TIF

TELECOMMUNICATIONS INDUSTRY FOUNDATION

Rooftop Sled Mount Testing

Valmont / Site Pro 1 Facility – Carrollton, Texas

- 09-19-2022 – Mount Assembly and Preparation
- 09-20-2022 – Slide and Overturn Testing

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Participation

- Engineers and Managers from 4 Manufacturers
- 2 Engineering firms
- TIF Representatives

Colliers Engineering & Design

ENGINEERED TOWER SOLUTIONS

Sabre Industries™

PTS Proactive Telecommunications Solutions, LLC

COMMSCOPE®

SITE PRO 1 A valmont COMPANY

PV

IES Tower Engineering Solutions

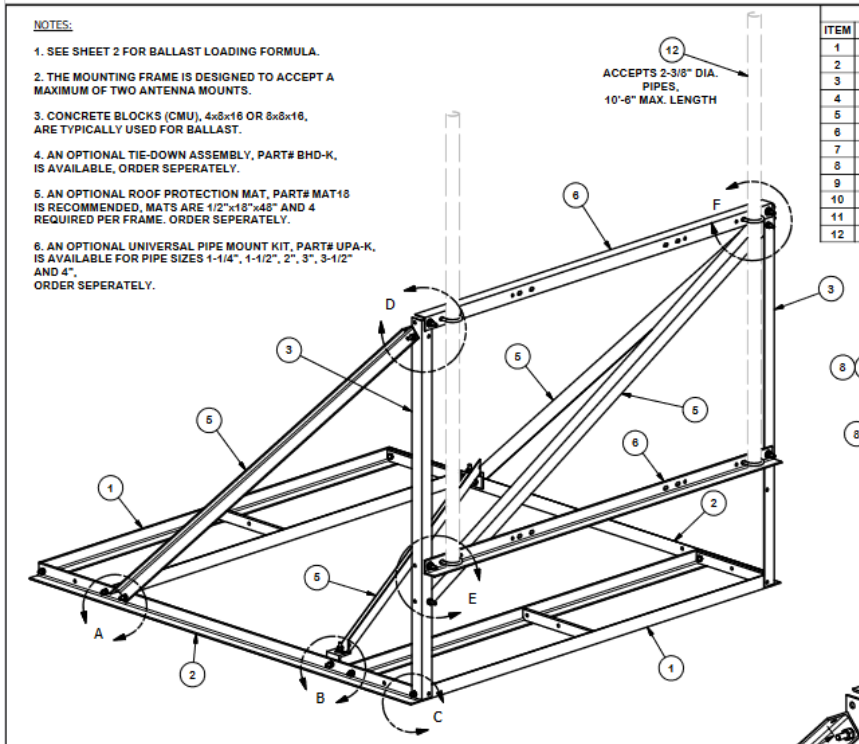
Mounts Utilized in Testing

- Site Pro 1 – RTW-7-2-96
- Perfect Vision – Roofcraft (PV-RC1-F10X2-PC-AP1)
- Commscope – RT-NF10-3-96

Site Pro 1: RTW-7-2-96

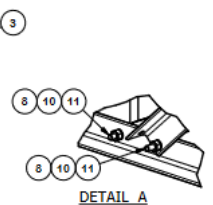
NOTES:

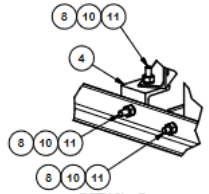
1. SEE SHEET 2 FOR BALLAST LOADING FORMULA.
2. THE MOUNTING FRAME IS DESIGNED TO ACCEPT A MAXIMUM OF TWO ANTENNA MOUNTS.
3. CONCRETE BLOCKS (CMU), 4x8x16 OR 8x8x16, ARE TYPICALLY USED FOR BALLAST.
4. AN OPTIONAL TIE-DOWN ASSEMBLY, PART# BHD-K, IS AVAILABLE, ORDER SEPERATELY.
5. AN OPTIONAL ROOF PROTECTION MAT, PART# MAT18 IS RECOMMENDED, MATS ARE 1/2"x18"x48" AND 4 REQUIRED PER FRAME. ORDER SEPERATELY.
6. AN OPTIONAL UNIVERSAL PIPE MOUNT KIT, PART# UPA-K, IS AVAILABLE FOR PIPE SIZES 1-1/4", 1-1/2", 2", 3", 3-1/2" AND 4", ORDER SEPERATELY.

