

# Foundation Specifications



## for 8.1-Meter Motorized Earth Station Antenna

### Introduction

This document specifies the typical foundation characteristics, designs, requirements, and dimensional specifications for the Kratos 8.1-Meter Earth Station Antenna.

### Foundation Loading Characteristics

The 8.1m foundation consists of a reinforced concrete pad with a reinforced concrete pier extending upward from the center of the pad. Foundation loads are applied to 3 points on the foundation pad and to the top of the center pier as shown in Figure 1. Positive applied forces are in the direction of the X, Y and Z coordinate system.

Varying load conditions are dependent upon incident wind angle and elevation/azimuth angles of the antenna. Foundation loads including antenna weight plus various wind conditions are listed in Table 1. Wind Vector (WV) in Table 1 is the angle of approach into the reflector measured clockwise from the reflector normal pointing direction as shown in Figure 1. Additional loads are provided in Table 1 for high wind sites with wind velocity up to 200 mph [322 kph] and the antenna stowed at 90-degree elevation.

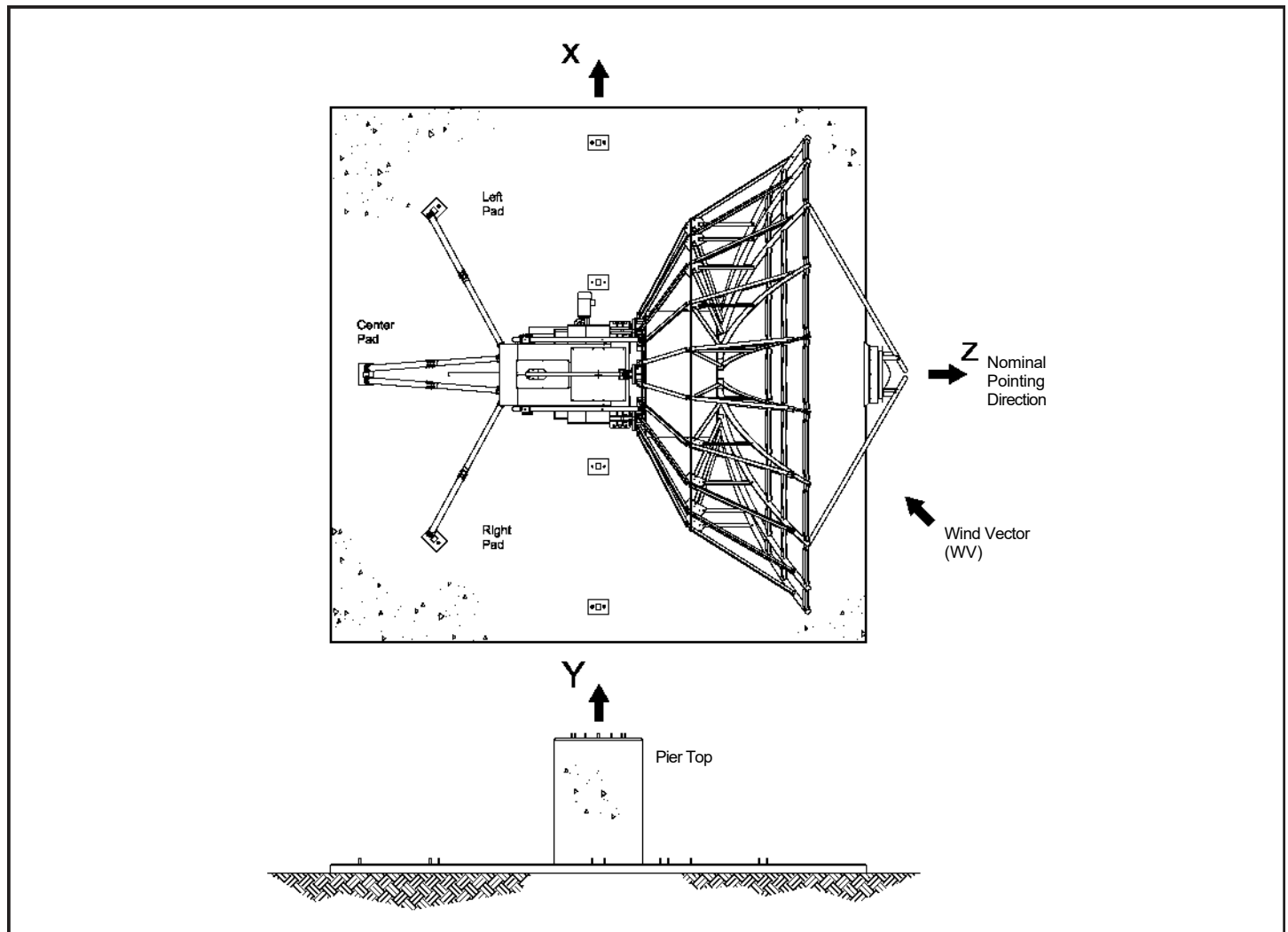


Figure 1

## Foundation Designs

The foundation design for a particular site is dependent upon local soil conditions. Soil borings and foundation analysis should be performed by a qualified civil engineer.

A typical foundation design is based on normal soil conditions is shown in Figure 2. This design represents the minimum requirements for the foundation, and defines the interface requirements between the antenna and mount. A copy of this design is available from Kratos on request. Refer to drawing 240443.

## Anchor Bolt Requirements

A typical anchor bolt installation configuration and corresponding dimensions are shown in Figure 3.

Kratos Type 304180, Foundation Kit includes anchor bolts and required mounting as shown in Figure 3.

## Foundation Orientation

Proper foundation orientation is required to obtain the desired orbital arc coverage from a particular site location. The required azimuth and elevation angles of the antenna, relative to the mount, must be determined to establish the appropriate foundation orientation.

