CHA COMPUTATION PAD

COMPLETED BY:	AM	PROJECT	PHASE	ORG
CHECKED BY:		18301	1077	28000
PROJECT NAME:	CT 1887	SHEET #: 13	OF	
PROJECT LOCATION:	COS COB, CT.	DATE:	7.17.12	
		SUBJECT:	CONNECTIONS DESIGN	

3. PLATFORM STEEL MEMBERS CONNECTION : PER RAM ADVANSE RXNS

$V_{z\,MAX} = 2.4^{K}$

PER SHEAR DGRM ATTACHED - P. 15A

USE 3/4" Φ A325-N BOLT FOR CONNECTION

ALLOWABLE SHEAR = 15.9K EA.

4. W12x26 POST CONNECTION : TO EXISTING TANK WALL

PER RAM ADVANSE : $F_y + F_z = \sqrt{(11.7^{K})^2 + (3.1^{K})^2} = 12.1^{K} \downarrow$ CASE 49 OUTPUT - P. 2A

$F_{x\,MAX} = 8.1^{K} \rightarrow$ CASE 51

USE STAINLESS STEEL NELSON STUD TYPE CONNECTION @ TANK WALL.

TRY 3/8" - 24 UNF STUD WELD.

CAPACITY EA. STUD => SHEAR : 4.9 K

TENSILE : 6.6 K

EA. POST WILL UTILIZE (5) STUDS PER FLANGE

PER NELSON STANDARDS ; USE F.S. = 0.6 * YIELD STRENGTH

∴ SHEAR : (5) * (4.9 K * 0.6) = 14.7 K > 8.1 K ✓ OK

TENSION : (5) * (6.6 K * 0.6) = 19.8 K > 12.1 K ✓ OK

* ACTUAL STUD QTY TO RESIST SHEAR = 10 STUDS.

NELSON TECH. INFO - ATTACHED P. 15B

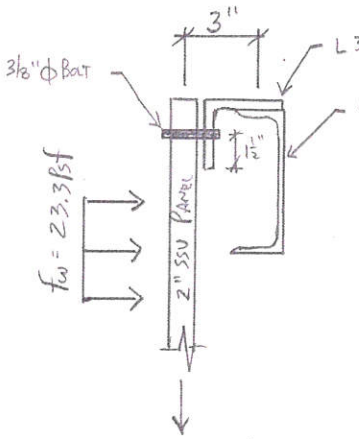
USE NELSON 3/8 - 24 UNF STUDS

CHA COMPUTATION PAD

COMPLETED BY:	AM	PROJECT	PHASE	ORG
CHECKED BY:		18301	1077	28000
PROJECT NAME:	CT 1887	SHEET #: 14	OF	
PROJECT LOCATION:	COS COB, CT.	DATE: 7.17.12		
		SUBJECT: CONNECTIONS DESIGN		

5. NEW C6x10.5 ROLLED CHANNEL : WT. of 10' x 4' x 2" PANEL = 1.4 psf

WT. = 10' x 4' x 1.4 psf = 56 lbs. EA.



e = 3"

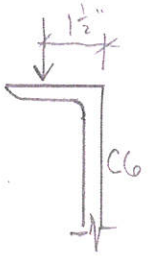
W_{PANEL} = 56 lb EA. * 5 PER SPAN ≅ 300 lbs. ↓

f_{WIND} = (23.3 psf) * (10' x 4') * 5 PANELS = 4660 lbs →

TOP FLANGE LOADS : PER 1' SECTION

DEAD : 300 lbs / 13.5' = 22.2 lbs/ft

MOMENT = (300 lbs x (3"/12)) / 13.5' = 6 lb.ft



WIND : 4660 lbs / 2 SIDES = 2330 lbs / 13.5' = 175 lbs/ft.