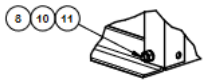


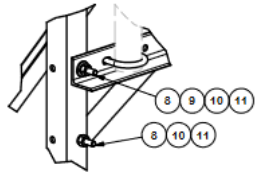
PARTS LIST

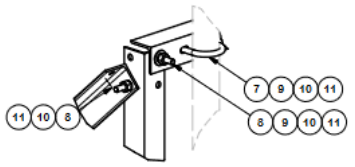
ITEM	QTY	PART NO.	PART DESCRIPTION	LENGTH	UNIT WT.	NET WT.
1	2	X-232696	BALLAST TRAY WELDMENT - SITE PRO 1		66.53	133.06
2	2	X-232699	SIDE BASE ANGLE 95" LENGTH - SITE PRO 1		25.76	51.52
3	2	X-232700	VERTICAL ANGLE 70-9/16" LENGTH - SITE PRO 1		19.08	38.15
4	2	SHCM-T	CHAIN MOUNT TIGHTENER BRACKET		1.84	3.68
5	4	X-232702	SUPPORT ANGLE 99-1/8" LENGTH - SITE PRO 1		26.94	107.75
6	2	X-232701	HORIZONTAL FACE ANGLE 86-1/2" LENGTH - SITE PRO 1		23.22	46.45
7	4	X-UB1212	1/2" X 2-1/2" X 4-1/2" X 2" GALV. U-BOLT		0.66	2.63
8	21	G1202	1/2" x 2" HDG HEX BOLT GR5		0.18	3.69
9	12	G12FW	1/2" HDG USS FLATWASHER		0.03	0.41
10	29	G12LW	1/2" HDG LOCKWASHER		0.01	0.40
11	29	G12NUT	1/2" HDG HEAVY 2H HEX NUT		0.07	2.08
12	B	C	2-3/8" O.D. VERTICAL MOUNTING PIPE	D	E	F

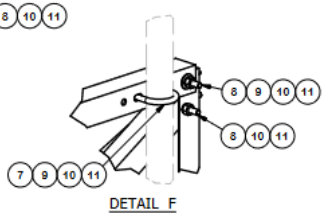












VARIABLE MOUNTING PIPES

ASSEMBLY "A"	QTY "B"	PART "C"	LENGTH "D"	UNIT WT. "E"	NET WT. "F"	TOTAL WEIGH
RTW-7	0	---	---	---	---	389.51
RTW-7-2-96	2	P296	96"	30.76	61.52	451.03
RTW-7-2-126	2	P2126	126"	40.37	80.74	470.25

REVISION HISTORY

REV	DESCRIPTION OF REVISIONS	CPD	BY	DATE
B	ADDED VARIABLE TABLE		KCS	06/06/2012
A	UPDATE BALLAST EQUATION	4893	BMC	5/17/2011

TOLERANCE NOTES

TOLERANCES ON DIMENSIONS, UNLESS OTHERWISE NOTED ARE:
SAWED, SHEARED AND GAS CUT EDGES *(± 0.030")*
DRILLED AND GAS CUT HOLES *(± 0.030")* - NO CONING OF HOLES
LASER CUT EDGES AND HOLES *(± 0.010")* - NO CONING OF HOLES
BENDS ARE ± 1/2 DEGREE
ALL OTHER MACHINING *(± 0.030")*
ALL OTHER ASSEMBLY *(± 0.060")*

DESCRIPTION: 7' NON-PENETRATING ROOF MOUNT SITE PRO 1

SITE PRO 1 — A valmont COMPANY

Engineering Support Team: 1-888-753-7446

Locations: New York, NY; Atlanta, GA; Los Angeles, CA; Plymouth, IN; Salem, OR; Dallas, TX

