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6593 Riverdale St.
San Diego, CA 92120

619-727-4800

Structural Calculations
for
CBKDSAV2025 Curb

Prepared for:

PROVENT

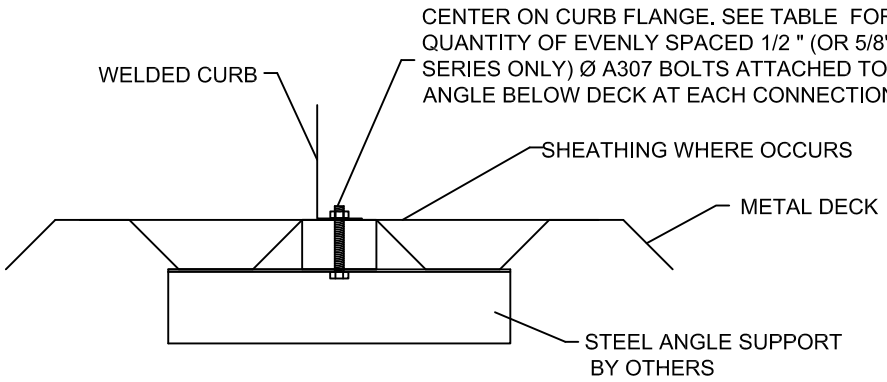
3847 Wabash Drive

Mira Loma, CA 91725

Date: December 19, 2022

Project Number: PV2206

STEEL ATTACHMENT



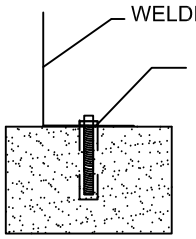
	NO. OF ANCHORAGE BOLTS REQUIRED	
CURB	LONG SIDE	SHORT SIDE
LXS	2 @ 34.5" O.C.	2 @ 19" O.C.
LXL	2 @ 34.5" O.C.	2 @ 29" O.C.
SUN3672	2 @ 60.5" O.C.	2 @ 39" O.C.
PRD3715	2 @ 68.88" O.C.	2 @ 39" O.C.
PRS	2 @ 58.88" O.C.	2 @ 28.69" O.C.
PRL	2 @ 72" O.C.	2 @ 41.5" O.C.
SLU180	3 @ 51.38" O.C.	2 @ 71.5" O.C.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



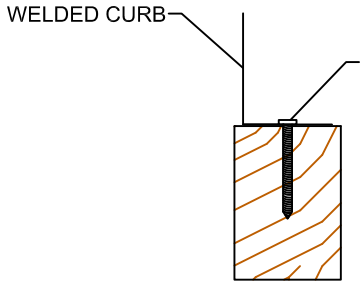
CENTER ON CURB FLANGE. SEE TABLE FOR QUANTITY OF EVENLY SPACED 3/4" Ø THREADED ROD IN HILTI HIT-HY 200 EPOXY WITH 4" EMBED

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

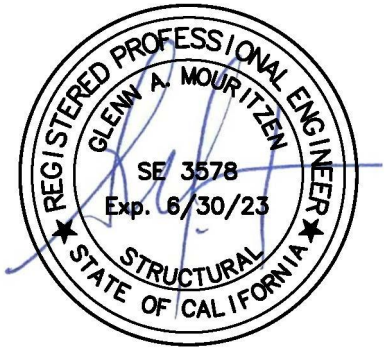


CENTER ON CURB FLANGE. SEE TABLE FOR QUANTITY OF EVENLY SPACED
¼" Ø SIMPSON SDS OR EQUIVALENT SCREWS
(3 ½ " MIN. EMBED. INTO WOOD FRAMING)

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

20-25

ProVent P/N	A	Est. Weight	SEISMIC CLIP P/N:	Est. Weight
CBKDSAV202508	8"	335 Lbs.	KDKITSAV2025	15 Lbs.
CBKDSAV202511	11"	380 Lbs.		
CBKDSAV202514	14"	425 Lbs.		
CBKDSAV202518	18"	525 Lbs.		