MOMENT = $\frac{(175)(13.5')^2}{8}$ = 3,990 lb.ft

f_b = 0.66 f_y f_y = 36 ksi

M_{MAX} (WEAK AXIS) = 3,990 lb.ft = 47.9 in.k

S_y (req'd) = $\frac{47.9 \text{ in.k}}{23.8 \text{ ksi}}$ = 2.01 in^3

$S_y = bd^2(1/6) \rightarrow d = \left(\frac{6(2.01 in^3)}{3"}\right)^{1/2}$ = 2.0 in.

C6x13 × (N.G.) S_y = 0.638 in^3 < 2.01 in^3 AISC 13TH

TRY C6x13 w/ UNBRACED ℓ = 6.25' w/ MID-SPAN SUPPORT BRACE

5. NEW ROLLED CHANNEL : CONT'D

TRY : C6 x 13 w/ ℓ_b = 6.25'

$$M_{MAX} = \frac{(175\ PLF)(6.25')^2}{8} = 855\ ^{lb.ft} = 10.3\ ^{IN.K}$$

S_y (req'd) = $10.3^{IN.K} / 23.8\ KSI$ = 0.43 IN^3

∴ C6x13 ✓(OK) w/ MID-SPAN BRACE

REQ'D 0.43 IN^3 < 0.638 IN^3 PROVIDED

USE C6x13 ROLLED w/ MID-SPAN BRACE

WELD DESIGN :

DESIGN WELD TO RESIST SHEAR FORCE DUE TO WIND
= 175 PLF x 13.5'
= 2400 lbs. TOTAL PER MAX ROLLED CHANNEL SPAN.

TRY 3/16" WELD w/ ℓ = 2" @ 12" O.C.

TOTAL RESISTANCE = $(0.9^K/_{IN} / {}^{1}/_{16}"\ WELD)^K (2")^K (3) = 5.4^K$

5.4^K x 13 OCCURRENCES = 70.2^K

$70.2^K > 2.4^K$ TOTAL FORCE

∴ USE 3/16" WELD @ 12" O.C. w/ ℓ = 2" EA.

Bentley

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Units system: English
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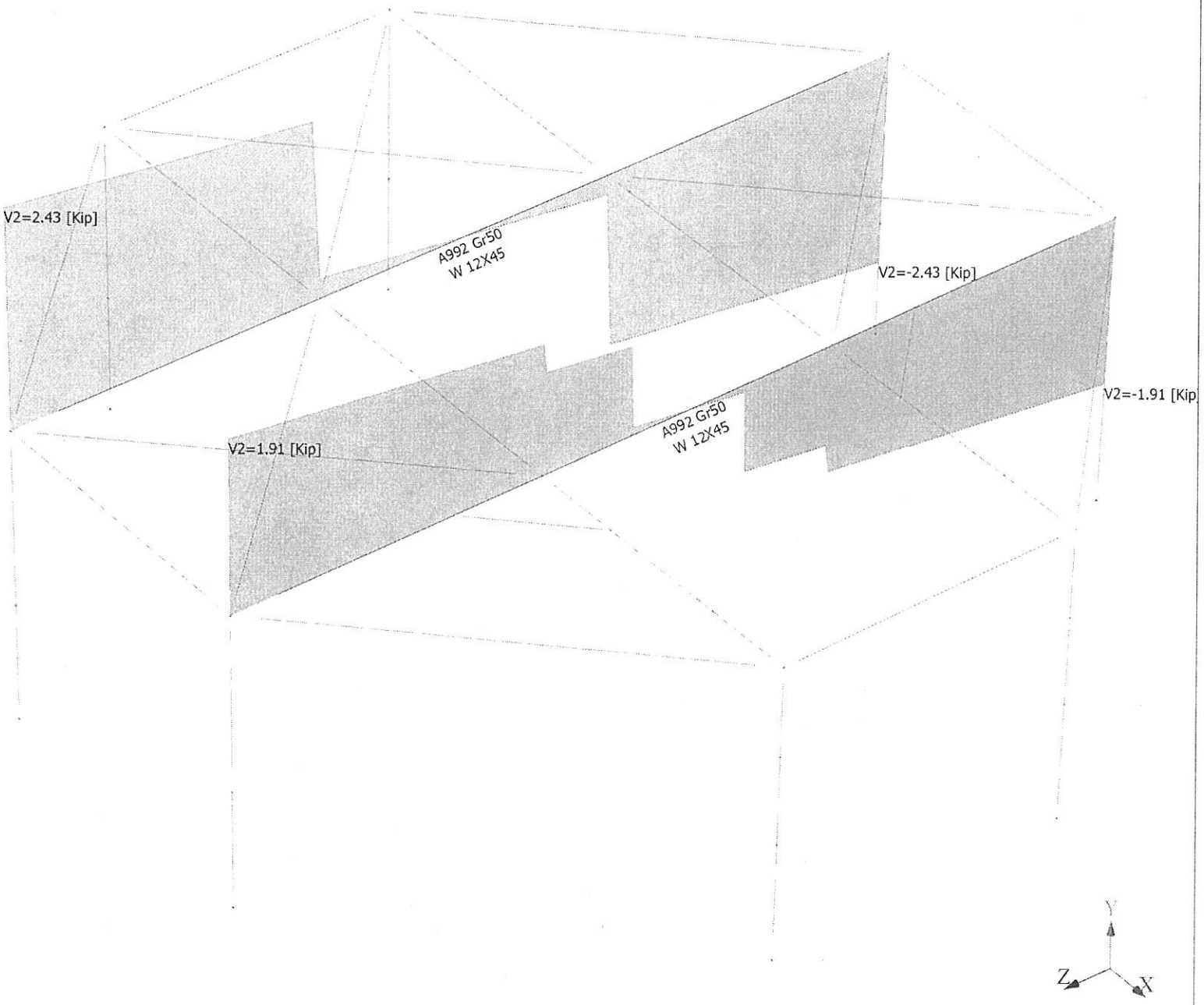


