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ENGINEERING + DESIGN

6593 Riverdale St.
San Diego, CA 92120

619-727-4800

Structural Calculations
for
CBKDSAV1518 Curb

Prepared for:

PROVENT

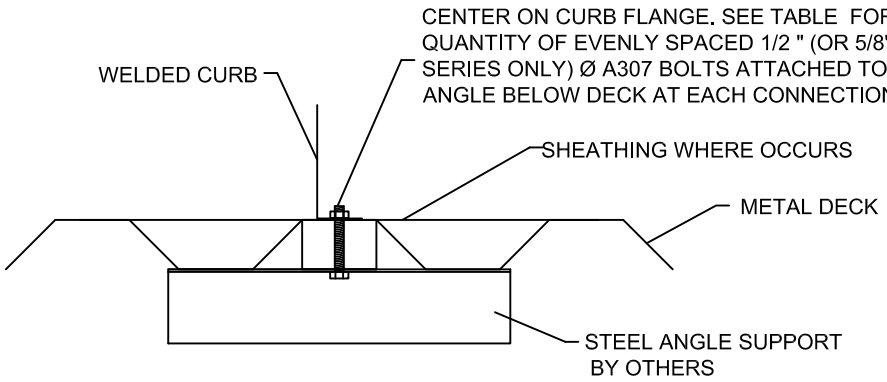
3847 Wabash Drive

Mira Loma, CA 91725

Date: December 19, 2022

Project Number: PV2206

STEEL ATTACHMENT



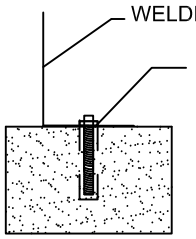
	NO. OF ANCHORAGE BOLTS REQUIRED	
CURB	LONG SIDE	SHORT SIDE
LXS	2 @ 34.5" O.C.	2 @ 19" O.C.
LXL	2 @ 34.5" O.C.	2 @ 29" O.C.
SUN3672	2 @ 60.5" O.C.	2 @ 39" O.C.
PRD3715	2 @ 68.88" O.C.	2 @ 39" O.C.
PRS	2 @ 58.88" O.C.	2 @ 28.69" O.C.
PRL	2 @ 72" O.C.	2 @ 41.5" O.C.
SLU180	3 @ 51.38" O.C.	2 @ 71.5" O.C.
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



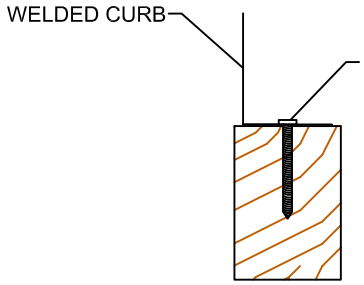
CENTER ON CURB FLANGE. SEE TABLE FOR QUANTITY OF EVENLY SPACED 3/4" Ø THREADED ROD IN HILTI HIT-HY 200 EPOXY WITH 4" EMBED

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

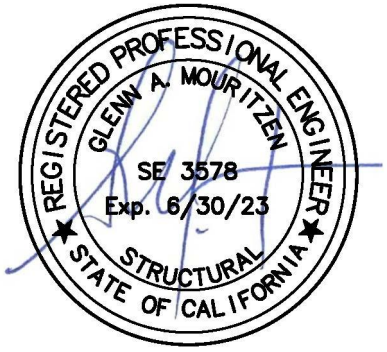


CENTER ON CURB FLANGE. SEE TABLE FOR QUANTITY OF EVENLY SPACED
¼" Ø SIMPSON SDS OR EQUIVALENT SCREWS
(3 ½ " MIN. EMBED. INTO WOOD FRAMING)

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

HOLD DOWN CLIPS FOR SUNCHOICE UNITS

15-18

ProVent P/N	A	Est. Weight	SEISMIC CLIP P/N:	Est. Weight
CBKDSAV151808	8"	335 Lbs.	KDKITSAV1518	20 Lbs.
CBKDSAV151811	11"	380 Lbs.		
CBKDSAV151814	14"	425 Lbs.		
CBKDSAV151818	18"	525 Lbs.		