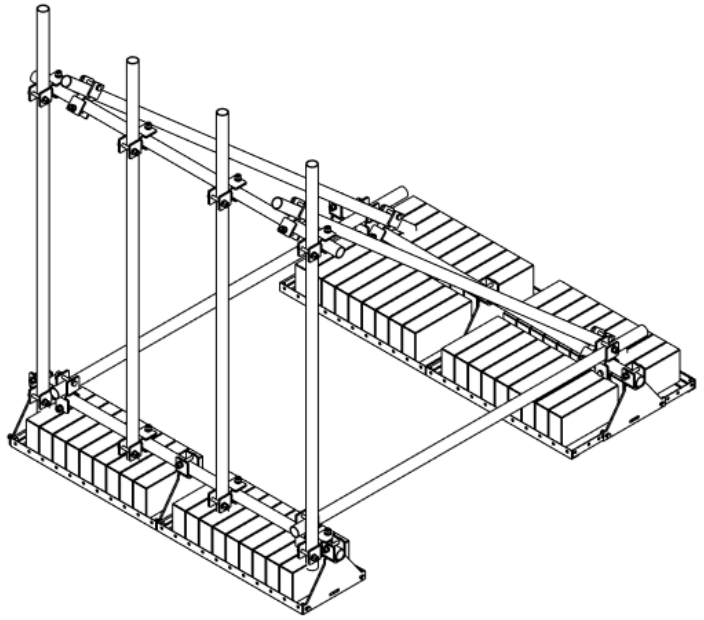
ORD NO.	DRAWN BY	ENG. APPROVAL	PART NO.
4893	RH18 12/6/2010		SEE ASSEMBLY "A"

CLASS	SUB	DRAWING USAGE	CHECKED BY	DWG. NO.
81	01	CUSTOMER	CEK 7/10/2012	RTW-7

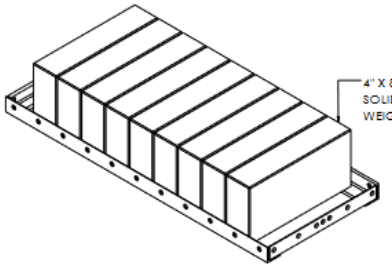
PAGE 1 OF 2

Perfect Vision: Roofcraft (PV-RC1-F10X2-PC-AP1)

ROOFCRAFT - FULLY LOADED BALLAST TRAYS



PV-RC1-F7X2-PC-AP1 SHOWN
6 BALLAST TRAYS
TOTAL BALLAST WEIGHT: 1800 LBS
SEE DETAIL A



DETAIL A
TYPICAL BALLAST TRAY SET UP
9 CMU BLOCKS PER TRAY
BALLAST TRAY WEIGHT: ~300 LBS

SHEET: 3 OF 10	THIRD ANGLE PROJECTION	CATEGORY: 03_Rooftop	4	AP3 / AP4 CONFIGS	5/7/21
		SERIES: D1_Non-Penetrating	3	AP3 CONFIGS 2023 CLASSIFICATIONS	12/21/22
5/7/2021	SCALE: 1:48	TYPE: PV-RC_Roofcraft	2	HARDWARE UPDATE	2/24/20
DIMENSIONS ARE IN INCHES TOLERANCES U.N.O. HOLES: +1/16", -1/32" ANGULAR: PROFILE ±1/4", BEND ±2° ALL OTHERS: ±1/16"		BY: DJN	1	HARDWARE UPDATE	2/24/20
		CHECKED: SJS	0	INITIAL RELEASE	9/23/19
		STATUS: APPROVED	REV	DESCRIPTION	DATE