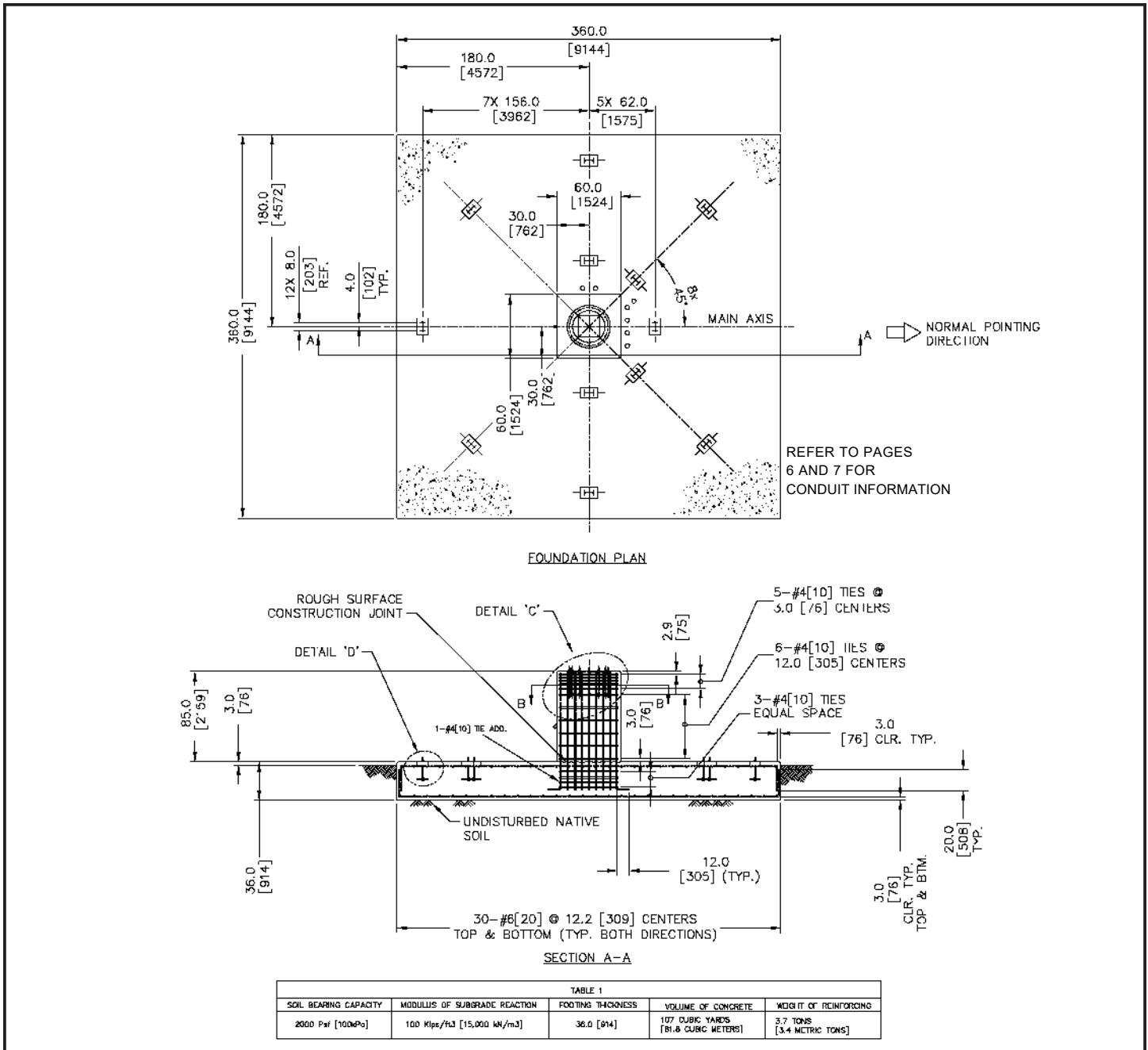


Figure 2

### 8.1M Foundation Load Table - Wind = 125 mph

LOAD CASE	FOUNDATION POINT	FX	FY lbs.	FZ	MX	MY in.lbs.	MZ
EI 0 W 0	Pier Top	48	-1,089	<b>-25,611</b>	<b>-1,060,000</b>	7,733	347
	Center Pad	1	<b>-8,005</b>	<b>-6,034</b>			
	Left Pad	2,059	-2,759	-1,006			
	Right Pad	<b>-2,081</b>	<b>-2,788</b>	<b>-1,017</b>			
	Reflector Pad	-26	<b>4,572</b>	0			
EI 0 W 60	Pier Top	<b>-2,882</b>	-1,034	-22,650	-941,600	-508,660	136,250
	Center Pad	487	-6,964	-5,239			
	Left Pad	<b>2,185</b>	<b>-2,925</b>	<b>-1,067</b>			
	Right Pad	-1,397	-1,890	-682			
	Reflector Pad	-79	2,511	0			
EI 0 W 120	Pier Top	<b>6,228</b>	-6,433	7,445	298,680	1,019,400	-302,490
	Center Pad	-959	2,074	1,669			
	Left Pad	-1,313	1,667	641			
	Right Pad	-223	-349	-109			
	Reflector Pad	97	-7,262	0			
EI 0 W 180	Pier Top	2	-8,146	16,752	683,170	-2,586	-1,165
	Center Pad	0	4,690	3,669			
	Left Pad	-1,212	1,534	592			
	Right Pad	1,214	1,537	593			
	Reflector Pad	1	<b>-9,785</b>	0			
EI 23 W 0	Pier Top	-150	-10,210	-22,004	-855,930	-29,261	24,124
	Center Pad	43	-6,918	-5,204			
	Left Pad	1,806	-2,428	-882			
	Right Pad	-1,813	-2,436	-886			
	Reflector Pad	-30	-1,442	-419			
EI 23 W 60	Pier Top	-1,721	-9,390	-18,088	-723,290	-351,630	241,420
