Chapter 6

APRONS AND OTHER PAVEMENTS

6.1. Contents. This chapter presents design standards for fixed and rotary-wing aircraft parking aprons, access aprons, maintenance pads, and wash racks. It provides minimum wing-tip clearance requirements, grades, and lateral clearance standards, as well as typical aircraft parking arrangements. The general principals of this chapter apply to the US Navy and Marine Corps. Specific data for Navy and Marine Corps aprons is contained in the referenced publications.

6.2. Apron Requirements. Aprons must provide sufficient space for parking fixed- and rotary-wing aircraft. They should be sized to allow safe movement of aircraft under their own power. Consider the effects of jet blast turbulence and temperature during design. Programming requirements for Air Force aviation facilities are found in AFH 32-1084, *Standard Facility Requirements Handbook.* Requirements for Navy and Marine Corps aviation facilities are contained in NAVFAC P-80 and MIL-HDBK-1021/1, *General Concepts for Airfield Pavement Design.* The general principles of this chapter apply to the Navy and the Marine Corps. Specific data on Navy/Marine Corps aprons is contained in the referenced publications.

6.3. Types of Aprons and Other Pavements. The following is a list of aprons and other aviation facilities:

6.3.1. Aircraft parking apron.

6.3.2. Transient parking apron.

6.3.3. Mobilization apron.

6.3.4. Aircraft maintenance apron.

6.3.5. Hangar access apron.

6.3.6. Warm-up pad (holding apron).

6.3.7. Unsuppressed power check pads.

6.3.8. Arm/disarm pad.

6.3.9. Compass calibration pad.

6.3.10. Hazardous cargo pad.

6.3.11. Alert pad.

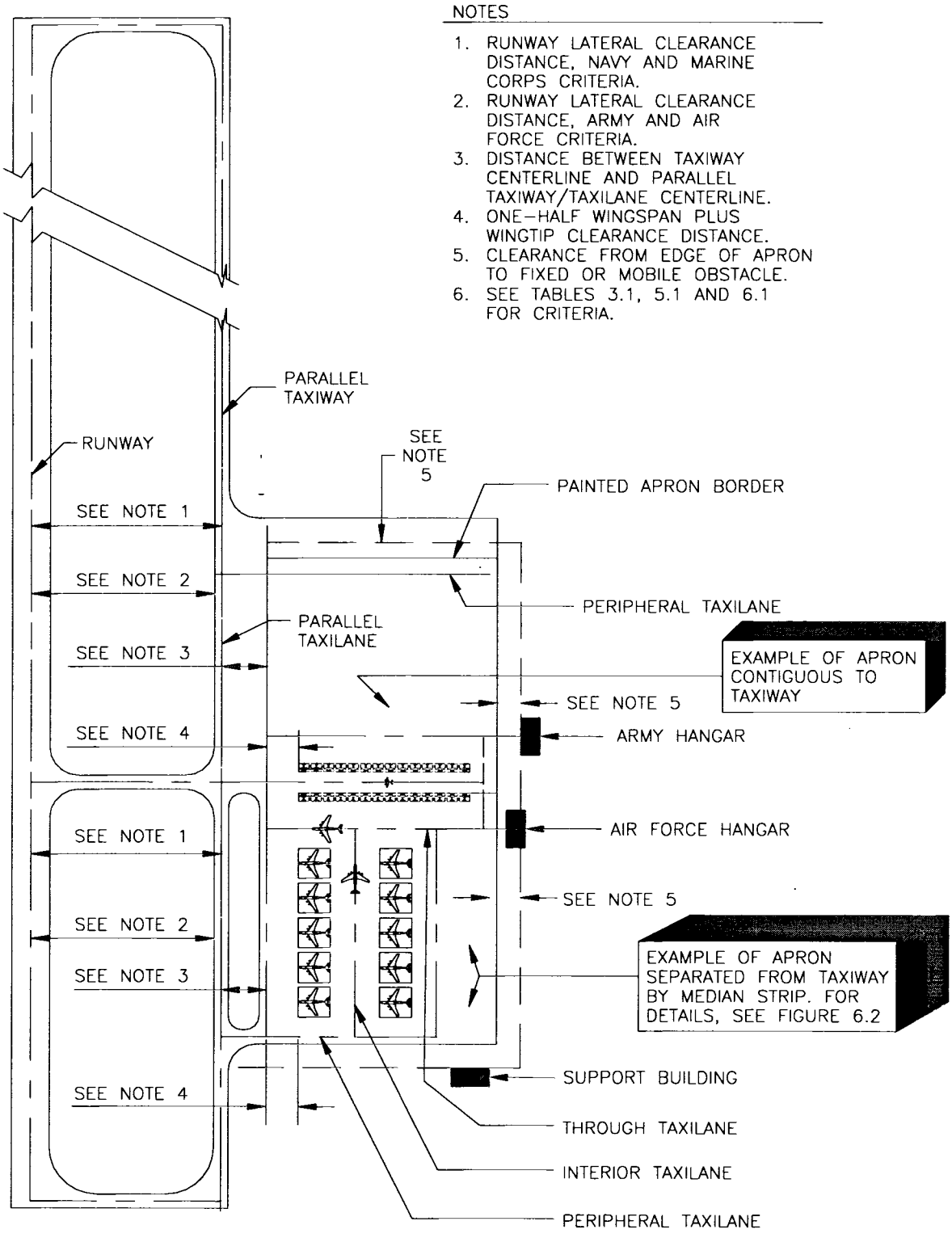
6.3.12. Aircraft wash rack.

6.4. Aircraft Characteristics. Dimensional characteristics of various military, civil, and commercial fixed- and rotary-wing aircraft are available in U.S. Army Engineering Technical Letter 1110-3-394, *Aircraft Characteristics for Airfield-Heliport Design and Evaluation.*

6.5. Parking Apron for Fixed-Wing Aircraft. Fixed-wing parking at an aviation facility may consist of separate aprons for parking operational aircraft, transient aircraft and transport aircraft, or an apron for consolidated parking.

6.5.1. Location. Parking aprons should be located near and contiguous to maintenance and hangar facilities. Do not locate them within runway and taxiway lateral clearance distances. A typical parking apron is illustrated in Figure 6.1.

Figure 6.1. Apron Nomenclature and Criteria.



6.5.2. Size. As a general rule, there are no standard sizes for aircraft aprons. Aprons are individually designed to support aircraft and missions at specific facilities. The actual dimensions of an apron are based on the number of authorized aircraft, maneuvering space, and type of activity the apron serves. Air Force allowances are provided in AFH 32-1084, *Standard Facility Requirements*

Handbook. Army facility authorizations are discussed in Attachment 3 and the individual service components programming directive. The ideal apron size affords the maximum parking capacity with a minimum amount of paving. Generally, this is achieved by reducing the area dedicated for use as taxilanes by parking aircraft perpendicular to the long axis of the apron.

6.5.3. Army Parking Apron Layout:

6.5.3.1. Variety of Aircraft. Where there is a large variety of fixed-wing aircraft types, fixed-wing aircraft mass parking apron dimensions will be based upon the C-12J (Huron). The C-12J parking space width is 17 meters [55 feet] and the parking space length is 18.25 meters [60 feet].

