

TOWER STRUCTURAL ANALYSIS
363' TYPE 380 GUYED TOWER
SITE: DENVER COLORADO
ADAM COUNTY

7-27-10



Leo L. Roberts
7-28-10

LEO L. ROBERTS, P.E.
8809 N. 145th E. AVE. OWASSO, OK 74055
918-272-8680

**Tower Analysis- Denver, Colorado- 363' Guyed Tower
Adam County**

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Authorization:

This structural analysis was authorized by Mr. Chris Alexander of Crawford Broadcasting on 7-25-10.

Description of Tower:

The structure is a 363' UTC 380 SR AM guyed tower. The tower manufacturer is Utility Tower Co. of Oklahoma City, OK. The date of installation is 1995-Reference original Utility Tower file 95-119.

The tower is welded construction and has a face width of 24" center to center of leg members.

The design is triangular lattice type with single laced diagonal bracing, 8 bays per 20ft. section.

The tower has a tapered base.

There are six guy wire elevations and a single anchor system at 252' average radius at 120 degree intervals.

Materials of Fabrication:

Leg Members:

<u>Elevation</u>	<u>Size</u>	<u>Material</u>
0' – 363'	1 1/2" Solid Round	50 ksi

Bracing Members:

<u>Elevation</u>	<u>Size</u>	<u>Material</u>
0' – 363'	3/4" Solid Round	36 ksi

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Materials of Fabrication-continued:

Existing Guy Wire System:

<u>Elevation</u>	<u>Size & Type</u>	<u>Ultimate Strength</u>
60'	5/16" EHS	11.2 k
120'	5/16" EHS	11.2 k
180'	3/8" EHS	15.4 k
240'	3/8" EHS	15.4 k
300'	3/8" EHS	15.4 k
350'	7/16" EHS	20.8 k

Method of Analysis:

The tower was analyzed using "Risa Tower" computer program for lattice type guyed structures. This program is well recognized for its accuracy.

The tower was examined for conformance with ANSI/TIA-222-G for 90 MPH wind with no ice. The tower was also examined for 50 MPH wind and 1/4" radial ice. The wind is applied to structure and tower appurtenances in accordance to TIA standards.

Existing & Proposed Loading:

<u>Load</u>	<u>Qty</u>	<u>Elev.</u>	<u>Waveguide</u>	<u>Mount</u>
* 4' Dish	1	300'	7/8"	Std. Leg Mt.

*Proposed antenna.

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Results of Analysis:

Guy Wires:

<u>Elevation</u>	<u>Safety Factor</u>	<u>Allowable (kip)</u>
60'	2.6	1.0
120'	2.3	1.0
180'	2.1	1.0
240'	1.7	1.0
300'	1.6	1.0
350'	1.9	1.0

Leg Members:

<u>Elevation</u>	<u>Load (kip)</u>	<u>Allowable (kip)</u>
0' – 363'	22.9	48.6

Diagonal Members:

<u>Elevation</u>	<u>Load (kip)</u>	<u>Allowable (kip)</u>
0' – 363'	1.8 kips	5.4 kips

Horizontal Members:

Not load carrying.

Tower Reactions:

Base-	Down- Horiz.	49.2 kips .3 kips
Anchor-	Uplift- Horiz.- Result.-	16.5 kips 19.8 kips 25.8 kips

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Summary and Recommendations:

The guy wires are all within their allowable capacity.

The leg members and diagonal members are satisfactory with no overstresses.

Foundations:

The foundations were analyzed and found to be adequate for the existing and proposed antennas.

Assumptions made for this analysis include the following:

