CHAPTER 13

TRANSPORTABLE TRANSMITTER/RECEIVER (TR) STATIONS

13.1 GENERAL

Transportable stations can be used as substitutes for permanent stations when (1) national policy prohibits construction of permanent facilities and (2) time does not permit construction of permanent facilities. Also, they can be used to replace disabled facilities or to augment existing ones. Transportable equipment falls into two major classes: tactical and semi-transportable. Tactical equipment is pre-packaged and designed for quick placement and short-term use. Semi-transportable equipment is designed to provide a fixed station capability for long-term use and to make feasible the recovery of a major portion of a station's total assets for possible redeployment. The use of semi-transportable equipment also makes possible a complete station check-out prior to shipment to the user location.

13.2 TACTICAL TRANSPORTABLE EQUIPMENT

Van-type enclosures outfitted with the necessary equipment required for specific communications applications are maintained in the government inventory for special purpose short-term tactical use. Volume II of DCAC 370-185-1 — "DCS Applications Engineering Manual " describes the various sets and the general installation requirements for each. Each set is self-sufficient for communications purposes but does not in itself provide for personnel support. A typical tactical equipment set is the AN/TSC-18, a 2- to 28-MHz, 40-kW independent sideband radio facility, complete with antennas and transmission lines.

The AN/TSC-18 system, illustrated in figure 13-1, includes three facilities: transmitting (one van), receiving (one shelter), and communication center (two shelters). These facilities are interconnected by a UHF link. The control and communications shelters are collocated and are within 10 miles (line of sight) of both the transmitter and receiver sites. The system characteristics are completely compatible with the DCS HF radio reference circuit described in chapter 2. Size and weight of the major components of a system are given in table 13-1.

The location of the AN/TSC-18 system depends upon the tactical situation, antenna siting considerations, and local terrain. Three sites are required: one for the transmitter van (approximately a 5-acre rectangular plot with 500 feet cleared in the direction of transmission), one for the receiver shelter (approximately a 10-acre square plot), and one for the facilities control and the communications shelters (approximately 2 acres). Where possible, the three ground sites should be level, dry and with good drainage. The following factors are pertinent to the siting and antenna layout for this system:

a. Radio signals are absorbed and sometimes reflected by nearby obstructions. Transmission and reception are best over water or level ground.