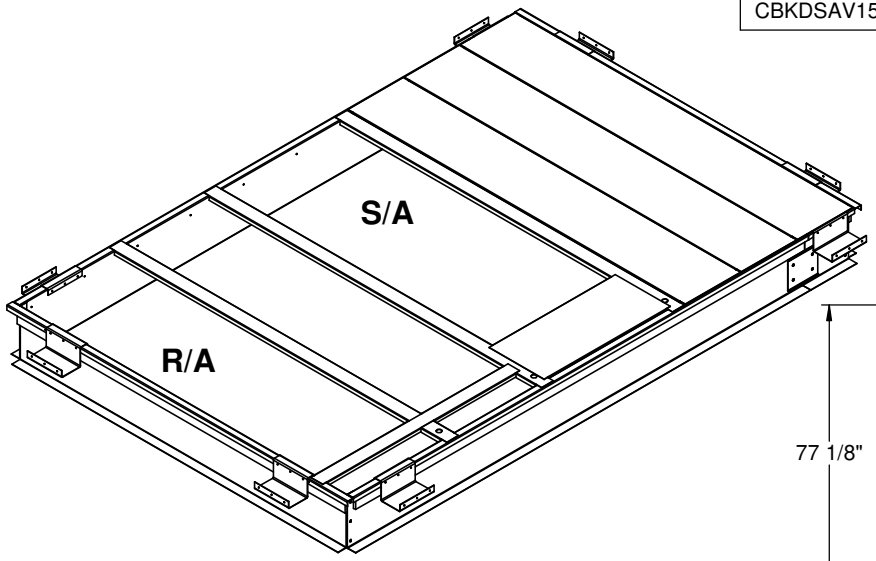
Meets seismic requirements for the following codes:
CBC 2019
IBC 2018

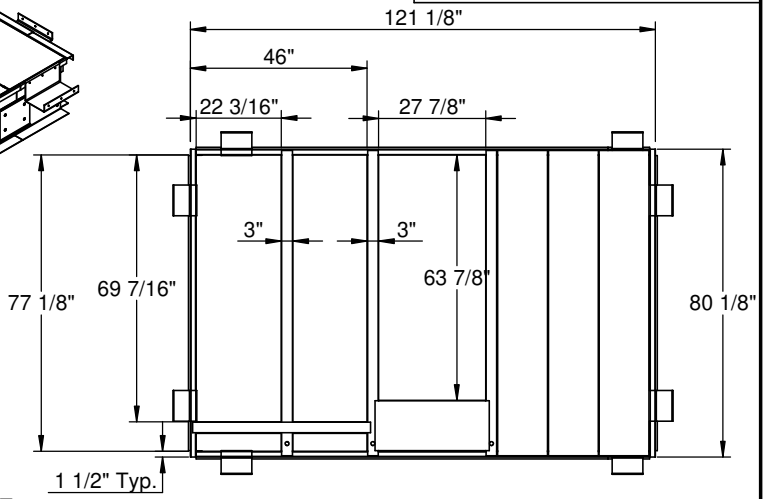
FEATURES

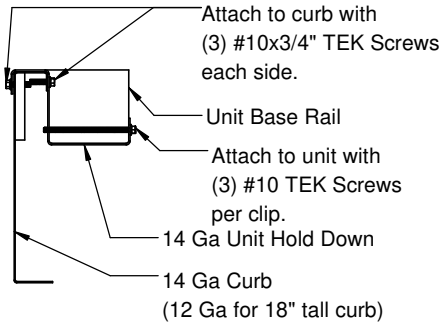
- Roof curb perimeter made of galvanized steel.
- Gasketing package provided.
- Heat treated wood nailer provided.
- Corner flanges are pre-threated for easy bolt on assembly.
- Pitched, adjustable height, welded, different height, isolation and calculated curbs are available.