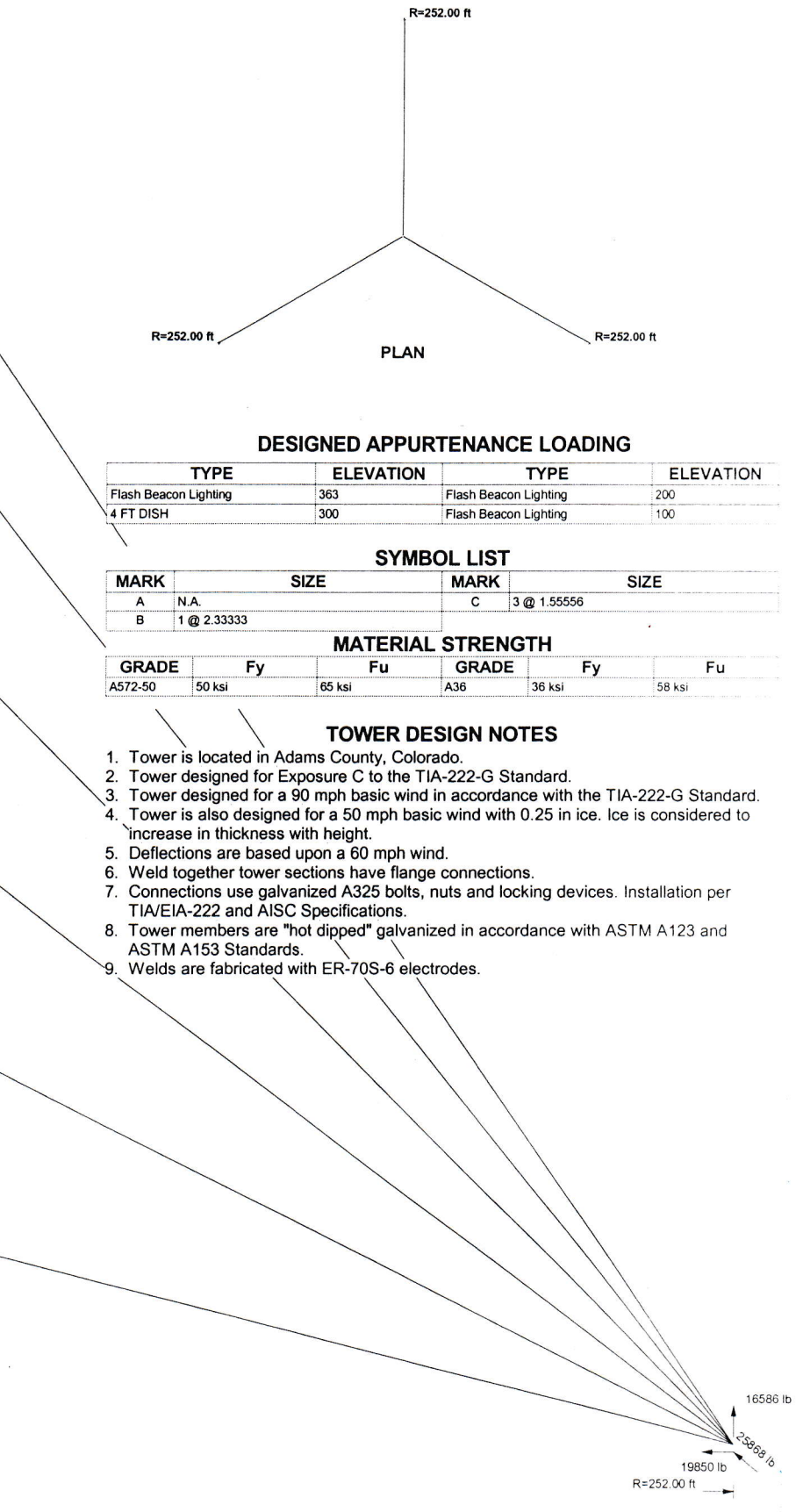
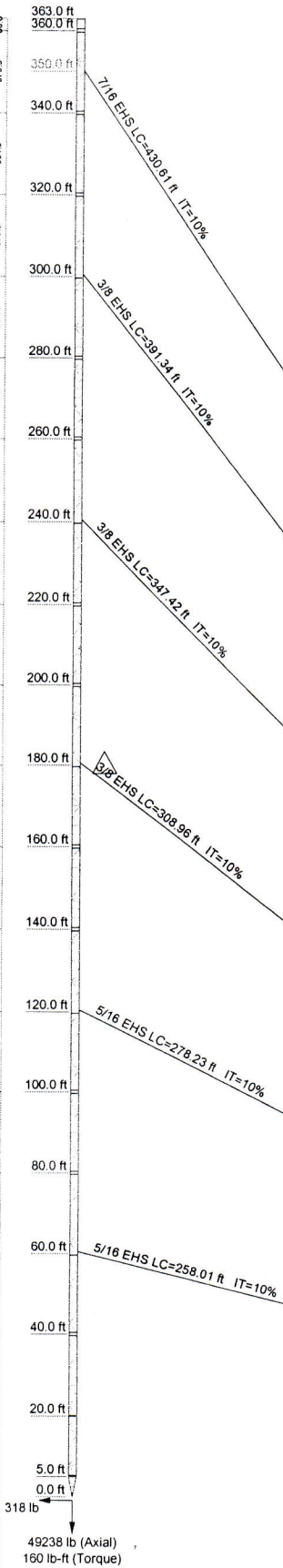
1. The tower was fabricated and installed as shown in Utility Tower file 95-119.
2. The tower guy wires have an initial tension of 10% of their breaking strength.
3. All leg steel is 50 KSI, all bracing is 36 KSI.
4. The guy wires are standard EHS type.
5. The tower has no damage.
6. Tower site is relatively level.