NELSON STUD WELDING

General Information for Stud Welding Studs

Stainless Steel (As Formed)) – 75,000psi Minimum Ultimate, 50,000 psi Minimum Yield

Thread Diameter	META[1] (sq. in.)	Yield Load (lbs.) at 50,000 psi	Ultimate Tensile Load (lbs) at 75,000 psi	Yield Torque[2] (ft-lbs) at 50,000 psi	Ultimate Torque (ft-lbs) at 75,000 psi	Shear Strength[3] (75% of Tensile Strength)
10-24 UNC	0.0174	870	1,305	2.4	4.1	979
10-32 UNF	0.0199	1,000	1,500	2.8	4.7	1,125
1/4-20 UNC	0.0317	1,590	1,590	5.8	9.9	1,789
1/4-28 UNF	0.0362	1,810	1,810	6.8	11.3	2,036
5/16-18 UNC	0.0522	2,620	3,930	12.1	20.4	2,948
5/16-24 UNF	0.0579	2,895	4,343	13.8	22.6	3,257
3/8-16 INC	0.0773	3,875	5,813	21.6	36.3	4,359
3/8-24 UNF	0.0876	4,380	6,570	25.4	41.1	4,928
7/16- 14 UNC	0.1060	5,315	7,973	34.6	58.1	5,979
7/16-20 UNF	0.1185	5,900	8,850	39.8	64.5	6,638
1/2-13 UNC	0.1416	7,095	10,643	53.2	88.7	7,982
1/2-20 UNF	0.1597	8,000	12,000	62.3	100.0	9,000
5/8-11 UNC	0.2256	11,300	16,950	106.6	176.6	12,713
5/8-18 UNF	0.2555	12,750	19,125	125.1	199.2	14,344
3/4-10 INC	0.3340	16,700	25,050	190.7	313.1	18,788
3/4-16 UNF	0.3724	18,600	27,900	219.9	348.8	20,925
7/8-9 UNC	0.4612	23,100	34,650	309.1	505.3	25,998
7/8-14 UNF	0.5088	25,450	38,175	351.5	556.7	28,631
1-8 UNC	0.6051	30,300	45,450	464.0	757.5	34,088
1-14 UNF	0.6791	33,900	50,850	534.4	847.5	38,138

* Torque figures based on assumption that excessive deformation of thread has not taken relationship between torque/tension out of its proportional range.