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

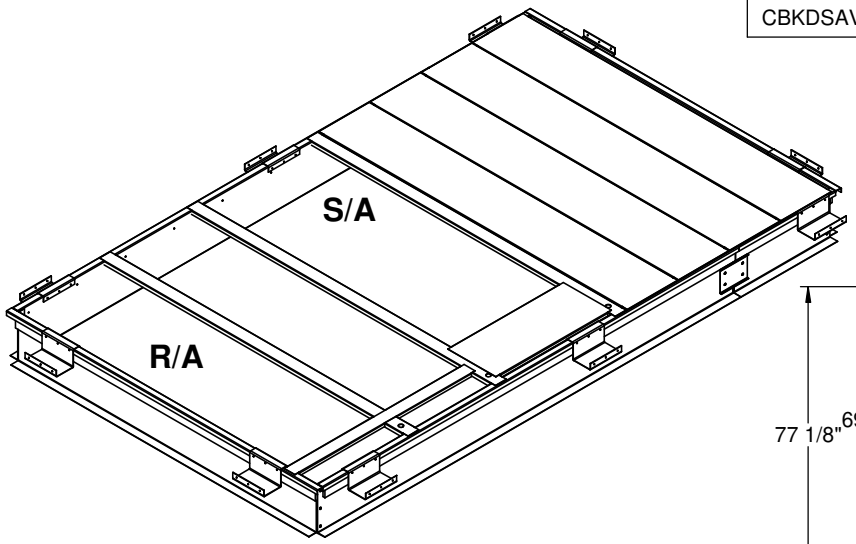
FEATURES

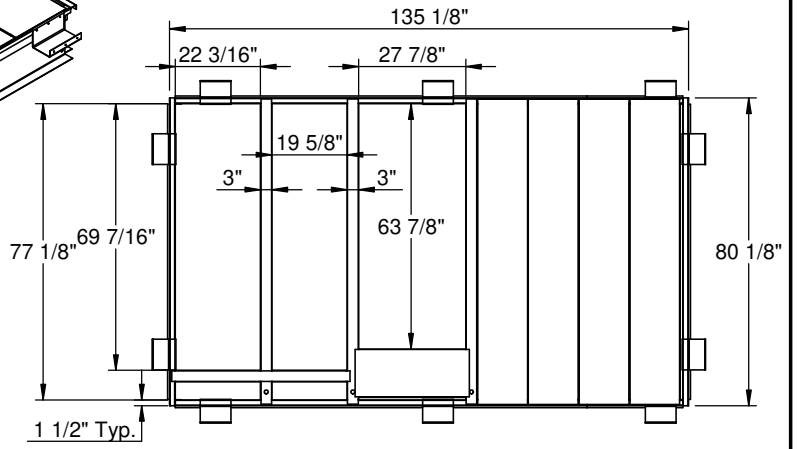
- Roof curb perimeter made of galvanized steel.
- Gasketing package provided.
- Heat treated wood nailer provided.
- Corner flanges are pre-threated for easy bolt on assembly.
- Pitched, adjustable height, welded, different height, isolation and calculated curbs are available.

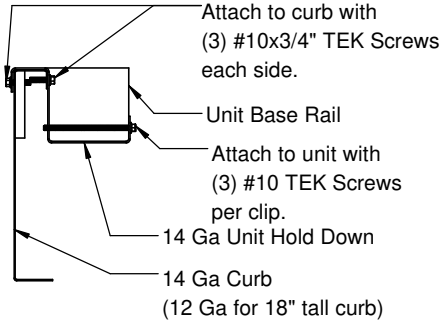
NOTES

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

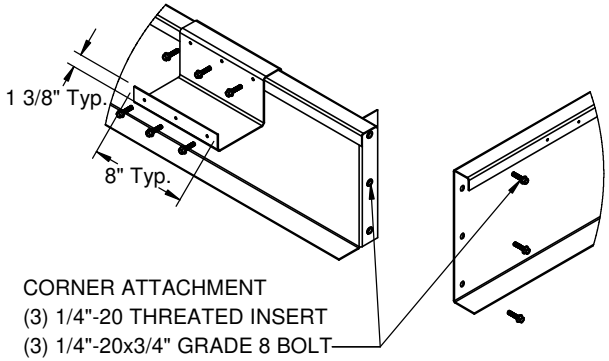
For wood, concrete and steel attachments see Roof Anchorage Detail, Form No. CB-60