6.5.3.2. Specific Aircraft. If the assigned aircraft are predominantly one type, the mass parking apron will be based on the specific dimensions of that aircraft.

6.5.3.3. Layout. Figure 6.2 illustrates a parking apron. These dimensions can be tailored for specific aircraft, including the C-12J (Huron).

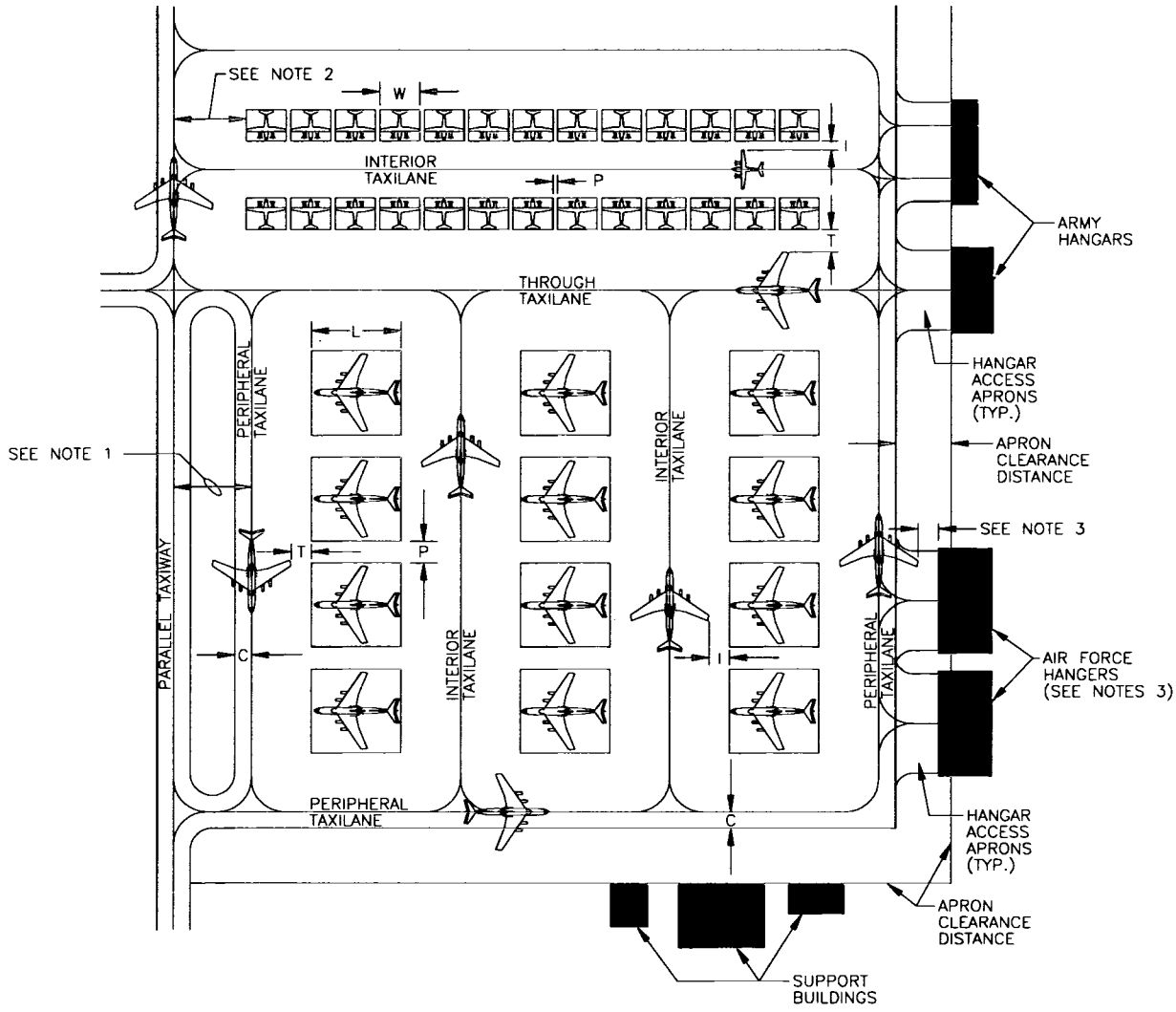
6.5.4. Air Force Parking Apron Layout. Parking apron dimensions for Air Force facilities will be based on the specific aircraft assigned to the facility and the criteria presented in AFH 32-1084, Standard Facility Requirements Handbook. A typical mass parking apron should be arranged in rows as shown in Figure 6.2.

6.5.5. Layout for Combined Army and Air Force Parking Aprons. Parking apron dimensions for combined Army and Air Force facilities will be based on the largest aircraft assigned to the facility.

6.5.6. Tactical/Fighter Parking Apron Layout. The recommended tactical/fighter aircraft parking arrangement is to park aircraft at a 45-degree (45°) angle as discussed in AFH 32-1084. Arranging these aircraft at a 45-degree angle is the most economical method for achieving the clearance needed to dissipate jet blast temperatures and velocities to levels that will not endanger aircraft or personnel. Jet blast relationships for tactical and fighter aircraft are discussed in Army ETL 1110-3-394.

6.5.7. Refueling Considerations. Layout of aircraft parking locations and taxilanes should consider aircraft taxiing routes when an aircraft is refueled. Refueling operations should not prevent an aircraft from leaving the parking apron. Two routes in and out of the apron may be required. During refueling, active ignition sources such as sparks from ground support equipment or jet engines (aircraft) are prohibited from a zone around the aircraft. The Army and Air Force refer to this zone as the Fuel Servicing Safety Zone (FSSZ). The Navy and Marine Corps refer to this zone as the Refueling Safety Zone (RSZ). An example of the refueling safety zone around a fixed-wing aircraft is shown in Figure 6.3. The safety zone is the area within 15 meters [50 feet] of a pressurized fuel carrying servicing component; e.g., servicing hose, fuel nozzle, single-point receptacle (SPR), hydrant hose car, ramp hydrant connection point, and 7.6 meters [25 feet] around aircraft fuel vent outlets. The fuel servicing safety zone is established and maintained during pressurization and movement of fuel. For additional information, see Air Force T.O. 00-25-172, *Ground Servicing of Aircraft and Static Grounding/Bonding.* For Navy, also see MIL-HDBK-274, *Electrical Grounding for Aircraft Safety.*

Figure 6.2. Army and Air Force Parking Plan.