The general condition of the tower must be considered anytime additional loading is being considered. Rust, corrosion, damage, etc. could cause problems.

It is the responsibility of the tower owners and representatives to verify the tower loading.

The tower information to perform this analysis was provided by Mr. Joe James and Mr. Chris Alexander who supplied the proposed antenna loads.

Section	120		119		118		117		116		115		114		113		112		111		110		109		108		107		106		105		104		103		102		
	Legs	Leg Grade	Diagonals	Diagonal Grade	Top Girts	Bottom Girts	Horizontals	Top Guy Full-Offs	Face Width (ft)	# Panels @ (ft)	Weight (lb)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z		



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Flash Beacon Lighting	363	Flash Beacon Lighting	200
4 FT DISH	300	Flash Beacon Lighting	100

SYMBOL LIST

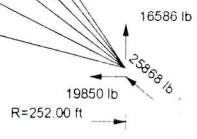
MARK	SIZE	MARK	SIZE
A	N.A.	C	3 @ 1.55556
B	1 @ 2.33333		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

TOWER DESIGN NOTES

1. Tower is located in Adams County, Colorado.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 90 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 50 mph basic wind with 0.25 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Weld together tower sections have flange connections.
7. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
8. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
9. Welds are fabricated with ER-70S-6 electrodes.



<p>LEO L ROBERTS PE</p> <p>8809 N. 145TH E. AVE OWASSO, OK. 74055</p> <p>Consulting Engineer Phone: 918-272-8680 FAX: 918-272-2508</p>		<p>Job: 363 FT UTC type 380 SR</p> <p>Project: Denver, CO</p> <p>Client: Mr. Cris Alexander Drawn by: LEO L ROBERTS PE App'd</p> <p>Code: TIA-222-G Date: 07/27/10 Scale: NTS</p> <p>Path: C:\Program Files\RISA\RISATower\Examples\DCO0710UR.er</p>	
		<p>Dwg No: E-1</p>	

RISATower LEO L ROBERTS PE 8809 N. 145TH E. AVE OWASSO, OK. 74055 Phone: 918-272-8680 FAX: 918-272-2508	Job	363 FT UTC type 380 SR	Page	56 of 58
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	Client	Mr. Cris Alexander	Designed by	LEO L ROBERTS PE

