For wood, concrete and steel attachments see Roof Anchorage Detail, Form No. CB-26.

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

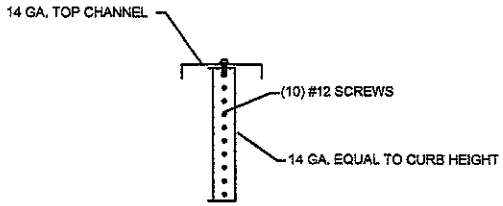
ZX, ZY 08-12; ZX 14; ZY 07

ProVent P/N	A	WEIGHT	CALCULATED KIT P/N	WEIGHT
80-268-4614	14"	99 Lbs	80-266-4614	37 Lbs
80-268-4618	18"	116 Lbs	80-266-4618	44 Lbs

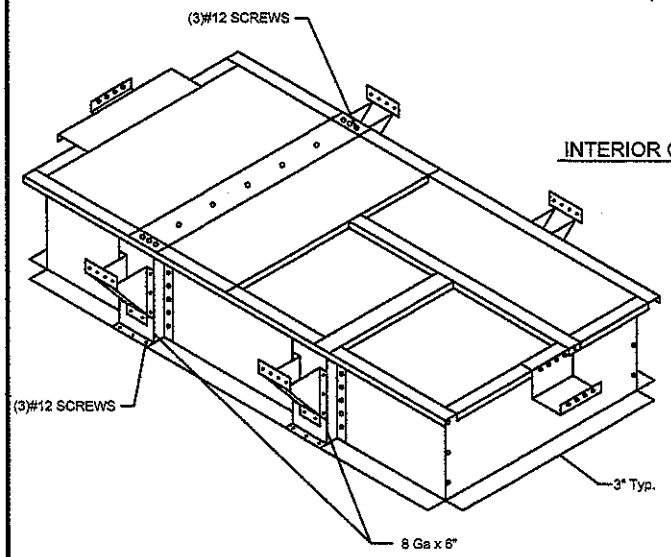
Meets wind, seismic requirements for the following codes:
FBC 2014
based on ASCE 7-10.

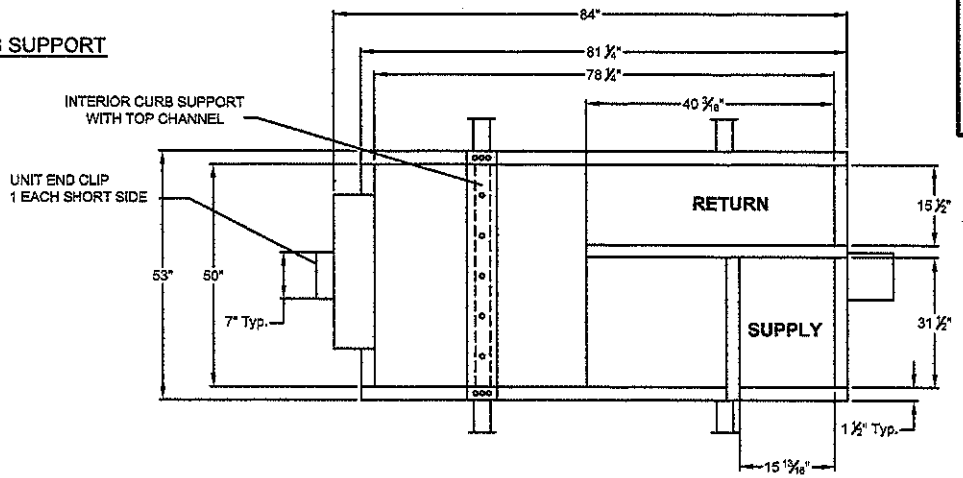
Wind:
190 mph exposure D category III or IV building, max BLDG height: 60 ft
Kzt=1.00 max

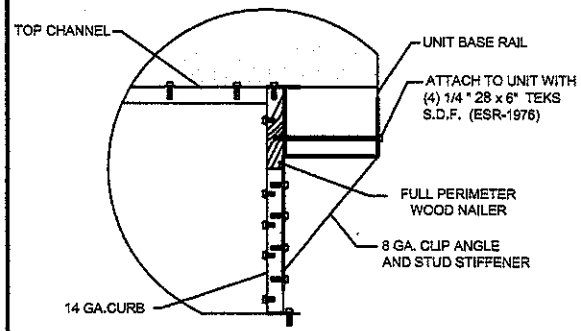
Seismic:
Sds=0.30 max
Sd1=0.187 max
Site Class D
Importance Factor: Ip=1.5