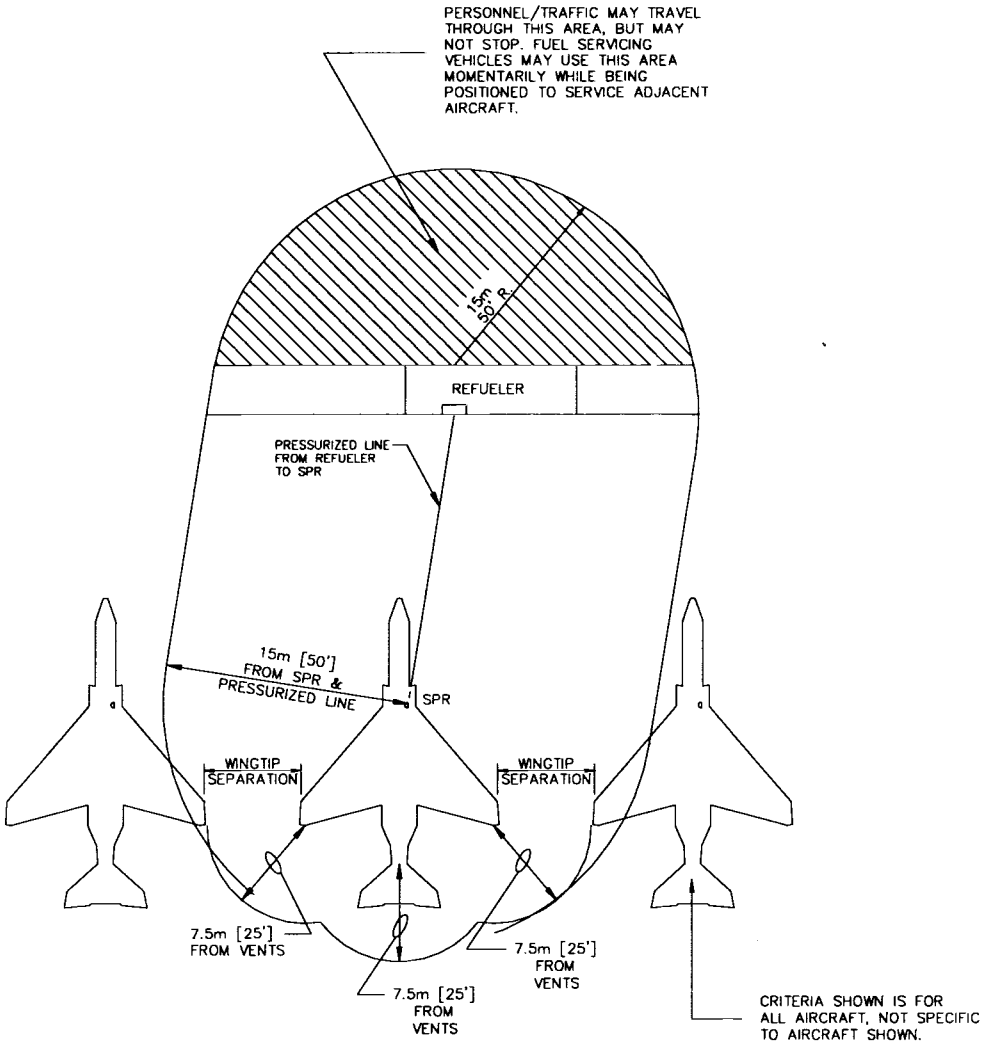
LEGEND

- W --- AIRCRAFT WIDTH
- L --- AIRCRAFT LENGTH
- I --- WINGTIP CLEARANCE FOR INTERIOR TAXILINE (MIN. TAXI CLEARANCE)
- T --- WINGTIP CLEARANCE FOR THROUGH AND PERIPHERAL TAXILINES
- P --- WINGTIP CLEARANCE FOR PARKED AIRCRAFT
- C --- DISTANCE FROM PERIPHERAL TAXILANE CENTERLINE TO THE APRON EDGE

NOTES

1. TAXIWAY CLEARANCE DISTANCE AT FACILITIES WITH PARALLEL TAXIWAYS; SEE TABLE 5.1, ITEM 11.
2. SEE TABLE 6.1 FOR DIMENSIONAL DEFINITIONS.
3. FOR AIR FORCE: INSURE MINIMUM WINGTIP CLEARANCE IS PROVIDED TO HANGARS OR OTHER PERMISSIBLE DEVIATIONS (SEE TABLE 6.1 ITEM 15 AND ATTACHMENT 14)

Figure 6.3. Truck Refueling Safety Zone Example.



N.T.S.

6.5.8. Parking Dimensions. Table 6.1 presents minimum geometric criteria for fixed-wing apron design. When designing new aprons for Air Mobility Command bases hosting C-5, C-17, KC-10, and KC-135 aircraft, provide 15.3 meter (50 foot) wingtip separation. EXCEPTION: When you are rehabilitating an existing apron, provide the maximum wingtip separation the existing apron size will allow (up to 15.3 meters (50 feet), but not less than 7.7 meters (25 feet). This additional separation is both desirable and permitted. At non-AMC bases, the maximum separation which can reasonably be provided for these aircraft is desirable.

6.5.8.1. Jet Blast Considerations. The clearances listed in Table 6.1 do not consider the effects of temperature and velocity due to jet blast. The effects of jet blast are described in Attachment 8.

6.5.8.2. Cargo Loading Considerations. Consider the effects of jet blast on aircraft loading operations and cargo storage locations when you design a layout for parking cargo aircraft.

Table 6.1. Fixed-Wing Aprons.

Item No.	Item Description	Class A Runway / Class B Runway Requirement	Remarks
1	Size and Configuration	Variable For Army and Air Force requirements, see criteria listed below and AFH 32-1084. For Navy and Marine Corps requirements, see Navy NAVFAC P-80.	As a general rule there are no standard sizes for aprons. They are individually designed to support specific aircraft uses. The dimensions are determined by the number and type of aircraft involved, the function of the apron, the maneuvering characteristics of the aircraft, jet blast of the aircraft, and the degree of unit integrity to be maintained. Other determinants are the physical characteristics of the site, relationship of the apron area to other airfield facilities and the objective of the comprehensive plan.
2	Parking Space Width ("W")	Design aircraft wingspan	Army and Air Force airfields.
3	Parking Space Length ("L")	Design aircraft length	Army and Air Force airfields.
4	Wingtip Clearance of Parked Aircraft ("P")	3.1 m [10 ft]	Army and Air Force airfields, aircraft with wingspans up to 33.5 m [110 ft].
		6.1 m [20 ft]	Army and Air Force airfields, aircraft with wingspans of 33.5 m (110 ft) or more except as noted below. See Note 1.
		7.7 m [25 ft]	Army and Air Force airfields, transient aprons, C-5 and C-17 aircraft (also see paragraph 6.5.8). See Note 1.
		15.3 m [50 ft]	Army and Air Force airfields, KC-10 and KC-135 aircraft to accommodate fuel load changes. See Note 1.

5	Wingtip Clearance of Aircraft on Interior Taxilanes ("I")	6.1 m [20 ft]	Army and Air Force airfields, aircraft with wingspans up to 33.5 m (110 ft), except transient aprons. See Note 1.
		7.7 m [25 ft]	Army and Air Force airfields, transient aprons. See Note 1.
		9.2 m [30 ft]	Army and Air Force airfields, aircraft with wingspans of 33.5 m [110 ft] or more. See Note 1.
6	Wingtip Clearance of Aircraft on Through or Peripheral Taxilanes ("T")	9.2 m [30 ft]	Army and Air Force airfields, aircraft with wingspans up to 33.5 m (110 ft). See Note 1.
		Min 15.3 m [50 ft]	Army and Air Force airfields, aircraft with wingspans of 33.5 m [110 ft] or more. See Note 1.
7	Distance from Peripheral Taxilane Centerline to the Apron Edge ("C")	7.7 m [25 ft]	Army and Air Force airfields. Designed for aircraft with wingspan up to 33.5 m [110 ft].
		11.5 m [37.5 ft]	Army and Air Force airfields. Designed for aircraft with wingspan of 33.5 m [110 ft] and greater.
8	Clear Distance Around Aircraft During Fueling (FSSZ) (RSZ)	7.7 m [25 ft]	Around aircraft fuel vent outlets (see T.O. 00-25-172).
		15.3 m [50 ft]	From a pressurized fuel carrying servicing component (see T.O. 00-25-172).
		See Remarks	Consider refueling operations when locating taxilanes.
9	Grades in the Direction of Drainage	Min 0.5% Max 1.5%	Avoid surface drainage patterns with numerous or abrupt grade changes. This can produce excessive flexing of aircraft and structural damage.

