



**MOUR GROUP**  
ENGINEERING + DESIGN

6593 Riverdale St.  
San Diego, CA 92120

619-727-4800

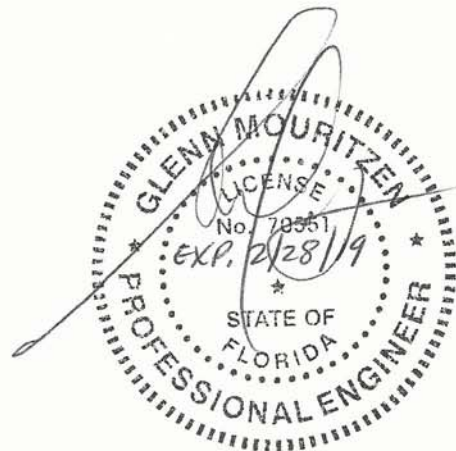
## **Structural Calculations**

**for**

## **CBKD-95 Roof Curb**

Kit #80-266-29\*\*

2017 Florida Building Code requirements



**Prepared for:**

**PROVENT**

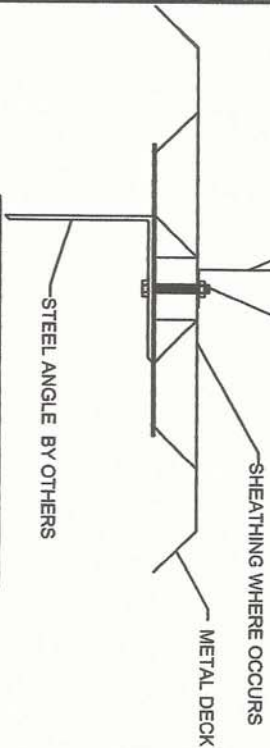
3847 Wabash Drive  
Mira Loma, CA 91725

**Date: June 15, 2018**

**Project Number: PV1807**

**STEEL ATTACHMENT**

CENTER ON CURB FLANGE. SEE TABLE FOR QUANTITY OF EVENLY SPACED 5/8" Ø A307 BOLTS ATTACHED TO STEEL ANGLE BELOW DECK AT EACH CONNECTION POINT.



CURB KIT	NO. OF ANCHORAGE BOLTS REQUIRED LONG SIDE *	SHORT SIDE *	UNIT
80-266-49	2 @ 34.5" o.c.	2 @ 19" o.c.	LXS
80-266-50	2 @ 34.5" o.c.	2 @ 29" o.c.	LXL
80-266-13	2 @ 61" o.c.	2 @ 25.3" o.c.	SUNLINE 3-6 TON
80-266-45	2 @ 58.4" o.c.	2 @ 28.2" o.c.	PRESTIGE SMALL
80-266-46	2 @ 72" o.c.	2 @ 41" o.c.	PRESTIGE LARGE
80-266-29	3 @ 34.7" o.c.	2 @ 39.5" o.c.	PREDATOR
80-266-19	3 @ 51.6" o.c.	2 @ 72" o.c.	ULTRA
80-266-18	4 @ 38.1" o.c.	3 @ 38" o.c.	SUNLINE 15-25 TON

**WIND AND SEISMIC LOAD ROOF ANCHORAGE DETAIL**

Meets wind, seismic requirements for the following codes:  
FBC 2017  
based on ASCE 7-10.

**Wind:**  
190 mph exposure D category III or IV building, max BLDG height: 60 ft  
Kzt=1.00 max

**Seismic:**  
Sds=0.30 max  
Sd1=0.187 max  
Site Class D  
Importance Factor: Ip=1.5

**CONCRETE ATTACHMENT**

CENTER ON CURB FLANGE. SEE TABLE FOR QUANTITY OF EVENLY SPACED 3/4" Ø THRD'D ROD IN HILTI HIT-HY 200 EPOXY, 4" MIN. EMBED INTO CONCRETE.

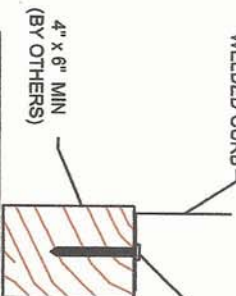


- NORMAL WEIGHT CONC SLAB
- f'c=4000 PSI MIN
- 6" MIN THICK CONC.
- SPECIAL INSPECTION REQUIRED (ESR-3187)

CURB KIT	NO. OF ANCHORAGE BOLTS REQUIRED LONG SIDE *	SHORT SIDE **	UNIT
80-266-49	5 @ 8.6" o.c.	4 @ 6.3" o.c.	LXS
80-266-50	5 @ 8.6" o.c.	5 @ 7.25" o.c.	LXL
80-266-13	9 @ 7.63" o.c.	6 @ 5.1" o.c.	SUNLINE 3-6 TON
80-266-45	6 @ 11.7" o.c.	4 @ 9.4" o.c.	PRESTIGE SMALL
80-266-46	6 @ 14.4" o.c.	5 @ 10.25" o.c.	PRESTIGE LARGE
80-266-29	16 @ 4.63" o.c.	10 @ 4.4" o.c.	PREDATOR
80-266-19	15 @ 7.4" o.c.	12 @ 6.5" o.c.	ULTRA
80-266-18	22 @ 5.4" o.c.	17 @ 4.5" o.c.	SUNLINE 15-25 TON