In actual practice, stud should not be used at its yield load. A factor of safety must be applied. It is generally recommended that studs not be used at more than 60% of yield strength, however, the factor of safety may vary up or down according to the particular application in which the studs are being used.

The user of these studs will make this determination

Formulae used to make the above calculations are as follows:

Ultimate Tensile	$L = SA$	Ultimate Torque	$T = 0.2 \times D \times L$
Yield	$Z = YA$	Yield Torque	$T = 0.2 \times D \times Z$

Where
D = Nominal Thread Diameter
S = Tensile Stress (psi)
L = Tensile Load (lbs)
A = Mean Effective Thread Area (META)
Y = Yield Stress (psi)
Z = Yield Load
T = Torque (in-lbs)

1 META is used instead of root area in calculating screw lengths because of closer correlation with actual tensile strength. META is based on mean diameter, which is the diameter of an imaginary co-axial cylinder whose surface would pass through the thread profile approximately midway between the minor and pitch diameters.

2 In actual practice, stud should not be used at its yield load. A factor of safety must be applied. It is generally recommended that studs not be used at more than 60% of yield strength, however, the factor of safety may vary up or down according to the particular application in which the studs are being used.

The user will make this safety factor determination

3 Shear values are based on Tensile Strength of the stud.

CHA COMPUTATION PAD

COMPLETED BY:	AM	PROJECT	PHASE	ORG
CHECKED BY:		18301	1077	28000
PROJECT NAME:	CT 1887	SHEET #: 16	OF	
PROJECT LOCATION:	COS COB, CT.	DATE: 7.2.12		
		SUBJECT: EXIST. TANK ANALYSIS		

STEEL TANK : PHYSICAL DIMENSIONS ;

DIAMETER =	30' - 0"
WALL HT. =	42'- 6"
DOME HT. =	4'- 6"
WALL THICKNESS =	0.35"

PER EXIST. DWGS 9/24/53

PER SITE VISIT NE - 8/10/11

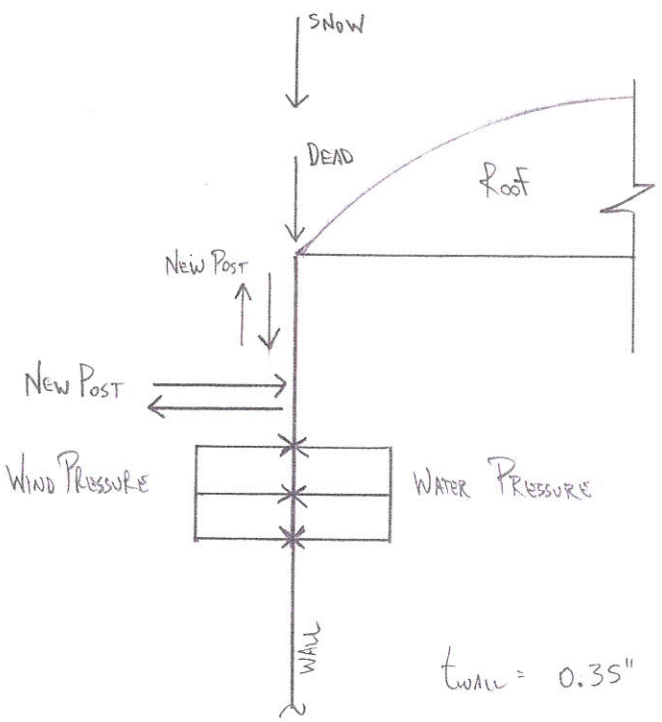
PER RAM ADVAN OUTPUT - P.2

PLATFORM RXNS : (WORST CASE)

- ALL RXNS WILL BE DISTRIBUTED OVER WELD STUDS OF POSTS TO ACTUAL TANK WALL.
- INITIAL PRESUMED STUD WELD QTY = 5 STUDS PER POST FLANGE, ASSUMING A TOTAL POST CONTACT LENGTH OF 4'-0".