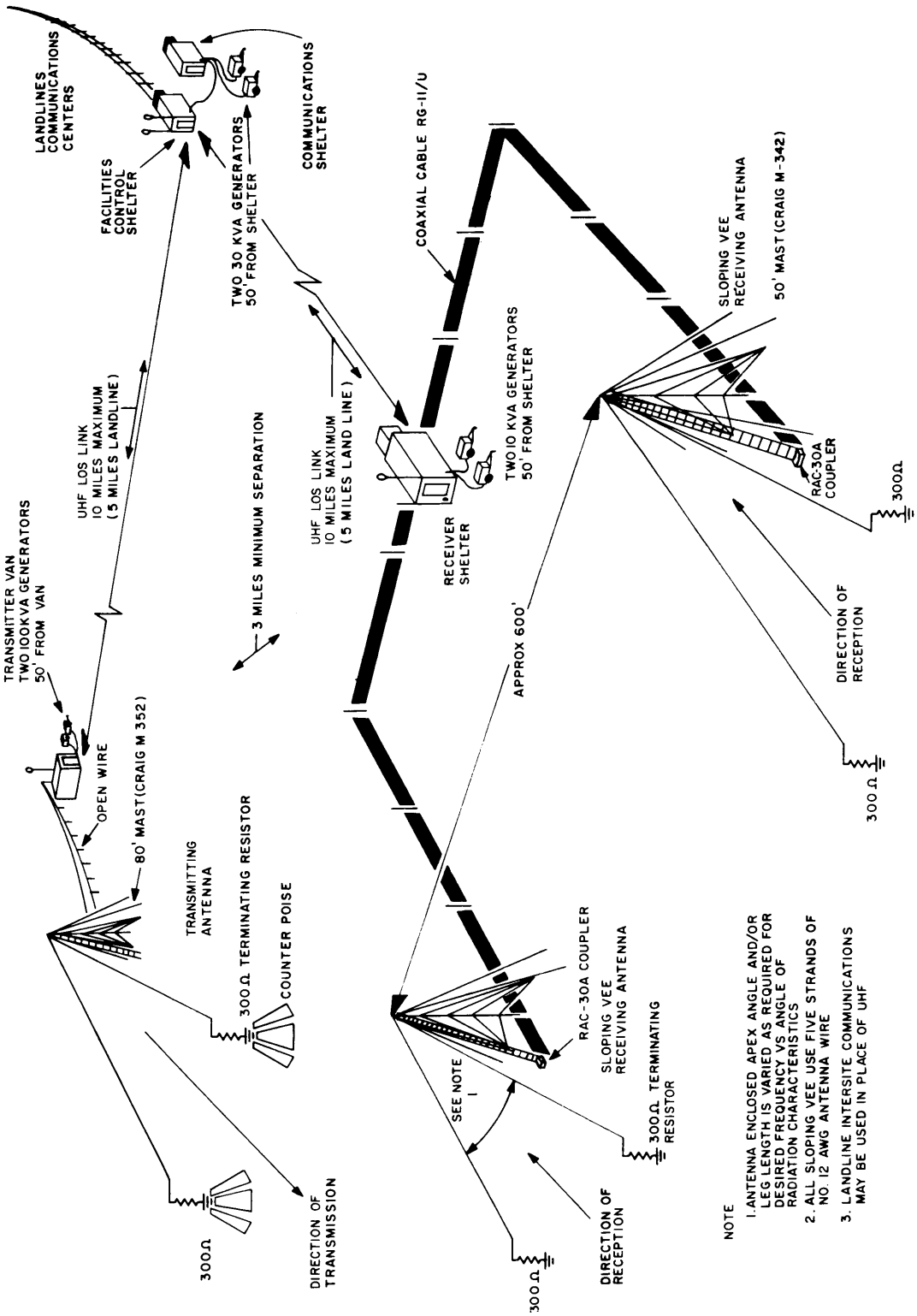


Figure 13-1. AN/TSC-18 System Facility and Antenna Plan

Table 13-1. Size and Weight of AN/TSC-18 System Components

COMPONENT	SIZE AND WEIGHT
Transmitter Van	Van: Model M373A2C Length 366' width 96", height 132" Weight: 22,700 lb fully loaded, 11,000 lb empty
Receiver Shelter	Shelter: S-141/G (Modified) Length 146", width 84", height 84" Weight: 7100 lb fully loaded, 1550 lb empty
Facilities Control Shelter	Shelter: S-141/G (Modified) Length 146", width 84", height 84" Weight: 5800 lb fully loaded, 1550 lb empty
Communications Shelter	Shelter: S-141/G (Modified) Length 146", width 84", height 84" Weight: 6800 lb fully loaded, 1550 lb empty

b. The site selected for the receiver shelter must have sufficient space for diversity receiving antennas. The receiving antennas are located on either side of the shelter a minimum of 5 wavelengths apart at the lowest operating frequency.

c. There should be at least a 3-mile separation between the receiver shelter and the transmitter van.

13.3 SEMI-TRANSPORTABLE EQUIPMENT

Semi-transportable stations, now in use at various overseas locations, were designed and built to fulfill the known fixed station communications requirement for these locations. Each station consists of groups of shelters, each shelter designed with equipment installed so that, when the shelters are interconnected, the composite group satisfies the entire communications requirement. Thus the long-term, sustained, high-capacity, long-haul, fixed-plant characteristics required of a communications station are provided, housed in transportable communications modules. The modules contain standard, presently available reception, transmission, switching, and technical control equipment along with all necessary facilities for personnel and equipment support. This modular concept permits the rapid creation, augmentation, or tear-down of a communications station in building-block fashion.

The modules are designed and arranged to conform to the requirements for separate functional areas defined by COMNAVCOMM INST 2300.3 dated 23 July 1969. Figures 13-2 and 13-3 show typical site plans for semi-transportable stations; the individual modules are identified by table 13-2. Figures 13-4 and 13-5 show typical equipment placement within the shelters and figures 13-6 through 13-8 are photographs of portions of the AN/TSC-35 semi-transportable communications system.

13.3.1 Typical Container Construction

The basic container used in the construction of these stations is similar to a Fruehauf van measuring 40 feet long, 10 feet wide and 9.5 feet high. The containers are made of structural steel framing covered with an exterior skin of aluminum and an interior lining of plywood. The corners have fittings for lifting and locking one to another for assembling the station. Fittings are also provided to serve as tie-down points to prevent shifting out of alignment.

At the site, each container is mounted on two or more special container support assemblies. Each leg of the assembly is equipped with two casters, a swiveled sand shoe, and an independent two-speed jack. The casters are mounted on leaf-springs that support the weight of the assembly and allow one man to easily move the assembly into position under a container. The independent jack in each leg can be adjusted to a height ranging from 34 to 50 inches, making it possible to easily and accurately level the containers on site.

13.3.2 Equipment Mounting and Installation

Equipment rack bases and bases for special cabinets such as those containing transmitters are included in the shelter design and are part of the basic structure. Most teletype equipment, furniture, safes, filing cabinets, storage and parts cabinets, and desks are attached directly to the floor.