**WOOD ATTACHMENT**

CENTER ON CURB FLANGE. SEE TABLE FOR QUANTITY OF EVENLY SPACED 5/8" Ø WOOD LAG SCREWS (3.5" MIN. EMBED. INTO WOOD FRAMING)

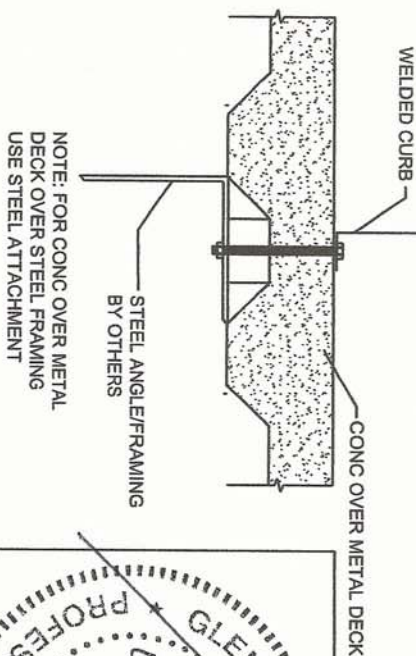


CURB KIT	NO. OF ANCHORAGE SCREWS REQUIRED LONG SIDE	SHORT SIDE	UNIT
80-266-49	5 @ 9.6" o.c.	3 @ 11.5" o.c.	LXS
80-266-50	5 @ 9.6" o.c.	5 @ 8.3" o.c.	LXL
80-266-13	8 @ 9.3" o.c.	4 @ 9.8" o.c.	SUNLINE 3-6 TON
80-266-45	6 @ 12.5" o.c.	3 @ 16.1" o.c.	PRESTIGE SMALL
80-266-46	6 @ 15.2" o.c.	4 @ 15" o.c.	PRESTIGE LARGE
80-266-29	14 @ 5.6" o.c.	7 @ 7.3" o.c.	PREDATOR
80-266-19	15 @ 7.7" o.c.	12 @ 6.9" o.c.	ULTRA
80-266-18	23 @ 5.4" o.c.	14 @ 5.8" o.c.	SUNLINE 15-25 TON

FOUR INCHES FROM EACH CORNER EVENLY SPACED.