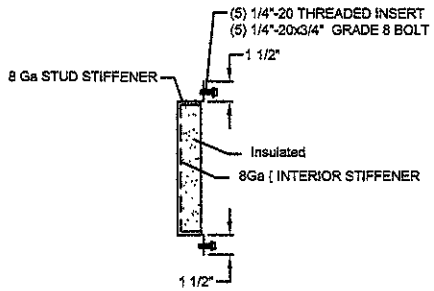
INTERIOR CURB SUPPORT



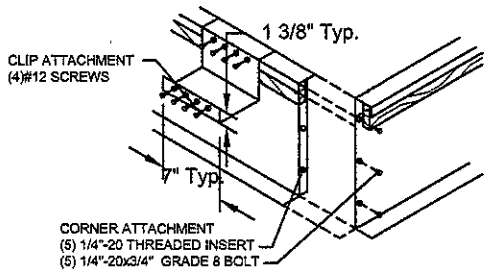




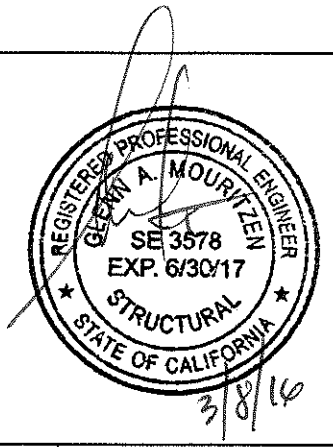
HOLD DOWN DETAIL



STUD STIFFENER



CORNER & END CLIP DETAIL

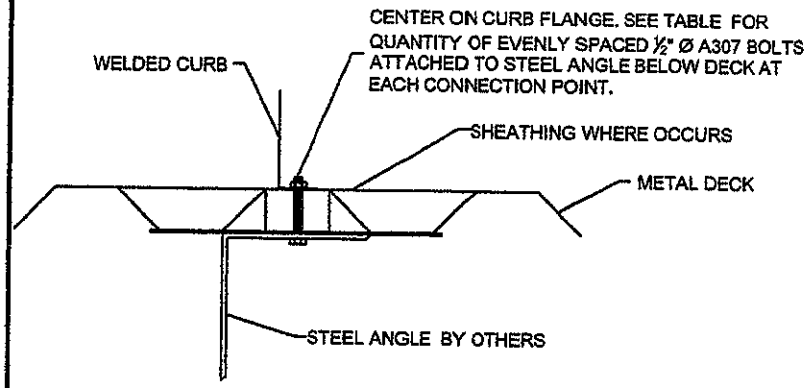


ProVent
3847 WABASH DR.
MIRA LOMA, CA 91725
PHONE (951) 685-1101
FAX (619) 872-9799

SUBMITTED TO: _____
COMPANY: _____
JOB NAME: _____
EQUIPMENT: _____
NOTES: _____

FORM NO:		PART NUMBER:
CBKD-162		80-268-46
DATE: 03/02/16	REV: 1	DRAWN BY: CNG

STEEL ATTACHMENT



CURB KIT	NO. OF ANCHORAGE BOLTS REQUIRED		
	LONG SIDE *	SHORT SIDE *	UNIT
80-266-49	2	2	LXS
80-266-50	2	2	LXL
80-266-45	2	2	PRESTIGE SMALL
80-266-46	2	2	PRESTIGE LARGE

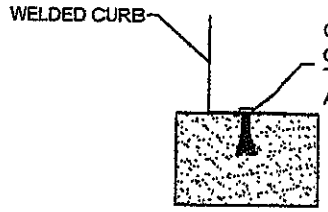
WIND AND SEISMIC LOAD ROOF ANCHORAGE DETAIL

Meets wind, seismic requirements for the following codes:
FBC 2014
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

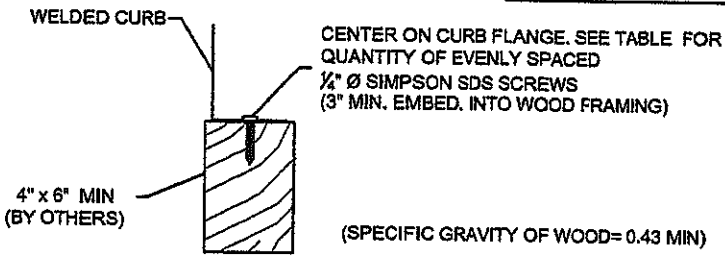


- NORMAL WEIGHT CONC SLAB
- f'c=4000 PSI MIN
- 6" MIN THICK CONC.
- SPECIAL INSPECTION REQUIRED (ESR REPORT 2713)

CURB KIT	NO. OF ANCHORAGE BOLTS REQUIRED		
	LONG SIDE *	SHORT SIDE **	UNIT
80-266-49	4	4	LXS
80-266-50	4	4	LXL
80-266-45	5	4	PRESTIGE SMALL
80-266-46	6	5	PRESTIGE LARGE

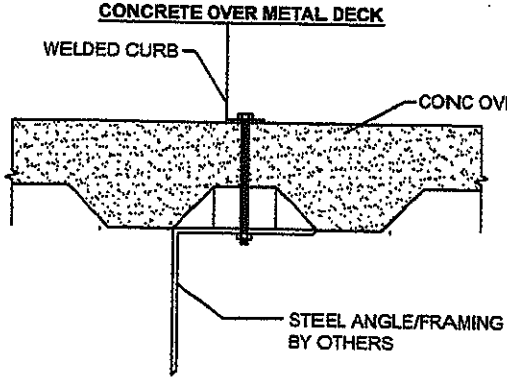
*** THREE INCHES FROM EACH CORNER EVENLY SPACED.**
**** CENTERED ONE FOOT FROM EACH CORNER EVENLY SPACED.**