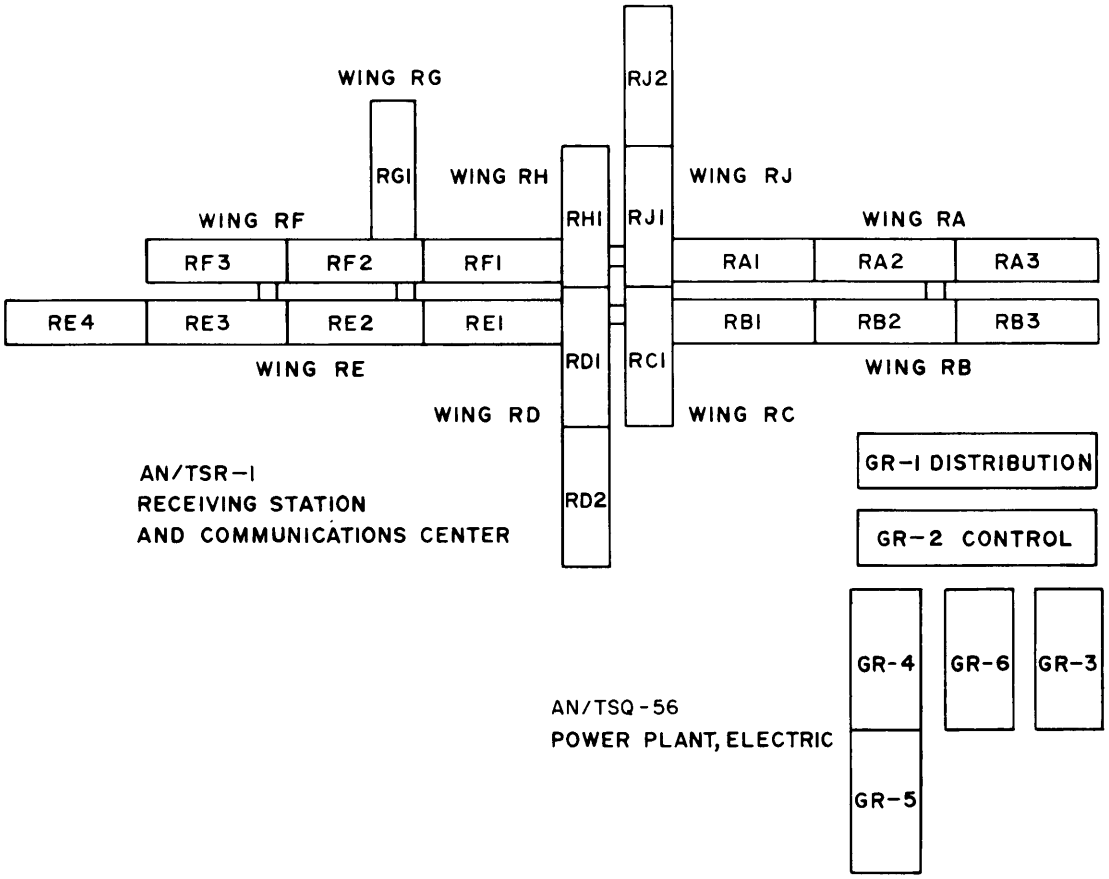


Figure 13-2. Site Plan, Transportable Communications Center and Receiver Station

13.3.3 Signal Distribution

Unless otherwise instructed, transportable stations must meet the requirements for Red and Black signal distribution as prescribed in NAVELEX Instructions 011120.1. Due to the nature of transportable structures, deviation from this instruction may be authorized on a case basis. The AN/TSC-35 shelter does provide ferrous shielding for all signal circuits. The ducting system was designed for approximately 50-percent cable loading at installation, thus allowing space for additional cable runs to accommodate future communications expansion.

13.3.4 Site Selection and Preparation

The general criteria for terrain and environmental conditions in NAVELEX 0101, 103 — "HF Radio Propagation and Facility Site Selection " is applicable to transportable equipment. After the general geographic location has been selected, careful consideration must be given to the soil bearing characteristics and wind loading to be encountered.

