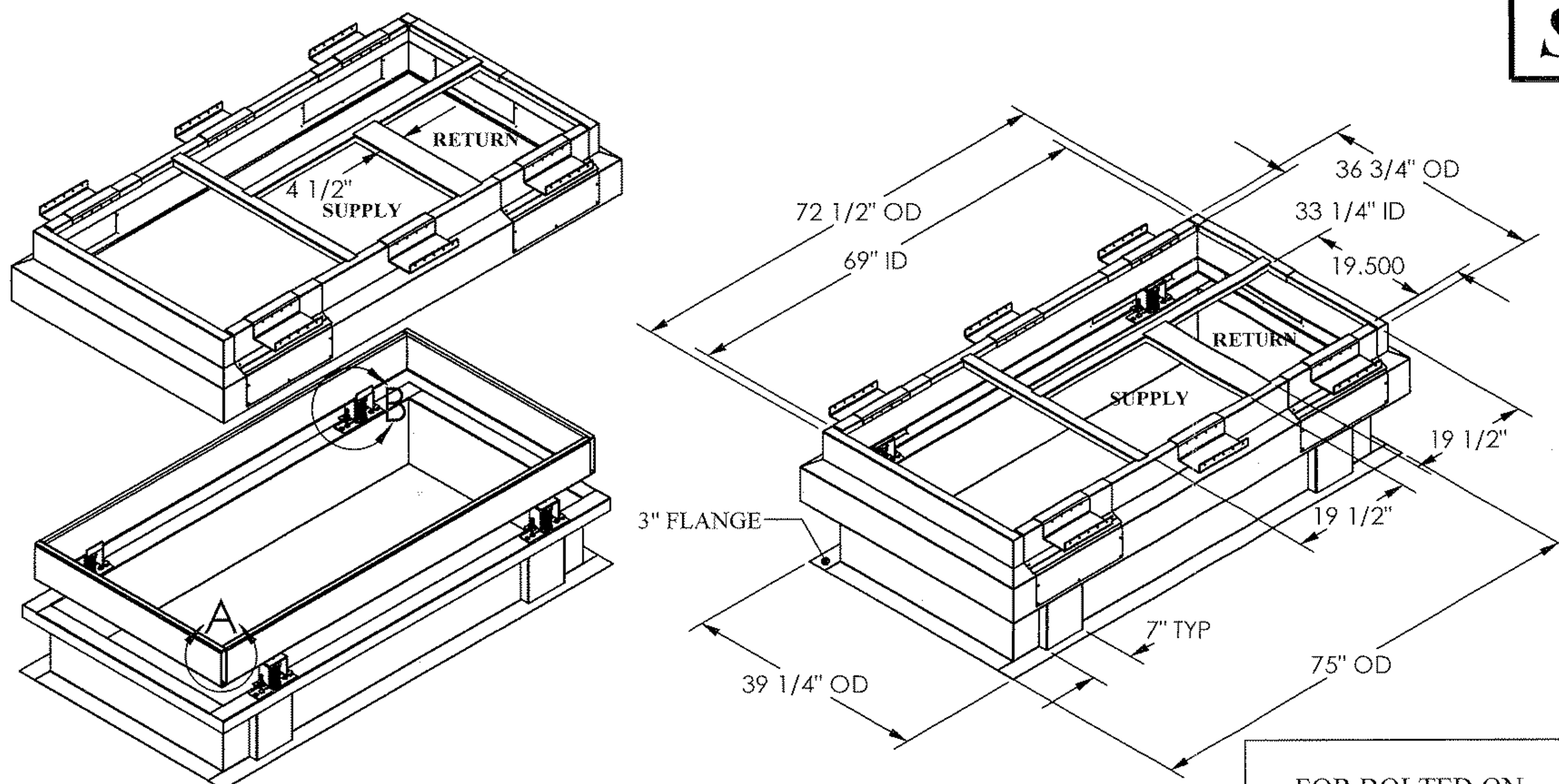
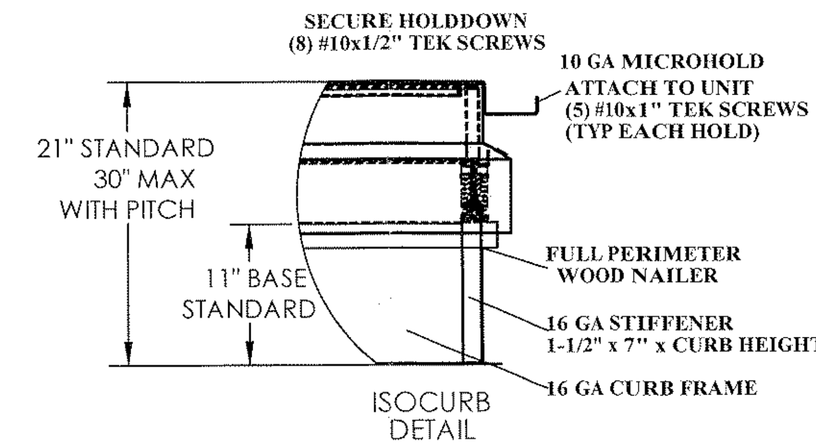
SUBMITTAL
0403-602A SERIES

