.75 in o.c. Vapplied = 756.5 lbs

Try using 3 bolts spaced at 69.75 in o.c. COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{apllied}}{V_{allow,ASD}} \le 1.2$ = 0.85 O.K.

Use 3 - 5/8"ϕ HAS rods in Hilti HIT-HY 200 V3 epoxy @ 69.8 in o.c. max. along long side of curb w/ 4.5in embed

Longitudinal: $Uplift_{MAX}$ = 1884 lbs $Shear_{MAX}$ = 3783 lbs

$Compression_{SEISMIC}$ = 4412 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb
$Tension_{SEISMIC}$ = 1884 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb
$Shear_{SEISMIC}$ = 3783 lbs =Ωo*FpmaxASD/2
Min Bolts Req'd Uplift = 0.62 spacing = 34.06 in o.c. Tapplied = 941.9 lbs
Min Bolts Req'd Shear = 2.11 spacing = 34.06 in o.c. Vapplied = 756.5 lbs

Try using 2 bolts spaced at 68.13 in o.c. COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{apllied}}{V_{allow,ASD}} \le 1.2$ = 0.73 O.K.

Use 2 - 5/8"ϕ HAS rods in Hilti HIT-HY 200 V3 epoxy @ 68.1 in o.c. max. along short side of curb w/ 4.5in embed

CURB DESIGN SUMMARY:	CBKDSAV28	**Unit:**	Sunchoice AV28
CURB RAIL THICKNESS:	0.1017 in 12 Gauge		
UNIT CLIP THICKNESS:	0.1017 in 12 Gauge		
# OF CLIPS (LONG SIDE) -	3 clips with 3 - #10 SMS screws each clip		
WEB STIFFENER:	NOT REQUIRED		
# OF CLIPS (SHORT SIDE) -	2 clips with 4 - #10 SMS screws each clip		
WEB STIFFENER:	NOT REQUIRED		
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 5/8"φ HAS rods in Hilti HIT-HY 200 V3 epoxy w/ 4.5in embed
LONG DIRECTION	7 @ 23.92 in o.c.	3 @ 69.75 in o.c.	3 @ 69.75 in o.c.
SHORT DIRECTION	5 @ 18.03 in o.c.	2 @ 68.13 in o.c.	2 @ 68.13 in o.c.

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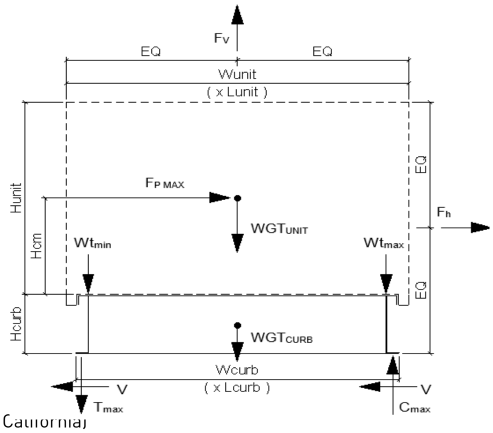
Client:	ProVent PV2206
Description:	CBKDSAV28 14"
Unit:	Sunchoice AV28

Curb Information

Hcurb = 14 in (Height of curb)
Lcurb = 151.5 in (Length of curb)
wcurb = 80.125 in (Width of curb)
WGTcurb = 335 lbs (Weight of curb)
# Clips long side = 3 # Clips short side = 2



Unit Information

WGTunit = 2720 lbs (Oper. Weight of Unit)
Wtmax = 748 lbs (Maximum corner weight)
Wtmin = 578 lbs (Minimum corner weight)
Hunit = 57.22 in (Height of unit above curb)
Hcm = 28.61 in (Height to center of mass)
Lunit = 160.06 in (Length of unit)
Wunit = 88.75 in (Width of unit)

Seismic Loading - 2018 IBC/2019 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) ap = 2.5
Sds = 2.280 (2/3*Sms) Rp = 6
Fpmax = 1.710 Wp (0.4*ap*Sds*Ip)*Wp*3/Rp <=1.6*Sds*Ip*Wp
FpmaxASD = 3256 lbs (0.7*Fpmax) FpmaxASD = 3657 lbs
(unit only) (unit and curb)

Wind Loading - 2018 IBC/2019 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 = 110 (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 29.8 psf = $0.00256*Kz*Kzt*Kd*V^2$ (Eq. 26.10-1 ASCE 7-16)
$F_{h\ ASD\ trans}$ = 2685 lbs = 0.6*qz*GCr*Lunit*(Hunit+Hcurb) (Eq. 29.4-2)
$F_{h\ ASD\ long}$ = 1489 lbs = 0.6*qz*GCr*Wunit*(Hunit+Hcurb)
$F_{vert\ ASD}$ = 2642 lbs = 0.6*qz*GCr*Lunit*Wunit (Eq. 29.4-3)