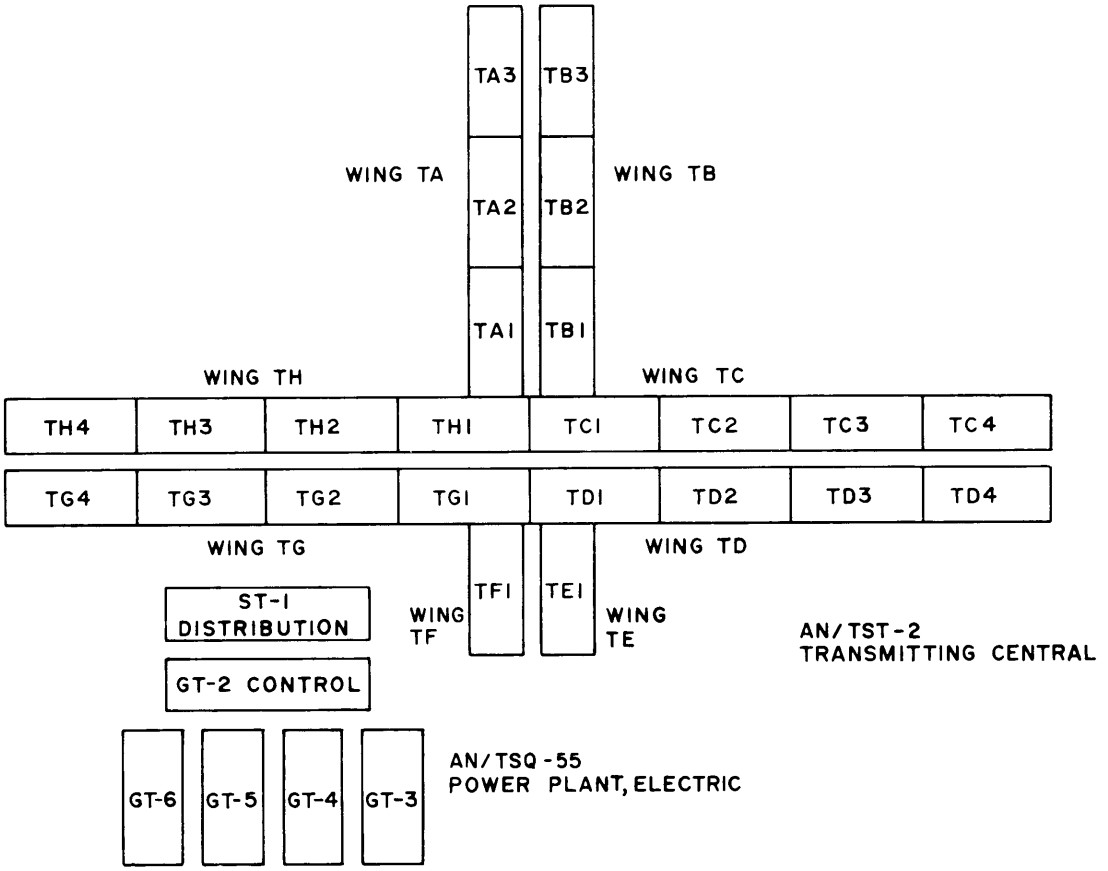


Figure 13-3. Site Plan, Transportable Transmitter Station

Table 13-3 can be used for preliminary estimates to determine the nominal bearing pressure of the soil. However, the nominal allowable soil bearing pressures for spread foundations listed in Table 13-3 must be used with caution. For additional guidance, refer to NAVFAC Design Manual DM-7. If it appears that the soil bearing capacity is insufficient for the size of footing and the weight of the transportable activity, the installation activity must compact the soil or install concrete foundations. All transportable equipment shelters are supplied with tie-down pads which are to be secured to anchorages having sufficient uplift capacity to prevent lateral movement by the wind. A 1.5 safety factor against transient or live load forces should be designed into the anchorage (shown in figure 13-9), and pull-out tests should be performed to determine the ultimate resistance of the anchorage.

13.3.5 Earth Ground Point

The criteria of chapter 12 are applicable to the installation of the earth ground point for the transportable station. When a shelter, or a group of shelters, is to be used for signal transmission and reception only, personnel and equipment protection are the sole considerations for the design of a grounding system. For personnel protection, the earth ground connection must not present more than 25 ohms resistance to ground.

Table 13-2. Communication System AN/TSC-35 Major Components

NAME	MILITARY NOMENCLATURE
Receiver Site	RECEIVING CENTRAL AN/TSR-1
Container RA1 - HICOM/ASC	RECEIVING CENTRAL GROUP OA-3887/TSR-1
Container RA2 - Off-Line and Crypto Repair	RECEIVING CENTRAL GROUP OA-4936/TSR-1
Container RA3 - Special Receiver Container	RECEIVING CENTRAL GROUP OA-7041/TSR-1
Container RB1 - Classified Control	TELETYPE CENTRAL AN/TGC-16
Container RB2 - Crypto	RECEIVING CENTRAL GROUP OA-4937/TSR-1
Container RB3 - Crypto	RECEIVING CENTRAL GROUP OA-4938/TSR-1
Container RC1 - Multi-Channel Crypto	RECEIVING CENTRAL GROUP OA-4939/TSR-1
Container RD1 - Electronic Repair	MAINTENANCE EQUIPMENT GROUP OA-4941/TSR-1
Container RD2 - Supply	SUPPLY CENTER OA-4942/TSR-1
Container RE1 - Unclassified Control	TELETYPE CENTRAL AN/TGC-17
Container RE2 - HICOM Voice and Microwave	RECEIVING CENTRAL GROUP OA-4943/TSR-1
Container RE3 - Receivers	RECEIVING CENTRAL GROUP OA-4944/TSR-1
Container RE4 - Receivers and RF Patching	RECEIVING CENTRAL AN/TSR-2
Container RF1 - Message Center	RECEIVING CENTRAL GROUP OA-4945/TSR-1
Container RF2 - C/W Ship/Shore	CONTROL-MONITOR GROUP OA-4950/TSR-1
Container RF3 - Air/Ground	CONTROL-MONITOR GROUP OA-4951/TSR-1
Container RG1 - Communication Office	RECEIVING CENTRAL GROUP OA-4966/TSR-1
Container RH1 - TTY Repair	MAINTENANCE EQUIPMENT GROUP OA-4967/TSR-1
Container RJ1 - NTX Receive	TELETYPE CENTRAL AN/TGC-18
Container RJ2 - NTX Send	TELETYPE CENTRAL AN/TGC-19
Electric Power System	POWER PLANT, ELECTRIC AN/TSQ-56
Container GR1 - Power Distribution	POWER DISTRIBUTION GROUP OA-4968/TSQ-56

Table 13-2. Communication System AN/TSC-35 Major Components (Continued)

NAME	MILITARY NOMENCLATURE
Container GR2 - Power Control	POWER CONTROL GROUP OA-4969/TSQ-56
Containers GR3 and GR6 - Generators	GENERATOR SET, DIESEL ENGINE PU-600/TSQ
Containers GR4 and GR5 - No-Break Power	GENERATOR SET, DIESEL ENGINE PU-612/TSQ
Transmitter Site	TRANSMITTING CENTRAL AN/TST-2
Containers TA1, TA2, TB2, TB3, TC4, TD4, and TG2 - Transmitter Set 10 kW	TRANSMITTING SET, RADIO AN/TRT-17
Container TA3 - Transmitter Set 1 kW and 10 kW	TRANSMITTING SET, RADIO AN/TRT-23
Containers TB1, TC2, TC3, TD2, TD3, TG3 and TH1 - Transmitter Set 40 kW	TRANSMITTING SET, RADIO AN/TRT-18
Container TC1 - Transmitter Control	CONTROL-MONITOR GROUP OA-4915/TST-2
Container TD1 - RF Distribution	INTERCONNECT GROUP OA-4916/TST-2
Container TE1 - Transmitter Set - Low Frequency	TRANSMITTING SET, RADIO AN/TRT-19
Container TF1 - Workshop	MAINTENANCE EQUIPMENT GROUP OA-4917/TST-2
Container TG1 - RF Distribution	INTERCONNECT GROUP OA-4918/TST-2
Container TH2 - Transmitter Set 40 kW	TRANSMITTING SET, RADIO AN/TRT-20
Container TH3 - Transmitter Set 200 kW	TRANSMITTING SET, RADIO AN/TRT-24
Container TH4 - Transmitter Set 50 kW and TG4 - Low Pass Filter	TRANSMITTING SET, RADIO AN/TRT-25
Helix Container	ANTENNA COUPLER GROUP OA-4940/TST-2
Electric Power System	POWER PLANT, ELECTRIC AN/TSQ-55
Container GT1 - Power Distribution	POWER DISTRIBUTION GROUP OA-4921/TSQ-55
Container GT2 - Power Control	POWER CONTROL GROUP OA-4922/TSQ-55
Containers GT3, GT4, GT5 and GT6 - Generators	GENERATOR SET, DIESEL ENGINE PU-600/TSQ
Mobile Workshop Trailer	