PERFECT VISION

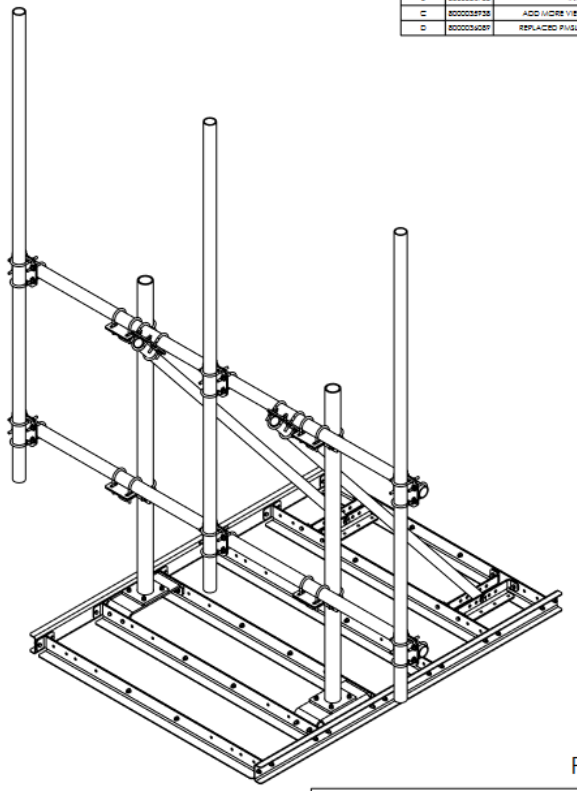
ROOFCRAFT - SINGLE SECTOR

DOCUMENT NUMBER: RC-ENG-01-R4 REV: 4

CommScope: RT-NF10-3-96

NOTES:
1.0 GENERAL
1.1 ALL METRIC DIMENSIONS ARE IN BRACKETS
1.2 FOR PATENT INFO :https://www.cs-pat.com
2.0 DESIGN NOTES
2.1 SEE STEP INSTRUCTIONS IN DRAWING PACKAGE FOR ASSEMBLY.
3.0 MANUFACTURING/SPECIAL REQUIRMENTS
4.0 TEST
5.0 PACKAGING

REVISIONS				
REV	ECN	DESCRIPTION	BY	DATE
B	8000034738	INITIAL RELEASE	RJC	04/29/19
C	8000035938	ADD MORE VIEWS FOR BETTER ASSEMBLY	RJC	06/19/19
D	8000036089	REPLACED PMGL02 WITH RTNP114 SEE SHT 6	RJC	07/02/19



RT-NF10-3-126 SHOWN

TOP LEVEL COMPONENTS

PART NO.	DESCRIPTION	BALLAST KIT	SECTOR KIT	CROSSOVER KIT	PIPE BUNDLE
RT-NF-BAL	BALLAST TRAY	RT-NF-BAL	N/A	N/A	N/A
RT-NF7-B	MOUNT, 7' BALLAST W/O PIPES	RT-NF-BAL	RT-NF-SCTR	N/A	PB0207K
RT-NF7-2-96	MOUNT, 7' BALLAST W/2 96" PIPES	RT-NF-BAL	RT-NF-SCTR	XP-2525 (QTY 4)	PB0208K0207K
RT-NF7-2-126	MOUNT, 7' BALLAST W/2 126" PIPES	RT-NF-BAL	RT-NF-SCTR	XP-2525 (QTY 4)	PB0210K0207K
RT-NF7-3-96	MOUNT, 7' BALLAST W/3 96" PIPES	RT-NF-BAL	RT-NF-SCTR	XP-2525 (QTY 6)	PB0308K0207K
RT-NF7-3-126	MOUNT, 7' BALLAST W3 126" PIPES	RT-NF-BAL	RT-NF-SCTR	XP-2525 (QTY 6)	PB0310K0207K
RT-NF10-B	MOUNT, 10' BALLAST W/O PIPES	RT-NF-BAL	RT-NF-SCTR	N/A	PB0210K
RT-NF10-3-96	MOUNT, 10' BALLAST W/3 96" PIPES	RT-NF-BAL	RT-NF-SCTR	XP-2525 (QTY 6)	PB0210K0308K
RT-NF10-3-126	MOUNT, 10' BALLAST W/3 126" PIPES	RT-NF-BAL	RT-NF-SCTR	XP-2525 (QTY 6)	PB0510K
RT-NF10-4-96	MOUNT, 10' BALLAST W/4, 96" PIPES	RT-NF-BAL	RT-NF-SCTR	XP-2525 (QTY 8)	PB0210K0408K
RT-NF10-4-126	MOUNT, 10' BALLAST W/4, 126" PIPES	RT-NF-BAL	RT-NF-SCTR	XP-2525 (QTY 8)	PB0610K
RT-NF12-B	MOUNT, 12' BALLAST W/O PIPES	RT-NF-BAL	RT-NF-SCTR	N/A	PB0212K
RT-NF12-3-96	MOUNT, 12' BALLAST W/3 96" PIPES	RT-NF-BAL	RT-NF-SCTR	XP-2525 (QTY 6)	PB0212K0308K
RT-NF12-3-126	MOUNT, 12' BALLAST W/4 126" PIPES	RT-NF-BAL	RT-NF-SCTR	XP-2525 (QTY 6)	PB0212K0310K
RT-NF12-4-96	MOUNT, 12' BALLAST W/4 96" PIPES	RT-NF-BAL	RT-NF-SCTR	XP-2525 (QTY 8)	PB0212K0408K
RT-NF12-4-126	MOUNT, 12' BALLAST W/4 126" PIPES	RT-NF-BAL	RT-NF-SCTR	XP-2525 (QTY 8)	PB0212K0410K