WOOD ATTACHMENT

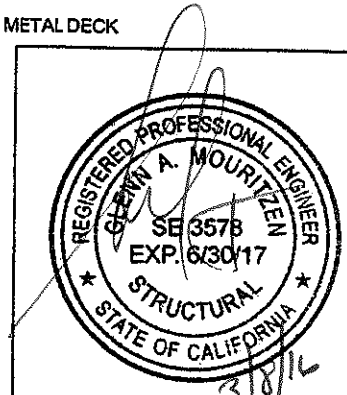


CURB KIT	NO. OF ANCHORAGE SCREWS REQUIRED		
	LONG SIDE *	SHORT SIDE *	UNIT
80-266-49	12	10	LXS
80-266-50	12	10	LXL
80-266-45	12	10	PRESTIGE SMALL
80-266-46	16	14	PRESTIGE LARGE

CONCRETE OVER METAL DECK



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



3/8/16

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SUBMITTED TO: _____
COMPANY: _____
JOB NAME: _____
EQUIPMENT: _____
NOTES: _____

FORM NO:		
CB-26		
DATE:	REV:	DRAWN BY:
03/02/16	2	CNG

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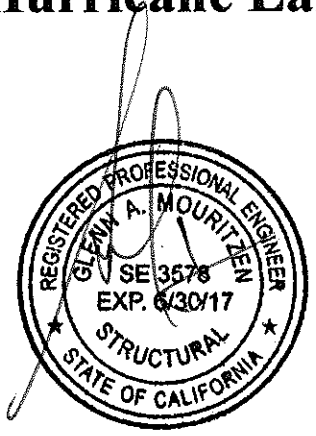
San Diego, CA 92120

619-727-4800

Structural Calculations

for

Prestige Hurricane Large Curbs



Prepared for:

PROVENT

3847 Wabash Drive
Mira Loma, CA 91725

Date: March 7, 2016

Project Number: PV1602

MOUR GROUP
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6595 Riverdale Street
San Diego, CA 92120
619-727-4800

JOB PV1602 ZYE07
SHEET NO. 1 OF 11
CALCULATED BY CD DATE 2/26/15
CHECKED BY DATE
SCALE

Provent Curb

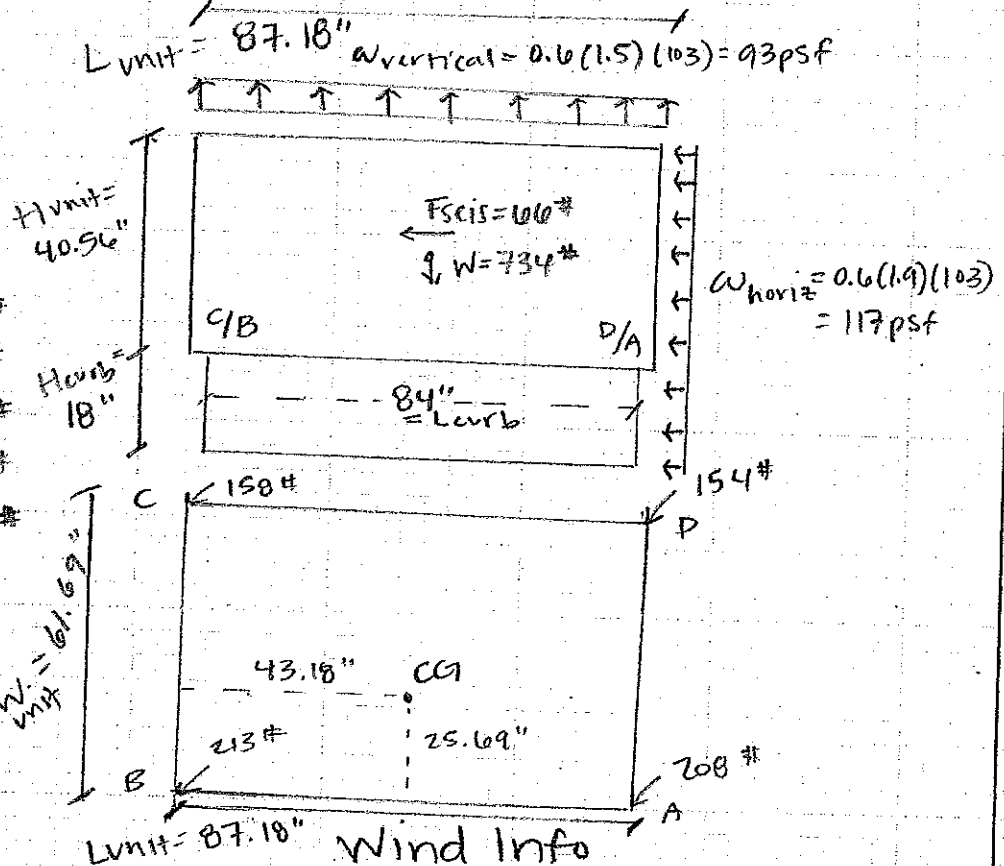
Description: ZYE 07
Form No: CBKD-163
Roof Anchorage Detail Form No.: CB-26

Curb Info

Hcurb = 18"
Lcurb = 84"
Wcurb = 53"

Unit Info

Wt. Unit = 734#
Wt. Crn A = 208#
Wt Crn B = 213#
Wt Crn C = 158#
Wt Crn D = 154#
Hunit = 40.56"
H c.o.m. = 20.28"
Lunit = 87.18"
Wunit = 61.69"



Seismic Info

$S_S = 0.05$
Site Class: D
$F_a = 1.6$ (ASCE Tab. 11.4-1)
$S_{MS} = 0.08$
$S_{DS} = 0.05$
$I_p = 1.5$ (ASCE 13.1.3)
$F_{p\,max\,ASD} = 0.7(1.6) S_{DS} I_p W_p$ (ASCE Eq. 13.3-2)
$F_{p\,max\,ASD} = 66$#

