

Structural Calculations  
*For*  
**VER D'LIGHT WING**

*Prepared for:*  
**Larry Hyatt**  
BSUTECenter 5465 E Terra Linda Way  
Nampa, Idaho 83687  
Job No. 10003.001

**Rogue Richardson, PE**  
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Revision #	Prepared by	Project #
0	Rogue Richardson	10003.001

**DESIGN CRITERIA:**

CODE: 2006 INTERNATIONAL BUILDING CODE

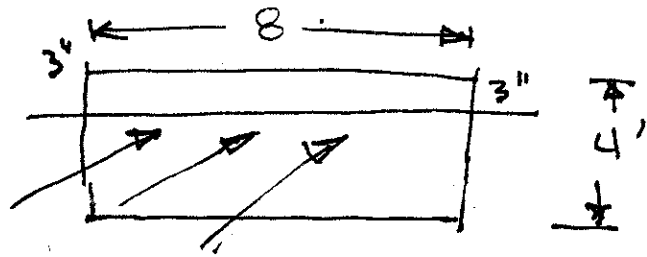
BY Rogue PROJECT Ver ADlight  
 DATE 1/22/10  
 SHEET NO. \_\_\_\_\_ CLIENT \_\_\_\_\_

CALCULATE STRENGTH OF SUPPORT

ROD BASED ON WING SIZE & 90 MPH

WIND LOAD

WIND PRESSURE HEIGHT	PRESSURE
0-15	18.4
20	19.6
25	20.5
30	21.3
35	22
40	22.7
45	23.2
50	23.8
55	24.2
60	24.7
65	25.1
70	25.5
75	25.9



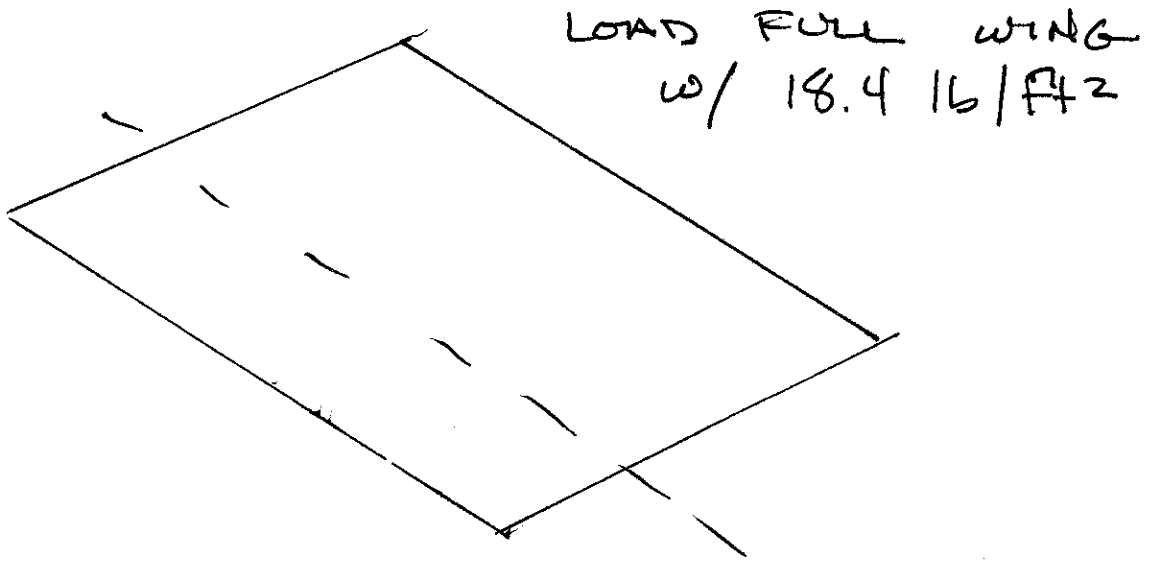
$8 \times 4 = 32 \text{ ft}^2$

$\text{WIND LOAD} = 18.4 \text{ lb/ft}^2$

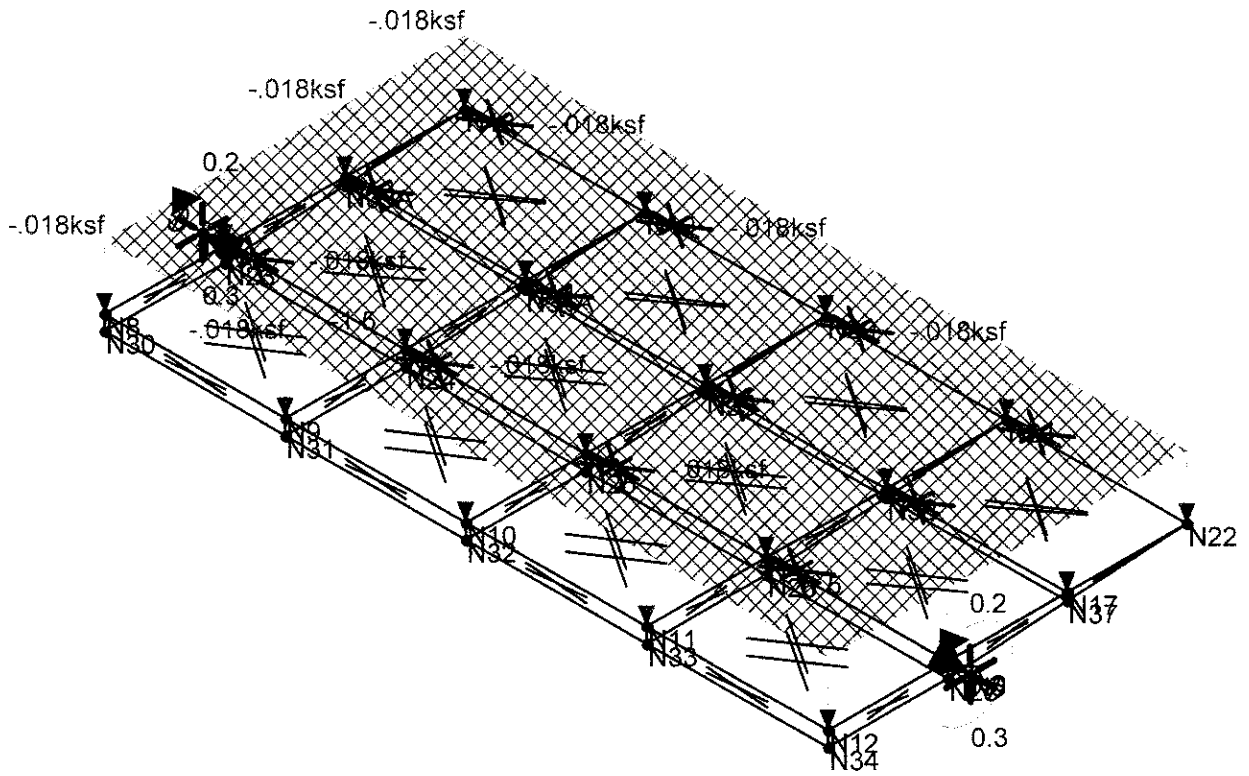
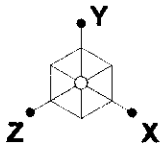
$\text{lbs per linear ft} = 4 \times 25.9 = 103.$

BY Rogue PROJECT Ver de l'Hotel  
DATE 1/20/10  
SHEET NO. \_\_\_\_\_ CLIENT \_\_\_\_\_