NOTES

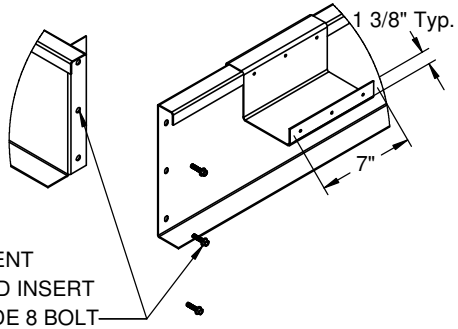
Attach ductwork to roof curb.
Flanges of duct rest on top of curb.
Support ductwork below the curb.







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: KDKITSAV1518

DATE:	REV:	DRAWN BY:
12/5/2022	1	JG

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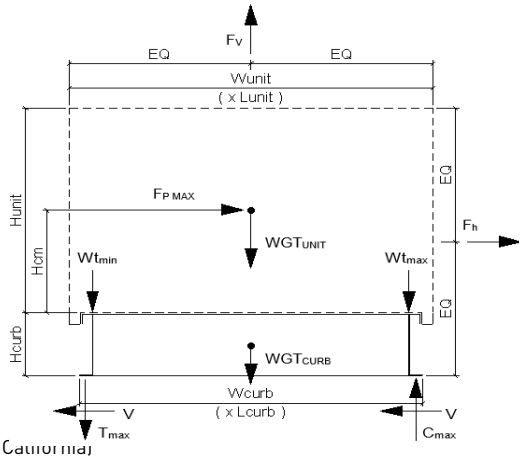
Client:	ProVent PV2206
Description:	CBKDSAV1518 18"
Unit:	Sunchoice AV15-18

Curb Information

Hcurb =	18	in	(Height of curb)
Lcurb =	121.125	in	(Length of curb)
wcurb =	80.125	in	(Width of curb)
WGTcurb =	525	lbs	(Weight of curb)
# Clips long side =	2		# Clips short side = 2

Unit Information

WGTunit =	2380	lbs	(Oper. Weight of Unit)
Wtmax =	655	lbs	(Maximum corner weight)
Wtmin =	506	lbs	(Minimum corner weight)
Hunit =	49.23	in	(Height of unit above curb)
Hcm =	24.615	in	(Height to center of mass)
Lunit =	129.75	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 =	2849	lbs	(0.7*Fpmax) FpmaxASD = 3477 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)
$F_{h\ ASD\ trans}$ =	2055	lbs	= 0.6*qz*GCr*Lunit*(Hunit+Hcurb) (Eq. 29.4-2)
$F_{h\ ASD\ long}$ =	1405	lbs	= 0.6*qz*GCr*Wunit*(Hunit+Hcurb)
$F_{vert\ ASD}$ =	2141	lbs	= 0.6*qz*GCr*Lunit*Wunit (Eq. 29.4-3)

Curb Loading

Transverse:

$Compression_{SEISMIC}$ =	2602	lbs	=[FpmaxASD*Hcm+2*(1+0.14S_{DS})*Wtmax*wcurb]/wcurb
$Tension_{SEISMIC}$ =	591	lbs	=[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*wcurb]/wcurb
$Compression_{WIND}$ =	346	lbs	=[$F_{h\ ASD\ trans}$*Hcm+2*0.6*Wtmax*wcurb-$F_{vert\ ASD}$*wcurb/2]/wcurb
$Tension_{WIND}$ =	1095	lbs	=[$F_{h\ ASD\ trans}$*Hcm-2*0.6*Wtmin*wcurb+$F_{vertASD}$*wcurb/2]/wcurb

---> Negative values indicate opposite load.

Longitudinal:

$Compression_{SEISMIC}$ =	2306	lbs	=[FpmaxASD*Hcm+2*(1+0.14*S_{DS})*Wtmax*Lcurb]/Lcurb
$Tension_{SEISMIC}$ =	295	lbs	=[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*Lcurb]/Lcurb
$Compression_{WIND}$ =	0	lbs	=[$F_{h\ ASD\ long}$*Hcm+2*0.6*Wtmax*Lcurb-$F_{vertASD}$*Lcurb/2]/Lcurb
$Tension_{WIND}$ =	749	lbs	=[$F_{h\ ASD\ long}$*Hcm-2*0.6*Wtmin*Lcurb+$F_{vertASD}$*Lcurb/2]/Lcurb

---> Negative values indicate opposite load.