10	Width of Shoulders (Total Width Including Paved and Unpaved)	7.5 m [25 ft]	15 m [50 ft]	For Army and Air Force airfields.
11	Paved Width of Shoulders	7.5 m [25 ft]	7.5 m [25 ft]	Army and Air Force airfields not otherwise specified.
		Not Applicable	15 m [50 ft]	Army and Air Force airfields that accom-modate B-52, C-5, E-4 and 747 aircraft.
12	Longitudinal Grade of Shoulders	Variable		Conform to longitudinal grade of the abutting primary pavement.
13	Transverse Grade of Paved Shoulder	Min 2.0% Max 4.0%		Army airfields and Air Force airfields not otherwise specified.
		NA	Min 1.5% Max 2.0%	Air Force airfields that accommodate B-52 aircraft.
14	Transverse Grade of Unpaved Shoulders	NA	(a) 40 mm [1-½"] drop off at edge of paved shoulder. (b) 5% slope first 3 m [10 ft] from paved shoulder. (c) Beyond 3 m [10 ft] from edge of paved shoulder, 2.0% min, 4.0% max.	
15	Clearance from Apron Boundary Marking to Fixed or Mobile Obstacles	30 m [100 ft]	40 m [125 ft]	Army airfields. This distance to be clear of all fixed and mobile obstacles.
		38.1 m [125 ft]		Air Force airfields. This distance to be clear of all fixed and mobile obstacles except as noted in Attachment 14. **Note: If light poles are within this distance, additional operational requirements may apply.**

16	Grades in Cleared Area Beyond Shoulders to Fixed or Mobile Obstacles	(a) 40 mm [1-½"] drop off at edge of paved shoulder. (b) 5% slope first 3 m [10 ft] from paved shoulder. (c) Beyond 3 m [10 ft] from the edge of the paved shoulder, 10%.	Max 10.0%	

Notes:

1. Wingtip clearances may be reduced to those allowed by AFI 11-218, Aircraft Operation and *Movement on the Ground*, with a waiver.
2. Metric units apply to new airfield construction, and where practical modifications to existing airfields and heliports, as discussed in Paragraph 1.4.4.
3. The criteria in this manual are based on aircraft specific requirements and are not direct conversions from inch-pound (English) dimensions. Inch-pound units are included only as a reference to the previous standard.
4. Airfield and heliport imaginary surfaces and safe wingtip clearance dimensions are shown as a direct conversion from inch-pound to SI units.

6.6. Taxiing Characteristics on Aprons for Fixed-Wing Aircraft:

6.6.1. Apron Taxilanes. Taxi routes across parking aprons, referred to as taxilanes, are marked on the apron for safe passage of the aircraft. Typical taxilane locations are illustrated in Figures 6.1 and 6.4. Minimum wingtip clearances between parked and taxiing aircraft are shown in Table 6.1. (See Figure 6.2.) AFI 11-218 provides authorization for operation of aircraft at reduced clearances under certain circumstances. If a decision is made to reduce clearances based upon this authorization, you must waive the safe clearance requirements provided within this chapter in accordance with Attachment 2.

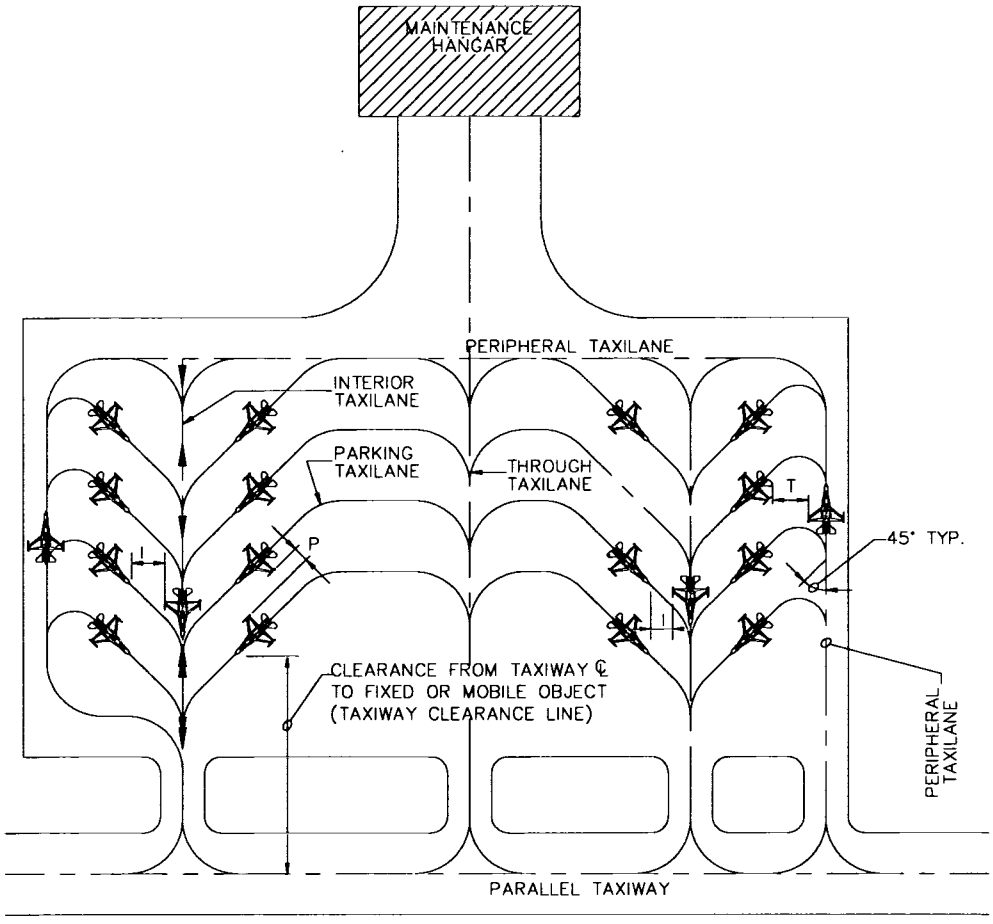
6.6.2. Turning Capabilities (Aircraft Turning and Maneuvering Characteristics). Army ETL 1110-3-394, *Aircraft Characteristics for Airfield-Heliport Design and Evaluation,* provides sources for obtaining various turning diagrams for U.S. Army, Air Force, and numerous civil and commercial fixed wing aircraft.

6.6.3. Departure Sequencing. Egress patterns from aircraft parking positions to taxiways should be established to prevent congestion at the apron exits.