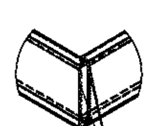


* WELDED CONSTRUCTION
* PERIMETER WOOD NAILER
* GASKET PACKAGE
* FACTORY INSTALLED HOLDDOWNS
* OSHPD PRE-APPROVED 2" DEF SEISMIC RESTRAINTS (OPA#0070)

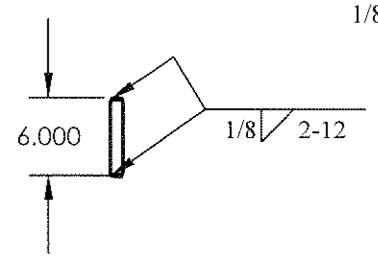


ISOCURB DETAIL

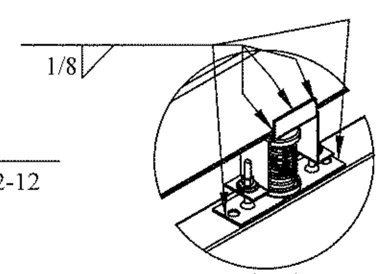
DETAIL A
SCALE 1 : 12



SEAM WELD TOP AND SIDES (TYP. 4 CORNERS)



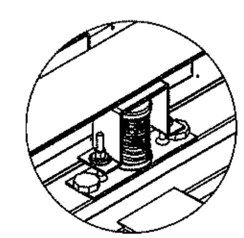
10 GA SUPPORT ASSY DETAILS



DETAIL B
SCALE 1 : 8

ISOLATOR WELDING STANDARD OFFERING

FOR BOLTED ON ISOLATORS

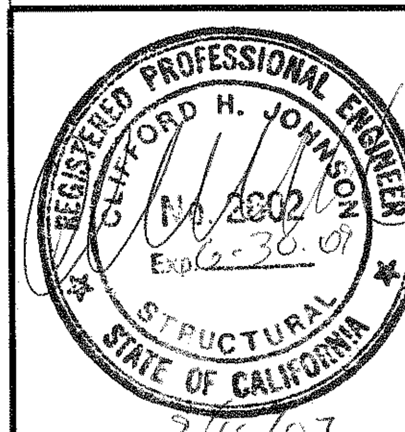


DETAIL C
SCALE 1 : 8

FOR BOLTED ON ISOLATORS ADD "BOLT" TO PART#
EX: 0403-602A-01CBC-BOLT

IF BOLTED RESTRAINTS ARE PREFERRED, IT MUST BE NOTED AT TIME OF ORDER.

BOLTS WILL BE 1/2" X 2", 2 PER ISOLATOR
1/2" FLAT WASHER, 2 PER BOLT,
1/2" NUT
1/4" THICK NEOPRENE PAD IS PLACED BETWEEN RESTRAINT AND CURB
NEOPRENE CUP WILL BE UNDER SPRING.