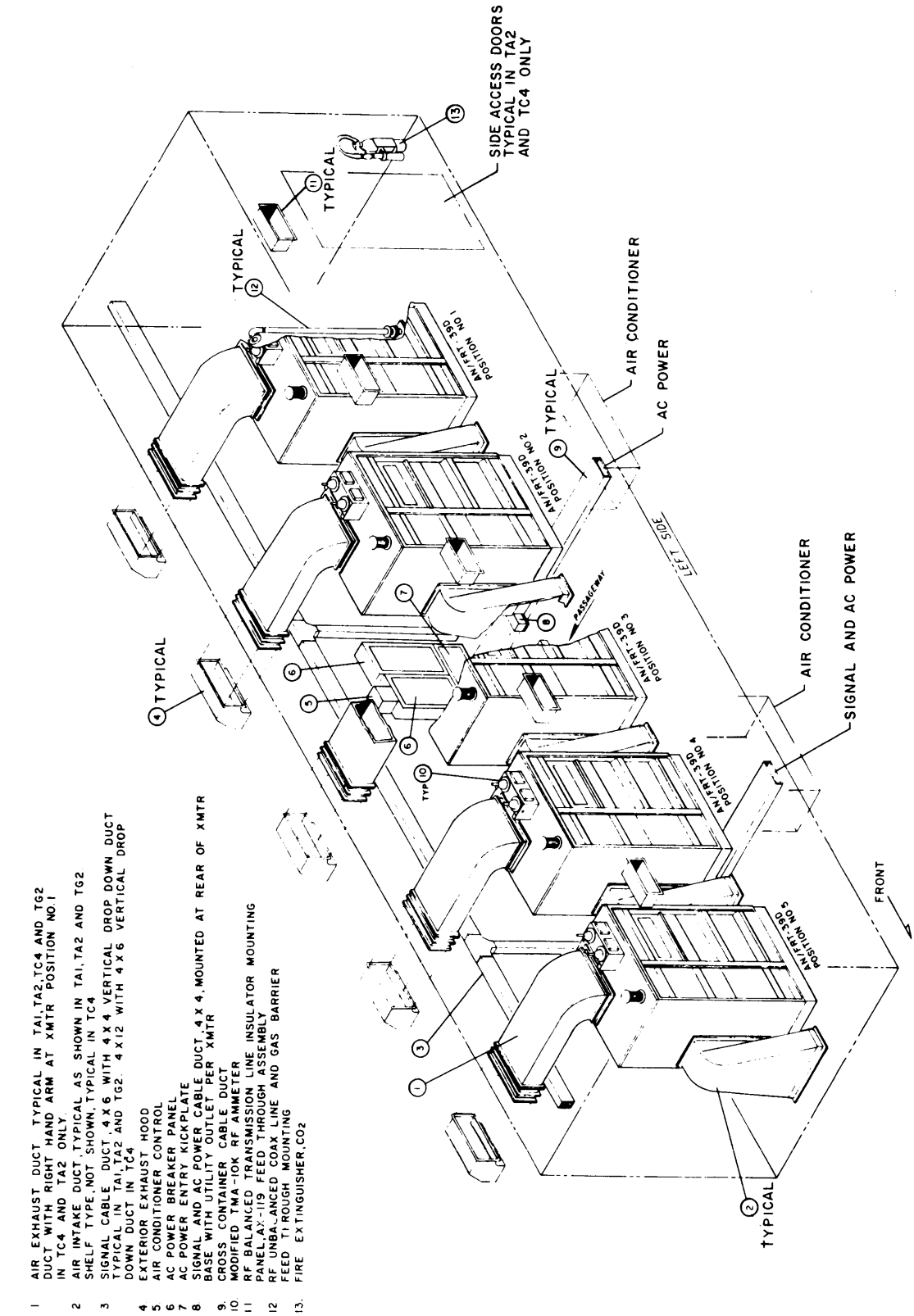


Figure 13-4. Typical Radio Transmitting Equipment Shelter