Wind Info

V = 190 mph
Exposure D Risk Cate. IV
$K_z = K_h = 1.31$ (ASCE Tab. 29.3-1) @ h = 60'
$K_{zt} = 1.0$ $K_d = 0.85$ (Tab 26.6-1)
$GC_{r\,horiz} = 1.9$ $GC_{r\,vert} = 1.5$ (ASCE 29.5.1)
$q_h = 0.00256 K_z K_{zt} K_d V^2$ (Eq 29.3-1)
$q_h = 103$ psf
$F_{h\,ASD} = 0.6(1.9) q_h A = 4159$# → controls
$F_{v\,ASD} = 0.6(1.5) q_h A = 3459$#

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JOB PV1602 2YE07
SHEET NO. 2 - OF 11
CALCULATED BY CS DATE 2/26/15
CHECKED BY DATE
SCALE

Prevent Curb Ctd.

Curb Loading.

Transverse: M_{OT} = Max of

$M_{OT\ Transv.\ seismic} = F_{seis\ ASD}(H_{c.o.m.})$

or

$M_{OT\ Transv\ Wind} = [0.6\,\omega_h (L_{unit})(H_{unit})^2/2 + 0.6\,\omega_v (L_{unit})(W_{unit})(W_{curb}/2)]$

$F_{h\ ASD} = 4159\#$
$\omega_{h\ ASD} = 117\ psf$
$F_{v\ ASD} = 3459\#$
$\omega_{v\ ASD} = 93\ psf$

$M_{OT\ seis} = 1339\ \#\cdot in$

or

$M_{OT\ wind} = 90186\ \#\cdot in$ ← controls

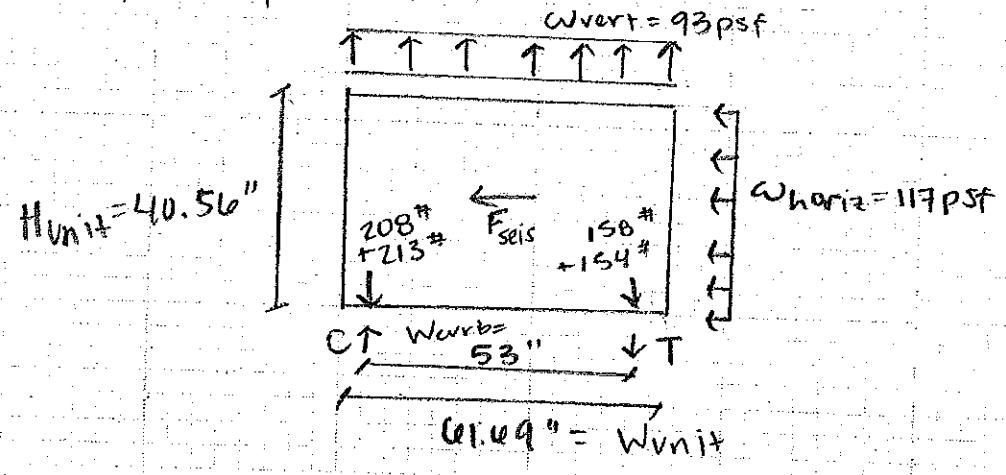
$M_{res\ Transv.} = 0.6\,W_{curb}(158\# + 154\#) = 9922\ \#\cdot in$

$C = Max\ comp. = \dfrac{(M_{OT} - M_{res}) + (208\# + 213\#)(61.69")}{W_{curb}}$

$C = 2004\#$

$T = Max\ tens. = \dfrac{(M_{OT} - M_{res}) - (208\# + 213\#)(61.69")(.6)}{W_{curb}} + \dfrac{F_v}{2}$

$T = 2950\#$



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JOB PV1602 ZYE07
SHEET NO. 3 OF 11
CALCULATED BY CD DATE 2/26/15
CHECKED BY DATE
SCALE

Provent Curb Ctd

Curb Loading

Longitudinal: M_{OT2}

$M_{OT\ Longit.\ Seismic} = F_{seis}$ Max of ASD or $(H_{c.o.M.}) = 1339\ \#\cdot in$