$F_{y\,MAX}$ =	12.1K ↓	(AXIAL FORCE ON TANK WALL)
$F_{x\,MAX}$ =	8.0K →	(TENSION FORCE ON TANK WALL)
$F_{z\,MAX}$ =	8.1K ↗	

FORCE CONSIDERATIONS : SKETCH



γ_{WATER} = 62.4 pcf

t_{WALL} = 0.35" (ASSUMED A7 STEEL, F_y = 33 ksi)

CHA COMPUTATION PAD

		PROJECT	PHASE	ORG
COMPLETED BY:	[illegible]	18301	1077	28000
CHECKED BY:		SHEET #: 17	OF	
PROJECT NAME:	CT 1887	DATE:	7.3.12	
PROJECT LOCATION:	COS COB, CT	SUBJECT:	EXIST. TANK ANALYSIS	

EXISTING LOADS:

DEAD; WT. of Roof = 10 psf × 811 ft² = 8,100 lbs PER CHA CALCS - 8/22/11 — DL

8,100 lbs / π (30' DIA.) = 86 PLF ↓ AXIAL / 45 NODES

WT. of WALLS = 14.3 psf ← TAKEN INTO ACCOUNT AUTOMATICALLY IN RAM MODEL

LIVE; WIND (x & z DIRECTIONS) — WL

$P_w = q_z G C_f \geq 30 C_f$ — AWWA EQN 3-1

$q_z = 0.00256 K_z I V^2$ — EQN 3-2

K_z = 1.09 (0'-50' - Exp. C) — TBL 3 AWWA

I = 1.15 (PER AWWA)

V = 110 mph (IBC 2009)

$\therefore q_z = 0.00256 (1.09)(1.15)(110)^2 = 38.8$ psf

G = 1.0 (DYNAMICALLY SENSITIVE STRUCTURE) — ASCE 7-05

C_f = 0.60 (CYLINDRICAL STRUCTURE) — TBL 2 AWWA

$P_w = (38.8 \text{ psf})(1.0)(0.60) \geq 30 (0.60)$

CONTROLS → 23.3 psf > 18 psf

Roof Live Load = 15 psf MINIMUM — AWWA 3.1.3.2

CHA COMPUTATION PAD

		PROJECT	PHASE	ORG
COMPLETED BY:	AM	18301	1077	28000
CHECKED BY:		SHEET #: 15	OF	
PROJECT NAME:	CT 1887	DATE:	7.12.12	
PROJECT LOCATION:	COS COB, CT.	SUBJECT:	EXIST. TANK ANALYSIS	

EXISTING LOADS : CONT'D

LIVE ; SNOW → PER CALCS BY CHA: 8.18.11 — SL

P_f = 27.7 psf > AWWA MINIMUM = 25 psf — AWWA 3.1.3.1

HOWEVER CT STATE MIN. = 30 psf ← CONTROLS

SEISMIC LOADS : PER ATTACHED SPREADSHEET - P. 11

S_S = 0.330 & S_1 = 0.068 — PER USGS

UPPER ENCLOSURE W_{TOTAL} = 4.01K

WIND FORCE CONTROLS (5.24K)

FLUID : $V_{TANK} = Ah = \pi D h = \pi(30')(42') = 3958\ ft^3$

$P = \gamma_{WATER} h$ — PRESSURE ON WALLS

			TOTAL
42' - 40' =	(62.4 pcf)(2') =	125 psf	125 psf
40' - 30' =	(62.4 pcf)(10') =	624 psf	750 psf
30' - 22' =	" (8') =	500 psf	1250 psf
22' - 12' =	" (10') =	624 psf	1873 psf
12' - 4' =	" (8') =	500 psf	2373 psf
4' - 0' =	" (4') =	250 psf	2623 psf