	Center Pad	396	-6,093	-4,573			
	Left Pad	1,684	-2,267	-823			
	Right Pad	-1,544	-2,084	-754			
	Reflector Pad	-29	-1,182	-340			
EI 23 W 120	Pier Top	4,998	-6,009	7,870	334,820	914,280	-657,010
	Center Pad	-1,007	2,285	1,830			
	Left Pad	-764	947	373			
	Right Pad	447	530	218			
	Reflector Pad	11	-5,260	-1,588			
EI 23 W 180	Pier Top	109	-5,618	13,598	602,830	16,462	-14,721
	Center Pad	-19	4,572	3,579			
	Left Pad	-1,243	1,575	607			
	Right Pad	1,232	1,561	602			
	Reflector Pad	3	-7,090	-2,148			
EI 45 W 0	Pier Top	-32	-21,235	-14,778	-481,640	-6,082	11,511
	Center Pad	18	-4,880	-3,646			
	Left Pad	1,306	-1,772	-638			
	Right Pad	-1,329	-1,801	-649			
	Reflector Pad	-23	-3,193	-1,111			
EI 45 W 60	Pier Top	-52	-15,481	-9,148	-350,320	-45,978	49,567
	Center Pad	77	-4,041	-3,005			
	Left Pad	1,105	-1,507	-540			
	Right Pad	-1,164	-1,585	-569			
	Reflector Pad	-14	-1,424	-476			
EI 45 W 120	Pier Top	3,422	-5,779	5,293	288,910	662,670	-850,840
	Center Pad	-918	2,400	1,918			
	Left Pad	-225	239	110			
	Right Pad	1,154	1,459	564			
	Reflector Pad	-48	-4,136	-1,450			
EI 45 W 180	Pier Top	53	-5,643	7,957	508,140	3,787	-8,852
	Center Pad	-4	<b>4,884</b>	3,817			
	Left Pad	-1,445	1,840	706			
	Right Pad	1,432	1,824	700			
	Reflector Pad	-3	-6,297	<b>-2,225</b>			