Governing Reactions:

Transverse:	$Comp_{MAX}$ =	2602	lbs	---> Along long edge of curb.
(on long edge)	$Tens_{MAX}$ =	1095	lbs	---> Along long edge of curb.
Longitudinal:	$Comp_{MAX}$ =	2306	lbs	---> Along short edge of curb.
(on short edge)	$Tens_{MAX}$ =	749	lbs	---> Along short edge of curb.

---> Negative values indicate opposite load.

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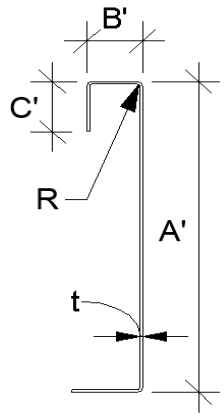
Curb Design

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 in	(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 = 1.424 k (Max Axial Comp) Ωc = 1.80
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)

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

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

Compression Check = **O.K.**

Check Web Crippling

h = 18 in -- Check limits: C = 4.00
t = 0.1017 in h/t = 176.99 ≤ 200 C_R = 0.14
N = 7.00 N/t = 68.83 ≤ 210 C_N = 0.35
Ω_w = 1.75 N/h = 0.388889 ≤ 2.0 C_h = 0.02
P_n = 4.390 k R/t = 1.50 ≤ 9.0 (See table C3.4.1-2, fastened to support, one flange, end loading)
P_n/Ω_w = 2.509 k
Long side: Pu_{Trans} = 1.301 k **O.K.** # clips = 2
Short side: Pu_{Long} = 1.153 k **O.K.** # clips = 2

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

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 = 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 = 869 lbs Max($F_{pmaxASD}$/4 -OR- $Fh_{ASDtrans}$/4 corner connections)
Vcrnmax = 1301 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 = 1.1
# of Bolts Used = [3.0]
Check Combined Stress in Bolts & Inserts: 0.476 **O.K.**

Check 1/8" welded connection

<--- USE WELD Ω = 2.35
Assume L/t > 25: 25*t = 2.543 in
Lreq'd = 0.617 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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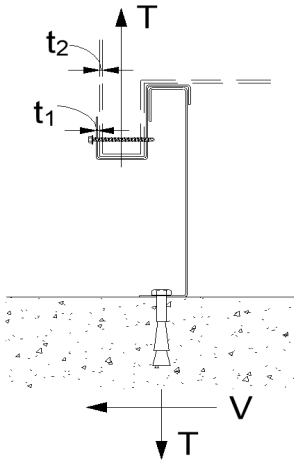
Page ___ of ___

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: | Pns = 3391 #

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

Pns/Ω = 1130 #
Pss/Ω = 540 # <- Controls

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

Tension: Pnot = 1.068 k (screw pull-out strength)
Pnov = 3.718 k (screw pull-over strength)
Pts/Ω = 356 # <- Controls
Pts/Ω = 820 # (full tensile screw capacity)

	Shear (k)	# clips	V_{clip} (k)	V_{allow}(lb)	# screws	spacing
Long side:	2.849	2	1.42	540 #	3	3.00 in
Short side:	2.849	2	1.42	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 = 0.1017 AISI BSR applies
Fy = 50 ksi | Ω = 2.22 bolt/screw connection
Agv = 0.661 in² | Anv = 0.613 in² | Ant = 0.060 in²
Rn/Ω = 10.697 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:	$Uplift_{MAX}$ = 1442 lbs		$Shear_{MAX}$ = 1739 lbs
$Compression_{SEISMIC}$ =	3766 lbs	=[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb	
$Tension_{SEISMIC}$ =	1442 lbs	=[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb	
$Compression_{WIND}$ =	894 lbs	=[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*wcurb/2-$F_{vert\ ASD}$*wcurb/2]/wcurb	
$Tension_{WIND}$ =	1292 lbs	=[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)-0.6*$WGT_{unit+curb}$*wcurb/2+$F_{vertASD}$*wcurb/2]/wcurb	
Longitudinal:	$Uplift_{MAX}$ = 816 lbs		$Shear_{MAX}$ = 1739 lbs
$Compression_{SEISMIC}$ =	3140 lbs	=[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb	
$Tension_{SEISMIC}$ =	816 lbs	=[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb	
$Compression_{WIND}$ =	295 lbs	=[$F_{h\ ASD\ long}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*Lcurb/2-$F_{vert\ ASD}$*Lcurb/2]/Lcurb	
$Tension_{WIND}$ =	694 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 = 2.34 | COMBINED LOADING: 0.985 O.K.
# of Screws Req'd for Shear = 2.59 | Screw Spacing = 28.3 in o.c.
Total # of screws Required = 5