6.7. Parking Apron for Rotary-Wing Aircraft. Mass parking of rotary-wing aircraft will require an apron designated for rotary-wing aircraft. Parking for transient rotary-wing aircraft and at aviation facilities where only a few rotary-wing aircraft are assigned, may be located on aprons for fixed-wing aircraft. At aviation facilities with assigned rotary-wing aircraft, a transport apron for fixed-wing aircraft is desirable.

6.7.1. Location. Parking aprons for rotary-wing aircraft should be located similar to parking aprons for fixed-wing aircraft. Rotary-wing aprons must not be located within the Lateral Clearance Distances discussed in Chapters 3 and 4 of this manual. Generally, company and/or squadron units should be parked together in rows for organizational integrity in locations adjacent to their assigned hangars. Parking aprons for small helicopters (OH, UH and AH) should be separate from parking areas used by cargo helicopters due to the critical operating characteristics of the larger aircraft.

Figure 6.4. Apron With Diagonal Parking.



NOTES

1. SEE TABLE 6.1 FOR DIMENSIONAL CRITERIA.
2. THIS PARKING ARRANGEMENT IS SHOWN FOR INFORMATION ONLY AND NOT NECESSARILY AN IDEAL PARKING ARRANGEMENT.

6.7.2. Apron Size. As with fixed-wing aircraft aprons, there is no standard size for rotary-wing aircraft aprons. The actual dimensions are based on the number of authorized aircraft, maneuvering space and type of activity the apron serves. Aircraft authorization is discussed in Attachment 3.

6.7.3. Maneuverability. The layout of the rotary-wing parking spacings should allow aircraft access to these locations.

6.7.3.1. Approach. Rotary-wing aircraft approach the parking spaces with either a front approach or a sideways approach.

6.7.3.2. Undercarriage. Rotary-wing aircraft are equipped with either a skid gear or wheel gear. Once on the ground, skid gear equipped helicopters cannot be easily moved. Wheeled rotary-wing aircraft can be moved once they are on the ground.

6.7.4. Army Parking Apron Layout. Rotary-wing aircraft are parked in one of two configurations referred to as Type 1 or Type 2.

6.7.4.1. Type 1. In this configuration, rotary-wing aircraft are parked in a single lane, which is perpendicular to the taxilane. When parked in this configuration, the parking arrangement resembles that of fixed-wing aircraft. This parking arrangement is preferred for wheeled aircraft.

6.7.4.1.1. Parking Space, All Aircraft Except CH-47. The parking space dimensions for all rotary-wing aircraft except the CH-47, in the Type 1 configuration, is a width of 25 meters [80 feet] and a length of 30 meters [100 feet]. This is illustrated in Figure 6.5.

6.7.4.1.2. Parking Space - CH-47. The parking space dimensions for the CH-47 rotary-wing aircraft, in the Type 1 configuration is a width of 30 meters [100 feet] and a length of 46 meters [150 feet]. This is illustrated in Figure 6.6.

6.7.4.2. Type 2. In this configuration, rotary-wing aircraft are parked in a double lane, which is parallel to the taxilane. This parking arrangement is preferred for skid-gear aircraft.

6.7.4.2.1. Parking Space, Skid-Gear Aircraft. The parking space dimensions for all skid-gear rotary-wing aircraft in the Type 2 configuration is a width of 25 meters [80 feet] and a length of 30 meters [100 feet]. This is illustrated in Figure 6.7.

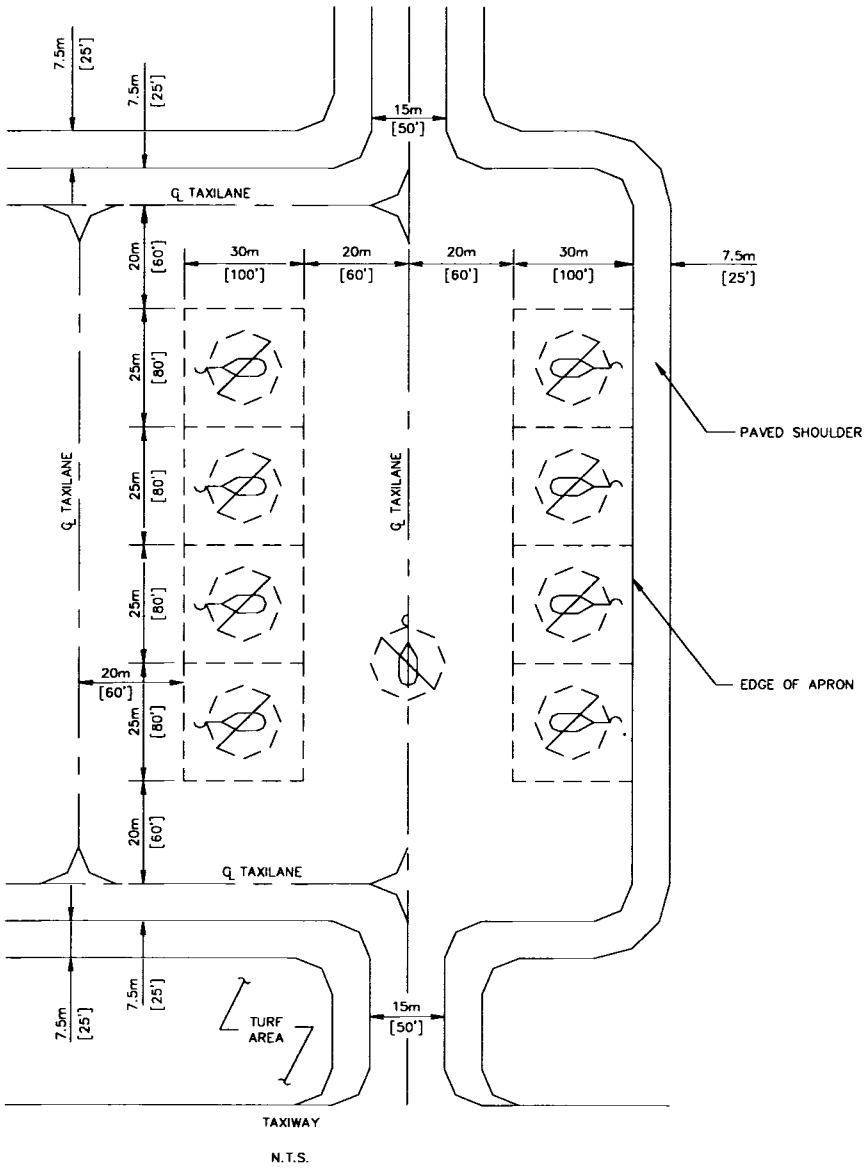
6.7.4.2.2. Parking Space, Wheeled. The parking space dimensions for all wheeled rotary-wing aircraft, in the Type 2 configuration is a width of 30 meters [100 feet] and a length of 50 meters [160 feet]. This is illustrated in Figure 6.8.

6.7.5. Air Force Parking Apron Layout. Rotary-wing aircraft at Air Force facilities are parked in a layout similar to fixed-wing aircraft. Parking space, taxilane, and clearance dimensions for Air Force facilities will be based on the rotor diameter of the specific aircraft assigned to the facility. See AFH 32-1084, table 2.7.

6.7.6. Refueling Considerations. As discussed in paragraph 6.6.8, layout of aircraft parking locations and taxilanes should consider aircraft taxiing routes when an aircraft is refueled. The safety zone for rotary-wing aircraft is the area 3 meters [10 feet] greater than the area bounded by the blades and tail of the aircraft. For additional information, see Air Force T.O. 00-25-172.