MicroMetl Corporation

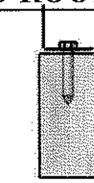
PRODUCT NUMBER:			STRUCTURALLY CALCULATED VIBRATION ISOLATION CURB FOR YORK ZJ, DJ, XP, ZP, 036-060, DR 036-072 DHG, DHE 036-060, DF 072 UNITS
0403-602A	0403-602A-8B-01CBC	18" TALL	
ISOLATION CURBS	0403-602A-01CBC	21" TALL	
	0403-602A-14B-01CBC	14" TALL	

Sparks, NV. (800) 884-4662
Indianapolis, IN. (800) 662-4822
Longview, TX. (903) 248-4800

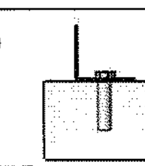
ANCHORAGE DETAILS TO ROOF:

STEEL ATTACHMENT:
SEE STEEL ATTACHMENT DETAIL SHEETS.

WOOD ATTACHMENT:
(DOUGLAS FIR)
(34) 1/4 x 3" SIMPSON SDS W/WASHER CENTER ON CURB FLANGE, EVENLY SPACED, (9) EACH LONG SIDE, (8) EACH SHORT SIDE



CONCRETE ATTACHMENT:
(3000 PSI MINIMUM, 4" MIN THICKNESS)
(6" MIN EDGE DISTANCE)
(14) 1/2"SIMPSON TITEN HD EVENLY SPACED,CENTER ON CURB FLANGE
8" MIN SPACING
(4) EACH LONG SIDE, (3) EACH SHORT SIDE



DATE:	07/2007
DRAWN BY:	MAC
WEIGHT:	300/320/340
MEETS SEISMIC REQUIREMENTS FOR FOLLOWING CODES:	
2001 CBC 2006 IBC	

BJG | ARCHITECTURE + ENGINEERING

Structural Calculations
BJG# 20070133

Project:

0403-602A

Prepared for:

MicroMetl Corporation
905 Southern Way
Sparks, NV 89431

Date:

August 2007

REGISTERED PROFESSIONAL ENGINEER
CLIFFORD H. JOHNSON
No. 2802
Exp. 6-30-09
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STATE OF CALIFORNIA

9/11/07

6995 Sierra Center Parkway Suite 200 Reno Nevada 89511 Phone 775.827.1010 Fax 775.827.1663 www.bjginc.com

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Frame and Support Curb Information **Product Number 0403-602A-01CBC**

h_{FRAME} =	**30**	in - Overall height from support substrate to top of curb
$h_{SUPPORT}$ =	**6**	in - Height of support curb from top of isolators to bottom of unit
L_{CURB} =	**69**	in - Longitudinal distance from center-to-center of transverse curb members
W_{CURB} =	**33.25**	in - Transverse distance from center-to-center of longitudinal curb members
h_i =	**4.5**	in - Height of isolator
d_i =	**7.5**	in - Dist. off long member end to isolator
d_{HD} =	**7.5**	in - Dist. off short member end to holddown

Unit Information DR072

W_P =	**1052**	lbs - Max. unit weight
h_{UNIT} =	**34.625**	in - Overall unit height above curb
h_{CM} =	**21.0**	in - Height above curb to center of mass
L_{UNIT} =	**82.25**	in - Overall unit length (longitudinal direction)
W_{UNIT} =	**44.875**	in - Overall unit length (transverse direction)

Seismic Loading - 2006 International Building Code (2006 IBC)

$Fp_{MAX} = 1.6 * S_{DS} * Ip * Wp$

Ss =	**2**	(2 is worst case in NV, OR, WA, AZ)
Fa =	**1**	(1.0 at worst case Site D, Ss ≥ 1.25)
Sms =	2	= FaSs
S_{DS} =	1.33	= 2/3 Sms
Ip =	**1.5**	(1.5 at worst case Occupancy)
Fp_{MAX} =	3.20	Wp
Fp_{MAX} =	2.29	Wp (ASD)
Fp_{MAX} =	2405	lb (ASD) - ASD values will be used throughout unless noted otherwise

Seismic Loading - 2001 California Building Code (2001 CBC)