1/4"φ x 3.5" Simpson SDS screws @ 28.3 in o.c. along long side of curb w/ 2.25" threaded embed

Longitudinal:
# of Screws Req'd for Uplift = 1.3 | COMBINED LOADING: 0.978 O.K.
# of Screws Req'd for Shear = 2.6 | Screw Spacing = 24.0 in o.c.
Total # of screws Required = 4

1/4"φ x 3.5" Simpson SDS screws @ 24 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 = 0.69 | COMBINED LOADING: 0.195 O.K.
# of Bolts Req'd for Shear = 0.79 | 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 = 0.39 | COMBINED LOADING: 0.280 O.K.
# of Bolts Req'd for Shear = 0.79 | 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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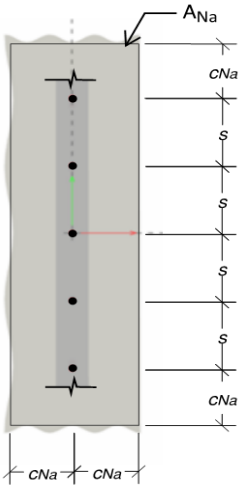
For Concrete anchorage: SEISMIC $(0.6\text{-}0.14S_{DS})D + 0.7\Omega_o E$ Ωo = 2.0

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
***Bond strength will govern over concrete breakout

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

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

A_{Na}= 985.55 in²
A_{Nao}= 328.52 in²
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) $\lambda_a = 1.0$
øNag = 15688 lbs (group) CONTROLS λ_a =1.0 for normal weight conc; 0.6 for lightweig

Breakout strength

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

A_{Nc} = 722.25 in² N_b = 10264 lbs ϕ_{conc} = 0.75
A_{Nco} = 182.25 in² kc = 17 ϕ_{bond} = 0.65
N_{cbg} = 40674 lbs (group) ϕ_{seis} = 0.75
øNcbg = 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: $Uplift_{MAX}$ = 3291 lbs $Shear_{MAX}$ = 3477 lbs

$Compression_{SEISMIC}$ = 5615 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb
$Tension_{SEISMIC}$ = 3291 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb
$Shear_{SEISMIC}$ = 3477 lbs =Ωo*FpmaxASD/2

Min Bolts Req'd Uplift = 1.07 spacing = 54.56 in o.c. Tapplied = 1097.0 lbs
Min Bolts Req'd Shear = 2.00 spacing = 109.13 in o.c. Vapplied = 695.5 lbs

Try using 3 bolts spaced at 54.56 in o.c.

COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{apllied}}{V_{allow,ASD}} \le 1.2$ = 0.75 O.K.

Use 3 - 5/8"ϕ HAS rods in Hilti HIT-HY 200 V3 epoxy @ 54.6 in o.c. max. along long side of curb w/ 4.5in embed

Longitudinal: $Uplift_{MAX}$ = 2039 lbs $Shear_{MAX}$ = 3477 lbs

$Compression_{SEISMIC}$ = 4363 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb
$Tension_{SEISMIC}$ = 2039 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb
$Shear_{SEISMIC}$ = 3477 lbs =Ωo*FpmaxASD/2

Min Bolts Req'd Uplift = 0.67 spacing = 34.06 in o.c. Tapplied = 1019.5 lbs
Min Bolts Req'd Shear = 2.00 spacing = 68.13 in o.c. Vapplied = 695.5 lbs

Try using 2 bolts spaced at 68.13 in o.c.

COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{apllied}}{V_{allow,ASD}} \le 1.2$ = 0.72 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:	CBKDSAV1518		Unit: Sunchoice AV15-18
CURB RAIL THICKNESS:	0.1017 in	12 Gauge	
UNIT CLIP THICKNESS:	0.1017 in	12 Gauge	
# OF CLIPS (LONG SIDE) -	2 clips with 3 - #10 SMS screws each clip		
WEB STIFFENER:	NOT REQUIRED		
# OF CLIPS (SHORT SIDE) -	2 clips with 3 - #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	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	5/8"φ HAS rods in Hilti HIT-HY 200 V3 epoxy w/ 4.5in embed
LONG DIRECTION	5 @ 28.28 in o.c.	3 @ 54.56 in o.c.	3 @ 54.56 in o.c.
SHORT DIRECTION	4 @ 24.04 in o.c.	2 @ 68.13 in o.c.	2 @ 68.13 in o.c.

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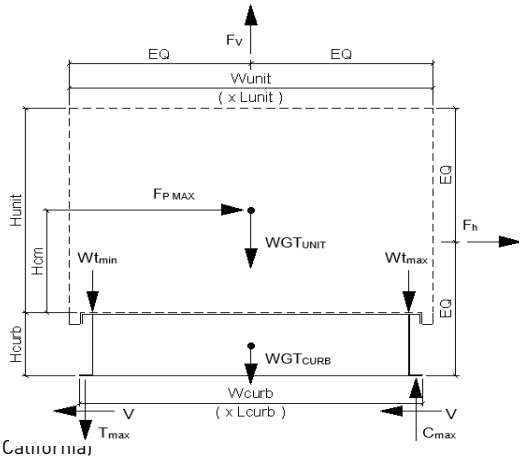
Client:	ProVent PV2206
Description:	CBKDSAV1518 14"
Unit:	Sunchoice AV15-18

Curb Information

Hcurb =	14	in	(Height of curb)
Lcurb =	121.125	in	(Length of curb)
wcurb =	80.125	in	(Width of curb)
WGTcurb =	425	lbs	(Weight of curb)
# Clips long side =	2		# Clips short side = 2

Unit Information

WGTunit =	2380	lbs	(Oper. Weight of Unit)
Wtmax =	655	lbs	(Maximum corner weight)
Wtmin =	506	lbs	(Minimum corner weight)
Hunit =	49.23	in	(Height of unit above curb)
Hcm =	24.615	in	(Height to center of mass)
Lunit =	129.75	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 =	2849	lbs	(0.7*Fpmax) FpmaxASD = 3358 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)
$F_{h\ ASD\ trans}$ =	1932	lbs	= 0.6*qz*GCr*Lunit*(Hunit+Hcurb) (Eq. 29.4-2)
$F_{h\ ASD\ long}$ =	1322	lbs	= 0.6*qz*GCr*Wunit*(Hunit+Hcurb)
$F_{vert\ ASD}$ =	2141	lbs	= 0.6*qz*GCr*Lunit*Wunit (Eq. 29.4-3)

Curb Loading

Transverse:

$Compression_{SEISMIC}$ =	2602	lbs	$=[FpmaxASD*Hcm+2*(1+0.14S_{DS})*Wtmax*wcurb]/wcurb$
$Tension_{SEISMIC}$ =	591	lbs	$=[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*wcurb]/wcurb$
$Compression_{WIND}$ =	308	lbs	$=[F_{h\ ASD\ trans}*Hcm+2*0.6*Wtmax*wcurb-F_{vert\ ASD}*wcurb/2]/wcurb$
$Tension_{WIND}$ =	1057	lbs	$=[F_{h\ ASD\ trans}*Hcm-2*0.6*Wtmin*wcurb+F_{vertASD}*wcurb/2]/wcurb$

---> Negative values indicate opposite load.