**STEEL AND CONCRETE ANCHORS ARE 6" FROM EACH CORNER EVENLY SPACED**

**CONCRETE OVER METAL DECK**



NOTE: FOR CONC OVER METAL DECK OVER STEEL FRAMING USE STEEL ATTACHMENT

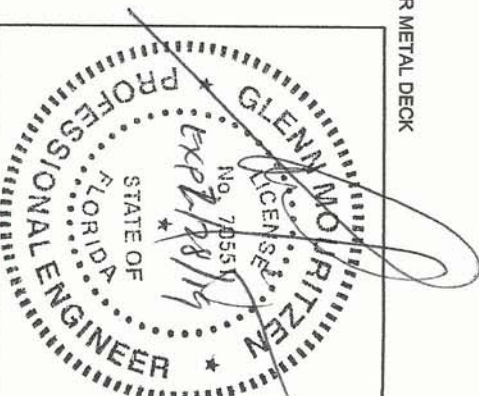


3847 WABASH DR.  
MIRA LOMA, CA 91725  
PHONE (951) 685-1101  
FAX (619) 872-9799

SUBMITTED TO: \_\_\_\_\_  
COMPANY: \_\_\_\_\_  
JOB NAME: \_\_\_\_\_  
EQUIPMENT: \_\_\_\_\_  
NOTES: \_\_\_\_\_

FORM NO: CB-25  
DATE: 06/06/18  
REV: 7

DRAWN BY: ALL





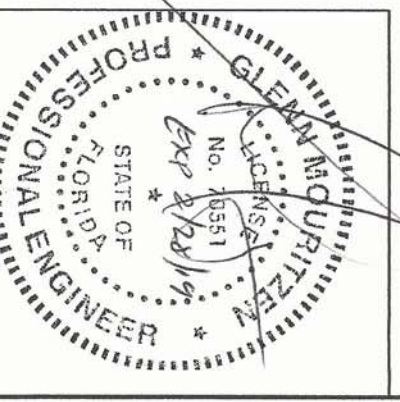
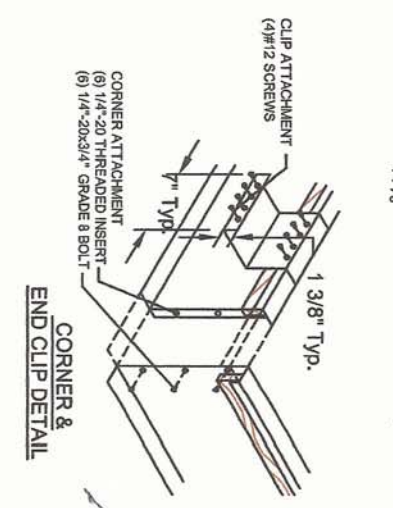
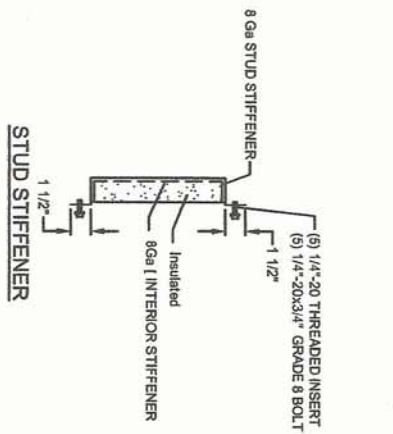
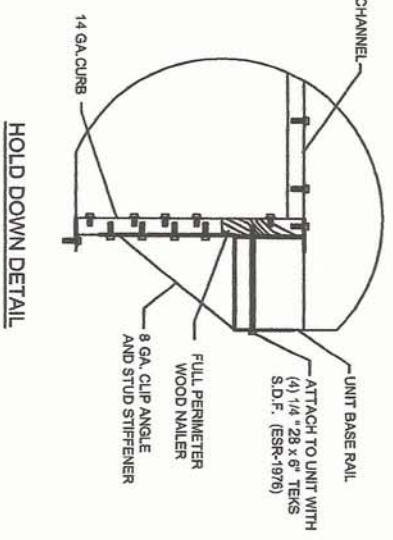
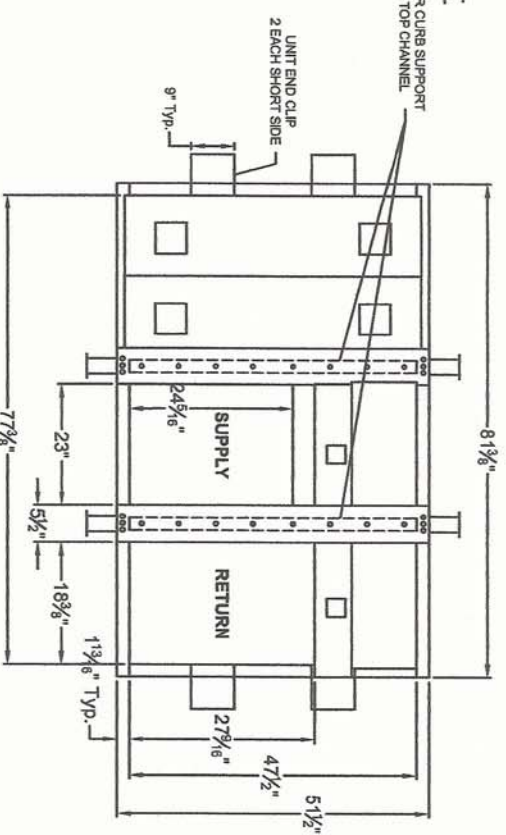
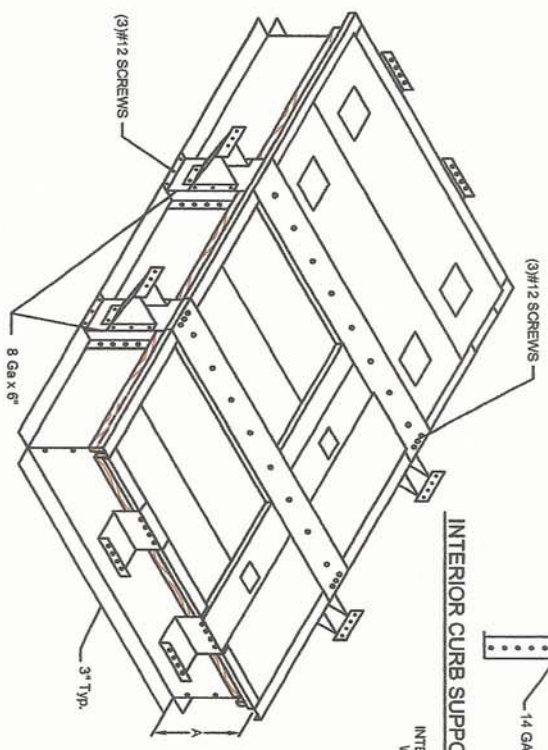
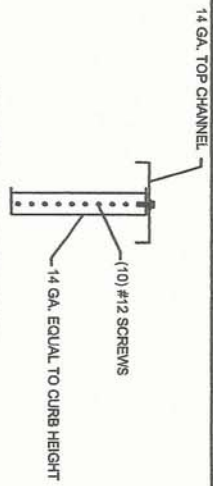
For wood, concrete and steel attachments see Roof Anchorage Detail, Form No. CB-25.

Will conform to wind load code requirements for knock-down or pre-assembled application. (Contact factory for assembled version.)