$Fp_{MAX} = 4 * Ca * Ip * Wp$

Ca =	**0.44**	(.44 at worst case at Zone 4, Soil Type Sd)
Na =	**1.5**	(1.5 at worst case Seismic Source Type A <= 2km)
Ip =	**1.5**	(1.5 at worst case Occupancy)
Fp_{MAX} =	3.96	Wp
Fp_{MAX} =	2.83	Wp (ASD)
Fp_{MAX} =	2976	lb (ASD) - ASD values will be used throughout unless noted otherwise

Controlling Seismic Loads

Fp_{MAX} =	2.83	Wp (ASD)
Fp_{MAX} =	2976	lb (ASD) - ASD values will be used throughout unless noted otherwise

Wind Loading Check

Max. Projected Area (A_{MAX}) = h_{UNIT} * MAX (L_{UNIT} or W_{UNIT})

A_{MAX} =	**2848**	in^2
=	**19.8**	ft^2

Equivalent wind pressure required to equal seisimic loading (P_{EQ}) = Fp_{MAX} / A_{MAX}

P_{EQ} =	**150**	psf (ASD) **OKAY BY INSPECTION: P > 60 PSF**

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Connectors from Unit to Support:

Use Self-drilling, Self Tapping Steel Screws, allowable load per Table IV-7A of the cold formed steel manual

#10 screw allowable load in 16 gage minimum material is **463** lbs each

Transverse or Longitudinal Loading

$V_{each\ side} = 2/3 * Fp_{MAX}$ (ASD)

V_{HD} = **1984** lb per side (where applicable)

Transverse Loading

Holddowns:

N_{HD} = **3** Number of holddowns per long side

$R_{HD1} = (Fp_{MAX} * h_{CM}) / (N_{HD} * W_{CURB}) - 1/3 * W_P$

R_{HD1} = **276** lb per HD uplift

V_{HD} = **0** lb per HD

Max Resultant Force = 276 lb per HD

Min Screws Required = 2 per HD

Isolators:

$R_{MAX} = (Fp_{MAX} * (h_{cm} + h_s)) / W_{CURB} + 2/3 * W_P$

R_{MAX} = **3118** lb per side - Downward

$RISO_{MIN} = (Fp_{MAX} * (h_{cm} + h_s)) / W_{CURB} - 1/3 * W_P$

$R_{ISO\ MIN}$ = **2066** lb per side uplift

$V_{ISO} = F_{pMAX}/(\#\ Iso)$

V_{ISO} = **0** lb per side

Longitudinal Loading

Holddowns:

$R_{HD1} = (F_{pmax} * h_{cm}) / (2*(L_{UNIT} - d_{HD}) - 1/6*W_P$

R_{HD1} = **243** lb per HD Assume all uplift into end holddowns

V_{HD} = **661** lb per HD

Max Resultant Force = 704 lb per HD

Min Screws Required = 2 per HD

Isolators:

$R_{MAX} = (Fp_{MAX} * (h_{cm} + h_s)) / (L_{CURB} - 2d_i) + 2/3 * W_P$

R_{MAX} = **2189** lb per side - Downward

$R_{ISO\ MIN} = (Fp_{MAX} * (h_{cm} + h_s)) / (L_{CURB} - 2d_i) - 1/3 * W_P$

$R_{ISO\ MIN}$ = **1137** lb per side uplift

$V_{ISO} = V_{each\ side}$

V_{ISO} = **1984** lb per side

Isolator Load Summary

USE	2	TYPE	**OPA0070**	Isolator restraints each long side for shear and vertical
USE	0	TYPE	**OPA0070**	Isolator restraints each short side for shear

Max. V_{ISO} ↔ = V_{ISO} max. due to transverse or longitudinal loading

Max. V_{ISO} ↔ = **1984** lb per side — Max. V_{ISO} ↔ = **992** lb each isolator

Max. R_{ISO} ↓ = max. downward force due to transverse or longitudinal loading

Max. R_{ISO} ↓ = **3118** lb per side — Max. R_{ISO} ↓ = **1559** lb each isolator

Max. R_{ISO} ↑ = max. uplift force due to transverse or longitudinal loading

Max. R_{ISO} ↑ = **2066** lb per side — Max. R_{ISO} ↑ = **1033** lb each isolator