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: KDKITSAV2025

DATE:	REV:	DRAWN BY:
11/4/2022	-	JG

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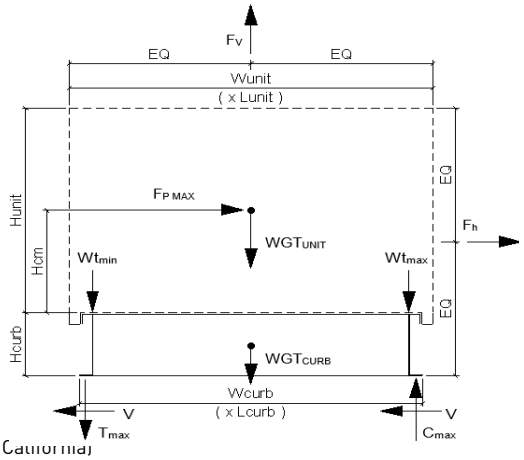
Client:	ProVent PV2206
Description:	CBKDSAV2025 18"
Unit:	Sunchoice AV20-25

Curb Information

Hcurb =	18	in	(Height of curb)
Lcurb =	135.125	in	(Length of curb)
wcurb =	80.125	in	(Width of curb)
WGTcurb =	525	lbs	(Weight of curb)
# Clips long side =	3	# Clips short side =	2

Unit Information

WGTunit =	2640	lbs	(Oper. Weight of Unit)
Wtmax =	726	lbs	(Maximum corner weight)
Wtmin =	561	lbs	(Minimum corner weight)
Hunit =	57.23	in	(Height of unit above curb)
Hcm =	28.615	in	(Height to center of mass)
Lunit =	143.81	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 =	3160	lbs	(0.7*Fpmax) FpmaxASD = 3789 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)
$F_{h\ ASD\ trans}$ =	2548	lbs	= 0.6*qz*GCr*Lunit*(Hunit+Hcurb) (Eq. 29.4-2)
$F_{h\ ASD\ long}$ =	1573	lbs	= 0.6*qz*GCr*Wunit*(Hunit+Hcurb)
$F_{vert\ ASD}$ =	2373	lbs	= 0.6*qz*GCr*Lunit*Wunit (Eq. 29.4-3)

Curb Loading

Transverse:

$Compression_{SEISMIC}$ =	3044	lbs	=[FpmaxASD*Hcm+2*(1+0.14S_{DS})*Wtmax*wcurb]/wcurb
$Tension_{SEISMIC}$ =	814	lbs	=[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*wcurb]/wcurb
$Compression_{WIND}$ =	595	lbs	=[$F_{h\ ASD\ trans}$*Hcm+2*0.6*Wtmax*wcurb-$F_{vert\ ASD}$*wcurb/2]/wcurb
$Tension_{WIND}$ =	1424	lbs	=[$F_{h\ ASD\ trans}$*Hcm-2*0.6*Wtmin*wcurb+$F_{vertASD}$*wcurb/2]/wcurb

---> Negative values indicate opposite load.

Longitudinal:

$Compression_{SEISMIC}$ =	2585	lbs	=[FpmaxASD*Hcm+2*(1+0.14*S_{DS})*Wtmax*Lcurb]/Lcurb
$Tension_{SEISMIC}$ =	354	lbs	=[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*Lcurb]/Lcurb
$Compression_{WIND}$ =	18	lbs	=[$F_{h\ ASD\ long}$*Hcm+2*0.6*Wtmax*Lcurb-$F_{vertASD}$*Lcurb/2]/Lcurb
$Tension_{WIND}$ =	846	lbs	=[$F_{h\ ASD\ long}$*Hcm-2*0.6*Wtmin*Lcurb+$F_{vertASD}$*Lcurb/2]/Lcurb

---> Negative values indicate opposite load.