Curb Loading

Transverse:

$Compression_{SEISMIC}$ = 3136 lbs =[FpmaxASD*Hcm+2*(1+0.14S_{DS})*Wtmax*wcurb]/wcurb
$Tension_{SEISMIC}$ = 838 lbs =[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*wcurb]/wcurb
$Compression_{WIND}$ = 536 lbs =[$F_{h\ ASD\ trans}$*Hcm+2*0.6*Wtmax*wcurb-$F_{vert\ ASD}$*wcurb/2]/wcurb
$Tension_{WIND}$ = 1586 lbs =[$F_{h\ ASD\ trans}$*Hcm-2*0.6*Wtmin*wcurb+$F_{vertASD}$*wcurb/2]/wcurb
---> Negative values indicate opposite load.

Longitudinal:

$Compression_{SEISMIC}$ = 2588 lbs =[FpmaxASD*Hcm+2*(1+0.14*S_{DS})*Wtmax*Lcurb]/Lcurb
$Tension_{SEISMIC}$ = 290 lbs =[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*Lcurb]/Lcurb
$Compression_{WIND}$ = -142 lbs =[$F_{h\ ASD\ long}$*Hcm+2*0.6*Wtmax*Lcurb-$F_{vertASD}$*Lcurb/2]/Lcurb
$Tension_{WIND}$ = 908 lbs =[$F_{h\ ASD\ long}$*Hcm-2*0.6*Wtmin*Lcurb+$F_{vertASD}$*Lcurb/2]/Lcurb
---> Negative values indicate opposite load.

Governing Reactions:

Transverse:	$Comp_{MAX}$ =	3136	lbs	---> Along long edge of curb.
(on long edge)	$Tens_{MAX}$ =	1586	lbs	---> Along long edge of curb.
Longitudinal:	$Comp_{MAX}$ =	2588	lbs	---> Along short edge of curb.
(on short edge)	$Tens_{MAX}$ =	908	lbs	---> Along short edge of curb.

---> Negative values indicate opposite load.

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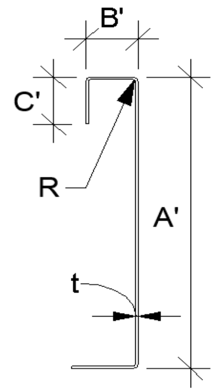

Curb Design

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

Calculate Section Properties of Curb

A'=	14.000	in	a =	13.644	in = A'-(2r+t)
B'=	1.500	in	a'=	13.929	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 =	0.128	in (Distance between centroid and web centerline)			
Ix =	25.770	in^4	rx =	4.65	in
Iy =	0.130	in^4	ry =	0.330	in
A =	1.19	in^2	rmin =	0.330	in

Axial Compression

Pu =	1.628 k	(Max Axial Comp)
Pn/Ωc =	4.830 k	
Fe =	8.31 ksi	
λc =	2.45	
Fn =	7.29 ksi	
Ly =	77 in	Lateral unbraced length
k_yL_y/r_y =	187	(assume k=0.8)

Ωc = 1.80

$$\frac{P_n}{\Omega_c} = \frac{F_n A}{\Omega_c} \qquad If\ \lambda_c \le 1.5;\ F_n = \left(0.658^{\lambda_c^2}\right) F_y \qquad If\ \lambda_c > 1.5;\ F_n = \frac{0.877}{\lambda_c^2} F_y$$

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

Compression Check = O.K.

Check Web Crippling

h =	14 in	-- Check limits:		C = 4.00
t =	0.0713 in	h/t =	196.35 ≤ 200	C_R = 0.14
N =	7.00	N/t =	98.18 ≤ 210	C_N = 0.35
Ω_w =	1.75	N/h =	0.5 ≤ 2.0	C_h = 0.02
P_n =	2.422 k	R/t =	1.50 ≤ 9.0	
P_n/Ω_w =	1.384 k			
Long side: Pu_{Trans} =	1.045 k	O.K.	# clips = 3	
Short side: Pu_{Long} =	1.294 k	O.K.	# clips = 2	

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

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

Check Web Stiffener 16Ga x 3/4" x 7" (C-channel)

width of stiffener =	7.000 in	ts =	0.0566 16 Gauge
web of stiff. w =	6.717 in	Rs =	0.0849 in
***Check w/ts ≤ 1.28√E/Fys		Ωc =	1.70
w/ts =	118.675		
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 =	2.422 k	Ae =	0.380 in^2
Pn =	15.002 k	Pn/Ω =	8.825 k

O.K.