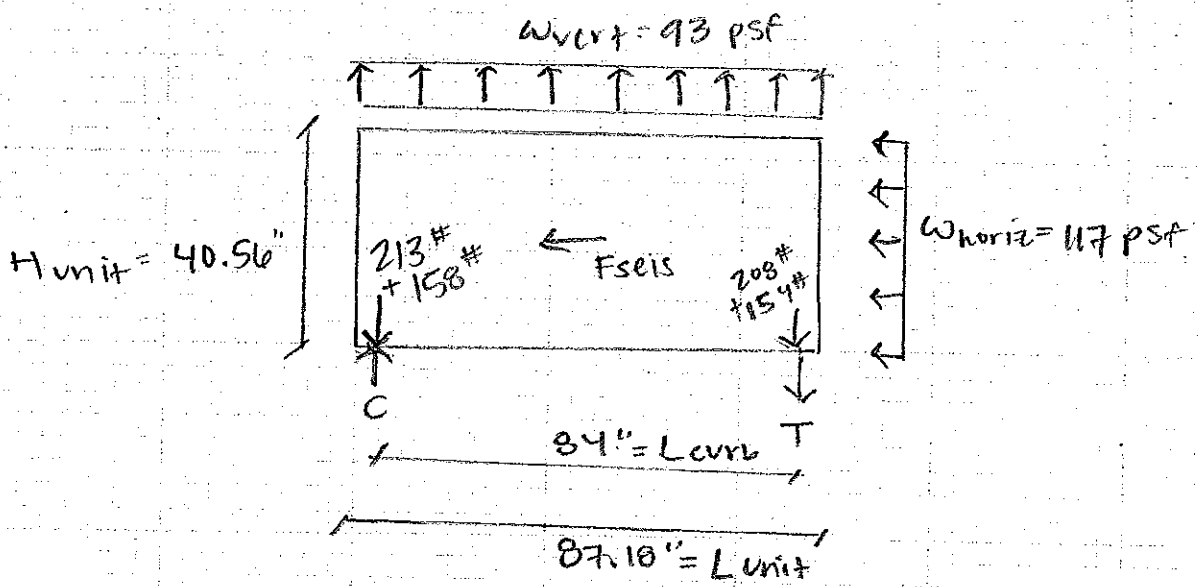
$M_{OT\ Longitd\ Wind} = \left[\begin{array}{l} 0.6\,\omega_h\,(W_{unit})\,(H_{unit})^2/2 \\ +\ 0.6\,\omega_v\,(L_{unit})(W_{unit})(L_{curb}/2) \end{array}\right] = \left[\begin{array}{l} 0.6(117)(61.7)(40.6)^2/2 \\ +0.6(93)(87.2)(61.7)(84/2) \end{array}\right] \div 144\ in^2/ft^2$

$M_{OT\ longitd\ WIND} = 112{,}267\ \#\cdot in$ ← controls

$M_{res\ Longit.} = 0.6\,L_{curb}(208\ \# + 154\ \#) = 18{,}245\ \#\cdot in$

$C = \dfrac{(M_{OT} - M_{res}) + (158\ \# + 213\ \#)(87.18")}{L_{curb}} = 1504\ \#$

$T = \dfrac{(M_{OT} - M_{res}) - (158\ \# + 213\ \#)(87.18")(.6)}{L_{curb}} + \dfrac{F_v}{2} = 2618\ \#$



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JOB PV1602 ZYE07
SHEET NO. 4 OF 11
CALCULATED BY CD DATE 2/26/15
CHECKED BY DATE
SCALE

Provent Curb Ctd.

Properties of Curb (AISI 3.3.2)

$E = 29500$ ksi $F_y = 50$ ksi $F_u = 60$ ksi

14 GA. $t = 0.0713$

$A' = 18"$
$B' = 1"$
$C' = 3"$
$R = 0.125"$
$r = R + \frac{t}{2} = 0.161$
$\alpha = 1.0$
(1.0 if lips, 0.0 if not)
$U = \pi r/2 = 0.252"$

$a = A' - [r + t/2 + \alpha(r + t/2)] = 18 - [.161 + \frac{.0713}{2} + .161 + \frac{0.0713}{2}]$
$a = 17.607"$
$a' = A' - (t/2 + \alpha t/2) = 18 - .0713/2 - 0.0713/2$
$a' = 17.929"$
$b = B' - (r + t/2) = 1" - 0.161 - .0713/2$
$b = 0.607"$
$b' = B' - t/2 = 1" - .0713"/2$
$b' = 0.929"$
$c = \alpha[C' - (r + t/2)] = 3" - .161 - \frac{.0713}{2}$
$c = 2.804"$
$c' = \alpha[C' - t/2] = 3" - 0.0713/2$
$c' = 2.904"$

$A = t[a + 2b + 2u + \alpha(2c + 2u) = 0.0713"[17.607" + 2(0.607" + 2.804") + 4(0.252")]$
$A = 1.81 in^2$

$\bar{x} = \frac{2t}{A}\{b(b/2 + r) + U(0.363r) + \alpha[U(b + 1.637r)^2 + c(b + 2r)]\}$
$= \frac{2(.0713)}{1.81}\{.607(.607/2 + .161) + .252(.363(.161)) + [.252(.607 + 1.637(.161))^2 + 2.804 \times (.607 + 2(.161))\}$
$\bar{x} = 0.245"$

$I_x = 2t\{0.0417a^3 + b(a/2 + r)^2 + U(a/2 + 0.637r)^2 + 0.149r^3 + \alpha[0.0833c^3 + \frac{c}{4}(a - c)^2 + U(\frac{a}{2} + 0.637r)^2 + 0.149r^3]\}$
$I_x = 67.295 in^4$

$I_y = 2t\{b(b/2 + r)^2 + b^3/12 + 0.356r^3 + \alpha[c(b + 2r)^2 + U(b + 1.637r)^2 + 0.149r^3]\} - A\bar{x}^2$
$I_y = 0.285 in^4$

$S_x = I_x/\bar{y} = 67.295 in^4/9" = 7.48 in^3$
$S_y = I_y/\bar{y} = 0.285 in^4/9" = 0.032 in^3$

$r_x = \sqrt{\frac{I_x}{A}} = \sqrt{\frac{67.295}{1.81}} = 6.09"$ $r_y = \sqrt{\frac{I_y}{A}} = \sqrt{\frac{0.285}{1.81}} = 0.40"$

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JOB PV1602 ZYE 07
SHEET NO. 5 OF 11
CALCULATED BY CD DATE 2/24/15
CHECKED BY DATE
SCALE

Provent Curb Ctd.