PIPE BUNDLE TABLE

PART NO.	FACE PIPE	ANTENNA PIPE
PB0207K	MT54684	N/A
PB0208K0207K	MT54684	MT54696
PB0210K0207K	MT54684	MT-546-126
PB0308K0207K	MT54684	MT54696
PB0310K0207K	MT54684	MT-546-126
PB0210K	MT-546-126	N/A
PB0210K0308K	MT-546-126	MT54696
PB0510K	MT-546-126	MT-546-126
PB0210K0408K	MT-546-126	MT54696
PB0610K	MT-546-126	MT-546-126
PB0212K	MT-546-150	N/A
PB0212K0308K	MT-546-150	MT54696
PB0212K0310K	MT-546-150	MT-546-126
PB0212K0408K	MT-546-150	MT54696
PB0212K0410K	MT-546-150	MT-546-126

COMMSCOPE, INC. OF NORTH CAROLINA

TOLERANCES: 0 PLACE X ± .25; 1 PLACE .X ± 0.12; 2 PLACE .XX ± 0.06; ANGLES ± 2°

SAP MATERIAL MASTER: RT-NF

FINISH: GALV A123

MATERIAL: A500, A1011

	NAME	DATE
DE	RJC	03/01/19
RM	BCAMPBELLCOX	07/02/2019
RV		
AD	MC1107	07/02/2019
RE	PA1024	07/02/2019

TITLE: NON-PENETRATING ROOF FRAME

ECN 8000003473B

SCALE: 1:20

DOCUMENT NO.: RT-NF

DENSITY	lbs/in³
MASS	963.26 lbs
VOLUME	3417.30 in³
SURFACE AREA	35982.98 in²
HEIGHT	
LENGTH	
WIDTH	

SIZE: C

WORK AREA: 24

MODEL			DRAWING			SHEET
VERSION	STATUS	REVISION	VERSION	STATUS	REVISION	
02	RE	D	01	RE	D	1 OF 7

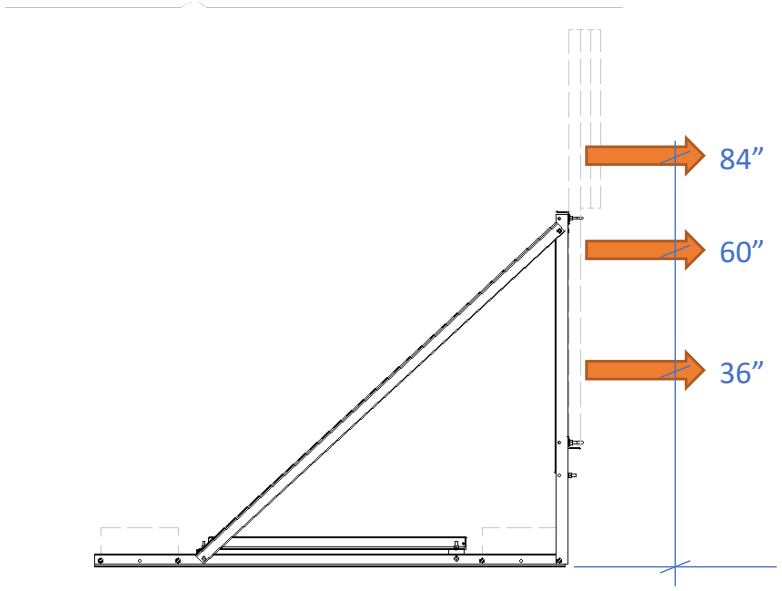
Method of Testing

- Two (2) Different Friction Considerations and Three (3) Different Ballast Configurations:

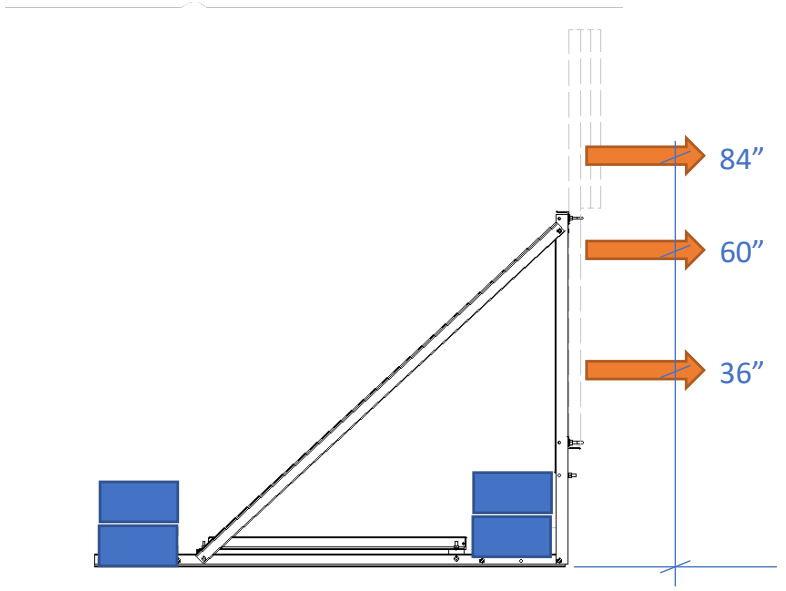
Steel on Concrete	Steel on Concrete	Steel on Concrete	W/ Rubber Mats	W/ Rubber Mats	W/ Rubber Mats
Empty Mount	Half Ballast	Full Ballast	Empty Mount	Half Ballast	Full Ballast

- Three (3) Different Load Application Elevations:
  - 36”
  - 60”
  - 84”

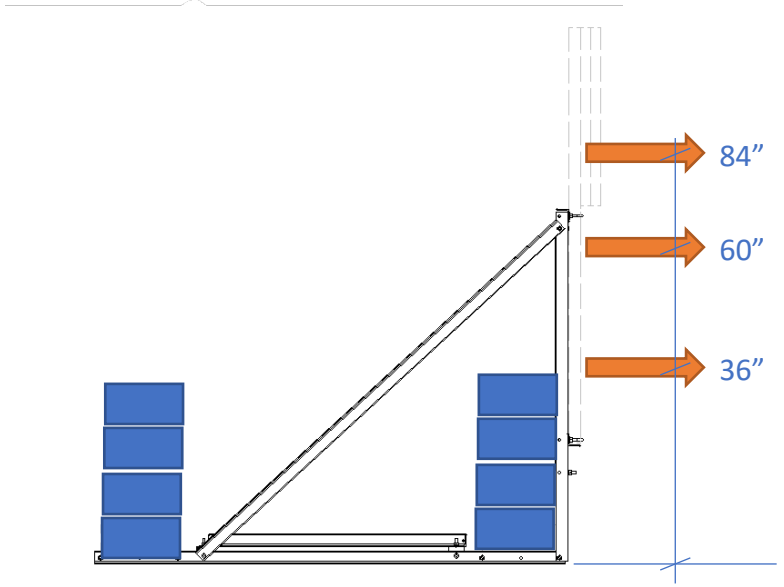
Testing of each mount began at an elevation of 36” with no ballast. The test was then repeated at two (2) additional elevations, 60” and 84”.