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

Tcrnmax =	914 lbs	Max($F_{pmaxASD}$/4 -OR- $Fh_{ASDtrans}$/4 corner connections)
Vcrnmax =	1568 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 = 0.4
# of Bolts required for Shear = 1.3
# of Bolts Used = 3.0
Check Combined Stress in Bolts & Inserts: 0.556 **O.K.**

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

Assume L/t > 25: 25*t = 1.783 in
Lreq'd = 1.060 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

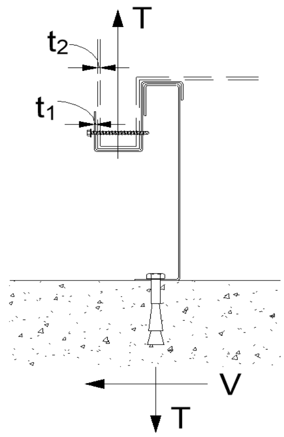
t1 = 0.0713 in — Fu1 = 65 ksi
t2 = 0.1017 in (unit base rail thickness) — Fu2 = 65 ksi
d = 0.190 in (screw diameter) — dw = 0.375 in (nom. washer diameter)
t2/t1 = 1.4

For t2/t1 ≤ 1.0: Pns = 2377 #
Shear: $P_{ns} = 4.2F_{u2}\sqrt{t_2^3 d}$ 3.86 k
$P_{ns} = 2.7t_1 dF_{u1}$ 2.38 k
$P_{ns} = 2.7t_2 dF_{u2}$ 3.39 k

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

Pns/Ω = 792 #
Pss/Ω = 540 # <- Controls
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:	3.256	3	1.09	540 #	3	3.00 in
Short side:	3.256	2	1.63	540 #	4	2.00 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 = 0.416 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: $(0.6-0.14S_{DS})D + 0.7E$ — WIND: 0.6D + W

Transverse: $Uplift_{MAX}$ = 1832 lbs — $Shear_{MAX}$ = 1828 lbs

$Compression_{SEISMIC}$ =	3960 lbs	=[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb
$Tension_{SEISMIC}$ =	1516 lbs	=[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb
$Compression_{WIND}$ =	1024 lbs	=[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*wcurb/2-$F_{vert\ ASD}$*wcurb/2]/wcurb
$Tension_{WIND}$ =	1832 lbs	=[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)-0.6*$WGT_{unit+curb}$*wcurb/2+$F_{vertASD}$*wcurb/2]/wcurb

Longitudinal: $Uplift_{MAX}$ = 823 lbs — $Shear_{MAX}$ = 1828 lbs

$Compression_{SEISMIC}$ =	3044 lbs	=[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb
$Tension_{SEISMIC}$ =	600 lbs	=[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb
$Compression_{WIND}$ =	14 lbs	=[$F_{h\ ASD\ long}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*Lcurb/2-$F_{vert\ ASD}$*Lcurb/2]/Lcurb
$Tension_{WIND}$ =	823 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 = 2.97 — COMBINED LOADING: 0.814 O.K.
# of Screws Req'd for Shear = 2.72 — Screw Spacing = 23.9 in o.c.
Total # of screws Required = 7
1/4"ϕ x 3.5" Simpson SDS screws @ 23.9 in o.c. along long side of curb w/ 2.25" threaded embed

Longitudinal:
# of Screws Req'd for Uplift = 1.3 — COMBINED LOADING: 0.811 O.K.
# of Screws Req'd for Shear = 2.7 — 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 = 0.88 — COMBINED LOADING: 0.248 O.K.
# of Bolts Req'd for Shear = 0.83 — Bolt Spacing = 69.8 in o.c.
Total # of Bolts Required = 3
1/2" ϕ A307 Bolts to steel angle below deck @ 69.8 in o.c. along long side of curb

Longitudinal:
# of Bolts Req'd for Uplift = 0.39 — COMBINED LOADING: 0.300 O.K.
# of Bolts Req'd for Shear = 0.83 — 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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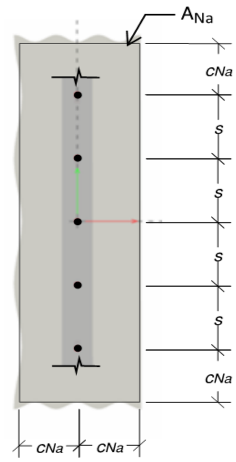
For Concrete anchorage: SEISMIC $(0.6\text{-}0.14S_{DS})D + 0.7\Omega_o E$ Ωo = 2.0

Concrete Attachment: **5/8"φ HAS rods in Hilti HIT-HY 200 V3 epoxy w/ 4.5in embed**

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



f'c =	4000	psi
h =	6	in (concrete thickness, t_min = h_ef + 2do) O.K.
h_ef =	4.5	in (effective embedment)
da =	0.625	in (anchor diameter) do = 0.75 in (hole diameter)
n =	3	(number of dummy anchors to check capacity with spacing effect)
s =	20	in (initial spacing estimate)
τk,cr / uncr =	1170 / 2220	psi (from ESR 4868, Table 14, Temp range B)
τk,cr / uncr =	1226 / 2327	psi If $f'_c > 2500$, multiply by $(f'_c/2500)^{0.1}$
c_Na=	9.0625	in (min. edge distance for full capacity); $c_{Na} = 10d_a\sqrt{\frac{\tau_{uncr}}{1100}}$