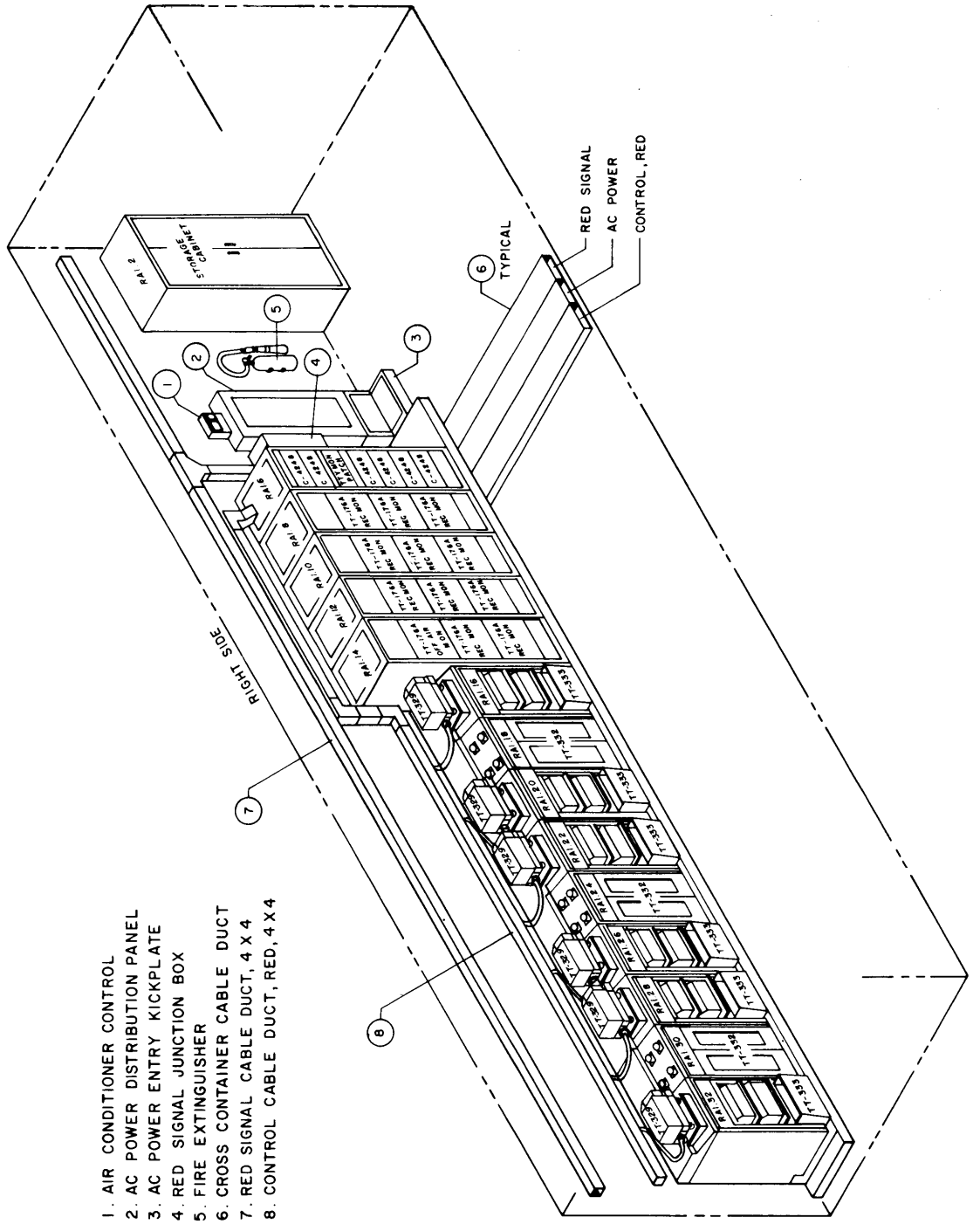
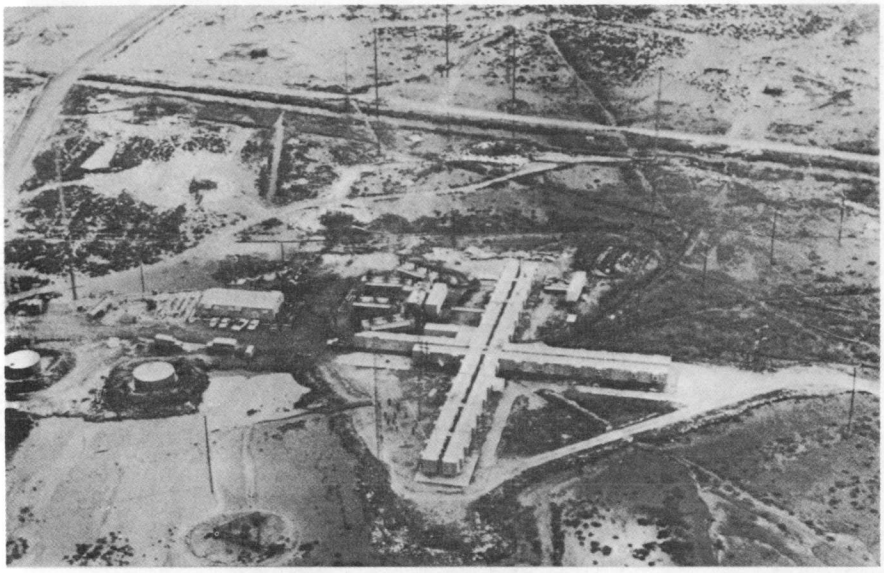
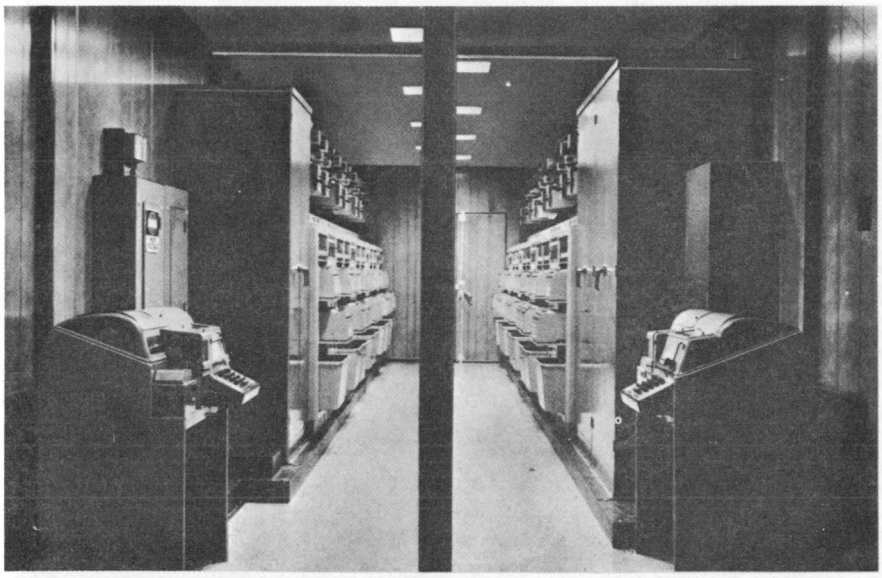