Compression of Curb (AISI C4.1)

$P_n/\Omega = A_e F_n/\Omega$ (AISI Eq. C4.1-1)

$\Omega = 1.80$

$\frac{KL}{r_{min}} = \frac{0.8\,(L_{curb} + 1/4(W_{curb})(2))}{0.40"} = 223$ C'=3"

$F_y = 50$ ksi

$\lambda = \sqrt{\frac{F_y}{F_e}}$

$F_e = \frac{\pi^2 E}{(KL/r_{min})^2} = \frac{\pi^2 (29500\ ksi)}{(223)^2} = 5.85$ ksi

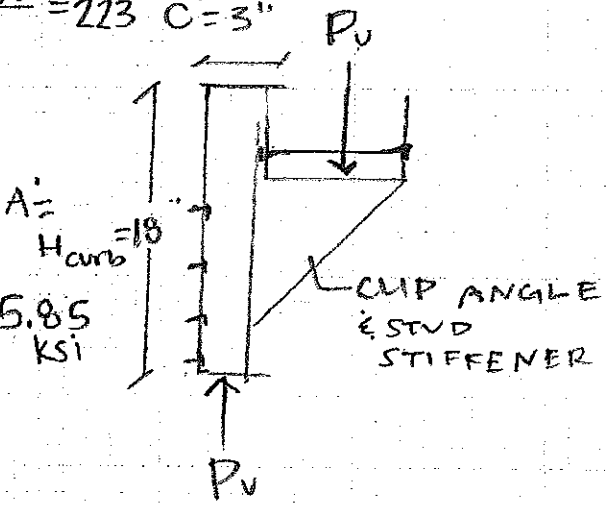
$\lambda = \sqrt{\frac{50}{5.85}} = 2.92$

$F_n = (0.658^{\lambda_c^2})\,F_y$ if $\lambda \le 1.5$

$F_n = \left[\frac{0.877}{\lambda_c^2}\right] F_y$ if $\lambda > 1.5$ ←

$F_n = 5.13$ ksi

$P_n/\Omega = 1.81\,in^2\,(5.13\ ksi)/1.8 = 5.17^K$



P_u = Max comp. = $2.004^K < 5.17^K$ OK ✓

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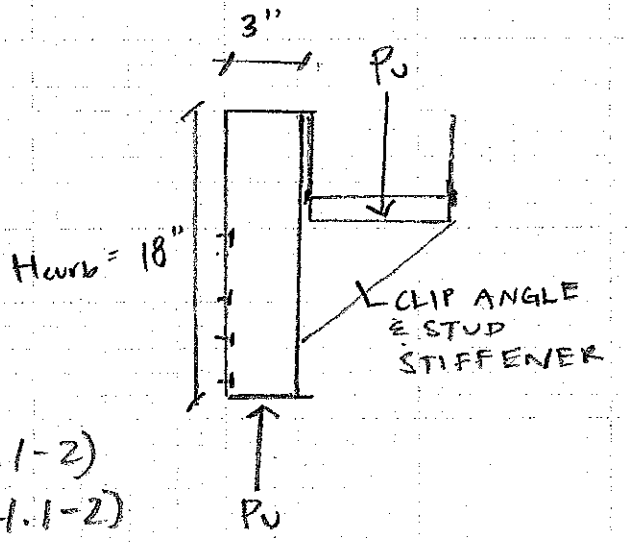
JOB PV1602 ZYE 07
SHEET NO. 6 OF 11
CALCULATED BY CD DATE 2/20/16
CHECKED BY DATE
SCALE

Provent Curb ctd.

Check Web Crippling (AISI C3.4.1)

$h = 18"$
$t = 0.0713"$
$N = 27"$
$F_y = 50\ ksi$
$\theta = 90°$
$\Omega = 1.75$
$R = 0.125"$
$C = 4.00$ (AISI Table C3.4.1-2)
$C_R = 0.14$ (AISI Table C3.4.1-2)
$C_N = 0.35$ (AISI Table C3.4.1-2)
$C_h = 0.02$ (AISI Table C3.4.1-2)



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

$$P_n/\Omega = \frac{1}{1.75}(4)(0.0713")^2(50\ ksi)(1)\left(1 - 0.14\sqrt{\frac{0.125}{.0713}}\right)\left(1 + 0.35\sqrt{\frac{27}{.0713}}\right) \times \left(1 - 0.02\sqrt{\frac{18}{.0713}}\right)$$

$P_n/\Omega = 2.52^k$

$P_u = 2.004^k < 2.52^k$ OK ✓

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JOB PV1602 ZYE 07
SHEET NO. 7 OF 11
CALCULATED BY CD DATE 2/26/16
CHECKED BY DATE
SCALE

Provent Curb Ctd.