Tension:
Bond strength

$$N_{ag} = \frac{A_{Na}}{A_{Nao}}\varphi_{ec,Na}\varphi_{ed,Na}\varphi_{cp,Na}N_{ba}$$ (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}= 985.55 in^2

A_{Nao}= 328.52 in^2

N_{ba} = 10727 lbs $N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef} \alpha_{n,seismic}$ $\alpha_{n,seismic} = 0.99$

N_{ag} = 32181 lbs (group) $\lambda_a = 1.0$

øN_{ag} = 15688 lbs (group) CONTROLS λ_a =1.0 for normal weight conc; 0.6 for lightweig

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} =	722.25 in^2	N_b = 10264	lbs	ϕ_{conc} =	0.75
A_{Nco} =	182.25 in^2	kc = 17		ϕ_{bond} =	0.65
N_{cbg} =	40674 lbs (group)			ϕ_{seis} =	0.75
øN_{cbg} =	22879 lbs (group)			ϕ_{steel} =	0.65

Shear: Vsa,eq = 7865 (from ESR4868, Table 11) $\alpha_{v,seismic}$ = 0.6

Steel strength øVsa,eq = 3067

$Tall_{LRFD}$ = 5229 lbs (anchor) $Vall_{LRFD}$ = 3067 lbs $\alpha = (1 + 0.2SDS)D + 2.5E$ =1.708

$Tall_{ASD}$ = $Tall_{LRFD}/\alpha$ = 3062 lbs $Vall_{ASD}$ = $Vall_{LRFD}/\alpha$ = 1796 lbs $(D = 0.758, E = 0.242)$

Transverse: $Uplift_{MAX}$ = 3460 lbs $Shear_{MAX}$ = 3657 lbs

$Compression_{SEISMIC}$ =	5904 lbs	=[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb
$Tension_{SEISMIC}$ =	3460 lbs	=[Ωo*FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb
$Shear_{SEISMIC}$ =	3657 lbs	=Ωo*FpmaxASD/2

Min Bolts Req'd Uplift = 1.13 spacing = 69.75 in o.c. Tapplied = 1153.5 lbs

Min Bolts Req'd Shear = 2.04 spacing = 69.75 in o.c. Vapplied = 731.4 lbs

Try using 3 bolts spaced at 69.75 in o.c. COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{apllied}}{V_{allow,ASD}} \leq 1.2$ = 0.78 O.K.

Use 3 - 5/8"ϕ HAS rods in Hilti HIT-HY 200 V3 epoxy @ 69.8 in o.c. max. along long side of curb w/ 4.5in embed

Longitudinal: $Uplift_{MAX}$ = 1628 lbs $Shear_{MAX}$ = 3657 lbs

$Compression_{SEISMIC}$ =	4072 lbs	=[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb
$Tension_{SEISMIC}$ =	1628 lbs	=[Ωo*FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb
$Shear_{SEISMIC}$ =	3657 lbs	=Ωo*FpmaxASD/2

Min Bolts Req'd Uplift = 0.53 spacing = 34.06 in o.c. Tapplied = 814.0 lbs

Min Bolts Req'd Shear = 2.04 spacing = 34.06 in o.c. Vapplied = 731.4 lbs

Try using 2 bolts spaced at 68.13 in o.c. COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{apllied}}{V_{allow,ASD}} \leq 1.2$ = 0.67 O.K.

Use 2 - 5/8"ϕ HAS rods in Hilti HIT-HY 200 V3 epoxy @ 68.1 in o.c. max. along short side of curb w/ 4.5in embed

CURB DESIGN SUMMARY:	CBKDSAV28		Unit: Sunchoice AV28
CURB RAIL THICKNESS:	0.0713 in 14 Gauge		
UNIT CLIP THICKNESS:	0.0713 in 14 Gauge		
# OF CLIPS (LONG SIDE) -	3 clips with 3 - #10 SMS screws each clip		
WEB STIFFENER:	NOT REQUIRED		
# OF CLIPS (SHORT SIDE) -	2 clips with 4 - #10 SMS screws each clip		
WEB STIFFENER:	NOT REQUIRED		
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 5/8"φ HAS rods in Hilti HIT-HY 200 V3 epoxy w/ 4.5in embed
LONG DIRECTION	7 @ 23.92 in o.c.	3 @ 69.75 in o.c.	3 @ 69.75 in o.c.
SHORT DIRECTION	5 @ 18.03 in o.c.	2 @ 68.13 in o.c.	2 @ 68.13 in o.c.