NOTE: ANALYSIS OF TANK WILL OCCUR @ TOP 12' ONLY; TOTAL STRESS WILL BE DETERMINED DUE TO NEW PST LOADS. POST RXNS FROM PLATFORM RAM DESIGN WILL BE INPUT AS (2) LL POINT LOADS PER POST (CONSERVATIVE)

Bentley

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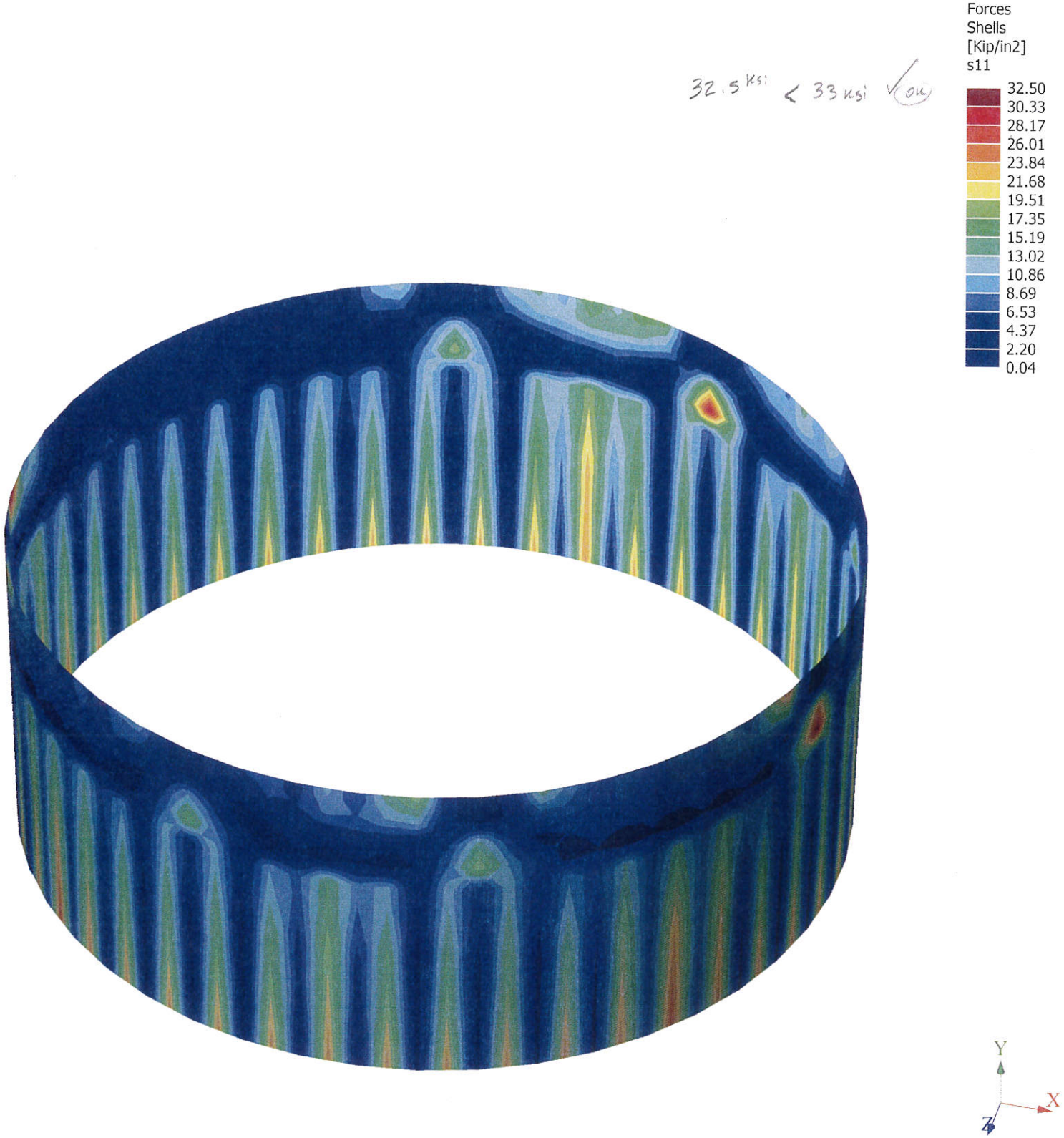
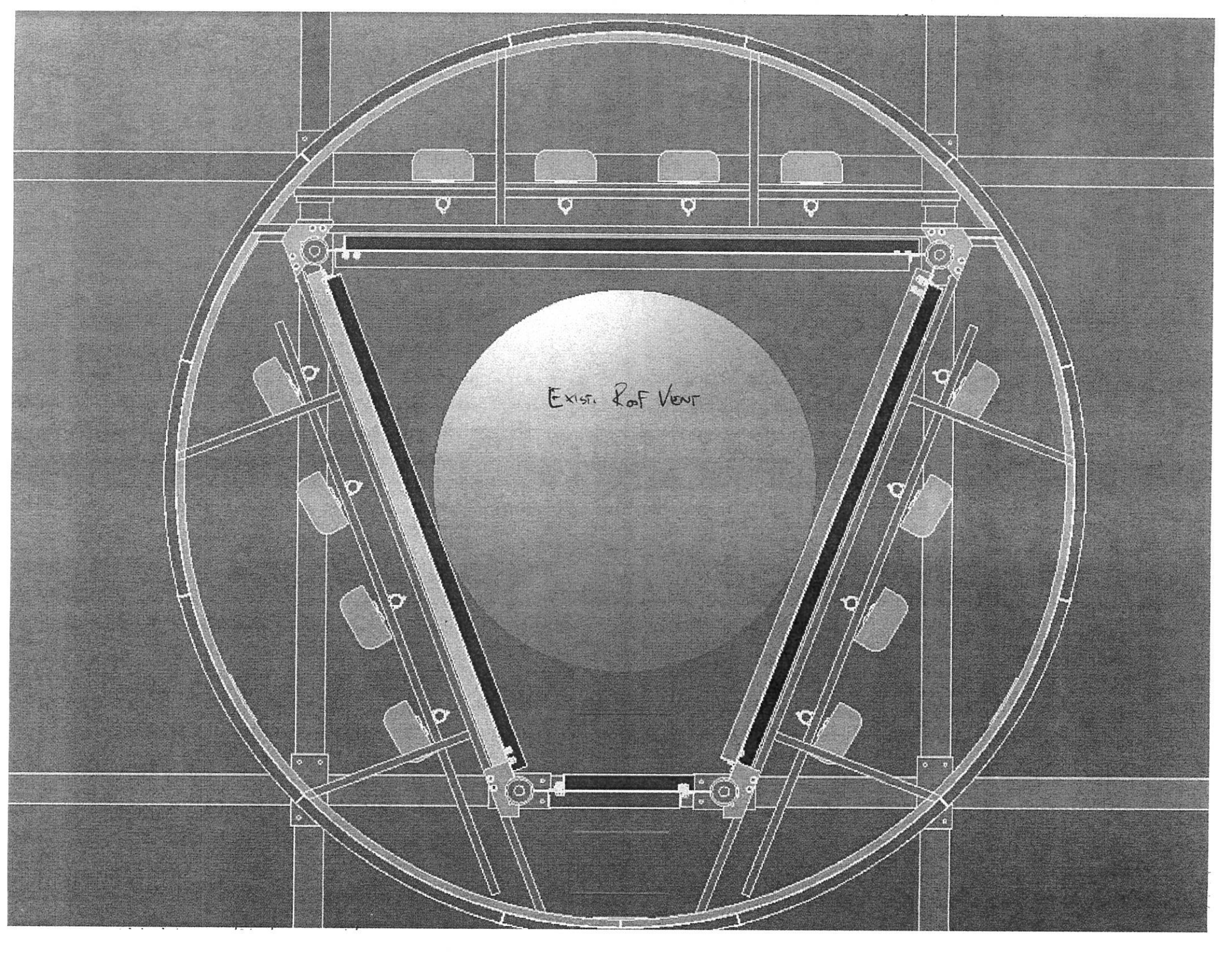
P. 16