Governing Reactions:

Transverse:	$Comp_{MAX}$ =	3044	lbs	---> Along long edge of curb.
(on long edge)	$Tens_{MAX}$ =	1424	lbs	---> Along long edge of curb.
Longitudinal:	$Comp_{MAX}$ =	2585	lbs	---> Along short edge of curb.
(on short edge)	$Tens_{MAX}$ =	846	lbs	---> Along short edge of curb.

---> Negative values indicate opposite load.

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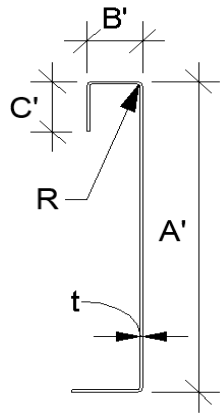
Curb Design

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 = 1.580 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} = 1.015 k **O.K.** # clips = 3
Short side: Pu_{Long} = 1.292 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 = 947 lbs Max($F_{pmaxASD}$/4 -OR- $Fh_{ASDtrans}$/4 corner connections)
Vcrnmax = 1522 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: 0.547 **O.K.**

Check 1/8" welded connection

<--- USE WELD Ω = 2.35
Assume L/t > 25: 25*t = 2.543 in
Lreq'd = 0.721 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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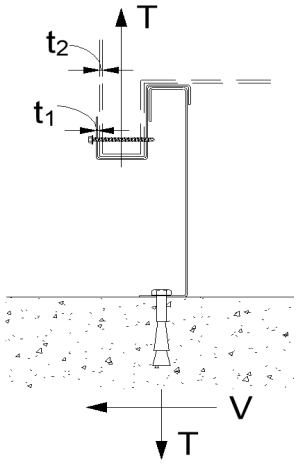
Page ___ of ___

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:	3.160	3	1.05	540 #	2	6.00 in
Short side:	3.160	2	1.58	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 in^2 | Anv = 0.613 in^2 | Ant = 0.060 in^2
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:	$Uplift_{MAX}$ = 1760 lbs	$Shear_{MAX}$ = 1894 lbs	
$Compression_{SEISMIC}$ =	4292 lbs	=[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb	
$Tension_{SEISMIC}$ =	1760 lbs	=[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb	
$Compression_{WIND}$ =	1245 lbs	=[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*wcurb/2-$F_{vert\ ASD}$*wcurb/2]/wcurb	
$Tension_{WIND}$ =	1720 lbs	=[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)-0.6*$WGT_{unit+curb}$*wcurb/2+$F_{vertASD}$*wcurb/2]/wcurb	
Longitudinal:	$Uplift_{MAX}$ = 863 lbs	$Shear_{MAX}$ = 1894 lbs	
$Compression_{SEISMIC}$ =	3395 lbs	=[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb	
$Tension_{SEISMIC}$ =	863 lbs	=[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb	
$Compression_{WIND}$ =	305 lbs	=[$F_{h\ ASD\ long}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*Lcurb/2-$F_{vert\ ASD}$*Lcurb/2]/Lcurb	
$Tension_{WIND}$ =	780 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 = 2.86 | COMBINED LOADING: 0.946 O.K.
# of Screws Req'd for Shear = 2.82 | Screw Spacing = 25.4 in o.c.
Total # of screws Required = 6

1/4"φ x 3.5" Simpson SDS screws @ 25.4 in o.c. along long side of curb w/ 2.25" threaded embed

Longitudinal:
# of Screws Req'd for Uplift = 1.4 | COMBINED LOADING: 0.844 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 = 0.84 | COMBINED LOADING: 0.246 O.K.
# of Bolts Req'd for Shear = 0.86 | Bolt Spacing = 61.6 in o.c.
Total # of Bolts Required = 3

1/2" φ A307 Bolts to steel angle below deck @ 61.6 in o.c. along long side of curb

Longitudinal:
# of Bolts Req'd for Uplift = 0.41 | COMBINED LOADING: 0.319 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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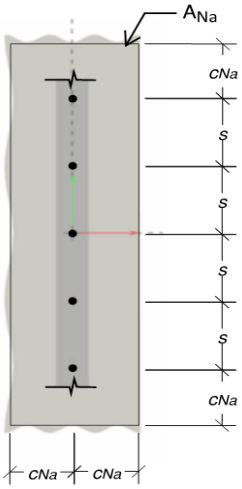
For Concrete anchorage: SEISMIC $(0.6\text{-}0.14S_{DS})D + 0.7\Omega_o E$ Ωo = 2.0