Longitudinal:

$Compression_{SEISMIC}$ =	2306	lbs	$=[FpmaxASD*Hcm+2*(1+0.14*S_{DS})*Wtmax*Lcurb]/Lcurb$
$Tension_{SEISMIC}$ =	295	lbs	$=[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*Lcurb]/Lcurb$
$Compression_{WIND}$ =	-17	lbs	$=[F_{h\ ASD\ long}*Hcm+2*0.6*Wtmax*Lcurb-F_{vertASD}*Lcurb/2]/Lcurb$
$Tension_{WIND}$ =	732	lbs	$=[F_{h\ ASD\ long}*Hcm-2*0.6*Wtmin*Lcurb+F_{vertASD}*Lcurb/2]/Lcurb$

---> Negative values indicate opposite load.

Governing Reactions:

Transverse:	$Comp_{MAX}$ =	2602	lbs	---> Along long edge of curb.
(on long edge)	$Tens_{MAX}$ =	1057	lbs	---> Along long edge of curb.
Longitudinal:	$Comp_{MAX}$ =	2306	lbs	---> Along short edge of curb.
(on short edge)	$Tens_{MAX}$ =	732	lbs	---> Along short edge of curb.

---> Negative values indicate opposite load.

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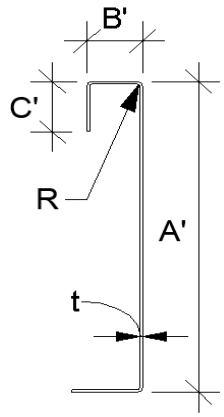
Curb Design

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 in	(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 = 1.424 k (Max Axial Comp) Ωc = 1.80
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)

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

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

Compression Check = **O.K.**

Check Web Crippling

h = 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} = 1.301 k **O.K.** # clips = 2
Short side: Pu_{Long} = 1.153 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 = 839 lbs Max($F_{pmaxASD}$/4 -OR- $Fh_{ASDtrans}$/4 corner connections)
Vcrnmax = 1301 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: 0.472 **O.K.**

Check 1/8" welded connection

<--- USE WELD Ω = 2.35
Assume L/t > 25: 25*t = 1.783 in
Lreq'd = 0.880 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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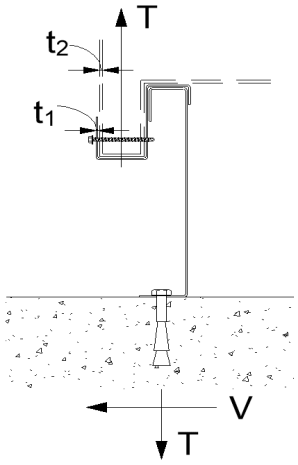
Connection Unit to Curb Clip | #10 SMS screw | Ω = 3.0

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 # | For t2/t1 ≥ 2.5: | 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 | $P_{ns} = 2.7t_1 dF_{u1}$ = 2.38 k

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

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

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

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)

	Shear (k)	# clips	V_{clip} (k)	V_{allow}(lb)	# screws	spacing
Long side:	2.849	2	1.42	540 #	3	3.00 in
Short side:	2.849	2	1.42	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 in² | Anv = 0.430 in² | Ant = 0.042 in²
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:	$Uplift_{MAX}$ = 1224 lbs	$Shear_{MAX}$ = 1679 lbs	
$Compression_{SEISMIC}$ =	3468 lbs	=[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb	
$Tension_{SEISMIC}$ =	1224 lbs	=[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb	
$Compression_{WIND}$ =	702 lbs	=[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*wcurb/2-$F_{vert\ ASD}$*wcurb/2]/wcurb	
$Tension_{WIND}$ =	1160 lbs	=[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)-0.6*$WGT_{unit+curb}$*wcurb/2+$F_{vertASD}$*wcurb/2]/wcurb	
Longitudinal:	$Uplift_{MAX}$ = 677 lbs	$Shear_{MAX}$ = 1679 lbs	
$Compression_{SEISMIC}$ =	2921 lbs	=[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb	
$Tension_{SEISMIC}$ =	677 lbs	=[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb	
$Compression_{WIND}$ =	192 lbs	=[$F_{h\ ASD\ long}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*Lcurb/2-$F_{vert\ ASD}$*Lcurb/2]/Lcurb	
$Tension_{WIND}$ =	651 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 = 1.99 | COMBINED LOADING: 0.897 O.K.
# of Screws Req'd for Shear = 2.50 | Screw Spacing = 28.3 in o.c.
Total # of screws Required = 5