## DESIGN CENTER ROTATION PIPE



SEE RISA RESULTS - NEXT PAGES



Loads: BLC 1, Wind  
 Results for LC 1, wind  
 Reaction units are k and k-ft

Rogue Richardson

January 21, 2010

9:39 AM

wing.r3d

Member: **M1**

Shape: **2 x 1/4**

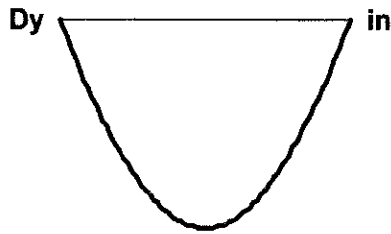
Length: **8.5 ft**

I Joint: **N7**

J Joint: **N6**

LC 1: wind

Max Code Check: **0.202**



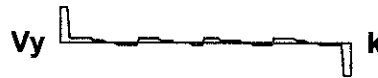
Dz \_\_\_\_\_ in  
Min: **-.002 at 4.25 ft**

Max: **.372 at 2.302 ft**



Min: **-1.455 at 0 ft**

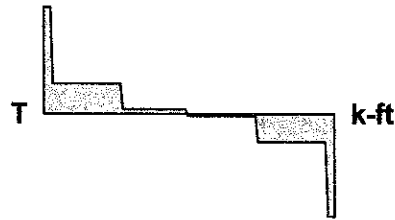
Max: **.288 at 0 ft**



Min: **-.286 at 8.5 ft**

Max: **.004 at .266 ft**  
Vz \_\_\_\_\_ k  
Min: **-.004 at 6.286 ft**

Max: **.166 at 0 ft**



Min: **-.166 at 8.323 ft**



Min: **-.051 at .177 ft**

Max: **.005 at 2.214 ft**  
My \_\_\_\_\_ k-ft  
Min: **-.003 at .266 ft**

Max: **.271 at 2.302 ft**



Min: **-1.059 at 0 ft**

Max: **1.135 at .177 ft**



Min: **-1.135 at .177 ft**

ft \_\_\_\_\_ ksi  
Min: **-1.135 at .177 ft**

**AISC ASD 9th Ed. Code Check**

Max Code Check **0.202**  
Location **3.365 ft**  
Equation **H1-1**

Max Shear Check **0.251 (s)**  
Location **0 ft**  
Max Defl Ratio **L/977**

**Compact**

Fy **21 ksi**  
Fa **2.049 ksi**  
Ft **12.6 ksi**  
Fby **13.86 ksi**  
Fbz **13.86 ksi**  
Fvy **8.4 ksi**  
Fvz **8.4 ksi**  
Cb **1**

Y-Y **.6**  
Z-Z **.85**  
Cm **.6**  
Lb **8.5 ft**  
KL/r **163.2**  
Sway **No**  
L Comp Flange **8.5 ft**  
Torque Length **NC**

Member: **M2**

Shape: **2 x 1/8**

Length: **8 ft**

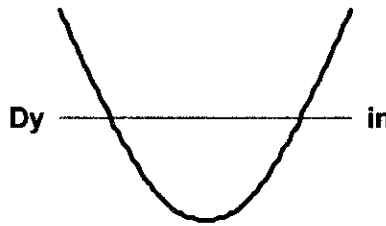
I Joint: **N8**

J Joint: **N12**

LC 1: wind

Max Code Check: **0.144**

Max: **.032 at 0 ft**



Min: **-0.031 at 4 ft**

Dz in

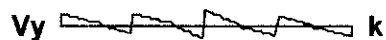
Min: **-0.002 at 4 ft**

Max: **.181 at 2 ft**



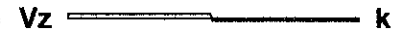
Min: **.09 at 6 ft**

Max: **.012 at 4 ft**



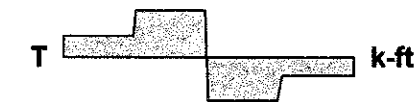
Min: **-0.011 at 3.917 ft**

Max: **.002 at 0 ft**



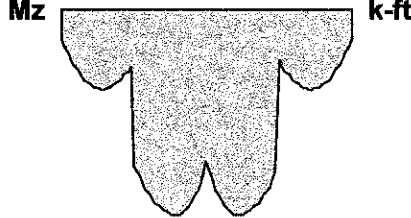
Min: **-0.002 at 6 ft**

Max: **.004 at 2 ft**



Min: **-0.004 at 4 ft**

Max: **-.003 at 8 ft**



Min: **-0.02 at 3.167 ft**

Max: **.003 at 6 ft**



Min: **-0.001 at 2 ft**

Max: **.245 at 2 ft**



Min: **.122 at 6 ft**

Max: **.747 at 3.167 ft**



Min: **.114 at 8 ft**

Max: **-.114 at 8 ft**



Min: **-.747 at 3.167 ft**

**AISC ASD 9th Ed. Code Check**

Max Code Check **0.144**  
 Location **3.167 ft**  
 Equation **H1-1**

Max Shear Check **0.012 (s)**  
 Location **4 ft**  
 Max Defl Ratio **L/1527**

**Compact**

Fy **21 ksi**  
 Fa **2.614 ksi**  
 Ft **12.6 ksi**  
 Fby **13.86 ksi**  
 Fbz **13.86 ksi**  
 Fvy **8.4 ksi**  
 Fvz **8.4 ksi**  
 Cb **1**

Y-Y  
 Cm **.6**  
 Lb **8 ft**  
 KL/r **144.495**  
 Sway **No**  
 L Comp Flange **8 ft**  
 Torque Length **NC**

Z-Z  
 .85  
 8 ft  
 144.495  
 No

**Global**

Steel Code	ASD: AISC 9th, AISI 99
Allowable Stress Increase Factor (ASIF)	1.333
Include Shear Deformation	Yes
Include Warping	Yes
No. of Sections for Member Calcs	5
Redesign Sections	Yes
P-Delta Analysis Tolerance	0.50%
Vertical Axis	Y

**Materials (General)**

Material Label	Young's Modulus (ksi)	Shear Modulus (ksi)	Poisson's Ratio	Thermal Coef. (per 10 <sup>5</sup> F)	Weight Density (k/ft <sup>3</sup> )	Yield Stress (ksi)
STL	29000	11154	.3	.65	.49	36
ALU	10600	4077	.3	1.29	.173	21

**Sections**

Section Label	Database Shape	Material Label	Area (in <sup>2</sup> )	SA(yy)	SA(zz)	I y-y (in <sup>4</sup> )	I z-z (in <sup>4</sup> )	J (Torsion) (in <sup>4</sup> )	T/C Only
SEC1	2 x 1/4	ALU	1.374	1.2	1.2	.537	.537	1.074	
SEC2	2 x 1/8	ALU	.736	1.2	1.2	.325	.325	.65	
S3	.25	ALU	.049	1.2	1.2	.000191748	.000191748	.000383495	

**Joint Coordinates**

Joint Label	X Coordinate (ft)	Y Coordinate (ft)	Z Coordinate (ft)	Joint Temperature (F)	Detach from Diaphragm
N1	0	0	0	0	No
N2	2	0	0	0	No
N3	4	0	0	0	No
N4	6	0	0	0	No
N5	8	0	0	0	No
N6	8.25	0	0	0	No
N7	-25	0	0	0	No
N8	0	0	1.33	0	No
N9	2	0	1.33	0	No
N10	4	0	1.33	0	No
N11	6	0	1.33	0	No
N12	8	0	1.33	0	No
N13	0	0	-1.33	0	No
N14	2	0	-1.33	0	No
N15	4	0	-1.33	0	No
N16	6	0	-1.33	0	No
N17	8	0	-1.33	0	No
N18	0	0	-2.66	0	No
N19	2	0	-2.66	0	No
N20	4	0	-2.66	0	No
N21	6	0	-2.66	0	No
N22	8	0	-2.66	0	No
N23	0	-.167	0	0	No
N24	2	-.167	0	0	No
N25	4	-.167	0	0	No
N26	6	-.167	0	0	No
N27	8	-.167	0	0	No
N30	0	-.167	1.33	0	No
N31	2	-.167	1.33	0	No
N32	4	-.167	1.33	0	No
N33	6	-.167	1.33	0	No
N34	8	-.167	1.33	0	No