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$_{MAX}$ =	3964 lbs	Shear$_{MAX}$ =	3789 lbs

$Compression_{SEISMIC}$ = 6496 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb

$Tension_{SEISMIC}$ = 3964 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb

$Shear_{SEISMIC}$ = 3789 lbs =Ωo*FpmaxASD/2

Min Bolts Req'd Uplift = 1.29 spacing = 61.56 in o.c. Tapplied = 1321.3 lbs

Min Bolts Req'd Shear = 2.11 spacing = 61.56 in o.c. Vapplied = 757.7 lbs

Try using 3 bolts spaced at 61.56 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 @ 61.6 in o.c. max. along long side of curb w/ 4.5in embed

Longitudinal:

Uplift$_{MAX}$ =	2170 lbs	Shear$_{MAX}$ =	3789 lbs

$Compression_{SEISMIC}$ = 4702 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb

$Tension_{SEISMIC}$ = 2170 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb

$Shear_{SEISMIC}$ = 3789 lbs =Ωo*FpmaxASD/2

Min Bolts Req'd Uplift = 0.71 spacing = 34.06 in o.c. Tapplied = 1084.8 lbs

Min Bolts Req'd Shear = 2.11 spacing = 34.06 in o.c. Vapplied = 757.7 lbs

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

COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{apllied}}{V_{allow,ASD}} \le 1.2$ = 0.78 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: CBKDSAV2025	**Unit:** Sunchoice AV20-25
CURB RAIL THICKNESS: 0.1017 in 12 Gauge **UNIT CLIP THICKNESS:** 0.1017 in 12 Gauge	
# OF CLIPS (LONG SIDE) - 3 clips with 2 - #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	6 @ 25.43 in o.c.	3 @ 61.56 in o.c.	3 @ 61.56 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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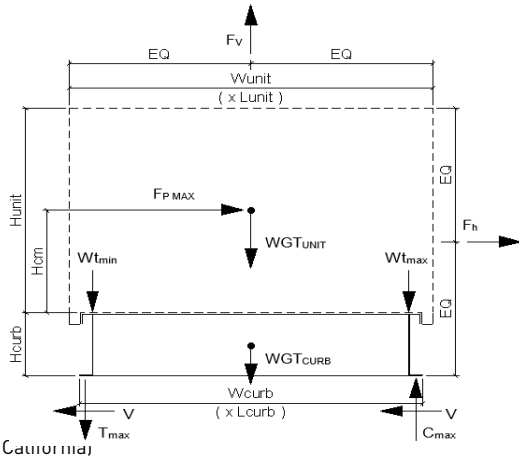
Client:	ProVent PV2206
Description:	CBKDSAV2025 14"
Unit:	Sunchoice AV20-25

Curb Information

Hcurb =	14	in	(Height of curb)
Lcurb =	135.125	in	(Length of curb)
wcurb =	80.125	in	(Width of curb)
WGTcurb =	425	lbs	(Weight of curb)
# Clips long side =	3	# Clips short side =	2

Unit Information

WGTunit =	2640	lbs	(Oper. Weight of Unit)
Wtmax =	726	lbs	(Maximum corner weight)
Wtmin =	561	lbs	(Minimum corner weight)
Hunit =	57.23	in	(Height of unit above curb)
Hcm =	28.615	in	(Height to center of mass)
Lunit =	143.81	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 =	3160	lbs	(0.7*Fpmax) FpmaxASD = 3669 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)
$F_{h\ ASD\ trans}$ =	2413	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)
$F_{vert\ ASD}$ =	2373	lbs	= 0.6*qz*GCr*Lunit*Wunit (Eq. 29.4-3)

Curb Loading

Transverse:

$Compression_{SEISMIC}$ =	3044	lbs	=[FpmaxASD*Hcm+2*(1+0.14S_{DS})*Wtmax*wcurb]/wcurb
$Tension_{SEISMIC}$ =	814	lbs	=[FpmaxASD*Hcm-2*(0.6-0.14S_{DS})*Wtmin*wcurb]/wcurb
$Compression_{WIND}$ =	546	lbs	=[$F_{h\ ASD\ trans}$*Hcm+2*0.6*Wtmax*wcurb-$F_{vert\ ASD}$*wcurb/2]/wcurb
$Tension_{WIND}$ =	1375	lbs	=[$F_{h\ ASD\ trans}$*Hcm-2*0.6*Wtmin*wcurb+$F_{vertASD}$*wcurb/2]/wcurb

---> Negative values indicate opposite load.