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T1	363 - 360	Leg	1 1/2	3	-310.09	49960.50	0.6	Pass
		Diagonal	3/4	10	-197.13	5623.84	3.5	Pass
		Top Girt	3/4	6	-73.07	9324.19	0.8	Pass
		Bottom Girt	3/4	8	-70.16	9324.19	0.8	Pass
T2	360 - 340	Leg	1 1/2	15	-8199.44	48684.30	16.8	Pass
		Diagonal	3/4	24	-1203.98	5446.22	22.1	Pass
		Horizontal	3/4	45	588.45	14313.90	4.1	Pass
		Top Girt	3/4	17	-97.44	9324.19	1.0	Pass
		Bottom Girt	3/4	19	-331.26	9324.19	3.6	Pass
		Guy A@350	7/16	996	6537.31	12480.00	52.4	Pass
		Guy B@350	7/16	995	5282.07	12480.00	42.3	Pass
		Guy C@350	7/16	991	6145.31	12480.00	49.2	Pass
		Top Guy Pull-Off@350	1 1/4	994	1634.57	55223.30	3.0	Pass
T3	340 - 320	Leg	1 1/2	69	-13383.00	48684.30	27.5	Pass
		Diagonal	3/4	120	-1102.70	5446.22	20.2	Pass
		Horizontal	3/4	117	-95.73	9324.19	1.0	Pass
		Top Girt	3/4	70	-260.32	9324.19	2.8	Pass
		Bottom Girt	3/4	73	-153.43	9324.19	1.6	Pass
T4	320 - 300	Leg	1 1/2	123	-17391.40	48684.30	35.7	Pass
		Diagonal	3/4	137	-593.53	5446.22	10.9	Pass
		Horizontal	3/4	135	96.57	14313.90	0.7	Pass
		Top Girt	3/4	126	-159.60	9324.19	1.7	Pass
		Bottom Girt	3/4	127	550.39	14313.90	3.8	Pass
		Guy A@300.375	3/8	1002	5459.59	9240.00	59.1	Pass
		Guy B@300.375	3/8	1001	4171.96	9240.00	45.2	Pass
		Guy C@300.375	3/8	997	5070.00	9240.00	54.9	Pass
T5	300 - 280	Top Guy Pull-Off@300.375	1 1/4	998	1528.86	55223.30	2.8	Pass
		Leg	1 1/2	177	-19473.60	48684.30	40.0	Pass
		Diagonal	3/4	227	-1120.49	5446.22	20.6	Pass
		Horizontal	3/4	189	146.41	14313.90	1.0	Pass
		Top Girt	3/4	179	-359.41	9324.19	3.9	Pass
T6	280 - 260	Bottom Girt	3/4	183	-257.98	9324.19	2.8	Pass
		Leg	1 1/2	231	-19120.40	48684.30	39.3	Pass
		Diagonal	3/4	240	-1641.77	5446.22	30.1	Pass
		Horizontal	3/4	243	208.20	14313.90	1.5	Pass
		Top Girt	3/4	232	-255.53	9324.19	2.7	Pass
T7	260 - 240	Bottom Girt	3/4	237	-379.43	9324.19	4.1	Pass
		Leg	1 1/2	285	-13092.20	48684.30	26.9	Pass
		Diagonal	3/4	294	-1811.29	5446.22	33.3	Pass
		Horizontal	3/4	333	150.40	14313.90	1.1	Pass
		Top Girt	3/4	286	-416.92	9324.19	4.5	Pass
		Bottom Girt	3/4	291	581.63	14313.90	4.1	Pass
		Guy A@240.375	3/8	1008	5165.56	9240.00	55.9	Pass
		Guy B@240.375	3/8	1007	3822.30	9240.00	41.4	Pass
T8	240 - 220	Guy C@240.375	3/8	1003	4767.77	9240.00	51.6	Pass
		Top Guy Pull-Off@240.375	1 1/4	1006	1615.64	55223.30	2.9	Pass
		Leg	1 1/2	337	-12096.00	48684.30	24.8	Pass
		Diagonal	3/4	389	-1022.31	5446.22	18.8	Pass
		Horizontal	3/4	386	129.16	14313.90	0.9	Pass
T9	220 - 200	Top Girt	3/4	341	-358.58	9324.19	3.8	Pass
		Bottom Girt	3/4	344	229.49	14313.90	1.6	Pass
		Leg	1 1/2	393	-12953.70	48684.30	26.6	Pass
		Diagonal	3/4	402	-964.87	5446.22	17.7	Pass
		Horizontal	3/4	405	167.48	14313.90	1.2	Pass
		Top Girt	3/4	395	-142.32	9324.19	1.5	Pass