Corner Connections

$T_{corner\ max} = Max(F_{SEIS}, F_{WIND})/_{4\ corners} = \frac{4771\#}{4} = 1040\#$

$V_{corner\ max} = 3027\#/(2\ conn/side) = 1475\#$

Use 1/4"Ø SAE Grade 8 Bolt w/ 1/4-20 UNC thrd'd inserts

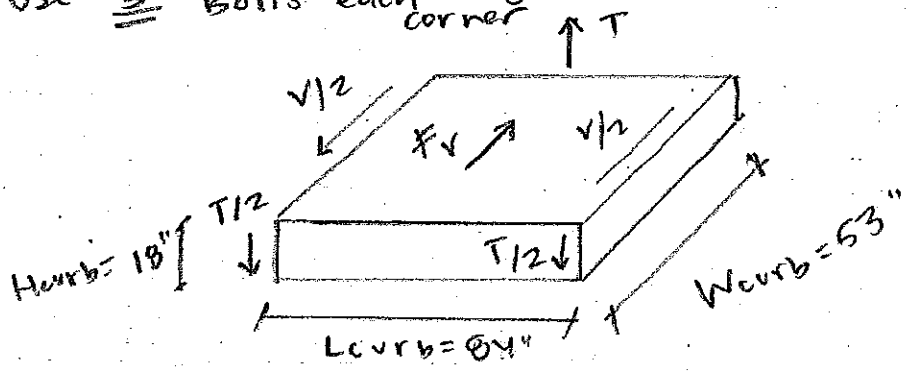
Bolt: Tallowable = 1990 #/2.25 = 884 # (AISI Table IV 6)
Vallowable = 1180 #/2.4 = 492 # (AISI Table IV 7)
Bearing allowable = 2530#/2.5 = 1012 # (AISI Table IV 8c)
Insert: Clamp Load allowable: 2860 #

No. Bolts Req'd for Tension = $\frac{1040}{884} = 1.18$

No. Bolts Req'd for Shear = $\frac{1475}{492} = 3.00$

Combined Loading: $\frac{1040}{5(884)} + \frac{1475}{5(492)} = 0.83 \leq 1.0$ OK ✓

Use 5 Bolts each corner



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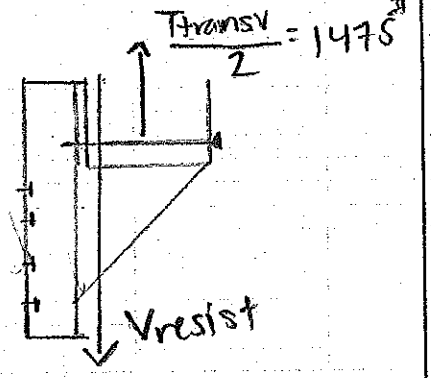
San Diego, CA 92120
619-727-4800

JOB PV1602 ZYE 07
SHEET NO. 8 OF 11
CALCULATED BY CD DATE 2/26/16
CHECKED BY DATE
SCALE

Provent Curb Ctd.

Connection of Curb to Unit

Use #12 SMS
$V_{allowable} = 730\#$
$T_{allowable} = 285\#$



Transverse:

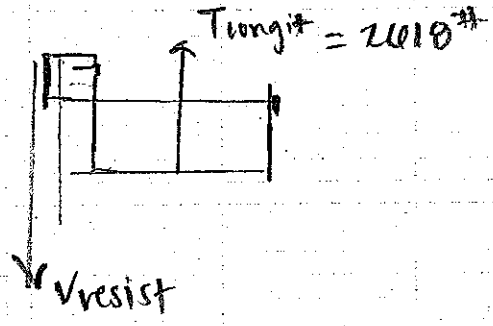
$V_{Transv\ SMS} = T_{Transv\ unit} = 2950\#/2\ attachments = 1475\#$

No. SMS req'd: $\frac{1475\#}{730\#} = 2.02$

Use 3 screws on long side (each attachment)

Longitudinal:

$V_{longit.\ SMS} = T_{longit.\ unit} = 2618\#$



No. SMS req'd: $\frac{2618\#}{730\#} = 3.59$

Use 4 screws on short side

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JOB PV1602 ZYE07
SHEET NO. 9 OF 11
CALCULATED BY CD DATE 2/26/16
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Provent Curb Ctd.

Connection of Curb to Supporting Structure

Wood Attachment

Use 1/4"Ø x 3" simpson SDS screws

$T_{allowable} = 172\#/in\,(3" - t_{curb}) = 504\#$

$V_{allowable} = 420\#$

Transverse:

$$Uplift = \frac{[F_h (H_{unit} + H_{curb})/2 - M_{res}]}{W_{curb}} + \frac{F_v}{2} = \frac{[9159\#\,(58.56"/2) - 9922\#in]}{53"} + \frac{3459\#}{2}$$

(Max of)

$Uplift_{WIND} = 3840\#$ ← controls

or

$$= \frac{F_{seis\ ASD}\,(H_{curb} + H_{c.o.m.}) - M_{res}}{W_{curb}} + \frac{F_v}{2} = \frac{66(38.28) - 9922}{53} + \frac{3459}{2} = 1590\#\ uplift.\ seismic$$

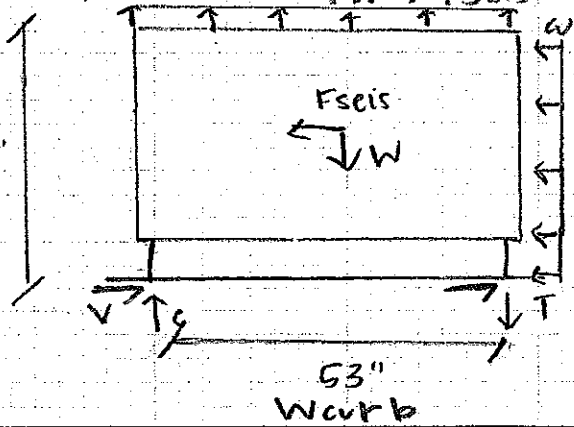
No. SDS reqd Tens.: $\frac{3840}{504} = 7.6$