**Bold values are maximums.**

Table 1

LOAD CASE	FOUNDATION POINT	FX	FY lbs.	FZ	MX	MY in.lbs.	MZ
EI 68 W 0	Pier Top	-7	<b>-22,951</b>	-4,272	-105,360	2,404	-1,794
	Center Pad	-2	-2,786	-2,046			
	Left Pad	853	-1,177	-417			
	Right Pad	-836	-1,155	-409			
	Reflector Pad	-10	-1,660	-454			
EI 68 W 60	Pier Top	946	-13,056	-1,315	-103,230	148,360	-389,480
	Center Pad	-289	-2,466	-1,801			
	Left Pad	1,171	-1,595	-572			
	Right Pad	-361	-530	-176			
	Reflector Pad	-47	-154	-10			
EI 68 W 120	Pier Top	1,921	-6,180	2,226	213,980	348,060	-902,210
	Center Pad	-728	2,056	1,655			
	Left Pad	338	-501	-165			
	Right Pad	<b>1,614</b>	2,062	789			
	Reflector Pad	-89	-3,086	-875			
EI 68 W 180	Pier Top	43	-7,636	2,667	423,750	-1,557	-2,805
	Center Pad	9	4,824	3,771			
	Left Pad	<b>-1,534</b>	<b>1,957</b>	<b>749</b>			
	Right Pad	1,491	1,901	729			
	Reflector Pad	-7	-5,305	-1,530			
EI 90 W 0	Pier Top	-79	<b>5,026</b>	3,038	-411,180	2,059	10,740
	Center Pad	-26	-6,257	-4,699			
	Left Pad	2,058	-2,758	-1,005			
	Right Pad	-1,962	-2,632	-958			
	EI 90 W 90	Pier Top	1,090	-5,353	522	2,147	66,800
Center Pad		-531	-591	-368			
Left Pad		1,665	-2,243	-814			
Right Pad		1,330	1,689	650			

### 8.1m Foundation Load Table - High Wind = 200 mph

EI 90 W 0	Pier Top	-190	26,080	6,640	-1,077,200	4,956	27,528
	Center Pad	-64	-14,843	-11,260			
	Left Pad	4,881	-6,465	-2,385			
	Right Pad	-4,651	-6,162	-2,272			
EI 90 W 90	Pier Top	2,802	-487	199	-19,070	170,690	-2,691,300
	Center Pad	-1,355	-337	-173			
	Left Pad	3,876	-5,145	-1,894			
	Right Pad	3,775	4,899	1,844			

**Bold values are maximums.**

Table 1 (continued)



## General Notes - Pedestal Mount

### General Notes:

1. All dimensions are shown in inches [millimeters] and (reference).
2. Contractor shall field verify all dimensions locating existing construction before fabrication of new construction begins.
3. Ground rods shall be driven to depths as shown (below permanent moisture level) and ground system resistance measured. The antenna structure shall be connected to a grounding system consisting of a number of interconnected ground rods. The system shall meet the standards of the Underwriters' Laboratories Publication No. UL96A for lightning protection. The ground rod system-to-earth resistance shall not exceed 1.0 ohms at any time during the year.
4. Grounding system shown is the minimum necessary. Local conditions will dictate grounding system design.

### Foundations:

1. Foundations have been designed to rest on undisturbed soil (per EIA-411-A and RS-222-D). Refer to Table 1 for soil design parameters.
2. Backfill shall be suitable excavated material or other suitable material compacted in 6" [152] lifts to 95% of maximum density as determined by ASTM D1557.
3. This foundation is a typical design only. Certification of its suitability for a particular installation engineer is required prior to its use for actual fabrication.
4. If this foundation is to be located in an area where by a professional the annual frost penetration depth exceeds the depth shown per footing thickness per Table 1 (sheet 2). The local building code specifying a minimum required foundation depth should be consulted.