**Joint Coordinates (continued)**

Joint Label	X Coordinate (ft)	Y Coordinate (ft)	Z Coordinate (ft)	Joint Temperature (F)	Detach from Diaphragm
N33A	0	-0.0833	-1.33	0	No
N34A	2	-0.0833	-1.33	0	No
N35	4	-0.0833	-1.33	0	No
N36	6	-0.0833	-1.33	0	No
N37	8	-0.0833	-1.33	0	No

**Boundary Conditions**

Joint Label	X Translation (k/in)	Y Translation (k/in)	Z Translation (k/in)	MX Rotation (k-ft/rad)	MY Rotation (k-ft/rad)	MZ Rotation (k-ft/rad)
N6	Reaction	Reaction	Reaction	Reaction		
N7	Reaction	Reaction	Reaction	Reaction		

**Member Data**

Member Label	I Joint	J Joint	K Joint	X-Axis Rotate (degrees)	Shape / Section Set	Material Set	Phys. O.M. Memb	End Releases			End Offsets		Inactive Code	Member Length (ft)
								I-End xyz	J-End xyz	I-End (in)	J-End (in)			
M1	N7	N6			SEC1	ALU	Y							8.5
M2	N8	N12			SEC2	ALU	Y							8
M3	N8	N18			S3	ALU	Y							3.99
M4	N9	N19			S3	ALU	Y							3.99
M5	N20	N10			S3	ALU	Y							3.99
M6	N21	N11			S3	ALU	Y							3.99
M7	N22	N12			S3	ALU	Y							3.99

**Steel Design / NDS Parameters**

Member Label	Section Set	Length (ft)	Lb y-y le2 (ft)	Lb z-z le1 (ft)	L_comp le_bend (ft)	K y-y	K z-z	Cm y-y		Cb	Sway		R
								CH	Cm z-z	B	y	z	
M1	SEC1	8.5				1.	1.						0.
M2	SEC2	8				1.	1.						0.
M3	S3	3.99				1.	1.						0
M4	S3	3.99				1.	1.						0
M5	S3	3.99				1.	1.						0
M6	S3	3.99				1.	1.						0
M7	S3	3.99				1.	1.						0

**Redesign Criteria**

Section Set	Max Depth (in)	Min Depth (in)	Max Width (in)	Min Width (in)	Max Code Check	Min Code Check
No Data to Print ...						

**Basic Load Case Data**

BLC No.	Basic Load Case Description	Category Code	Category Description	Gravity			Joint	Point	Load Type Totals			
				X	Y	Z			Direct Dist	Area	Surf.	
1	Wind	WL	Wind Load							82	12	
2	LC 1 Transient Area Lo...	None										

**Area Loads on Members, Category : WL, BLC 1 : Wind**

Joint A	Joint B	Joint C	Joint D	Direction	Magnitude (ksf)
N18	N19	N14	N13	Y	-.018
N19	N20	N15	N14	Y	-.018
N20	N21	N16	N15	Y	-.018
N21	N22	N17	N16	Y	-.018
N13	N14	N2	N1	Y	-.018

**Area Loads on Members, Category : WL, BLC 1 (continued)**

Joint A	Joint B	Joint C	Joint D	Direction	Magnitude (ksf)
N2	N14	N15	N3	Y	-.018
N3	N15	N16	N4	Y	-.018
N4	N16	N17	N5	Y	-.018
N4	N5	N12	N11	Y	-.018
N3	N4	N11	N10	Y	-.018
N9	N2	N3	N10	Y	-.018
N8	N1	N2	N9	Y	-.018

**Load Combinations**

Num	Description	Env	WS	PD	SRSS	CD	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	wind	y				1	1	1						

**Joint Displacements, By Combination**

LC	Joint Label	X Translation (in)	Y Translation (in)	Z Translation (in)	X Rotation (radians)	Y Rotation (radians)	Z Rotation (radians)
1	N1	0	-.011	0	-1.366e-3	5.304e-5	-3.584e-3
1	N2	0	-.079	-.002	-4.301e-3	1.39e-5	-2.055e-3
1	N3	0	-.104	-.002	-4.58e-3	1.431e-7	4.61e-6
1	N4	0	-.079	-.002	-4.284e-3	-1.365e-5	2.06e-3
1	N5	0	-.011	0	-1.363e-3	-5.285e-5	3.57e-3
1	N6	0	0	0	0	-5.285e-5	3.796e-3
1	N7	0	0	0	0	5.304e-5	-3.811e-3
1	N8	0	.032	0	-3.911e-3	9.902e-5	-2.101e-3
1	N9	0	-.012	-.002	-4.105e-3	1.376e-5	-1.553e-3
1	N10	0	-.031	-.002	-4.578e-3	6.783e-8	1.646e-7
1	N11	0	-.012	-.002	-4.099e-3	-1.354e-5	1.551e-3
1	N12	0	.032	0	-3.9e-3	-9.863e-5	2.098e-3
1	N13	.001	-.072	0	-6.071e-3	-2.141e-4	-3.774e-3
1	N14	0	-.148	-.002	-4.359e-3	-2.528e-5	-2.611e-3
1	N15	0	-.18	-.002	-4.834e-3	2.475e-7	1.182e-5
1	N16	0	-.148	-.002	-4.354e-3	2.554e-5	2.616e-3
1	N17	-.001	-.072	0	-6.051e-3	2.138e-4	3.76e-3
1	N18	0	-.141	0	-2.778e-3	2.907e-4	-3.354e-3
1	N19	0	-.219	-.002	-4.499e-3	9.406e-5	-3.129e-3
1	N20	0	-.257	-.002	-4.814e-3	-7.215e-7	1.699e-5
1	N21	0	-.219	-.002	-4.483e-3	-9.436e-5	3.138e-3
1	N22	0	-.141	0	-2.77e-3	-2.893e-4	3.339e-3
1	N23	-.006	-.011	.006	-1.882e-3	3.13e-4	-3.455e-3
1	N24	-.003	-.079	.007	-4.25e-3	7.017e-5	-2.109e-3
1	N25	0	-.104	.007	-4.605e-3	-5.441e-7	5.853e-6
1	N26	.003	-.079	.007	-4.235e-3	-7.022e-5	2.11e-3
1	N27	.006	-.011	.006	-1.877e-3	-3.116e-4	3.445e-3
1	N30	-.003	.032	.006	-3.394e-3	-4.024e-5	-2.16e-3
1	N31	-.003	-.012	.006	-4.151e-3	2.985e-5	-1.538e-3
1	N32	0	-.031	.007	-4.566e-3	1.504e-7	-2.271e-7
1	N33	.003	-.012	.006	-4.142e-3	-2.977e-5	1.537e-3
1	N34	.003	.032	.006	-3.385e-3	4.047e-5	2.156e-3
1	N33A	-.003	-.072	.003	-5.808e-3	-2.213e-4	-3.812e-3
1	N34A	-.002	-.148	.003	-4.383e-3	4.054e-6	-2.597e-3
1	N35	0	-.18	.002	-4.819e-3	-5.408e-8	1.152e-5
1	N36	.002	-.148	.003	-4.376e-3	-3.9e-6	2.602e-3
1	N37	.003	-.072	.003	-5.789e-3	2.214e-4	3.797e-3

**Reactions, By Combination**

LC	Joint Label	X Force (k)	Y Force (k)	Z Force (k)	X Moment (k-ft)	Y Moment (k-ft)	Z Moment (k-ft)
1	N6	1.455	.286	0	.166	0	0
1	N7	-1.455	.288	0	.166	0	0
1	Totals:	0	.575	0			
1	COG (ft):	X: 3.988	Y: 0	Z: -.64			