PRE-APPROVED MAXIMUM ALLOWABLE LOADS

Allowable Horizontal =	1000	lb each isolator	**OKAY**
Allowable Vertical =	1600	lb each isolator	**OKAY**

Tube Steel Support Assembly

Use 10GA cold-formed overlapping channels, 6" tall, 1.125" wide; Use properties for hollow rectangle

Conditions and formulas per AISI Cold-Formed Steel Specification (2001) — Analyze as a beam

Bending: (Per C3.1)

$t =$	0.134	in
$Fy =$	33	ksi
$b =$	1.125	in
$d =$	6	in
$C_b =$	1.14	AISC 13th ed. Table 3-1
$E =$	29000	ksi
$G =$	11500	ksi
$I_y =$	0.41	in^4
$J =$	1.71	in^4
$S_x =$	2.057	in^3
$Ax =$	1.61	in^2
$b_1 = b - 2 * t =$	0.857	in
$d_1 = d - 2 * t =$	5.732	in
$L = L_{CURB} - 2 * d_i =$	54	in
$L_u = L / 2 =$	27.00	in
$b_{eff} = b - 3 * t =$	0.723	in
$h_{eff} = d - 3 * t =$	5.598	in

Allowed Lateral Unbraced Length, L_A

$L_A = 0.36*C_b\pi/(FyS_y)*(EGJIy)^{1/2}$

$L_A =$ **291.2** in (Eq. C3.1.2.2-1)

$\Omega_b =$ **1.67**

If laterally unbraced length is less than or equal to L_u, then the nominal moment M_n shall be used

Lu < La OKAY

$M_n = S_eF_y$

$M_n / \Omega_b =$ **40.6** k-in (Eq. C3.1.1-1)

Max moment due to center holddown, M_u

$M_u = (R_{MAX} / L * 1/3L) / 2 * L/2 = R_{MAX} * L / 12$

$M_u =$ **14029.45** lb-in

$M_u =$ **14.03** k-in

BENDING OKAY

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Shear: (Per C3.2.1)

Ω_v =	1.60	
h / t =	44.8	
k_v =	5.34	
$\sqrt{(Ek_v / F_y)}$ =	68.5	
Aw =	1.61	in^2
F_v =	19.80	ksi

F_v per Eqs. C3.2.1-2, 3, 4

Nominal Shear Strength

$V_n = A_w F_v$

V_n =	31.8	kips	(Eq. C3.2.1-1)
V_n / Ω_v =	19.9	kips	

Max Shear Force

$V_u = R_{MAX} / 2$

V_u =	1.56	kips	**OKAY**

Web Crippling: (Per C3.4.1)

C =	7.5	
C_h =	0.048	
C_N =	0.12	
C_R =	0.08	
Ω_w =	1.75	
N =	4	in.
R =	0.25	in.
θ =	90	°

Note: N = Bearing length per isolator

Nominal Web Crippling Strength

$P_n = Ct^2F_y \sin\theta(1-C_R(R/t)^{1/2})(1+C_N(N/t)^{1/2})(1-C_h(h/t)^{1/2})$

P_n =	4.45	kips / web	(Eq. C3.4.1-1)
P_n =	8.90	kips	
P_n / Ω_w =	5.084	kips	

$P_u = R_{MAX}$ / # of isolators per side

P_u =	1.559	kips	(long side)
P_u =	0.00	kips	(short side)

OKAY

Frame Assembly Stiffeners

Use 16 gage stiffener material

Conditions and formulas per AISI Cold-Formed Steel Specification (2001)

t =	0.060	in
Fy =	33	ksi
Length =	7	in
Width =	1.5	in
Height =	20	in
Ω_C =	1.8	
A =	0.59	in^2
r_1 =	0.66	in
r_2 =	2.53	in
kl/r_{min} =	30.4	

$F_e = \pi^2E/(KL/r)^2$

F_e =	309.96	ksi	(Eq. C4.1-1)

$\lambda_c = \sqrt{(F_y/F_e)}$

λ_c =	0.33		(Eq. C4-4)
F_n =	25.11	ksi	(Eq. C4-2,3)