### Concrete:

1. Concrete and related work shall be mixed, placed and cured in accordance with the "Building Code Requirements for Reinforced Concrete" ACI 318 and "Specifications for Structural Concrete" ACI 301, publication SP-15.
2. Concrete shall develop a compressive strength of at least 3500 psi [25 MPa] in 28 days with a maximum slump of 3" [76] at time of placing. Cement shall be normal Portland cement (Type 10) unless local soil conditions require the use of sulphate resistant cement.
3. Concrete subjected to freeze-thaw cycles to be air-entrained to 5%-8%.
4. Reinforcing bars shall conform to ASTM A615 (S1) grade 60 deformed type  $F_y = 60,000$  psi [400 MPa].
5. Unless otherwise noted, concrete cover for reinforcing bars shall conform to the minimum requirements of ACI 318.
6. Fabrication of reinforcing steel shall be in accordance with the "Manual of Standard Practice for Detailing Reinforced Concrete Structures" ACI 315.

7. Provide 3/4" x 45° [19x45°] chamfer on all exposed concrete edges.
8. A tolerance of  $\pm 1/8$ " [3] applies to all anchor bolt layout dimensions.
9. Level all plates for struts (Detail 'D') individually and to within  $\pm 1/4$ " [6] of each other.
10. Level plate for antenna (Detail 'C') to within 0.1 degree of horizontal.

### Grounding System:

1. The grounding system shown represents the minimum requirements to achieve satisfactory grounding. Actual site conditions and soil resistivity levels will determine final grounding system design to comply with the following:
2. All ground ring, ground rod and antenna structure connections to be ERICO products, Inc. Calweld exothermic type welded electrical connections or equivalent.
3. Ground rods shall be driven to a depth below permanent moisture level (minimum depth shown) as dictated by geographical location.
4. The antenna structure shall be connected to a grounding electrode system consisting of a number of interconnected ground rods. The system shall meet the requirements of the Underwriters' Laboratories Publication No. UL96A for Lightning Protection.
5. The grounding electrode system to earth resistance shall not exceed 10 ohms, measured with a Biddle 3 terminal device or equivalent. The grounded conductor (neutral) supplied to all AC equipment on the antenna structure should be disconnected before taking measurement.
6. Actual site conditions may require longer ground rods, additional ground rods and/or landfill additives to reduce soil resistivity levels.
7. Avoid sharp bends when routing grounding wire. Grounding wires to antenna structure to be run as short and straight as possible.
8. Final grade directly above grounding electrode system to be water permeable.
9. The copper grounding cable should be laid in a 2" conduit if it is to be routed through the slab and brought out at the base of the column. The conduit should be sloped when installed in the foundation to allow water drainage out to the slab perimeter.

### Conduit: (refer to Figure 3A)

1. Prime power stub-ups for C1 & C2 to include a 50" [1270] pig tail to permit the feeder wire connection to the antenna located load center.
2. Conduits C3, C4, C5 & C6 to include pull ropes from customer building to the 8.1m antenna foundation location.

(Notes continued on next sheet)

3. All conduits to stub-up 6" [152] above the top of the foundation.
4. All conduits to have caps installed after installation to prevent water fill-up.
5. Interfacility conduit between the customer building and the 8.1m foundation to include swept bends of not less than 36" [914mm] radius, not right angles.
6. Interfacility conduit between the customer building and the 8.1m foundation to include pull boxes as required.

Conduit Schedule					
Conduit	Purpose	From	To	Size [mm]	Notes
C1	Utility power	Customer Load Center	Antenna Foundation	4" [101.6] 6" [152.4]	Without de-ice With de-ice
C2	Technical Power	Customer Load Center	Antenna Foundation	4" [101.6]	All 8.1m sites
C3	Signal	Antenna Foundation	Customer Building	6" [152.4]	All 8.1m sites
C4	Signal	Antenna Foundation	Customer Building	6" [152.4]	All 8.1m sites
C5	M&C	Antenna Foundation	Customer Building	6" [152.4]	All 8.1m sites
C6	Spare	Antenna Foundation	Customer Building	6" [152.4]	All 8.1m sites

**Gas Supply: (refer to Figure 3A)**

1. The installation of a gas supply line (for gas powered heating/de-ice equipment) is the responsibility of the customer and must be installed according to local regulations for the installation site.
2. Location 'G1' is a recommended location. Ensure that the supply line is installed with a minimum distance of 12" away from adjacent conduit and objects.
3. The supply line stub-up must be a minimum 12" above the foundation surface and capped with an appropriate shut-off valve.