**Material Takeoff**

Material	Shape	Length (ft)	Weight (k)
ALU	2 x 1/4	8.5	.014
	2 x 1/8	8	.007
	.25	19.95	.001
ALU	Totals:	36.45	.022

**Member Section Forces, By Combination**

LC	Member Label	Section	Axial (k)	Shear y-y (k)	Shear z-z (k)	Torque (k-ft)	Moment y-y (k-ft)	Moment z-z (k-ft)
1	M1	1	-1.455	.288	0	.166	0	0
		2	-.187	-.011	.004	.045	.004	-.027
		3	.369	.016	-.002	-.005	.002	-.036
		4	-.191	.011	-.004	-.044	.004	-.027
		5	-1.455	-.286	0	-.166	0	0
1	M2	1	.091	.009	.002	.002	0	-.003
		2	.181	.009	.001	.004	-.001	-.015
		3	.18	.012	-.001	-.004	.001	-.015
		4	.09	.006	-.002	-.002	.003	-.005
		5	.09	-.009	-.002	-.002	0	-.003
1	M3	1	-.005	.003	0	0	0	.001
		2	-.005	-.003	0	0	0	0
		3	-.021	.002	0	0	0	0
		4	0	.007	0	0	0	0
		5	0	-.011	0	0	0	.003
1	M4	1	.003	.004	0	0	0	.001
		2	.003	-.005	0	0	0	0
		3	.002	0	0	0	0	-.002
		4	0	.014	0	0	0	-.001
		5	0	-.022	0	0	0	.005
1	M5	1	0	.022	0	0	0	.005
		2	0	-.014	0	0	0	-.001
		3	.002	-.002	0	0	0	-.002
		4	.003	.004	0	0	0	0
		5	.003	-.002	0	0	0	0
1	M6	1	0	.022	0	0	0	.005
		2	0	-.014	0	0	0	-.001
		3	.002	-.002	0	0	0	-.002
		4	.003	.005	0	0	0	0
		5	.003	-.004	0	0	0	.001
1	M7	1	0	.011	0	0	0	.003
		2	0	-.007	0	0	0	0
		3	-.021	-.002	0	0	0	0
		4	-.005	.003	0	0	0	0
		5	-.005	-.003	0	0	0	.001

**Member Stresses, By Combination**

LC	Member Label	Section	Axial (ksi)	Shear y-y (ksi)	Shear z-z (ksi)	Bending y-top (ksi)	Bending y-bot (ksi)	Bending z-top (ksi)	Bending z-bot (ksi)
1	M1	1	-1.059	.252	0	0	0	0	0
		2	-.136	-.01	.004	.609	-.609	.097	-.097
		3	.269	.014	-.002	.804	-.804	.055	-.055
		4	-.139	.01	-.004	.6	-.6	.097	-.097
		5	-1.059	-.25	0	0	0	0	0
1	M2	1	.123	.014	.003	.112	-.112	-.021	.021
		2	.245	.014	.002	.567	-.567	-.038	.038
		3	.245	.02	-.002	.555	-.555	.052	-.052
		4	.122	.011	-.003	.187	-.187	.096	-.096
		5	.122	-.014	-.003	.112	-.112	-.02	.02
1	M3	1	-.093	.084	0	-7.993	7.993	.025	-.025
		2	-.093	-.062	0	.11	-.11	-.007	.007
		3	-.437	.046	0	3.934	-3.934	.022	-.022
		4	-.01	.17	0	4.903	-4.903	-.045	.045
		5	-.01	-.269	0	-20.091	20.091	-.036	.036
1	M4	1	.07	.108	0	-11.221	11.221	.009	-.009
		2	.07	-.111	0	2.317	-2.317	-.004	.004
		3	.04	.007	0	16.739	-16.739	.003	-.003
		4	-.015	.341	0	9.215	-9.215	-.009	.009
		5	-.015	-.537	0	-40.674	40.674	-.012	.012
1	M5	1	.012	.537	0	-40.665	40.665	0	0
		2	.012	-.341	0	9.23	-9.23	0	0
		3	.045	-.049	0	12.675	-12.675	0	0
		4	.051	.097	0	4.906	-4.906	0	0
		5	.051	-.049	0	-6.077	6.077	0	0
1	M6	1	-.015	.537	0	-40.673	40.673	-.012	.012
		2	-.015	-.341	0	9.216	-9.216	-.009	.009
		3	.04	-.049	0	12.69	-12.69	.003	-.003
		4	.07	.111	0	2.318	-2.318	-.004	.004
		5	.07	-.108	0	-11.22	11.22	.009	-.009
1	M7	1	-.01	.269	0	-20.092	20.092	-.036	.036
		2	-.01	-.17	0	4.902	-4.902	-.045	.045
		3	-.436	-.046	0	3.935	-3.935	.022	-.022
		4	-.092	.062	0	.11	-.11	-.007	.007
		5	-.092	-.084	0	-7.994	7.994	.025	-.025

**Member Deflections, By Combination**

LC	Member Label	Section	x-Translation (in)	y-Translation (in)	z-Translation (in)	x-Rotation (radians)	(n) L/y Ratio	(n) L/z Ratio
1	M1	1	0	0	0	0	NC	NC
		2	0	-.076	-.002	-4.118e-3	1337.229	NC
		3	0	-.104	-.002	-4.58e-3	976.611	NC
		4	0	-.076	-.002	-4.102e-3	1340.171	NC
		5	0	0	0	0	NC	NC
1	M2	1	0	.032	0	-3.911e-3	NC	NC
		2	0	-.012	-.002	-4.105e-3	2175.784	NC
		3	0	-.031	-.002	-4.578e-3	1527.239	NC
		4	0	-.012	-.002	-4.099e-3	2174.684	NC
		5	0	.032	0	-3.9e-3	NC	NC
1	M3	1	0	.032	0	2.101e-3	NC	NC
		2	0	-.032	0	3.213e-3	2354.299	NC
		3	0	-.084	0	3.679e-3	1632.023	NC
		4	0	-.177	.002	3.669e-3	609.679	NC
		5	0	-.141	0	3.354e-3	NC	NC
1	M4	1	.002	-.012	0	1.553e-3	NC	NC
		2	.002	-.114	0	1.93e-3	965.88	NC

**Member Deflections, By Combination, (continued)**

LC	Member Label	Section	x-Translation (in)	y-Translation (in)	z-Translation (in)	x-Rotation (radians)	(n) L/y Ratio	(n) L/z Ratio
		3	.002	-.311	0	2.333e-3	245.345	NC
		4	.002	-.331	0	2.741e-3	293.291	NC
		5	.002	-.219	0	3.129e-3	NC	NC
1	M5	1	-.002	-.257	0	1.699e-5	NC	NC
		2	-.002	-.364	0	1.311e-5	292.764	NC
		3	-.002	-.292	0	8.215e-6	323.086	NC
		4	-.002	-.134	0	3.498e-6	1027.753	NC
		5	-.002	-.031	0	1.646e-7	NC	NC
1	M6	1	-.002	-.219	0	3.138e-3	NC	NC
		2	-.002	-.33	0	2.747e-3	293.264	NC
		3	-.002	-.264	0	2.338e-3	322.443	NC
		4	-.002	-.114	0	1.932e-3	965.585	NC
		5	-.002	-.012	0	1.551e-3	NC	NC
1	M7	1	0	-.141	0	3.339e-3	NC	NC
		2	0	-.176	.002	3.655e-3	609.544	NC
		3	0	-.084	0	3.665e-3	1627.296	NC
		4	0	-.032	0	3.202e-3	2350.581	NC
		5	0	.032	0	2.098e-3	NC	NC