Longitudinal:

$Compression_{SEISMIC}$ =	2585	lbs	=[FpmaxASD*Hcm+2*(1+0.14*S_{DS})*Wtmax*Lcurb]/Lcurb
$Tension_{SEISMIC}$ =	354	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
$Tension_{WIND}$ =	829	lbs	=[$F_{h\ ASD\ long}$*Hcm-2*0.6*Wtmin*Lcurb+$F_{vertASD}$*Lcurb/2]/Lcurb

---> Negative values indicate opposite load.

Governing Reactions:

Transverse:	$Comp_{MAX}$ =	3044	lbs	---> Along long edge of curb.
(on long edge)	$Tens_{MAX}$ =	1375	lbs	---> Along long edge of curb.
Longitudinal:	$Comp_{MAX}$ =	2585	lbs	---> Along short edge of curb.
(on short edge)	$Tens_{MAX}$ =	829	lbs	---> Along short edge of curb.

---> Negative values indicate opposite load.

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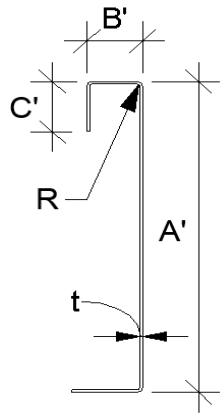
Curb Design

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 = 1.580 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} = 1.015 k **O.K.** # clips = 3
Short side: Pu_{Long} = 1.292 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 = 917 lbs Max($F_{pmaxASD}$/4 -OR- $Fh_{ASDtrans}$/4 corner connections)
Vcrnmax = 1522 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: 0.543 **O.K.**

Check 1/8" welded connection

<--- USE WELD Ω = 2.35
Assume L/t > 25: 25*t = 1.783 in
Lreq'd = 1.029 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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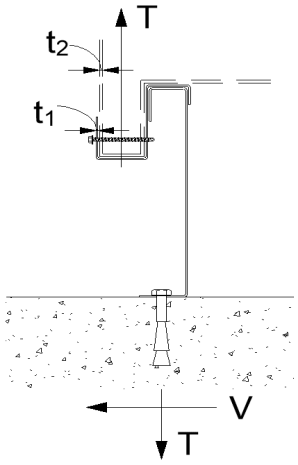
Connection Unit to Curb Clip | #10 SMS screw | Ω = 3.0

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:	3.160	3	1.05	540 #	2	6.00 in
Short side:	3.160	2	1.58	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: (0.6-0.14S_{DS})D + 0.7E | WIND: 0.6D + W

Transverse:	$Uplift_{MAX}$ =	1550 lbs	$Shear_{MAX}$ =	1834 lbs
$Compression_{SEISMIC}$ =	3973 lbs	=[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb		
$Tension_{SEISMIC}$ =	1521 lbs	=[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb		
$Compression_{WIND}$ =	1016 lbs	=[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*wcurb/2-$F_{vert\ ASD}$*wcurb/2]/wcurb		
$Tension_{WIND}$ =	1550 lbs	=[$F_{h\ ASD\ trans}$*(Hcm+Hcurb)-0.6*$WGT_{unit+curb}$*wcurb/2+$F_{vertASD}$*wcurb/2]/wcurb		
Longitudinal:	$Uplift_{MAX}$ =	737 lbs	$Shear_{MAX}$ =	1834 lbs
$Compression_{SEISMIC}$ =	3179 lbs	=[FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb		
$Tension_{SEISMIC}$ =	727 lbs	=[FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*Lcurb/2]/Lcurb		
$Compression_{WIND}$ =	202 lbs	=[$F_{h\ ASD\ long}$*(Hcm+Hcurb)+0.6*$WGT_{unit+curb}$*Lcurb/2-$F_{vert\ ASD}$*Lcurb/2]/Lcurb		
$Tension_{WIND}$ =	737 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 emt** (SGmin = 0.43)