**CALCULATED WIND AND SEISMIC ROOF CURBS FOR YORK UNITS**

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

Provent P/N	A	WEIGHT	CALCULATED KIT P/N	WEIGHT
80-268-2914	14"	201 Lbs	80-268-2914	69 Lbs
80-268-2918	18"	260 Lbs	80-268-2918	90 Lbs



185 mph exposure D category III or IV building, max BLDG height: 80 ft  
**Wind:**  
 based on ASCE 7-10.  
**Seismic:**  
 Sds=0.30 max  
 Sd1=0.187 max  
 Site Class E  
 Importance Factor: Ip=1.5



3847 WABASH DR.  
MIRA LOMA, CA 91725  
PHONE (951) 685-1101  
FAX (619) 872-9799

SUBMITTED TO: \_\_\_\_\_  
 COMPANY: \_\_\_\_\_  
 JOB NAME: \_\_\_\_\_  
 EQUIPMENT: \_\_\_\_\_  
 NOTES: \_\_\_\_\_

FORM NO: CBKD-95  
 DATE: 6/12/18  
 REV: 4

PART NUMBER: 80-266-29  
 DRAWN BY: JG



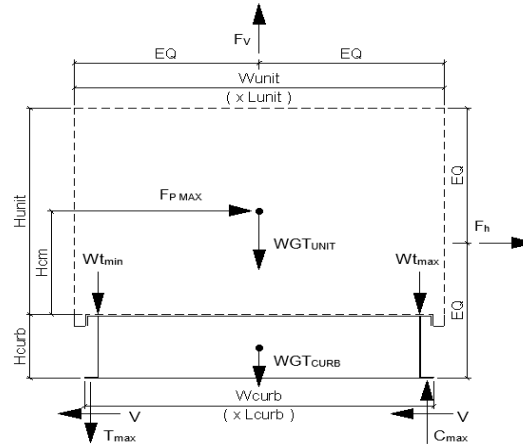
Client: **ProVent PV1807**  
Description: **CBKD-95 (80-266-29\*\*)**  
Unit: **ZR,ZJ,ZH 037-150 / ZF,XP 078-150**

**Curb Information**

Hcurb = **18** in (Height of curb)  
Lcurb = **81.375** in (Length of curb)  
wcurb = **51.5** in (Width of curb)  
WGTcurb = **350** lbs (Weight of curb)

**Unit Information**

WGTunit = **1253** lbs (Weight of Unit)  
Wtmax = **381** lbs (Maximum corner weight)  
Wtmin = **251** lbs (Minimum corner weight)  
Hunit = **50.75** in (Height of unit above curb)  
Hcm = **25.375** in (Height to center of mass)  
Lunit = **119.5** in (Length of unit)  
Wunit = **59** in (Width of unit)



**Seismic Loading - 2017 FBC/2015 IBC**

Ss = **0.15** (Worst Case for state of Florida)  
Fa = **2.5** (Worst case Site class E from Table 11.4-1 ASCE 7-10)  
Sms = **0.375** (Fa\*Ss)  
Sds = **0.250** (2/3\*Sms)  
Ip = **1.5** (Importance Factor Category III or IV Building)  
Fpmax = **0.6000** Wp (1.6\*Sds\*Ip)\*Wp  
FpmaxASD = **526** lbs (0.7\*Fpmax)  
FpmaxASD = **673** lbs (unit and curb)  
(unit only)

**Wind Loading - 2017 FBC/2015 IBC**

\*\*\* Exposure Category D \*\*\*  
Kz = **1.31** (For 60 ft roof height, Exposure D - Table 29.3-1 ACSE 7-10)  
Kzt = **1.66** (Max. assumed topographic factor)  
Kd = **0.85** (Directionality factor Table 26.6-1 ASCE 7-10)  
V = **190** (Wind velocity, mph for Occupancy Cat III-IV bldgs Exp. Cat D)  
GCr(horiz) = **1.9** (Refer Sect 29.5.1 ASCE 7-10)  
GCr(vert) = **1.5** (Refer Sect 29.5.1 ASCE 7-10)  
qz = **170.8** psf = 0.00256\*Kz\*Kzt\*Kd\*V<sup>2</sup> (Eq. 29.3-1 ASCE 7-10)  
Fh ASD trans = **11110** lbs = 0.6\*qz\*GCr\*Lunit\*(Hunit+Hcurb) (Eq. 29.5-2)  
Fh ASD long = **5485** lbs = 0.6\*qz\*GCr\*Wunit\*(Hunit+Hcurb)  
Fvert ASD = **7527** lbs = 0.6\*qz\*GCr\*Lunit\*Wunit (Eq. 29.5-3)