**Member Section Torsion, By Combination**

LC	Member Label	Section	Torque (k-ft)	Torsion Shear (ksi)	y-y Warp Shear (ksi)	z-z Warp Shear (ksi)	z-Bot Warp Bend (ksi)	z-Top Warp Bend (ksi)
1	M1	1	.166	1.857	NC	NC	NC	NC
		2	.045	.499	NC	NC	NC	NC
		3	-.005	-.05	NC	NC	NC	NC
		4	-.044	-.496	NC	NC	NC	NC
		5	-.166	-1.852	NC	NC	NC	NC
1	M2	1	.002	.033	NC	NC	NC	NC
		2	.004	.08	NC	NC	NC	NC
		3	-.004	-.081	NC	NC	NC	NC
		4	-.002	-.034	NC	NC	NC	NC
		5	-.002	-.034	NC	NC	NC	NC
1	M3	1	0	-.047	NC	NC	NC	NC
		2	0	-.047	NC	NC	NC	NC
		3	0	-.006	NC	NC	NC	NC
		4	0	.013	NC	NC	NC	NC
		5	0	.013	NC	NC	NC	NC
1	M4	1	0	-.016	NC	NC	NC	NC
		2	0	-.016	NC	NC	NC	NC
		3	0	-.018	NC	NC	NC	NC
		4	0	-.017	NC	NC	NC	NC
		5	0	-.017	NC	NC	NC	NC
1	M5	1	0	0	NC	NC	NC	NC
		2	0	0	NC	NC	NC	NC
		3	0	0	NC	NC	NC	NC
		4	0	0	NC	NC	NC	NC
		5	0	0	NC	NC	NC	NC
1	M6	1	0	.017	NC	NC	NC	NC
		2	0	.017	NC	NC	NC	NC
		3	0	.018	NC	NC	NC	NC
		4	0	.016	NC	NC	NC	NC
		5	0	.016	NC	NC	NC	NC
1	M7	1	0	-.013	NC	NC	NC	NC
		2	0	-.013	NC	NC	NC	NC
		3	0	.006	NC	NC	NC	NC
		4	0	.047	NC	NC	NC	NC
		5	0	.047	NC	NC	NC	NC

**Member AISC ASD 9th Code Checks, By Combination**

LC	Member Label	Code Chk	Loc (ft)	Shear Chk	Loc (ft)	Dir	ASD Eqn.	Message
1	M1	.202	3.365	.251	0		H1-1	
1	M2	.144	3.167	.012	4		H1-1	
1	M3	1.599	2.66	.045	2.66		H2-1	
1	M4	3.435	1.288	.089	2.66		H1-1	
1	M5	3.478	1.33	.083	1.288		H1-1	
1	M6	3.995	2.66	.085	1.288		H1-1	
1	M7	1.296	1.288	.043	1.288		H2-1	

**Member AISC ASD 9th Code Details, By Combination**

LC	Member Label	Fa (ksi)	Ft (ksi)	Fb y-y (ksi)	Fb z-z (ksi)	Cb	Cm y-y	Cm z-z
1	M1	2.049	12.6	13.86	13.86	1	.6	.85
1	M2	2.614	12.6	13.86	13.86	1	.6	.85
1	M3	.093	12.6	15.75	15.75	1	.6	.85
1	M4	.093	12.6	15.75	15.75	1	.6	.85
1	M5	.093	12.6	15.75	15.75	1	.6	.85
1	M6	.093	12.6	15.75	15.75	1	.6	.85
1	M7	.093	12.6	15.75	15.75	1	.6	.85

**Rogue Richardson, PE**  
 2114 E Greenhurst  
 Nampa, Idaho 83686  
 (208) 577-7071

CLIENT:  
 DESCRIPTION:  
 JOB:  
 DESIGNER:  
 DATE:  
 COMMENTS:

**Hybrid Energy Villages**  
 Ver D'Light  
 Rogue Richardson  
 Jan. 18, 2010

COMMENTS:

**ANALYSIS OF FLAT PLATES (Ref.: Flat Plates, pp. 1-5, Appendix)**

**SECTION PROPERTIES:**

thickness, t:	0.0598 in	Fb:	20 ksi
width, b:	24 in	edge fixation:	fixed
length, B:	32.0 in		
	= 2' 8"		

**LOADING:**

Wind Load	25.90 psf =	0.180 psi
-----------	-------------	-----------

**FACTORS:**

B/b =	1.33
B <sub>1</sub> =	0.454
φ <sub>1</sub> =	0.0240

**BENDING:**

FROM UNIFORM LOAD:

$f_b = B_1 * p * b^2 / t^2 =$	13153 psi	
F <sub>B</sub> =	20000 psi	<b>O.K.</b>

**DEFLECTION:**

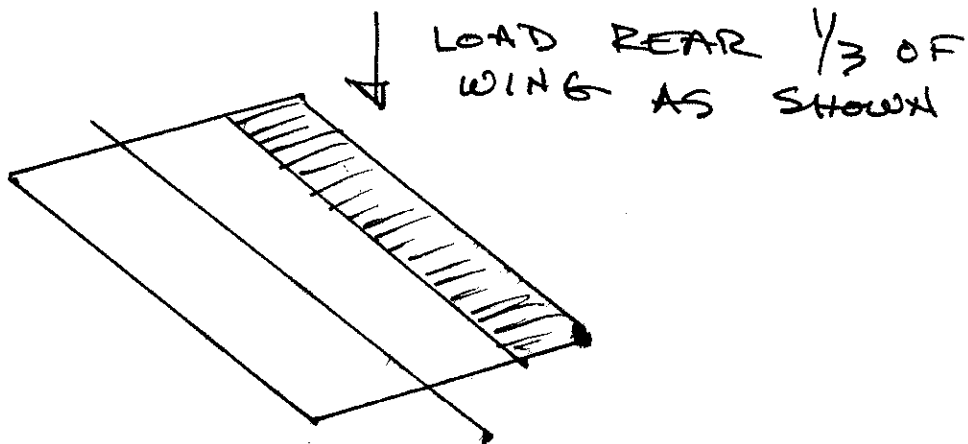
FROM UNIFORM LOAD:

$\Delta = (\phi_1 * p * b^4) / (E * t^3) =$	0.23 in	
Limit Δ to 24" for sheet deflection	0.25 in	<b>O.K.</b>

## TORSION - SPRING LOAD

IT IS ASSUMED UPLIFT DESIGN LOADING IS 10 LB/FT<sup>2</sup> WHEN DESIGNING STRUCTURES.  
USE 10 LB/FT<sup>2</sup> WHEN DESIGNING TORSION SPRING.