RISA Tower LEO L ROBERTS PE 8809 N. 145TH E. AVE OWASSO, OK. 74055 Phone: 918-272-8680 FAX: 918-272-2508	Job	363 FT UTC type 380 SR	Page	57 of 58
	Project	Denver, CO	Date	13:29:34 07/27/10
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Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T10	200 - 180	Bottom Girt	3/4	397	-235.72	9324.19	2.5	Pass
		Leg	1 1/2	447	-22984.20	48684.30	47.2	Pass
		Diagonal	3/4	462	-1422.09	5446.22	26.1	Pass
		Horizontal	3/4	495	139.04	14313.90	1.0	Pass
		Top Girt	3/4	448	-288.98	9324.19	3.1	Pass
		Bottom Girt	3/4	453	511.33	14313.90	3.6	Pass
		Guy A@180.375	3/8	1014	4239.05	9240.00	45.9	Pass
		Guy B@180.375	3/8	1013	3040.16	9240.00	32.9	Pass
		Guy C@180.375	3/8	1009	3870.06	9240.00	41.9	Pass
		Top Guy Pull-Off@180.375	1 1/4	1012	1420.37	55223.30	2.6	Pass
T11	180 - 160	Leg	1 1/2	501	-22986.80	48684.30	47.2	Pass
		Diagonal	3/4	551	-1180.96	5446.22	21.7	Pass
		Horizontal	3/4	548	145.11	14313.90	1.0	Pass
		Top Girt	3/4	503	-382.08	9324.19	4.1	Pass
		Bottom Girt	3/4	506	-224.42	9324.19	2.4	Pass
T12	160 - 140	Leg	1 1/2	555	-17176.60	48684.30	35.3	Pass
		Diagonal	3/4	605	-768.34	5446.22	14.1	Pass
		Horizontal	3/4	602	131.21	14313.90	0.9	Pass
		Top Girt	3/4	557	-202.08	9324.19	2.2	Pass
		Bottom Girt	3/4	559	138.81	14313.90	1.0	Pass
T13	140 - 120	Leg	1 1/2	609	-19285.50	48684.30	39.6	Pass
		Diagonal	3/4	624	-798.33	5446.22	14.7	Pass
		Horizontal	3/4	620	144.31	14313.90	1.0	Pass
		Top Girt	3/4	612	157.26	14313.90	1.1	Pass
		Bottom Girt	3/4	615	378.32	14313.90	2.6	Pass
		Guy A@120.375	5/16	1020	2903.95	6720.00	43.2	Pass
		Guy B@120.375	5/16	1019	2302.06	6720.00	34.3	Pass
		Guy C@120.375	5/16	1015	2596.00	6720.00	38.6	Pass
T14	120 - 100	Top Guy Pull-Off@120.375	1 1/4	1018	1050.88	55223.30	1.9	Pass
		Leg	1 1/2	663	-19288.20	48684.30	39.6	Pass
		Diagonal	3/4	713	-1273.10	5446.22	23.4	Pass
		Horizontal	3/4	711	167.14	14313.90	1.2	Pass
		Top Girt	3/4	665	-372.35	9324.19	4.0	Pass
		Bottom Girt	3/4	668	-248.15	9324.19	2.7	Pass
		Leg	1 1/2	717	-17908.50	48684.30	36.8	Pass
		Diagonal	3/4	767	-736.81	5446.22	13.5	Pass
T15	100 - 80	Horizontal	3/4	729	146.54	14313.90	1.0	Pass
		Top Girt	3/4	719	260.57	14313.90	1.8	Pass
		Bottom Girt	3/4	723	134.99	14313.90	0.9	Pass
		Leg	1 1/2	771	-17583.30	48684.30	36.1	Pass
		Diagonal	3/4	792	-763.70	5446.22	14.0	Pass
T16	80 - 60	Horizontal	3/4	788	138.10	14313.90	1.0	Pass
		Top Girt	3/4	772	138.86	14313.90	1.0	Pass
		Bottom Girt	3/4	777	362.31	14313.90	2.5	Pass
		Guy A@60.375	5/16	1026	2527.55	6720.00	37.6	Pass
		Guy B@60.375	5/16	1025	2159.01	6720.00	32.1	Pass
		Guy C@60.375	5/16	1021	2272.69	6720.00	33.8	Pass
		Top Guy Pull-Off@60.375	1 1/4	1024	1006.42	55223.30	1.8	Pass
		Leg	1 1/2	825	-18947.90	48684.30	38.9	Pass
T17	60 - 40	Diagonal	3/4	875	-927.17	5446.22	17.0	Pass
		Horizontal	3/4	873	158.02	14313.90	1.1	Pass
		Top Girt	3/4	827	-257.21	9324.19	2.8	Pass
		Bottom Girt	3/4	830	184.08	14313.90	1.3	Pass
		Leg	1 1/2	879	-19579.90	48272.90	40.6	Pass
T18	40 - 20	Diagonal	3/4	929	-488.86	5389.20	9.1	Pass
		Horizontal	3/4	891	134.09	14313.90	0.9	Pass
		Top Girt	3/4	881	165.60	14313.90	1.2	Pass
		Bottom Girt	3/4	885	93.21	14313.90	0.7	Pass

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T19	20 - 5	Leg	1 1/2	933	-18967.60	48013.70	39.5	Pass	
		Diagonal	3/4	942	-703.00	5353.32	13.1	Pass	
		Horizontal	3/4	945	127.97	14313.90	0.9	Pass	
		Top Girt	3/4	934	111.85	14313.90	0.8	Pass	
		Bottom Girt	3/4	939	348.55	14313.90	2.4	Pass	
		Leg	1 1/2	975	-17371.40	50032.80	34.7	Pass	
T20	5 - 0	Diagonal	3/4	983	-761.88	9214.23	8.3	Pass	
		Horizontal	3/4	980	262.93	14313.90	1.8	Pass	
		Top Girt	3/4	978	2037.13	14313.90	14.2	Pass	
		Summary							
		Leg (T11)					47.2	Pass	
		Diagonal (T7)					33.3	Pass	
Horizontal (T2)					4.1	Pass			
Top Girt (T20)					14.2	Pass			
Bottom Girt (T6)					4.1	Pass			
Guy A (T4)					59.1	Pass			
Guy B (T4)					45.2	Pass			
Guy C (T4)					54.9	Pass			
Top Guy Pull-Off (T2)					3.0	Pass			
RATING =							59.1	Pass	