**Curb Loading**

**Transverse:**  
Compression<sub>SEISMIC</sub> = **1048** lbs = [FpmaxASD\*Hcm+2\*(1+0.14S<sub>DS</sub>)\*Wtmax\*wcurb]/wcurb  
Tension<sub>SEISMIC</sub> = **340** lbs = Comp<sub>SEISMIC</sub>-(0.6-0.14S<sub>DS</sub>)\*WGTunit  
Compression<sub>WIND</sub> = **2168** lbs = [F<sub>h trans ASD</sub>\*Hcm+2\*0.6\*Wtmax\*wcurb-F<sub>vert ASD</sub>\*wcurb/2]/wcurb  
Tension<sub>WIND</sub> = **8943** lbs = Comp<sub>WIND</sub>+Fvert-0.6\*WGTunit  
---> Negative values indicate Compression load rather than Tension.  
**Longitudinal:**  
Compression<sub>SEISMIC</sub> = **953** lbs = [FpmaxASD\*Hcm+2\*(1+0.14\*S<sub>DS</sub>)\*Wtmax\*Lcurb]/Lcurb  
Tension<sub>SEISMIC</sub> = **245** lbs = Comp<sub>SEISMIC</sub>-(0.6-0.14S<sub>DS</sub>)\*WGTunit  
Compression<sub>WIND</sub> = **-1596** lbs = [F<sub>h trans ASD</sub>\*Hcm+2\*0.6\*Wtmax\*Lcurb-F<sub>vert ASD</sub>\*Lcurb/2]/Lcurb  
Tension<sub>WIND</sub> = **5180** lbs = Comp<sub>WIND</sub>+Fvert-0.6\*WGTunit  
---> Negative values indicate Compression load rather than Tension.

**Governing Reactions:**

<b>Transverse:</b> (on long edge)	Comp <sub>MAX</sub> = <b>2168</b> lbs	---> Along long edge of curb.
	Tens <sub>MAX</sub> = <b>8943</b> lbs	---> Along long edge of curb.
<b>Longitudinal:</b> (on short edge)	Comp <sub>MAX</sub> = <b>953</b> lbs	---> Along short edge of curb.
	Tens <sub>MAX</sub> = <b>5180</b> lbs	---> Along short edge of curb.

---> Negative values indicate Compression load rather than Tension.

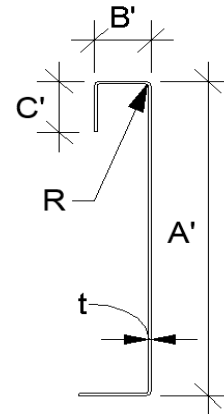


**Curb Design**

F<sub>y</sub> = 50 ksi      F<sub>u</sub> = 65 ksi      t = 0.0713 14 Gauge  
E = 29500 ksi

**Calculate Section Properties of Curb**

A' = <span style="border: 1px solid black; padding: 2px;">18.000</span> in	a = 17.644 in = A' - (2r + t)
B' = <span style="border: 1px solid black; padding: 2px;">3.000</span> in	a' = 17.929 in = A' - t
C' = <span style="border: 1px solid black; padding: 2px;">1.000</span> in (0 if no lips)	b = 2.644 in = B' - [r + t/2 + a(r + t/2)]
α = <span style="border: 1px solid black; padding: 2px;">1.000</span> (0 - no Lip; 1 w/ lip)	b' = 2.929 in = B' - [t/2 + αt/2]
R = 0.1069 (Inside bend radius)	c = 0.822 in = a[C' - (r + t/2)]
t = 0.0713 in	c' = 0.964 in = a[C' - t/2]
r' = 0.143 in = R + t/2	u = 0.224 in = πr/2
x = 0.544 in (Distance between centroid and web centerline)	
I <sub>x</sub> = 76.324 in (Moment of Inertia about X-Axis)	
I <sub>y</sub> = 1.759 in (Moment of Inertia about Y-Axis)	
A = 1.82 in <sup>2</sup>	
r <sub>x</sub> = 6.48 in	
r <sub>y</sub> = 0.984 in	
r <sub>min</sub> = 0.984 in	



**Axial Compression**

P <sub>u</sub> = 5.555 k	(Max Axial Comp)	Ω <sub>c</sub> = 1.80
P <sub>n</sub> /Ω <sub>c</sub> = 36.083 k		
F <sub>e</sub> = 62.46 ksi	$\frac{P_n}{\Omega_c} = \frac{F_n A}{\Omega_c}$	$\lambda_c = \sqrt{\frac{F_y}{F_e}}$
λ <sub>c</sub> = 0.89	$\frac{P_n}{\Omega_c} = \frac{F_n A}{\Omega_c}$	$F_e = \frac{\pi^2 E}{(kl/r)^2}$
F <sub>n</sub> = 35.76 ksi	$\frac{P_n}{\Omega_c} = \frac{F_n A}{\Omega_c}$	
L <sub>y</sub> = 84 in	Lateral unbraced length	
k <sub>y</sub> L <sub>y</sub> /r <sub>y</sub> = 68	(assume k=0.8)	

**Compression Check = O.K.**

**Check Web Crippling**

h = 18 in	-- Check limits:	C = 4.00	} (See table C3.4.1-2, fastened to support, one flange, end loading)
t = 0.0713 in	h/t = 252.45 ≤ 200	C <sub>R</sub> = 0.14	
N = 7.00	N/t = 98.18 ≤ 210	C <sub>N</sub> = 0.35	
Ω <sub>w</sub> = 1.75	N/h = 0.388889 ≤ 2.0	C <sub>h</sub> = 0.02	
P <sub>n</sub> = 2.296 k	R/t = 1.50 ≤ 9.0		
P <sub>n</sub> /Ω <sub>w</sub> = 1.312 k			
Long side: P <sub>uTrans</sub> = 1.084 k	<b>O.K.</b> # clips = 2	$P_n = Ct^2 F_y \sin(90) \left(1 - C_R \sqrt{\frac{R}{t}}\right) \left(1 + C_N \sqrt{\frac{N}{t}}\right) \left(1 - C_h \sqrt{\frac{h}{t}}\right)$	
Short side: P <sub>uLong</sub> = 0.476 k	<b>O.K.</b> # clips = 2		