LOAD THE WING AS SHOWN BELOW



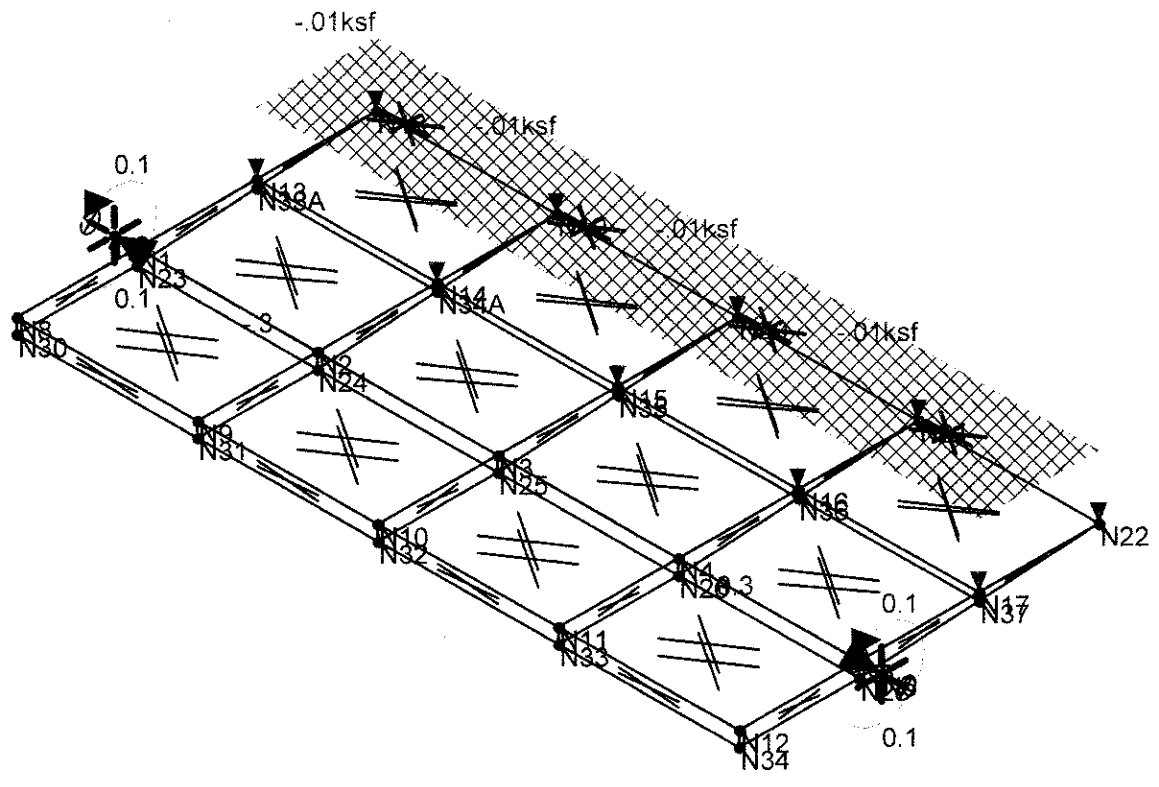
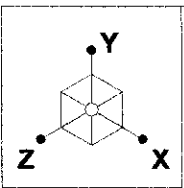
RISA RESULTS NEXT PAGE - 4x8 WING

1 SPRING - 70.16S

2 SPRINGS - 35 lbs

4x6 WING = 53 lbs

4x4 WING = 35 lbs



Loads: LC 1, wind  
 Results for LC 1, wind  
 Reaction units are k and k-ft

		January 21, 2010
Rogue Richardson		9:15 AM
		wing.r3d

**Global**

Steel Code	ASD: AISC 9th, AISI 99
Allowable Stress Increase Factor (ASIF)	1.333
Include Shear Deformation	Yes
Include Warping	Yes
No. of Sections for Member Calcs	5
Redesign Sections	Yes
P-Delta Analysis Tolerance	0.50%
Vertical Axis	Y

**Materials (General)**

Material Label	Young's Modulus (ksi)	Shear Modulus (ksi)	Poisson's Ratio	Thermal Coef. (per 10 <sup>5</sup> F)	Weight Density (k/ft <sup>3</sup> )	Yield Stress (ksi)
STL	29000	11154	.3	.65	.49	36
ALU	10600	4077	.3	1.29	.173	21

**Sections**

Section Label	Database Shape	Material Label	Area (in <sup>2</sup> )	SA(yy)	SA(zz)	I y-y (in <sup>4</sup> )	I z-z (in <sup>4</sup> )	J (Torsion) (in <sup>4</sup> )	T/C Only
SEC1	2 x1/4	ALU	1.374	1.2	1.2	.537	.537	1.074	
SEC2	2 x 1/8	ALU	.736	1.2	1.2	.325	.325	.65	
S3	.25	ALU	.049	1.2	1.2	.000191748	.000191748	.000383495	

**Joint Coordinates**

Joint Label	X Coordinate (ft)	Y Coordinate (ft)	Z Coordinate (ft)	Joint Temperature (F)	Detach from Diaphragm
N1	0	0	0	0	No
N2	2	0	0	0	No
N3	4	0	0	0	No
N4	6	0	0	0	No
N5	8	0	0	0	No
N6	8.25	0	0	0	No
N7	-25	0	0	0	No
N8	0	0	1.33	0	No
N9	2	0	1.33	0	No
N10	4	0	1.33	0	No
N11	6	0	1.33	0	No
N12	8	0	1.33	0	No
N13	0	0	-1.33	0	No
N14	2	0	-1.33	0	No
N15	4	0	-1.33	0	No
N16	6	0	-1.33	0	No
N17	8	0	-1.33	0	No
N18	0	0	-2.66	0	No
N19	2	0	-2.66	0	No
N20	4	0	-2.66	0	No
N21	6	0	-2.66	0	No
N22	8	0	-2.66	0	No
N23	0	-167	0	0	No
N24	2	-167	0	0	No
N25	4	-167	0	0	No
N26	6	-167	0	0	No
N27	8	-167	0	0	No
N30	0	-167	1.33	0	No
N31	2	-167	1.33	0	No
N32	4	-167	1.33	0	No
N33	6	-167	1.33	0	No
N34	8	-167	1.33	0	No

**Joint Coordinates (continued)**

Joint Label	X Coordinate (ft)	Y Coordinate (ft)	Z Coordinate (ft)	Joint Temperature (F)	Detach from Diaphragm
N33A	0	-0.0833	-1.33	0	No
N34A	2	-0.0833	-1.33	0	No
N35	4	-0.0833	-1.33	0	No
N36	6	-0.0833	-1.33	0	No
N37	8	-0.0833	-1.33	0	No

**Boundary Conditions**

Joint Label	X Translation (k/in)	Y Translation (k/in)	Z Translation (k/in)	MX Rotation (k-ft/rad)	MY Rotation (k-ft/rad)	MZ Rotation (k-ft/rad)
N6	Reaction	Reaction	Reaction	Reaction		
N7	Reaction	Reaction	Reaction	Reaction		

**Member Data**

Member Label	J Joint	K Joint	X-Axis Rotate (degrees)	Shape / Section Set	Material Set	Phys. O.M. Memb	End Releases			End Offsets		Inactive Member Code	Member Length (ft)
							I-End xyz	J-End xyz	I-End (in)	J-End (in)			
M1	N7	N6		SEC1	ALU	Y							8.5
M2	N8	N12		SEC2	ALU	Y							8
M3	N8	N18		S3	ALU	Y							3.99
M4	N9	N19		S3	ALU	Y							3.99
M5	N20	N10		S3	ALU	Y							3.99
M6	N21	N11		S3	ALU	Y							3.99
M7	N22	N12		S3	ALU	Y							3.99

**Steel Design / NDS Parameters**

Member Label	Section Set	Length (ft)	Lb y-y le2 (ft)	Lb z-z le1 (ft)	L_comp le_bend (ft)	K y-y	K z-z	Cm y-y CH	Cm z-z	Cb B	Sway y z	R
M1	SEC1	8.5				1.	1.					0.
M2	SEC2	8				1.	1.					0.
M3	S3	3.99				1.	1.					0
M4	S3	3.99				1.	1.					0
M5	S3	3.99				1.	1.					0
M6	S3	3.99				1.	1.					0
M7	S3	3.99				1.	1.					0

**Redesign Criteria**

Section Set	Max Depth (in)	Min Depth (in)	Max Width (in)	Min Width (in)	Max Code Check	Min Code Check
No Data to Print ...						