## Antenna Geometry

Basic dimensional characteristics and elevation and azimuth adjustment ranges are shown in Figures 4 & 5. The antenna has five coarse azimuth positions consisting of the normal position as shown in Figure 5, plus positions at 45 deg. and 90 deg. right and left of center. Foundation pads are provided to allow ground struts to be connected at any of the coarse azimuth positions. At any coarse azimuth setting the antenna

has +/-24 degrees continuous azimuth adjustment and 0 to 90 degrees continuous elevation adjustment. Figures 4 and 6 illustrate varying dimensions from the ground reference of selected antenna points as the elevation angle changes from 0 degrees to 90 degrees.

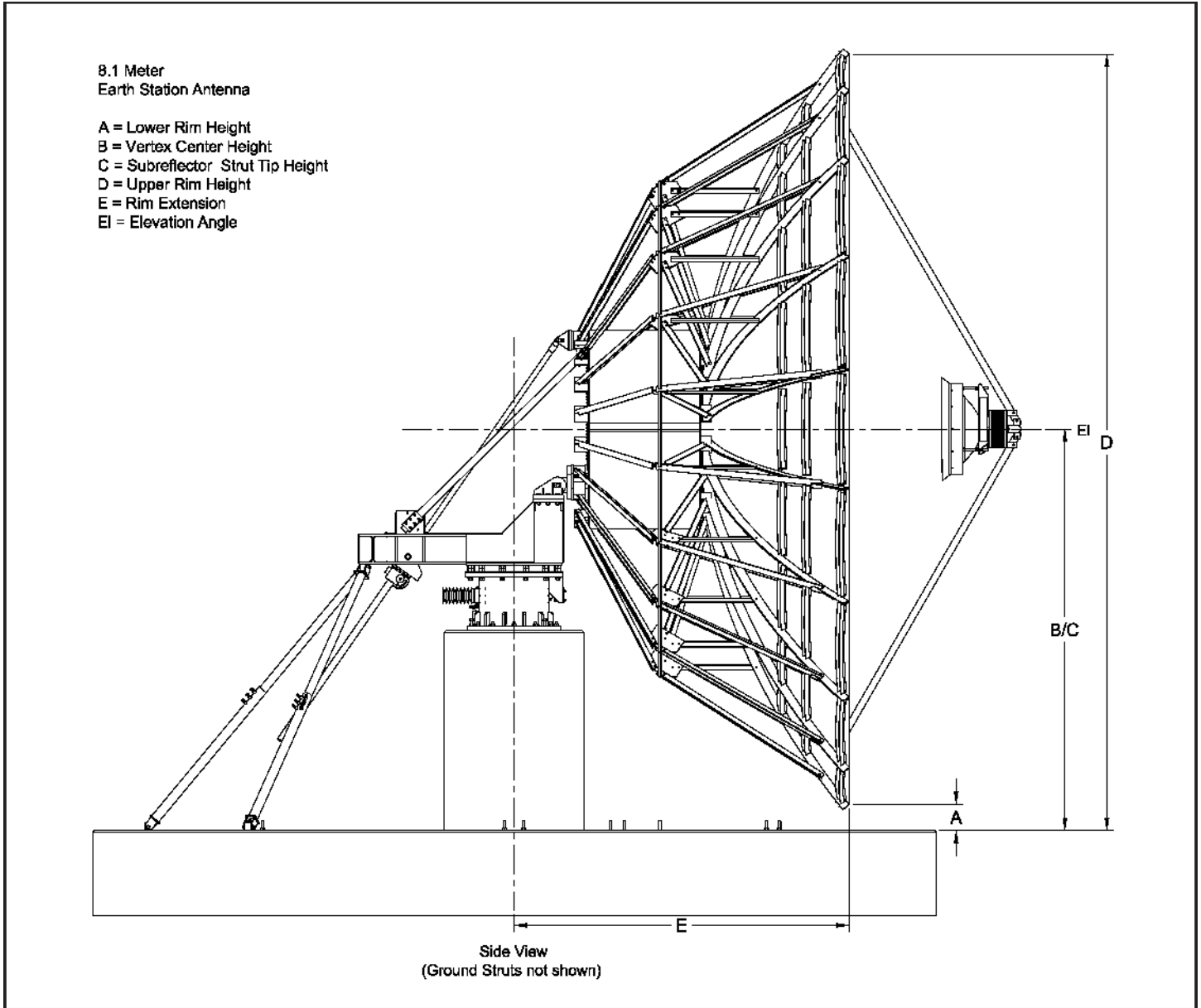
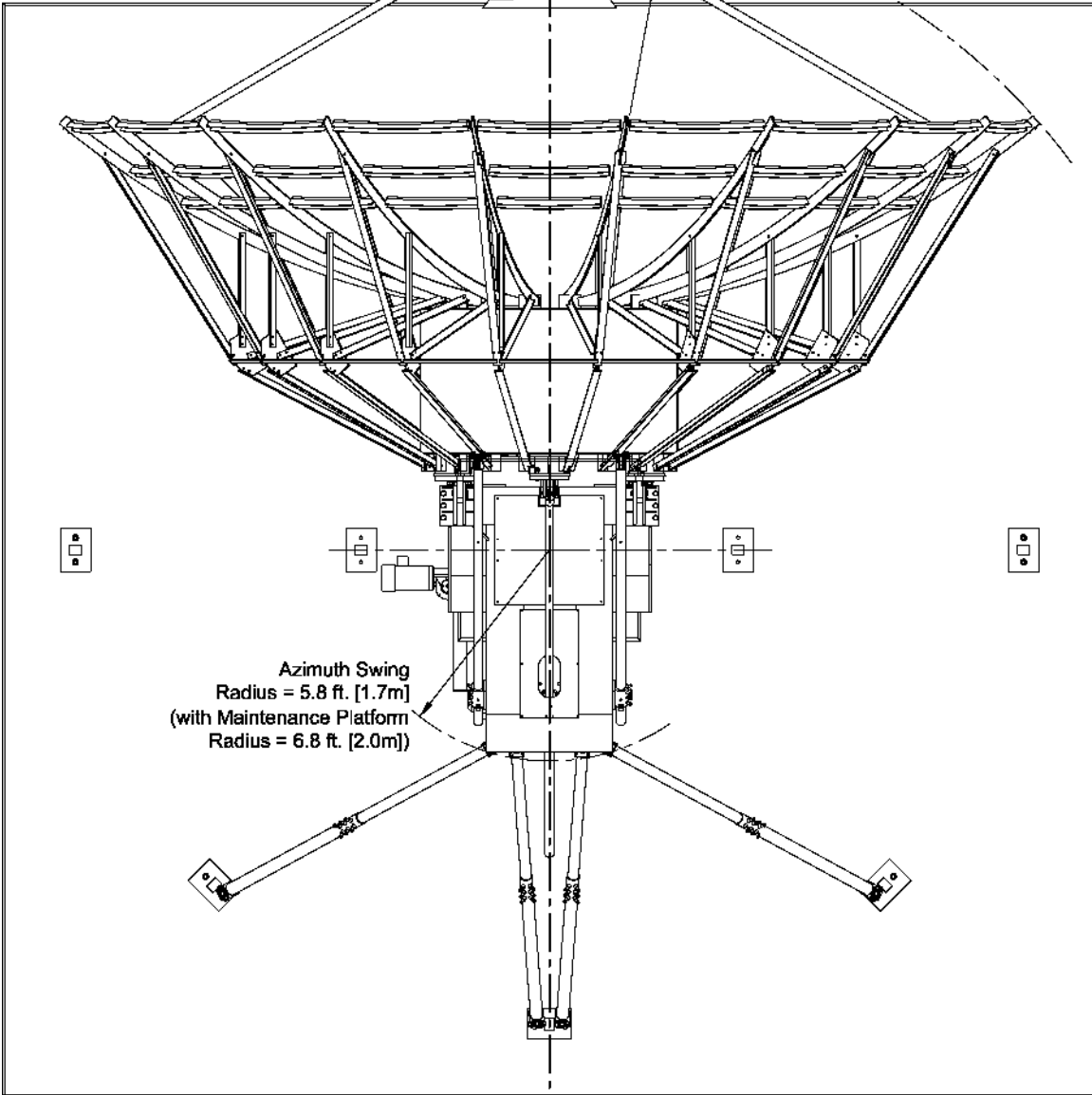