32.5 ksi < 33 ksi ✓ OK




EXIST. ROOF VENT

VECTOR ENGINEERS

UTAH OFFICES
Sandy
Layton
St. George

STRUCTURAL CALCULATIONS
for
CT 1887 (SITE # CT 1887)
at
455 VALLEY ROAD
COS COB, CT 06807
for
STEALTH® CONCEALMENT SOLUTIONS (CT11-01022W-33R3)

BY: ROGER T. ALWORTH, P.E.
PRINCIPAL

PROJECT #: U0142-630-121

DATE: August 2, 2012 2

NOTE: The calculations presented in this package are intended for a single use at the location indicated above, for the client listed above. These calculations shall not be reproduced, reused, "card filed", sold to a third party, or altered in any way without the written authorization of Vector Structural Engineers, PC.

VECTOR ENGINEERS

JOB NO.: U0142-630-121 DESIGNED: BDV
DATE: 06/22/12 CHECKED: TPH

SHEET 1 OF 31

PROJECT: CT 1887

Design Criteria:

Code: Structural design is based on the International Building Code, 2003 Edition

Wind: Basic wind speed = 110 mph (3-second gust) per the ASCE 7 standard

Wind importance factor, I = 1
Occupancy category: II
Wind exposure: C

General Notes:

1 The contractor shall verify dimensions, conditions and elevations before starting work. The engineer shall be notified immediately if any discrepancies are found.
2 The typical notes and details shall apply in all cases unless specifically detailed elsewhere. Where no detail is shown, the construction shall be as shown for other similar work and as required by the building code.
3 These calculations are limited to the structural members shown in these calculations only. The connection of the members shown in these calculations to the existing structure shall be by others.
4 The contractor shall be responsible for compliance with local construction safety orders. Approval of shop drawings by the architect or structural engineer shall not be construed as accepting this responsibility.
5 All structural framing members shall be adequately shored and braced during erection and until full lateral and vertical support is provided by adjoining members.

Structural Steel:

1 All structural steel code checks based on the AISC, 13th Edition per the ASCE 7 standard
2 All steel pipe to be per A500 GR. B (42 KSI), U.N.O.
3 All other structural steel shapes & plates shall be per ASTM A36, U.N.O.
4 All bolts for steel-to-steel connections shall be per ASTM A325N, U.N.O.
5 All bolted connections shall be tightened to "snug tight" condition as defined by AISC
6 All welding shall be performed by certified welders in accordance with the latest edition of the American Welding Society (AWS) D1.1
7 All steel surfaces shall be galvanized in accordance with the ASTM A123 and ASTM A153 standards, U.N.O.

Fiberglass Reinforced Plastic (FRP):

1 All structural shapes shall be Bedford FRP Series 1525 produced using the pultrusion process.
2 All cut edges and holes shall be sealed with a resin compatible with the resin matrix used in the structural shape.
3 The fabricator and contractor shall exercise precautions necessary to protect the fiberglass pultruded structural shapes from abuse to prevent breakage, nicks, gouges, etc. during fabrication, handling, and installation.
4 Structural shapes shall be fabricated and assembled as indicated on the design drawings.
5 Isoplast bolts and nuts shall be tightened to snug tight and turned an additional 1/2 turn and locked with epoxy.

U0142-630-121
Sh. 2A