**\*\*\*h/t > 200; use web stiffeners**

**Check Web Stiffener**

16Ga x 3/4" x 7" [C-channel]

width of stiffener = 7.000 in	ts = 0.0566 <span style="border: 1px solid black; padding: 2px;">16 Gauge</span>
web of stiff. w = 6.717 in	Rs = 0.0849 in
***Check w/ts ≤ 1.28√E/F <sub>y</sub>	Ω <sub>c</sub> = 1.70
w/ts = 118.675	
1.28√(E/F <sub>y</sub> ) = 31.091	--> w/ts over limit Use C3.7.2
P <sub>n</sub> = 0.7(P <sub>wc</sub> + A <sub>e</sub> F <sub>y</sub> ) ≥ P <sub>wc</sub>	
P <sub>wc</sub> = 2.296 k	A <sub>e</sub> = 0.380 in <sup>2</sup>
P <sub>n</sub> = 14.913 k	P <sub>n</sub> /Ω = 8.773 k

**O.K.**

**Corner Connections**

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

T <sub>crnmax</sub> = 2778 lbs	Max(F <sub>pmaxASD</sub> /4 -OR- F <sub>hASDtrans</sub> /4 corner connections)
V <sub>crnmax</sub> = 4472 lbs	(Max Ten/2 corner connections per side)
Bolt: Tall = <span style="border: 1px solid black; padding: 2px;">2480</span> lbs	Vall = <span style="border: 1px solid black; padding: 2px;">1096</span> lbs
Threaded Insert: Tall = <span style="border: 1px solid black; padding: 2px;">2860</span> lbs	Vall = <span style="border: 1px solid black; padding: 2px;">1714</span> lbs
# of Bolts required for Tension = 1.1	
# of Bolts required for Shear = 4.1	
# of Bolts Used = <span style="border: 1px solid black; padding: 2px;">5.0</span>	***If combined fails: USE --> 6.0
Check Combined Stress in Bolts & Inserts: 1.040 <b>N.G.</b>	StressComb = 0.867 <b>O.K.</b>

**Check 1/8" welded connection**

<--- USE WELD      Ω = 2.35

Assume L/t > 25: 25*t = 1.783 in	$\frac{P_n}{\Omega} = \frac{1}{\Omega} 0.75tLF_u \geq V_{req}$	$L_{req'd} = \frac{V_{req}\Omega}{0.75tF_u}$
L <sub>req'd</sub> = 3.023 in		



### Connection Unit to Curb Clip

#14 SMS screw

$\Omega = 3.0$

$t_1 = 0.0713$  in

$F_{u1} = 65$  ksi

$t_2 = 0.1017$  in (unit base rail thickness)

$F_{u2} = 65$  ksi

$d = 0.242$  in (screw diameter)

$d_w = 0.500$  in (nom. washer diameter)

$t_2/t_1 = 1.4$

For  $t_2/t_1 \leq 1.0$ :

**Shear:**  $P_{ns} = 4.2F_{u2}\sqrt{t_2^3d}$  3028 # 4.36 k

$P_{ns} = 2.7t_1dF_{u1}$  3.03 k

$P_{ns} = 2.7t_2dF_{u2}$  4.32 k

$P_{ns}/\Omega = 1009$  # <- Controls

$P_{ss}/\Omega = 1045$  #

**Tension:**

$P_{not} = 1.360$  k (screw pull-out strength)

$P_{nov} = 3.476$  k (screw pull-over strength)

$P_{ts}/\Omega = 453$  # <- Controls

$P_{ts}/\Omega = 1220$  #

(full tensile screw capacity)

For  $t_2/t_1 \geq 2.5$ :

$P_{ns} = 3028$  #

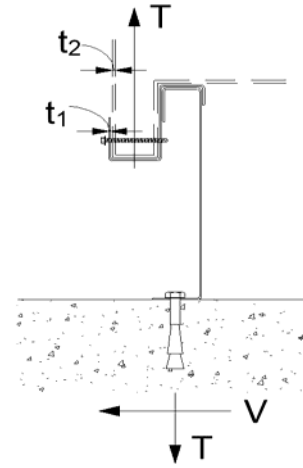
$P_{ns} = 2.7t_1dF_{u1}$  3.03 k

$P_{ns} = 2.7t_2dF_{u2}$  4.32 k

$P_{not} = 0.85t_c dF_{u2}$

$t_c = \min(t_1, t_2)$

$P_{nov} = 1.5t_1 d_w F_{u1}$



	Shear (k)	# clips	$V_{clip}$ (k)	$V_{allow}$ (lb)	# screws	spacing
Long side:	11.110	2	5.56	1009 #	6	1.20 in
Short side:	5.485	2	2.74	1009 #	3	3.00 in

clip width (in) = 7.00

clip height = 2.5 in

min spacing = 0.73 in

edge distance = 0.5 in (min. 1.5d)