No. SDS reqd Shear: $\frac{4159}{420} = 9.9$ total curb

COMBINED: $\frac{3840}{14(504)} + \frac{4159}{14(420)} = 0.904 < 1$

Shear = Max of F_h & F_{seis} = 4159

Use 14 SDS on long side



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6595 Riverdale Street
San Diego, CA 92120
619-727-4800

JOB PV1602 ZYE07
SHEET NO. 10 OF 11
CALCULATED BY CD DATE 2/26/16
CHECKED BY DATE
SCALE

Provent Curb Ctd.

Connection of Curb to Supporting Structure

Wood Attachment

Use 1/4" Ø x 3" Simpson SDS Screws
Tallowable = 504#
Vallowable = 420#

Longitudinal:

Uplift: $\dfrac{\text{Max of } [F_h(H_{unit}+H_{curb})/2 - M_{res}]}{L_{curb}} + \dfrac{F_v}{2} = \dfrac{4159(58.56''/2) - 18245}{84''} + \dfrac{3459^{\#}}{2}$

$\text{Uplift}_{WIND} = 2962^{\#}$ ← controls

or

$\dfrac{F_{seis}(H_{curb} + H_{c.o.m.}) - M_{res}}{L_{curb}} + \dfrac{F_v}{2} = \dfrac{66(38.28) - 18245}{84''} + \dfrac{3459^{\#}}{2}$

$\text{Uplift}_{seismic} = 1542^{\#}$

Uplift = 2962#

Shear = Max of F_h & F_{seis} = 4159#

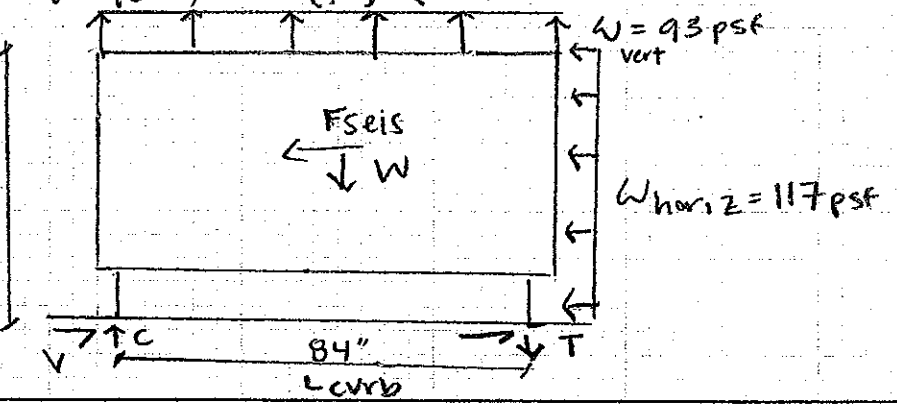
No. SDS req'd tens: $\frac{2962}{504} = 5.9$

No. SDS req'd shear: $\frac{4159}{420} = 9.9$ total

Combined Loading: $\dfrac{2962}{(12)(504)} + \dfrac{4159/2}{(12)(420)} = 0.90 < 1.0$

Use 12 SDS on short side

$H_{unit} + H_{curb} = 58.56''$



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SHEET NO. 11 OF 11
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Provent Curb Ctd

Connection of Curb to Supporting Structure

Concrete Attachment

Use 1/2"Ø Simpson Titen HD w/ 3" min embed.

Tallowable = 1155#
Vallowable = 1605#

Transverse: T = 3840# (see Wood Attachment calcs)
V = 4159#

No. Fasteners req'd Tension: 3840/1155 = 3.3
No Fasteners req'd shear: 4159/1605 = 2.6

COMBINED $\frac{3840}{6(1155)} + \frac{4159/2}{6(1605)} = 0.77 < 1.0$

Longitudinal: T = 2962# (see wood Attachment calcs)
V = 4159#

No req'd Tens: $\frac{2962}{1155} = 2.56$
No req'd shear: 4159/1605 = 2.6

COMBINED $\frac{2962}{4(1155)} + \frac{4159/2}{4(1605)} = 0.965 < 1.0$

Use 6 Titen HD on long side and 4 on short side

Steel Deck Attachment

Use 1/2"Ø A307 Bolt to L5x5x1/4 below deck @ eq. conn.

Tallowable = 4420#
Vallowable = 2650#

Transverse: T = 3840# → # Bolts req'd = $\frac{3840}{4420} = 0.87$
V = 4159# → # Bolts req'd = $\frac{4159}{2650} = 1.57$ total curb

COMBINED: $\frac{3840}{2(4420)} + \frac{4159/2}{2(2650)} = 0.83 < 1.0$

Longitudinal: T = 2962# → # Bolts req'd = $\frac{2962}{4420} = 0.67$
V = 4159# → # Bolts req'd = 1.57 total curb

COMBINED: $2962/(2 \cdot 4420) + 4159/2/(2 \cdot 2650) = 0.73 < 1.0$

Use 2 Bolts on long side and 2 on short side