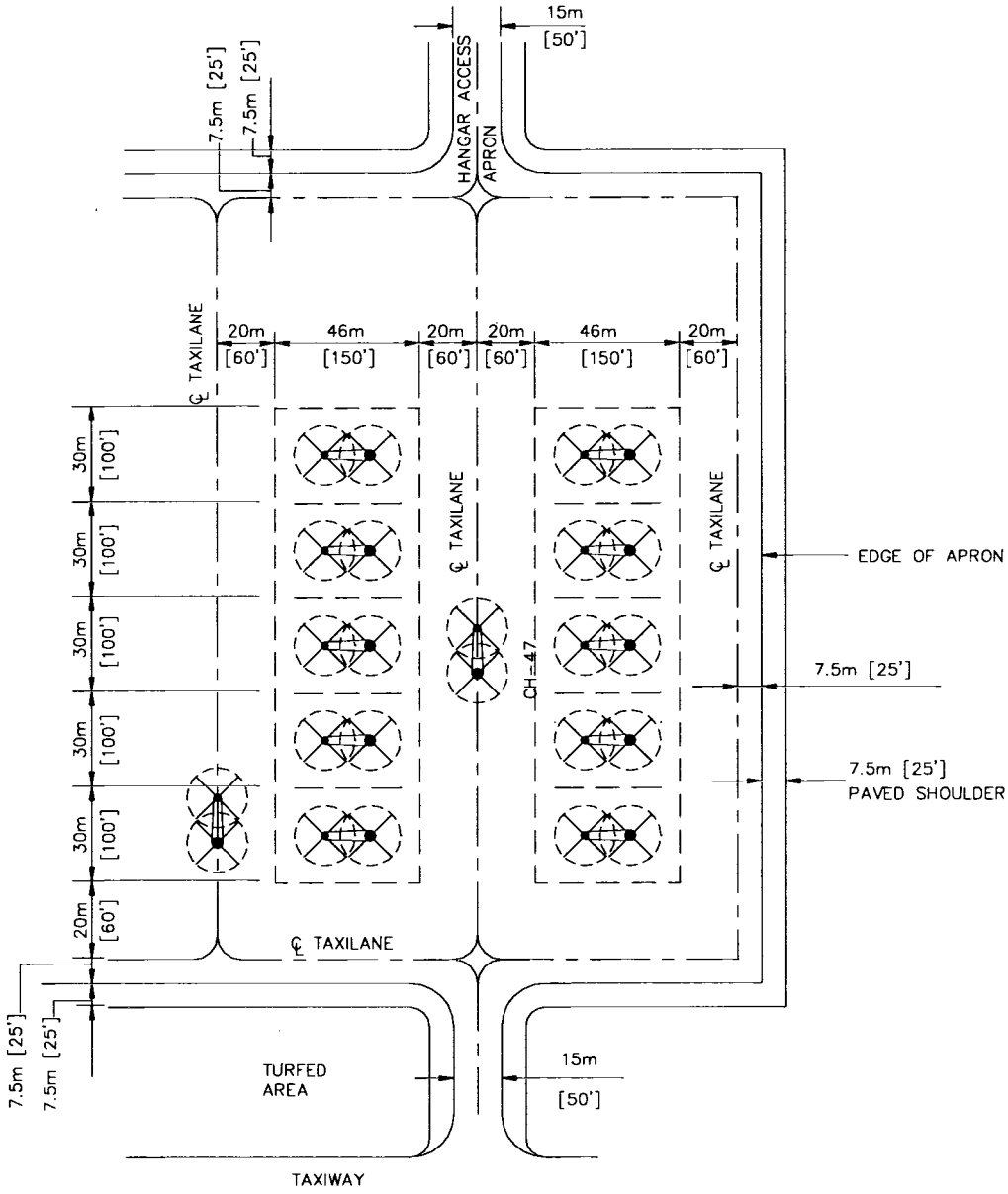
6.7.7. Parking Dimensions. Table 6.2 presents the criteria for rotary-wing apron design for Army airfields. Included in this table are parking space widths, grade requirements and clearances. Criteria for rotary-wing apron design for the Air Force are presented in AFH 32-1084 and for the Navy in NAVFAC P-80. USAF activities may use Army criteria presented in this manual or the criteria given in AFH 32-1084.

Figure 6.5. Type 1 Parking for All Rotary Wing Aircraft Except CH-47.



NOTE
THE DASHED LINES FORMING BOXES AROUND THE PARKING POSITIONS SHOW THE LIMITS OF THE SAFETY ZONE AROUND THE PARKED AIRCRAFT. AIRCRAFT ARE TO BE PARKED IN THE CENTER OF THE BOX TO PROVIDE PROPER TAXIWAY CLEARANCES.

Figure 6.6. Type 1 Parking for CH-47.