Check Block shear rupture: O.K.

thinnest part = 0.0713 AISI BSR applies

$F_y = 50$  ksi

$\Omega = 2.22$  bolt/screw connection

$A_{gv} = 0.463$  in<sup>2</sup>

$A_{nv} = 0.369$  in<sup>2</sup>

$A_{nt} = 0.080$  in<sup>2</sup>

$R_n/\Omega = 8.620$  k

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

(AISI Sect. E5.3)

**BSR O.K.**

### Connection of Curb to Supporting Structure

**Roof Loading**

SEISMIC: (0.6-0.14SDS)D + 0.7E

WIND: 0.6D + W

	Uplift <sub>MAX</sub>	Shear <sub>MAX</sub>
Transverse:	12640 lbs	5555 lbs
Compression <sub>SEISMIC</sub>	1397 lbs	$= [F_{pmaxASD} * (H_{cm} + H_{curb}) + (1 + 0.14S_{DS}) * (WGT_{unit+curb}/2) * w_{curb}] / w_{curb}$
Tension <sub>SEISMIC</sub>	491 lbs	$= Comp_{SEISMIC} - (0.6 - 0.14S_{DS}) * (WGT_{unit+curb})$
Compression <sub>WIND</sub>	6075 lbs	$= [F_{htransASD} * (H_{cm} + H_{curb}) + 0.6 * (WGT_{unit+curb}/2) * w_{curb} - F_{vertASD} * w_{curb}/2] / w_{curb}$
Tension <sub>WIND</sub>	12640 lbs	$= [F_{htransASD} * (H_{cm} + H_{curb}) - 0.6 * (WGT_{unit+curb}/2) * w_{curb} + F_{vertASD} * w_{curb}/2] / w_{curb}$
Longitudinal:	6207 lbs	2743 lbs
Compression <sub>SEISMIC</sub>	1188 lbs	$= [F_{pmaxASD} * (H_{cm} + H_{curb}) + (1 + 0.14S_{DS}) * (WGT_{unit+curb}/2) * L_{curb}] / L_{curb}$
Tension <sub>SEISMIC</sub>	283 lbs	$= Comp_{SEISMIC} - (0.6 - 0.14S_{DS}) * (WGT_{unit+curb})$
Compression <sub>WIND</sub>	-359 lbs	$= [F_{htransASD} * (H_{cm} + H_{curb}) + 0.6 * (WGT_{unit+curb}/2) * L_{curb} - F_{vertASD} * L_{curb}/2] / L_{curb}$
Tension <sub>WIND</sub>	6207 lbs	$= [F_{htransASD} * (H_{cm} + H_{curb}) - 0.6 * (WGT_{unit+curb}/2) * L_{curb} + F_{vertASD} * L_{curb}/2] / L_{curb}$

**Wood Attachment:**

Use 5/8"  $\phi$  wood lag screws

w/ 3.5" Min. Embed

Transverse:	$T_{allmetal} = 946.67$ lbs	$V_{allmetal} = 1043.33$ lbs
	$T_{allwood} = 1195.95$ lbs	$V_{allwood} = 1024$ lbs
# of Screws Req'd for Uplift =	13.35	COMBINED LOADING: 0.832 O.K.
# of Screws Req'd for Shear =	5.42	Screw Spacing = 5.6 in o.c.
Total # of screws Required =	14	

Use 5/8"  $\phi$  wood lag screws @ 5.6 in o.c. along long side of curb w/ 3.5" Min. Embed

Longitudinal:

# of Screws Req'd for Uplift =	6.6	COMBINED LOADING: 0.809 O.K.
# of Screws Req'd for Shear =	2.7	Screw Spacing = 7.3 in o.c.
Total # of screws Required =	7	

Use 5/8"  $\phi$  wood lag screws @ 7.3 in o.c. along short side of curb w/ 3.5" Min. Embed

**Steel Deck Attachment:**

Use 5/8"  $\phi$  A307 Bolts attached to steel angle below deck

Transverse:	$T_{allbolt} = 6903$ lbs	$V_{allbolt} = 3682$ lbs
	$T_{allbolt} = 6903$ lbs	$V_{allbolt} = 3682$ lbs
# of Bolts Req'd for Uplift =	1.83	COMBINED LOADING: 0.757 O.K.
# of Bolts Req'd for Shear =	1.51	Bolt Spacing = 34.7 in o.c.
Total # of Bolts Required =	3	

Use 5/8"  $\phi$  A307 Bolts attached to steel angle below deck @ 34.7 in o.c. along long side of curb

Longitudinal:

# of Bolts Req'd for Uplift =	0.90	COMBINED LOADING: 0.457 O.K.
# of Bolts Req'd for Shear =	0.74	Req'd Min Spacing = 39.5 in o.c.
Total # of Bolts Required =	2	