Transverse: $Tall_{metal}$ = 997 lbs | $Vall_{metal}$ = 1097 lbs
$Tall_{wood}$ = 616 lbs | $Vall_{wood}$ = 672 lbs
# of Screws Req'd for Uplift = 2.52 | COMBINED LOADING: 0.874 O.K.
# of Screws Req'd for Shear = 2.73 | Screw Spacing = 25.4 in o.c.
Total # of screws Required = 6

1/4"φ x 3.5" Simpson SDS screws @ 25.4 in o.c. along long side of curb w/ 2.25" threaded embed

Longitudinal:
# of Screws Req'd for Uplift = 1.2 | COMBINED LOADING: 0.785 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**

Transverse: $Tall_{bolt}$ = 3927 lbs | $Vall_{bolt}$ = 2209 lbs
$Tall_{metal}$ = 2086 lbs | $Vall_{metal}$ = 2192 lbs
# of Bolts Req'd for Uplift = 0.74 | COMBINED LOADING: 0.217 O.K.
# of Bolts Req'd for Shear = 0.84 | Bolt Spacing = 61.6 in o.c.
Total # of Bolts Required = 3

1/2" φ A307 Bolts to steel angle below deck @ 61.6 in o.c. along long side of curb

Longitudinal:
# of Bolts Req'd for Uplift = 0.35 | COMBINED LOADING: 0.290 O.K.
# of Bolts Req'd for Shear = 0.84 | 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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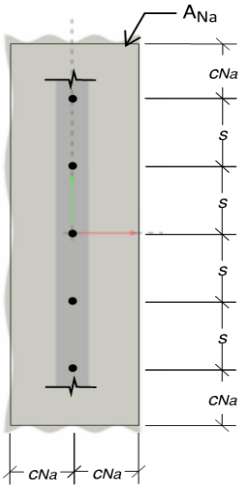
For Concrete anchorage: SEISMIC $(0.6\text{-}0.14S_{DS})D + 0.7\Omega_o E$ Ωo = 2.0

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:

$Uplift_{MAX}$ =	3472 lbs	$Shear_{MAX}$ =	3669 lbs

$Compression_{SEISMIC}$ = 5924 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)+(1+0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb

$Tension_{SEISMIC}$ = 3472 lbs =[Ωo*FpmaxASD*(Hcm+Hcurb)-(0.6-0.14S_{DS})*$WGT_{unit+curb}$*wcurb/2]/wcurb

$Shear_{SEISMIC}$ = 3669 lbs =Ωo*FpmaxASD/2

Min Bolts Req'd Uplift = 1.13 spacing = 61.56 in o.c. Tapplied = 1157.4 lbs

Min Bolts Req'd Shear = 2.04 spacing = 61.56 in o.c. Vapplied = 733.8 lbs

Try using 3 bolts spaced at 61.56 in o.c.

COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{apllied}}{V_{allow,ASD}} \le 1.2$ = 0.79 O.K.

Use 3 - 5/8"ϕ HAS rods in Hilti HIT-HY 200 V3 epoxy @ 61.6 in o.c. max. along long side of curb w/ 4.5in embed

Longitudinal:

$Uplift_{MAX}$ =	1884 lbs	$Shear_{MAX}$ =	3669 lbs

$Compression_{SEISMIC}$ = 4336 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

$Shear_{SEISMIC}$ = 3669 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 = 2.04 spacing = 34.06 in o.c. Vapplied = 733.8 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: CBKDSAV2025	**Unit:** Sunchoice AV20-25
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: 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	6 @ 25.43 in o.c.	3 @ 61.56 in o.c.	3 @ 61.56 in o.c.
SHORT DIRECTION	5 @ 18.03 in o.c.	2 @ 68.13 in o.c.	2 @ 68.13 in o.c.