$P_n = A_e F_n$

P_n =	14.89	kips	(Eq. C4-1)
P_n/Ω_c =	8.27	kips	

$P_U = R_{MAX} / 2$

P_U =	1558.83	lbs	
P_U =	1.56	kips	**STIFFENER OKAY**

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Anchorage to Supporting Structure

Shear to each long side = **1984** lbs
Shear to each short side = **1984** lbs

$R_{ISO\ MIN} = (Fp_{MAX} * (h_{cm} + h_{frame})) / W_{CURB} - 1/3 * W_P$
Uplift to each long side = **4213** lbs
$R_{ISO\ MIN} = (Fp_{MAX} * (h_{cm} + h_{frame})) / (L_{CURB} - 2 * d_i) - 1/3 * W_P$
Uplift to each short side = **2460** lbs

Anchorage to Concrete Pad

4 in. thick conrete pad - min. embedment of 3 in., min. spacing of 8 in. and min. edge distance of 6 in.

w/ 1/2" Simpson Titen HD, allow = **1605** lbs in **shear**
w/ 1/2" Simpson Titen HD, allow = **1155** lbs in **tension**

Try **4** Titen HD's per long side at a minimum
Try **3** Titen HD's per short side

(Actual Shear / Allowable Shear)^(5/3) + (Actual Tension / Allowable Tension)^(5/3) ≤1.0

Elliptical Interaction Equation = **0.999** at the long sides **OK, less than 1.0**
Elliptical Interaction Equation = **0.793** at the short sides **OK, less than 1.0**

Anchorage to Wood sub-Structure

With Simpson 1/4 x 3" SDS screws...

Allow Shear = **470** lb per simpson catalog
Allow Tension = **550** lb assuming 2" penetration per NDS Table 11.2B (#14 wood screw)

4 screws required for uplift long side
3 screws required for uplift short side

5 screws required for shear both sides

9 **total screws required long side** — **8.60** inches maximum spacing
8 **total screws required short side** — **4.7** inches maximum spacing

Anchorage to Steel sub-Structure

The steel sub-structure will have wood blocking in place between flutes of metal deck, therefore the required number of SDS screws will be the same as for the wood sub-structure.

Note: Connection evaluated without consideration of bolt hole deformation.

Anchorage to Steel

With A307 1/2" Bolts...

t =	**0.060**	in
F_y =	**33**	ksi
F_u =	**45**	ksi
e=	**1**	in.
d=	**1/2**	in.
width=	**3**	in.

$R_{ISO\ MIN} = (Fp_{MAX} * (h_{cm} + h_{frame})) / W_{CURB} - 1/3 * W_P$

Uplift to each long side = **4213** lbs

$R_{ISO\ MIN} = (Fp_{MAX} * (h_{cm} + h_{frame})) / (L_{CURB} - 2 * d_i) - 1/3 * W_P$

Uplift to each short side = **2460** lbs

Shear to each long side = **1984** lbs

Shear to each short side = **1984** lbs

Design strength based on spacing and edge distance:

P_n=	2.7	kips/bolt
F_u/F_y=	1.36	
Ω=	2.00	
Φ=	0.70	
P_n/Ω=	1.35	kips/bolt
ΦP_n=	1.89	kips/bolt
3d=	1 1/2	NOTE: Distance between bolt hole centers must be greater than 3d.
1.5d=	3/4	NOTE: Distance from edge of connection to bolt hole center must be greater than 1.5d

Design strength based on bearing:

NOTE: bolt hole deformation is not considered

C=	3	in^2
m_f=	0.75	Table E3.3.1-2
Ω=	2.50	
Φ=	0.60	
P_n=	3.0375	kips/bolt
P_n/Ω=	1.215	kips/bolt
ΦP_n=	1.82	kips/bolt

Design strength based on bolt shear:

P_n=	5.3	kips/bolt (Table IV-6)
Ω=	2.40	
Φ=	0.65	
P_n/Ω=	2.21	kips/bolt
ΦP_n=	3.45	kips/bolt

Governing limit state:

			Governing Limit State
P_n/Ω=	1.22	kips/bolt	Bearing Strength
ΦP_n=	1.82	kips/bolt	Bearing Strength

4	# of bolts for the long side
3	# of bolts for the short side