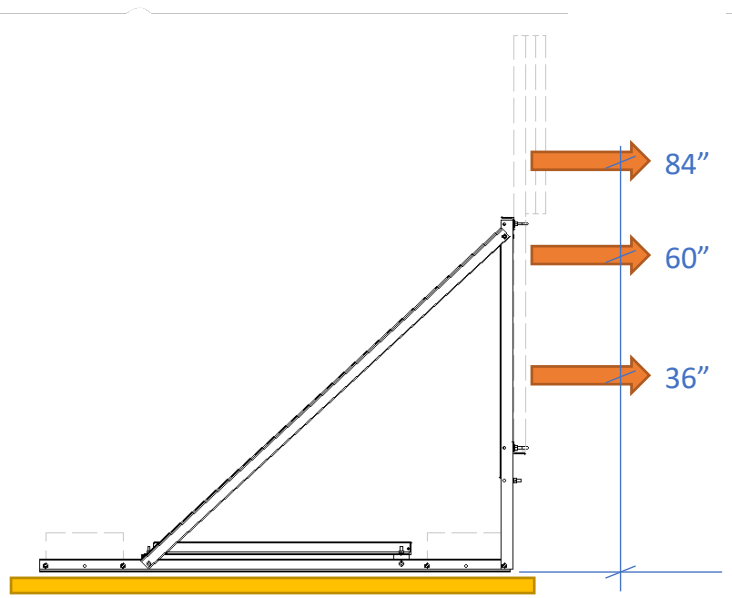
CMU blocks were added (50% design ballast) to the mount trays and testing was repeated at the same three (3) elevations; 36”, 60”, and 84”.

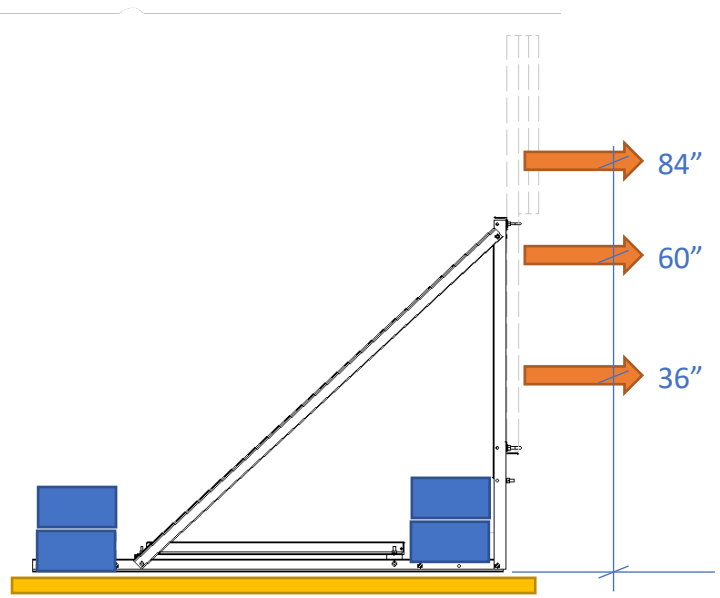


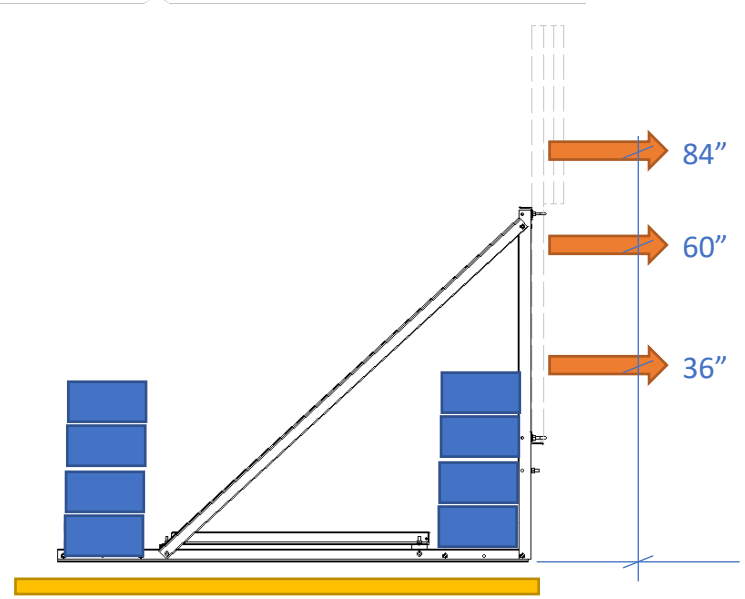
Additional CMU blocks were added (100% design ballast) to the mount trays and testing was repeated. Testing was repeated at the same three (3) elevations; 36”, 60”, and 84”.