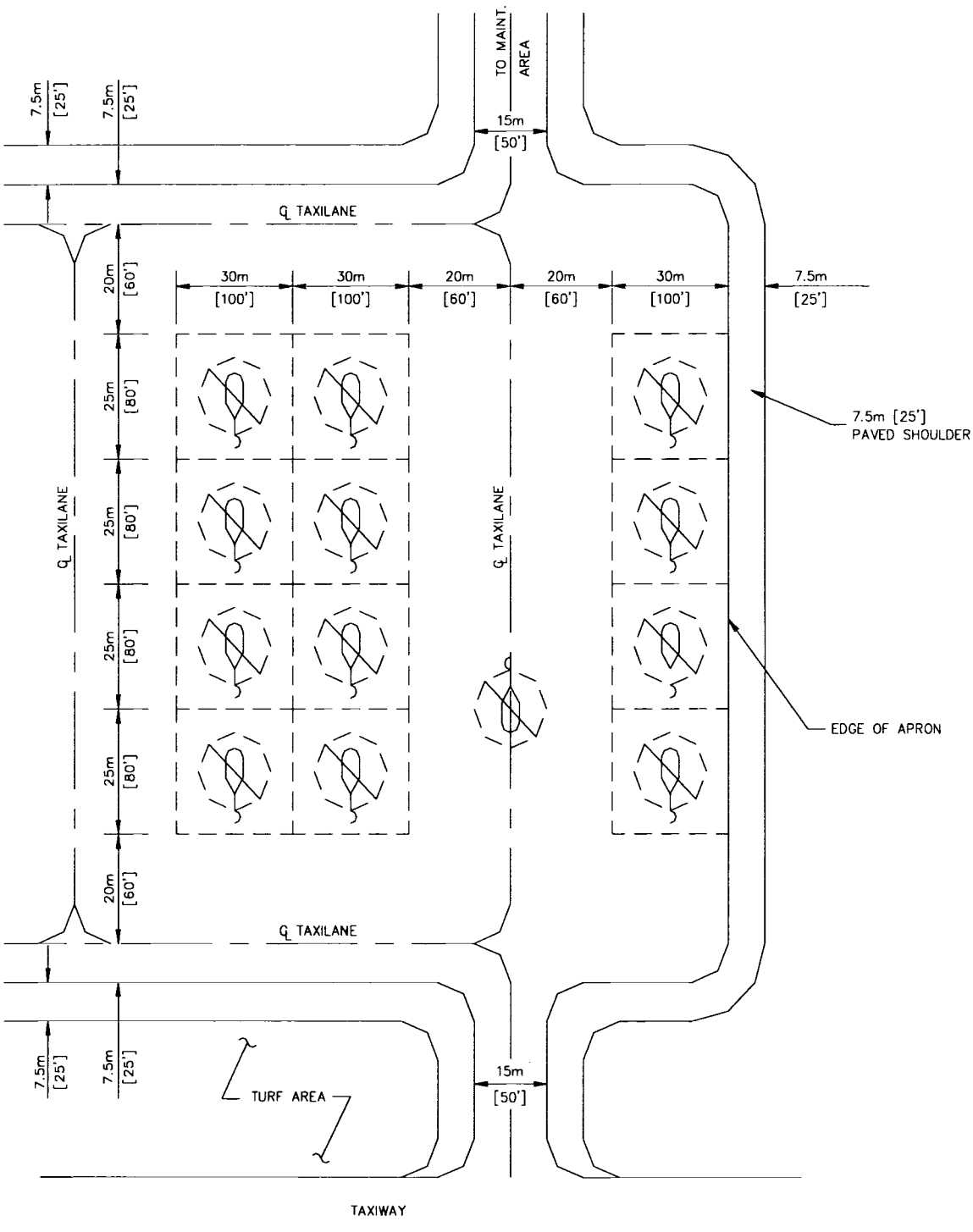


N.T.S.

NOTE

THE DASHED LINES FORMING BOXES AROUND THE PARKING POSITIONS SHOW THE LIMITS OF THE SAFETY ZONE AROUND THE PARKED AIRCRAFT. AIRCRAFT ARE TO BE PARKED IN THE CENTER OF THE BOX TO PROVIDE PROPER TAXIWAY CLEARANCES.

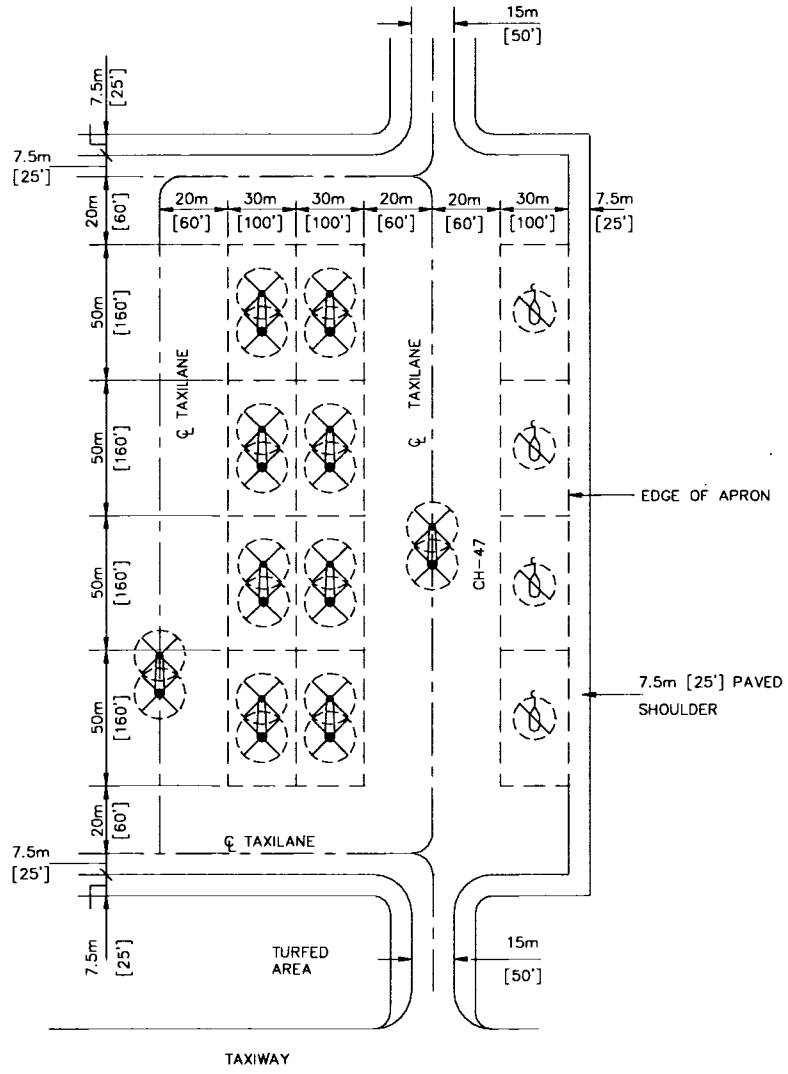
Figure 6.7. Type 2 Parking for Skid Rotary Wing Aircraft.



N.T.S.

NOTE
THE DASHED LINES FORMING BOXES AROUND THE PARKING POSITIONS SHOW THE LIMITS OF THE SAFETY ZONE AROUND THE PARKED AIRCRAFT. AIRCRAFT ARE TO BE PARKED IN THE CENTER OF THE BOX TO PROVIDE PROPER TAXIWAY CLEARANCES.

Figure 6.8. Type 2 Parking for Wheeled Rotary Wing Aircraft.



N.T.S.

NOTES

1. THE DASHED LINES FORMING BOXES AROUND THE PARKING POSITIONS SHOW THE LIMITS OF THE SAFETY ZONE AROUND THE PARKED AIRCRAFT. AIRCRAFT ARE TO BE PARKED IN THE CENTER OF THE BOX TO PROVIDE PROPER TAXIWAY CLEARANCES.
2. PARKING AREAS FOR CH-47 AIRCRAFT AND AH-64/UH-60 SHOULD BE SEPARATED BY A TAXIWAY.

6.7.7.1. Distances Between Parking Spaces. The parking space dimensions, discussed in Table 6.2, include separation distances between parked aircraft. When laying out the rotary-wing parking spaces, the spaces should abut next to each other. Separation between rotors and the aircraft bodies are also included in the parking space dimension.

6.7.7.2. Rotor Blade Clearances. Taxilane and hoverlane dimensions provided in Table 6.2 provide adequate rotor blade clearances for the size of helicopter noted.

Table 6.2. Rotary-Wing Aprons for Army Airfields.

Item No.	Item Description	Requirement	Remarks
1	Size and Configuration	Variable For Air Force space requirements, see AFH 32-1084. For Navy and Marine Corps space requirements, see NAVFAC P-80.	Aprons are determined by the types and quantities of helicopters to be accommodated. Other determinants are the physical characteristics of the site and the objective of the master plan.
2	Type 1 Parking Space Width	25 m [80 ft]	Army helicopters not otherwise specified.
		30 m [100 ft]	Army CH-47 helicopters.
			Helicopters parked in single lanes and perpendicular to the taxilane. Park helicopter in center of parking space.
3	Type 1 Parking Space Length	30 m [100 ft]	Army helicopters not otherwise specified.
		46 m [150 ft]	Army CH-47 helicopters.
			Helicopters parked in a single lane and perpendicular to the taxilane. Park helicopter in center of parking space.
4	Type 2 Parking Space Width	25 m [80 ft]	Army helicopters, skid configuration.
		30 m [100 ft]	Army helicopters, wheeled configuration.
			Helicopter parked in double lanes and parallel to the taxilane. Park helicopter in center of parking space.
5	Type 2 Parking Space Length	30 m [100 ft]	Army helicopters with skid configuration.
		50 m [160 ft]	Army helicopters with wheeled configuration.
			Helicopter parked in double lanes and parallel to the taxilane. Park helicopter in center of parking space.