**Basic Load Case Data**

BLC No.	Basic Load Case Description	Category Code	Category Description	X	Y	Z	Joint	Point	Load Type Totals		
									Direct Dist.	Area	Surf.
1	Wind	WL	Wind Load						28	4	
2	LC 1 Transient Area Lo..	None									

**Area Loads on Members, Category : WL, BLC 1 : Wind**

Joint A	Joint B	Joint C	Joint D	Direction	Magnitude (ksf)
N18	N19	N14	N13	Y	-01
N19	N20	N15	N14	Y	-01
N20	N21	N16	N15	Y	-01
N21	N22	N17	N16	Y	-01

**Load Combinations**

Num	Description	Env	WS	PD	SRSS	CD	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	wind	y				1	1	1						

**Joint Displacements, By Combination**

LC	Joint Label	X Translation (in)	Y Translation (in)	Z Translation (in)	X Rotation (radians)	Y Rotation (radians)	Z Rotation (radians)
1	N1	0	-.002	0	-7.835e-4	1.556e-5	-7.475e-4
1	N2	0	-.017	0	-2.182e-3	2.421e-6	-4.213e-4
1	N3	0	-.022	0	-2.266e-3	0	0
1	N4	0	-.017	0	-2.182e-3	-2.421e-6	4.213e-4
1	N5	0	-.002	0	-7.835e-4	-1.556e-5	7.475e-4
1	N6	0	0	0	0	-1.556e-5	7.896e-4
1	N7	0	0	0	0	1.556e-5	-7.896e-4
1	N8	0	.023	0	-2.309e-3	2.232e-5	-2.434e-4
1	N9	0	.018	0	-2.098e-3	8.219e-7	-2.132e-4
1	N10	0	.015	0	-2.303e-3	0	0
1	N11	0	.018	0	-2.098e-3	-8.219e-7	2.132e-4
1	N12	0	.023	0	-2.309e-3	-2.232e-5	2.434e-4
1	N13	0	-.034	0	-3.057e-3	-5.5e-5	-8.73e-4
1	N14	0	-.051	0	-2.202e-3	-7.341e-6	-6.155e-4
1	N15	0	-.059	0	-2.397e-3	0	0
1	N16	0	-.051	0	-2.202e-3	7.341e-6	6.155e-4
1	N17	0	-.034	0	-3.057e-3	5.5e-5	8.73e-4
1	N18	0	-.069	0	-1.399e-3	6.778e-5	-7.404e-4
1	N19	0	-.087	0	-2.261e-3	2.91e-5	-8.05e-4
1	N20	0	-.097	0	-2.357e-3	0	0
1	N21	0	-.087	0	-2.261e-3	-2.91e-5	8.05e-4
1	N22	0	-.069	0	-1.399e-3	-6.778e-5	7.404e-4
1	N23	-.001	-.002	.004	-1.088e-3	8.124e-5	-7.285e-4
1	N24	0	-.017	.004	-2.153e-3	2.239e-5	-4.285e-4
1	N25	0	-.022	.004	-2.281e-3	0	0
1	N26	0	-.017	.004	-2.153e-3	-2.239e-5	4.285e-4
1	N27	.001	-.002	.004	-1.088e-3	-8.124e-5	7.285e-4
1	N30	0	.023	.004	-2.011e-3	-8.197e-6	-2.514e-4
1	N31	0	.018	.004	-2.119e-3	8.46e-6	-2.124e-4
1	N32	0	.015	.004	-2.296e-3	0	0
1	N33	0	.018	.004	-2.119e-3	-8.46e-6	2.124e-4
1	N34	0	.023	.004	-2.011e-3	8.197e-6	2.514e-4
1	N33A	0	-.034	.002	-2.903e-3	-4.828e-5	-8.78e-4
1	N34A	0	-.051	.002	-2.215e-3	2.418e-6	-6.13e-4
1	N35	0	-.059	.002	-2.388e-3	0	0
1	N36	0	-.051	.002	-2.215e-3	-2.418e-6	6.13e-4
1	N37	0	-.034	.002	-2.903e-3	4.828e-5	8.78e-4

**Reactions, By Combination**

LC	Joint Label	X Force (k)	Y Force (k)	Z Force (k)	X Moment (k-ft)	Y Moment (k-ft)	Z Moment (k-ft)
1	N6	.309	.053	0	.095	0	0
1	N7	-.309	.053	0	.095	0	0
1	Totals:	0	.106	0			
1	COG (ft):	X: 4	Y: 0	Z: -1.962			

**Material Takeoff**

Material	Shape	Length (ft)	Weight (k)
ALU	2 x 1/4	8.5	.014
	2 x 1/8	8	.007
	.25	19.95	.001
ALU	Totals:	36.45	.022

**Member Section Forces, By Combination**

LC	Member Label	Section	Axial (k)	Shear y-y (k)	Shear z-z (k)	Torque (k-ft)	Moment y-y (k-ft)	Moment z-z (k-ft)
1	M1	1	-0.309	.053	0	.095	0	0
		2	-0.038	0	.002	.021	.002	-0.007
		3	.077	0	0	-0.001	0	-0.009
		4	-0.038	0	-0.002	-0.021	.002	-0.007
		5	-0.309	-0.053	0	-0.095	0	0
1	M2	1	.006	0	0	-0.002	0	0
		2	.014	0	0	.002	0	-0.002
		3	.014	0	0	-0.002	0	-0.003
		4	.006	0	0	.002	0	0
		5	.006	0	0	.002	0	0
1	M3	1	.002	0	0	0	0	0
		2	.002	0	0	0	0	0
		3	-0.008	0	0	0	0	0
		4	0	.004	0	0	0	0
		5	0	-0.006	0	0	0	.001
1	M4	1	0	0	0	0	0	0
		2	0	0	0	0	0	0
		3	0	0	0	0	0	0
		4	0	.008	0	0	0	0
		5	0	-0.012	0	0	0	.003
1	M5	1	0	.012	0	0	0	.003
		2	0	-0.008	0	0	0	0
		3	0	0	0	0	0	0
		4	0	0	0	0	0	0
		5	0	0	0	0	0	0
1	M6	1	0	.012	0	0	0	.003
		2	0	-0.008	0	0	0	0
		3	0	0	0	0	0	0
		4	0	0	0	0	0	0
		5	0	0	0	0	0	0
1	M7	1	0	.006	0	0	0	.001
		2	0	-0.004	0	0	0	0
		3	-0.008	0	0	0	0	0
		4	.002	0	0	0	0	0
		5	.002	0	0	0	0	0

**Member Stresses, By Combination**

LC	Member Label	Section	Axial (ksi)	Shear y-y (ksi)	Shear z-z (ksi)	Bending y-top (ksi)	Bending y-bot (ksi)	Bending z-top (ksi)	Bending z-bot (ksi)
1	M1	1	-0.225	.046	0	0	0	0	0
		2	-0.028	0	.001	.158	-0.158	.037	-0.037
		3	.056	0	0	.191	-0.191	.02	-0.02
		4	-0.028	0	-0.001	.158	-0.158	.037	-0.037
		5	-0.225	-0.046	0	0	0	0	0
1	M2	1	.009	0	.001	.015	-0.015	-0.013	.013
		2	.019	0	0	.091	-0.091	-0.02	.02
		3	.019	0	0	.097	-0.097	.021	-0.021
		4	.009	0	-0.001	.012	-0.012	.032	-0.032