Use 5/8"  $\phi$  A307 Bolts attached to steel angle below deck @ 39.5 in o.c. along short side of curb



**For Concrete anchorage:** SEISMIC (0.6-0.14SDS)D + 0.7Ω<sub>o</sub>E (Ω<sub>o</sub> = 2.5)

**Concrete Attachment:** 3/4" φ Hilti Hit-HY 200 adhesive anchors w/ 4" embed

Tall<sub>LRFD</sub> = 1722 lbs Vall<sub>LRFD</sub> = 2032 lbs α = (1 + 0.2SDS)D + 2.5E = 1.87

Tall<sub>ASD</sub> = Tall<sub>LRFD</sub>/α = 920.9 lbs Vall<sub>ASD</sub> = Vall<sub>LRFD</sub>/α = 1086.6 lbs (D = 0.465, E = 0.535)

<b>Transverse:</b>	Uplift <sub>MAX</sub> = 12640 lbs	Shear <sub>MAX</sub> = 5555 lbs
--------------------	-----------------------------------	---------------------------------

Compression<sub>SEISMIC</sub> = 2247 lbs = [2.5\*FpmaxASD\*(Hcm+Hcurb)+(1+0.14SDS)\*(WGT<sub>unit+curb</sub>/2)\*wcurb]/wcurb

Tension<sub>SEISMIC</sub> = 1341 lbs = Comp<sub>SEISMIC</sub> - [0.6-0.14SDS]\*(WGT<sub>unit+curb</sub>)

Shear<sub>SEISMIC</sub> = 842 lbs = 2.5\*FpmaxASD/2

Min Bolts Req'd Uplift = 13.73 spacing = 4.41 in o.c. T<sub>applied</sub> = 790.0 lbs

Min Bolts Req'd Shear = 5.11 spacing = 11.475 in o.c. V<sub>applied</sub> = 347.2 lbs

Try using 16 bolts spaced at 4.63 in o.c.	COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{applied}}{V_{allow,ASD}} \leq 1.2 = 1.18$
---	--

Use 16 - 3/4" φ Hilti Hit-HY 200 adhesive anchors @ 4.6 in o.c. max. along long side of curb w/ 4" embed

<b>Longitudinal:</b>	Uplift <sub>MAX</sub> = 6207 lbs	Shear <sub>MAX</sub> = 5555 lbs
----------------------	----------------------------------	---------------------------------

Compression<sub>SEISMIC</sub> = 1727 lbs = [2.5\*FpmaxASD\*(Hcm+Hcurb)+(1+0.14SDS)\*(WGT<sub>unit+curb</sub>/2)\*Lcurb]/Lcurb

Tension<sub>SEISMIC</sub> = 821 lbs = Comp<sub>SEISMIC</sub> - [0.6-0.14SDS]\*(WGT<sub>unit+curb</sub>)

Shear<sub>SEISMIC</sub> = 842 lbs = 2.5\*FpmaxASD/2

Min Bolts Req'd Uplift = 6.74 spacing = 4.583333 in o.c. T<sub>applied</sub> = 620.7 lbs

Min Bolts Req'd Shear = 5.11 spacing = 5.5 in o.c. V<sub>applied</sub> = 555.5 lbs

Try using 10 bolts spaced at 4.39 in o.c.	COMBINED LOADING = $\frac{T_{applied}}{T_{allow,ASD}} + \frac{V_{applied}}{V_{allow,ASD}} \leq 1.2 = 1.19$
---	--

Use 10 - 3/4" φ Hilti Hit-HY 200 adhesive anchors @ 4.4 in o.c. max. along short side of curb w/ 4" embed

<b>CURB DESIGN SUMMARY:</b> CBKD-95			
CURB RAIL THICKNESS: 0.0713 in 14 Gauge			
UNIT CLIP THICKNESS: 0.0713 in 14 Gauge			
# OF CLIPS (LONG SIDE) - 2 clips with 6 - #14 SMS screws each clip			
WEB STIFFENER: 16Ga x 3/4" x 7" (C-channel) stiffener at each clip			
# OF CLIPS (SHORT SIDE) - 2 clips with 3 - #14 SMS screws each clip			
WEB STIFFENER: 16Ga x 3/4" x 7" (C-channel) stiffener at each clip			
CORNER CONNECTION: Use 6 - 1/4" φ SAE Grade 8 bolts w/ 1/4-20-UNC Threaded inserts			
<b>CURB ANCHORAGE</b>	<b>WOOD</b> 5/8" φ lag screw w/ min. 3.5" embed (SGmin=0.43)	<b>STEEL</b> 5/8" φ A307 bolts	<b>CONCRETE</b> 3/4" φ thr'd rod in Hilti HIT-HY 200 epoxy, min. 4" embed
<b>LONG DIRECTION</b>	14 @ 5.64 in o.c.	3 @ 34.69 in o.c.	16 @ 4.63 in o.c.
<b>SHORT DIRECTION</b>	7 @ 7.25 in o.c.	2 @ 39.5 in o.c.	10 @ 4.39 in o.c.