1/4"φ x 3.5" Simpson SDS screws @ 28.3 in o.c. along long side of curb w/ 2.25" threaded embed

Longitudinal:
# of Screws Req'd for Uplift = 1.1 | COMBINED LOADING: 0.899 O.K.
# of Screws Req'd for Shear = 2.5 | Screw Spacing = 24.0 in o.c.
Total # of screws Required = 4

1/4"φ x 3.5" Simpson SDS screws @ 24 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 = 0.59 | COMBINED LOADING: 0.169 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 = 0.32 | COMBINED LOADING: 0.250 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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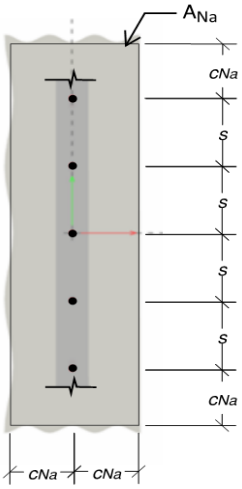
For Concrete anchorage: SEISMIC $(0.6\text{-}0.14S_{DS})D + 0.7\Omega_o E$ Ωo = 2.0

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

***Bond strength will govern over concrete breakout

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

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

A_{Na}=	985.55	in²		
A_{Nao}=	328.52	in²		
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)		λ_a =1.0
øN_{ag} =	15688	lbs (group)	CONTROLS	λ_a =1.0 for normal weight conc; 0.6 for lightweig

Breakout strength

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

A_{Nc} =	722.25	in²	N_b = 10264	lbs	ϕ_{conc} =	0.75
A_{Nco} =	182.25	in²	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:

$Uplift_{MAX}$ =	2842 lbs	$Shear_{MAX}$ =	3358 lbs

$Compression_{SEISMIC}$ = 5086 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb

$Tension_{SEISMIC}$ = 2842 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 = 0.93 spacing = 54.56 in o.c. Tapplied = 947.5 lbs

Min Bolts Req'd Shear = 2.00 spacing = 109.13 in o.c. Vapplied = 671.5 lbs

Try using 3 bolts spaced at 54.56 in o.c.

COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{apllied}}{V_{allow,ASD}} \le 1.2$ = 0.68 O.K.

Use 3 - 5/8"ϕ HAS rods in Hilti HIT-HY 200 V3 epoxy @ 54.6 in o.c. max. along long side of curb w/ 4.5in embed

Longitudinal:

$Uplift_{MAX}$ =	1747 lbs	$Shear_{MAX}$ =	3358 lbs

$Compression_{SEISMIC}$ = 3991 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb

$Tension_{SEISMIC}$ = 1747 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 = 0.57 spacing = 34.06 in o.c. Tapplied = 873.5 lbs

Min Bolts Req'd Shear = 2.00 spacing = 68.13 in o.c. Vapplied = 671.5 lbs

Try using 2 bolts spaced at 68.13 in o.c.

COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{apllied}}{V_{allow,ASD}} \le 1.2$ = 0.66 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: CBKDSAV1518	**Unit:** Sunchoice AV15-18
CURB RAIL THICKNESS: 0.0713 in 14 Gauge **UNIT CLIP THICKNESS:** 0.0713 in 14 Gauge	
# OF CLIPS (LONG SIDE) - 2 clips with 3 - #10 SMS screws each clip **WEB STIFFENER:** NOT REQUIRED	
# OF CLIPS (SHORT SIDE) - 2 clips with 3 - #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	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	5/8"φ HAS rods in Hilti HIT-HY 200 V3 epoxy w/ 4.5in embed
LONG DIRECTION	5 @ 28.28 in o.c.	3 @ 54.56 in o.c.	3 @ 54.56 in o.c.
SHORT DIRECTION	4 @ 24.04 in o.c.	2 @ 68.13 in o.c.	2 @ 68.13 in o.c.