Figure 4



8.1 Meter  
Earth Station Antenna

Azimuth Swing  
Radius = 18 ft. [5.5m]



Top View

Figure 5

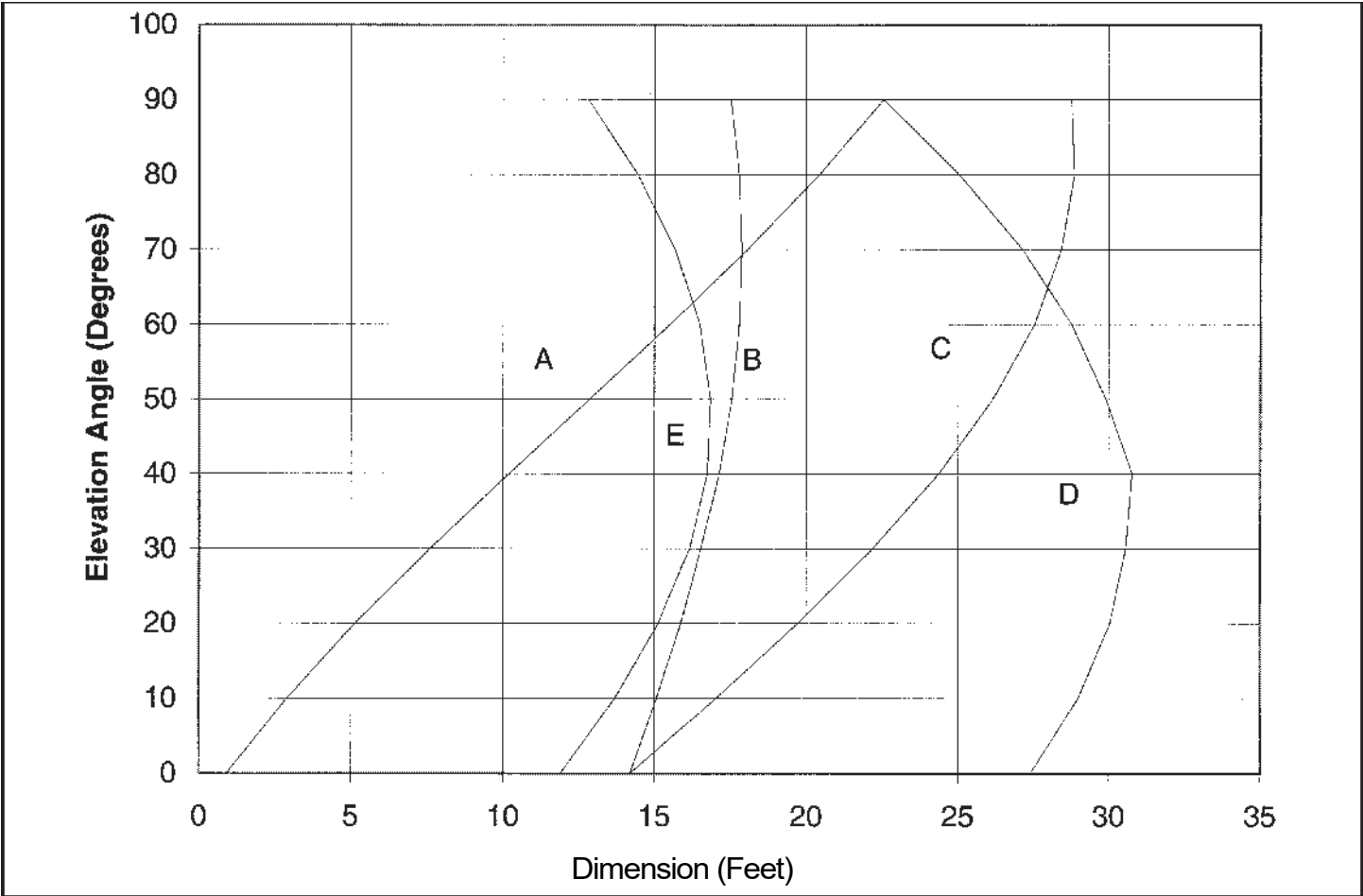


Figure 6