FIGURE 13-5. TYPICAL TELETYPE EQUIPMENT SHELTER, ONE SIDE SHOWN

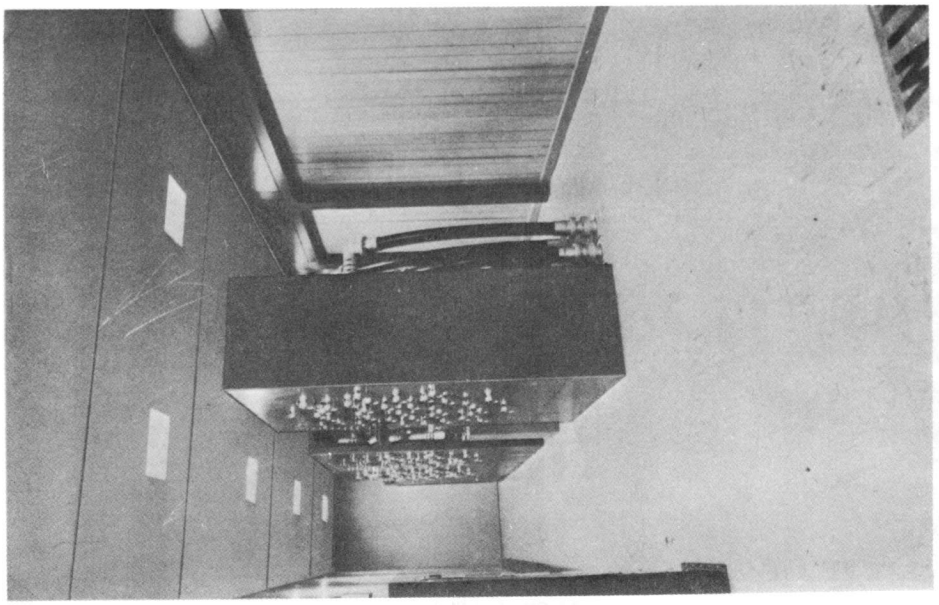


STATION COMPLEX

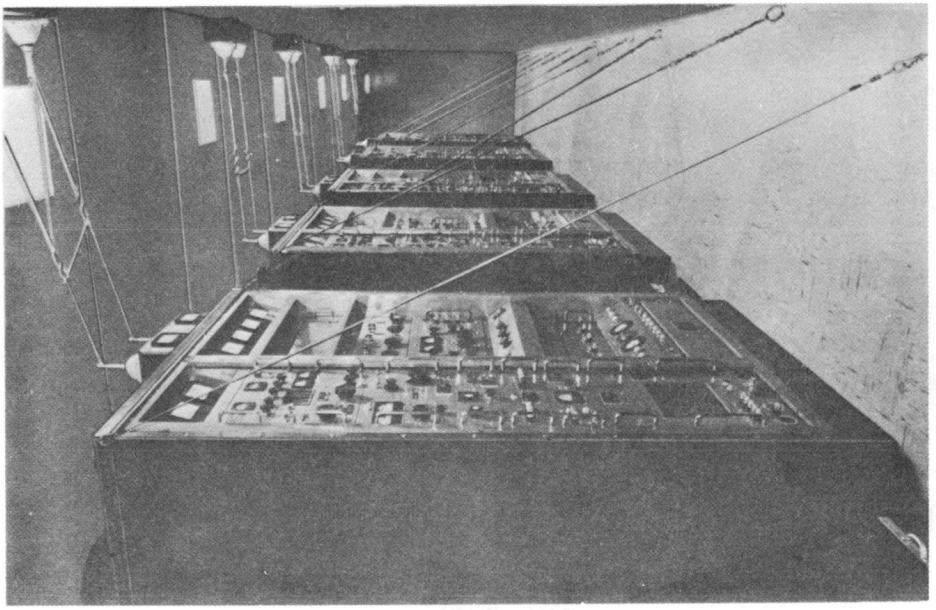


TELETYPE ROOM

Figure 13-6. Transportable Communications Center

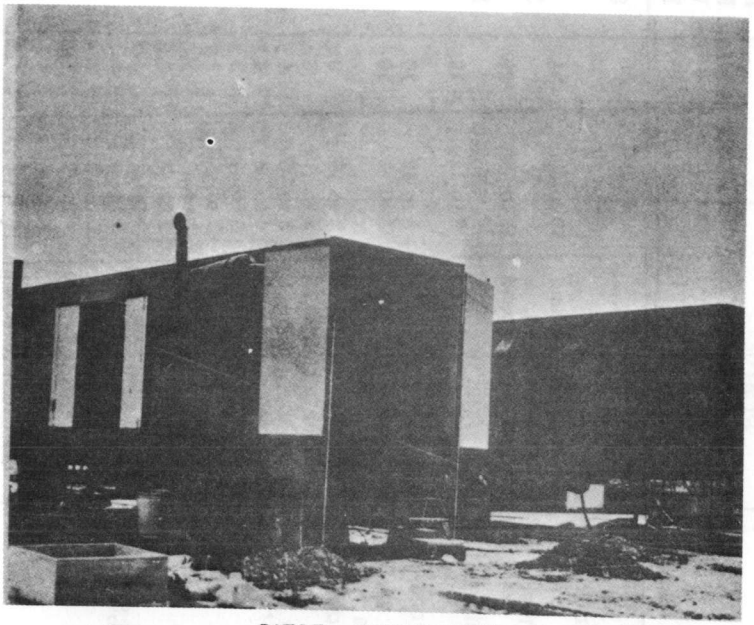


COAXIAL ANTENNA SWITCHES

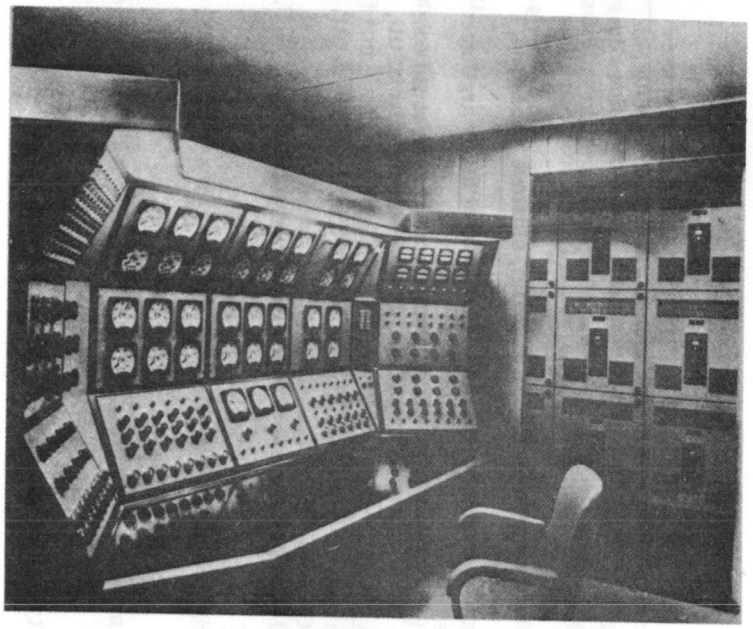


TRANSMITTERS

Figure 13-7. Transportable Transmitter Equipment



DIESEL GENERATORS



POWER CONTROL CONSOLE

Figure 13-8. Transportable Power Equipment

TABLE 13-3. NOMINAL ALLOWABLE SOIL BEARING PRESSURES

TYPE OF BEARING MATERIAL	CONSISTENCY IN PLACE	ALLOWABLE BEARING PRESSURE * TONS PER SQ FT	
		ORDINARY RANGE	RECOMMENDED VALUE FOR USE
Massive crystalline igneous and metamorphic rock: granite, diorite, basalt, gneiss, thoroughly cemented conglomerate (sound condition allows minor cracks).	Hard, sound rock	60 to 100	80
Foliated metamorphic rock: slate, schist (sound condition allows minor cracks).	Medium hard, sound rock	30 to 40	35
Sedimentary rock: hard cemented shales, siltstone, sandstone, limestone without cavities.	Medium hard, sound rock	15 to 25	20
Weathered or broken bedrock of any kind except highly argillaceous rock (shale).	Soft rock	8 to 12	10