The same three (3) tests were performed on the mounts with the rubber mats in place, with each test occurring at three (3) different elevations; 36”, 60”, and 84”.







Overturning vs Sliding

- OVERTURNING = Rear trays start to lose contact (lift) and:
  - Continue to lift and pivot about the front of the tray, or
  - Reduce the friction resistance, allowing the mount to slide after the back of the tray starts to lift
- SLIDING = Mount moves horizontally with no measureable upward movement at the back of the tray
  - Note: possible reduction in pressure on the rear tray may have occurred but was not recordable due to testing limitations.

Used fixed anchorage, slings, and load cells to apply loads to the mounts

Used fixed anchorage, slings, and load cells to apply loads to the mounts

Recorded if uplift on the back of the mount, or sliding was observed first

Recorded if uplift on the back of the mount, or sliding was observed first

Additional photos of the testing

Additional photos of the testing

Observations

- The rubber mats significantly increase the friction resistance to the concrete
- Sliding on rubber mat occurred as a gradual movement, whereas sliding on concrete occurred as an abrupt displacement
- Proper quantity and type of secured ballast installed in the correct design locations has a significant impact on performance of the mount
- Overturning controls at typical antenna installations elevations (84”)
- Sliding controls at 36” and below
- Frame rigidity directly contributed to ballast engagement

Controlling Mode

Ballast	Load Elevation (in)	Surface	Mount A	Mount B	Mount C
0%	84	Concrete only	Overturning	Overturning	*
0%	84	Concrete + Mats	*	*	Overturning
50%	84	Concrete only	Overturning	Overturning	Overturning
50%	84	Concrete + Mats	Overturning	Overturning	Overturning
100%	84	Concrete only	Overturning	Overturning	Overturning
100%	84	Concrete + Mats	Overturning	Overturning	Overturning
0%	60	Concrete only	Overturning	Sliding	*
0%	60	Concrete + Mats	*	*	Overturning
50%	60	Concrete only	Overturning	Overturning	Overturning
50%	60	Concrete + Mats	Overturning	Sliding	Overturning
100%	60	Concrete only	Sliding	Sliding	Sliding
100%	60	Concrete + Mats	Overturning	Sliding	Overturning
0%	36	Concrete only	Overturning	Sliding	*
0%	36	Concrete + Mats	*	*	Sliding
50%	36	Concrete only	Sliding	Sliding	Sliding
50%	36	Concrete + Mats	Sliding	Sliding	Sliding
100%	36	Concrete only	Sliding	Sliding	Sliding
100%	36	Concrete + Mats	Sliding	Sliding	Sliding
0%	12	Concrete only	Sliding	Sliding	*

Not all tests were completed for all mounts. * means test was not performed

Summary and next steps

- Overturning controlled at typical elevation for antenna placement. Further testing is recommended to better define behavior of ballast mounts

<u>Recommendations:</u>

- Controlled test setup to simulate field conditions:
  - Constant displacement vs constant force
  - Dynamic peak force vs static
- Confirmation of end users antenna radiation centerlines
- Friction coefficient testing for different surface types
- Readings of pressure differences between ballast trays and surface under loading conditions

Thank You

The Telecommunications Industry Foundation would once again like to thank the following participants who supported their respective employee's participation in this testing event. The participants took time out of their busy schedules to work in conjunction with competitors in order to move our industry forward. The observations and empirical data gathered from this event will serve to educate many.

- ❑ Valmont / Site Pro 1
- ❑ Perfect Vision
- ❑ CommScope
- ❑ Sabre
- ❑ Colliers Engineering & Design
- ❑ Engineered Tower Solutions
- ❑ Tower Engineering Solutions
- ❑ Proactive Telecommunications Solutions