**Member Stresses, By Combination, (continued)**

LC	Member Label	Section	Axial (ksi)	Shear y-y (ksi)	Shear z-z (ksi)	Bending y-top (ksi)	Bending y-bot (ksi)	Bending z-top (ksi)	Bending z-bot (ksi)
1	M3	5	.009	0	-.001	.015	-.015	-.013	.013
		1	.047	0	0	.106	-.106	.01	-.01
		2	.047	0	0	.137	-.137	-.004	.004
		3	-.168	0	0	-.189	.189	.006	-.006
		4	-.011	.095	0	2.664	-2.664	-.012	.012
1	M4	5	-.011	-.149	0	-11.141	11.141	-.006	.006
		1	.008	0	0	-.004	.004	.003	-.003
		2	.008	0	0	-.008	.008	-.002	.002
		3	-.006	0	0	-.002	.002	0	0
		4	-.005	.19	0	5.028	-5.028	-.003	.003
1	M5	5	-.005	-.298	0	-22.524	22.524	-.004	.004
		1	.002	.298	0	-22.518	22.518	0	0
		2	.002	-.19	0	5.037	-5.037	0	0
		3	0	0	0	-.011	.011	0	0
		4	.005	0	0	.005	-.005	0	0
1	M6	5	.005	0	0	0	0	0	0
		1	-.005	.298	0	-22.524	22.524	-.004	.004
		2	-.005	-.19	0	5.028	-5.028	-.003	.003
		3	-.006	0	0	-.002	.002	0	0
		4	.008	0	0	-.008	.008	-.002	.002
1	M7	5	.008	0	0	-.004	.004	.003	-.003
		1	-.011	.149	0	-11.141	11.141	-.006	.006
		2	-.011	-.095	0	2.664	-2.664	-.012	.012
		3	-.168	0	0	-.189	.189	.006	-.006
		4	.047	0	0	.137	-.137	-.004	.004
		5	.047	0	0	.106	-.106	.01	-.01

**Member Deflections, By Combination**

LC	Member Label	Section	x-Translation (in)	y-Translation (in)	z-Translation (in)	x-Rotation (radians)	(n) L/y Ratio	(n) L/z Ratio
1	M1	1	0	0	0	0	NC	NC
		2	0	-.016	0	-2.095e-3	6420.712	NC
		3	0	-.022	0	-2.266e-3	4715.136	NC
		4	0	-.016	0	-2.095e-3	6420.712	NC
		5	0	0	0	0	NC	NC
1	M2	1	0	.023	0	-2.309e-3	NC	NC
		2	0	.018	0	-2.098e-3	NC	NC
		3	0	.015	0	-2.303e-3	NC	NC
		4	0	.018	0	-2.098e-3	NC	NC
		5	0	.023	0	-2.309e-3	NC	NC
1	M3	1	0	.023	0	2.434e-4	NC	NC
		2	0	.002	0	6.215e-4	2242.033	NC
		3	0	-.013	0	8.103e-4	1314.574	NC
		4	0	-.09	0	8.399e-4	422.946	NC
		5	0	-.069	0	7.404e-4	523.068	NC
1	M4	1	0	.018	0	2.132e-4	NC	NC
		2	0	-.008	0	3.693e-4	1884.433	NC
		3	0	-.034	0	5.184e-4	930.211	NC
		4	0	-.151	0	6.628e-4	284.136	NC
		5	0	-.087	0	8.05e-4	457.549	NC
1	M5	1	0	-.097	0	0	428.621	NC
		2	0	-.159	0	0	275.091	NC
		3	0	-.04	0	0	871.786	NC
		4	0	-.013	0	0	1741.557	NC
		5	0	.015	0	0	NC	NC
1	M6	1	0	-.087	0	8.05e-4	457.549	NC
		2	0	-.151	0	6.628e-4	284.136	NC

**Member Deflections, By Combination, (continued)**

LC	Member Label	Section	x-Translation (in)	y-Translation (in)	z-Translation (in)	x-Rotation (radians)	(n) L/y Ratio	(n) L/z Ratio
		3	0	-.034	0	5.184e-4	930.211	NC
		4	0	-.000	0	3.093e-4	1004.433	NC
		5	0	.018	0	2.132e-4	NC	NC
1	M7	1	0	-.069	0	7.404e-4	523.068	NC
		2	0	-.09	0	8.399e-4	422.946	NC
		3	0	-.013	0	8.103e-4	1314.574	NC
		4	0	.002	0	6.215e-4	2242.033	NC
		5	0	.023	0	2.434e-4	NC	NC

**Member Section Torsion, By Combination**

LC	Member Label	Section	Torque (k-ft)	Torsion Shear (ksi)	y-y Warp Shear (ksi)	z-z Warp Shear (ksi)	z-Bot Warp Bend (ksi)	z-Top Warp Bend (ksi)
1	M1	1	.095	1.065	NC	NC	NC	NC
		2	.021	.238	NC	NC	NC	NC
		3	-.001	-.014	NC	NC	NC	NC
		4	-.021	-.238	NC	NC	NC	NC
		5	-.095	-1.065	NC	NC	NC	NC
1	M2	1	-.002	-.036	NC	NC	NC	NC
		2	.002	.035	NC	NC	NC	NC
		3	-.002	-.035	NC	NC	NC	NC
		4	.002	.036	NC	NC	NC	NC
		5	.002	.036	NC	NC	NC	NC
1	M3	1	0	-.016	NC	NC	NC	NC
		2	0	-.016	NC	NC	NC	NC
		3	0	-.004	NC	NC	NC	NC
		4	0	.004	NC	NC	NC	NC
		5	0	.004	NC	NC	NC	NC
1	M4	1	0	-.007	NC	NC	NC	NC
		2	0	-.007	NC	NC	NC	NC
		3	0	-.006	NC	NC	NC	NC
		4	0	-.006	NC	NC	NC	NC
		5	0	-.006	NC	NC	NC	NC
1	M5	1	0	0	NC	NC	NC	NC
		2	0	0	NC	NC	NC	NC
		3	0	0	NC	NC	NC	NC
		4	0	0	NC	NC	NC	NC
		5	0	0	NC	NC	NC	NC
1	M6	1	0	.006	NC	NC	NC	NC
		2	0	.006	NC	NC	NC	NC
		3	0	.006	NC	NC	NC	NC
		4	0	.007	NC	NC	NC	NC
		5	0	.007	NC	NC	NC	NC
1	M7	1	0	-.004	NC	NC	NC	NC
		2	0	-.004	NC	NC	NC	NC
		3	0	.004	NC	NC	NC	NC
		4	0	.016	NC	NC	NC	NC
		5	0	.016	NC	NC	NC	NC

**Member AISC ASD 9th Code Checks, By Combination**

LC	Member Label	Code Chk	Loc (ft)	Shear Chk	Loc (ft)	Dir	ASD Eqn.	Message
1	M1	.036	4.25	.132	8.323		H1-1	
1	M2	.012	4	.004	6		H1-1	
1	M3	.857	2.66	.021	2.66		H2-1	
1	M4	1.734	2.66	.043	2.66		H2-1	
1	M5	1.454	1.288	.042	1.205		H1-1	
1	M6	1.436	1.288	.043	1.205		H2-1	

Company :  
 Designer : **Rogue Richardson**  
 Job Number :

January 21, 2010  
 9:17 AM  
 Checked By: \_\_\_\_\_

**Member AISC ASD 9th Code Checks, By Combination, (continued)**

LC	Member Label	Code Chk	Loc (ft)	Shear Chk	Loc (ft)	Dir	ASD Eqn.	Message
1	M7	.709	1.288	.021	1.205		H2-1	

**Member AISC ASD 9th Code Details, By Combination**

LC	Member Label	Fa (ksi)	Ft (ksi)	Fb y-y (ksi)	Fb z-z (ksi)	Cb	Cm y-y	Cm z-z
1	M1	2.049	12.6	13.86	13.86	1	.6	.6
1	M2	2.614	12.6	13.86	13.86	1	.6	.6
1	M3	.093	12.6	15.75	15.75	1	.6	.85
1	M4	.093	12.6	15.75	15.75	1	.6	.85
1	M5	.093	12.6	15.75	15.75	1	.6	.85
1	M6	.093	12.6	15.75	15.75	1	.6	.85
1	M7	.093	12.6	15.75	15.75	1	.6	.85