Compaction shale or other highly argillaceous rock in sound condition	Soft rock	8 to 12	10
Well graded mixture of fine and coarse grained soil: glacial till, hardpan, boulder clay (GW-GC, GC, SC).	Very compact	8 to 12	10
Gravel, gravel-sand mixtures, boulder-gravel mixtures (GW, GP, SW, SP)	Very compact	7 to 10	8
	Medium to compact	5 to 7	6
	Loose	3 to 6	4
Coarse to medium sand, sand with little gravel (SW, SP)	Very compact	4 to 6	4
	Medium to compact	3 to 4	3
	Loose	2 to 3	2
Fine to medium sand, silty of clayey medium to coarse sand (SW, SM,SC)	Very compact	3 to 5	3
	Medium to compact	2 to 4	2.5
	Loose	1 to 2	1.5
Fine sand, silty or clayey medium to fine sand (SP, SM, SC)	Very compact	3 to 4	3
	Medium to compact	2 to 3	2
	Loose	1 to 2	1.5
Homogeneous inorganic clay, sandy or silty clay (CL, CH)	Very stiff to hard	3 to 6	4
	Medium to stiff	1 to 3	2
	Soft	.5 to 1	.5
Inorganic silt, sandy or clayey silt, varved silt-clay-fine sand (ML, MH)	Very stiff to hard	2 to 4	3
	Medium to stiff	1 to 3	1.5
	Soft	.5 to 1	.5

*See paragraph 13.3.4 for guidance in the use of this Table.

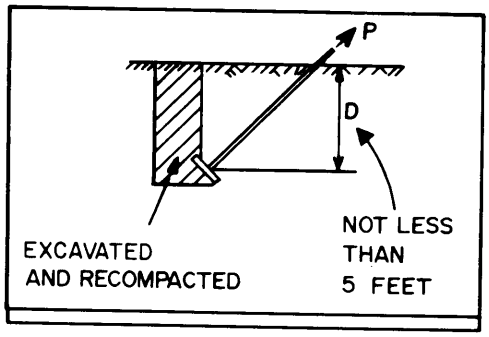


Figure 13-9. Guy Anchorage to Resist Axial Load