6	Distance Between Edge of Parking Space and Taxilane Centerline	20 m [60 ft]	All Army helicopters.
7	Grades in the direction of drainage	Min 0.5% Max 1.5%	Engineering analysis occasionally may indicate a need to vary these limits. However, arbitrary deviation is not intended. Avoid surface drain-age with numerous or abrupt grade changes that can cause adverse flexing in the rotor blades.
8	Interior Taxilane/ Hoverlane Width (Between Rows of Aircraft)	40 m [120 ft]	From edge of parking space to edge of parking space.
9	Peripheral Taxilane/ Hoverlane Width	26 m [85 ft]	From edge of parking space to edge of apron.
10	Distance Between Peripheral Taxilane Centerline and Edge of Apron	7.5 m [25 ft]	From taxilane centerline to edge of apron.
11	Clear Distance Around Refueling Aircraft	3 m [10 ft]	Outside of an area formed by lines connecting the tips of the blades and tail.
12	Paved Shoulders		See Table 4.4.
13	Clearance from Edge of Apron to Fixed and Mobile Obstacles	23 m [75 ft]	Measured from rear and side of apron. Distance to other aircraft operational pavements may require a greater clearance.
		30 m [100 ft]	For aprons regularly servicing H-53 helicopters.

Notes:

1. Metric units apply to new airfield construction and where practical modification to existing airfields and heliports, as discussed in paragraph 1.4.4.
2. The criteria in this manual are based on aircraft specific requirements and are not direct conversions from inch-pound (English) dimensions. Inch-pound units are included only as a reference to the previous standard.
3. Airfield and heliport imaginary surfaces and safe wingtip clearance dimensions are shown as a direct conversion from inch-pound to SI units.

6.8. Warm-Up Pads. A warm-up pad, also referred to as a holding apron, is a paved area adjacent to a taxiway at or near the end of a runway. The intent of a warm-up pad is to provide a parking location, off the taxiway, for aircraft which must hold due to indeterminate delays. It allows other departing aircraft unencumbered access to the runway.

6.8.1. Navy and Marine Corps. Warm up pads are not usually required at Navy facilities. Typically the end cross over taxiway is widened to 46 m [150 ft] which provides room to accommodate aircraft warming up or waiting for other reasons.

6.8.2. Location.

6.8.2.1. At End Turnoff Taxiway. The most advantageous position for a warm-up pad is adjacent to the end turnoff taxiway, between the runway and parallel taxiway, as shown in Figure 6.9. However, other design considerations such as airspace and navigational aids may make this location undesirable.

6.8.2.2. Along Parallel Taxiway. If airspace and navigational aids prevent locating the warm-up pad adjacent to the end turnoff taxiway, the warm-up pad should be located at the end of and adjacent to the parallel taxiway, as shown in Figure 6.10.

Figure 6.9. Warm-Up Pad at End of Parallel Taxiway.

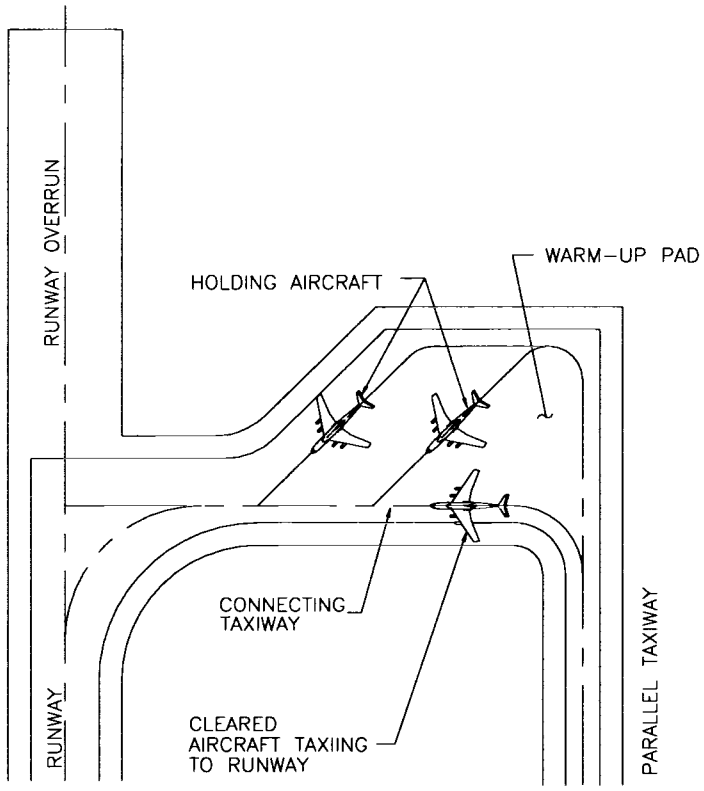
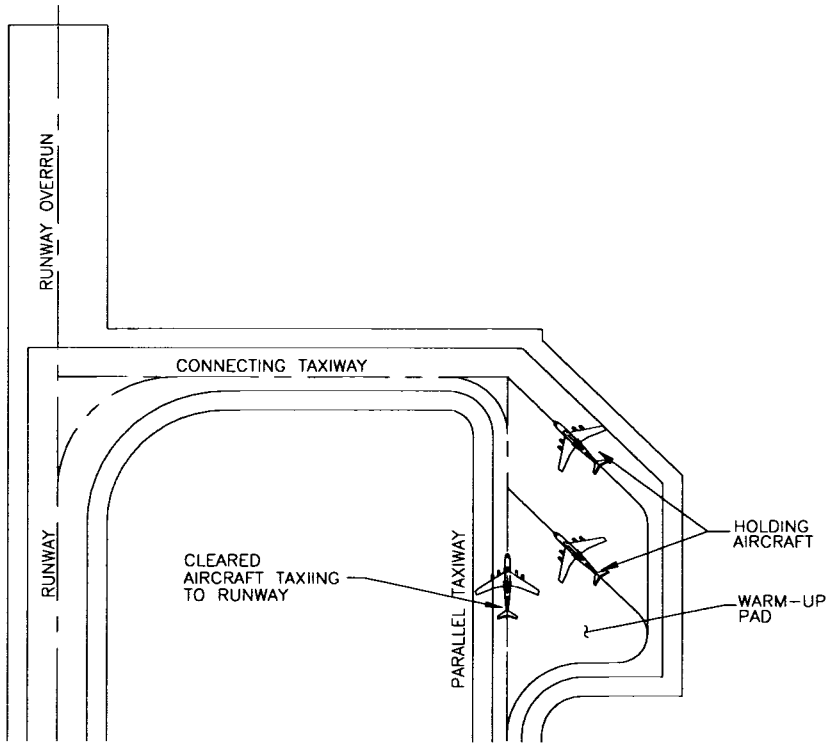


Figure 6.10. Warm-Up Pad Next to Parallel Taxiway.

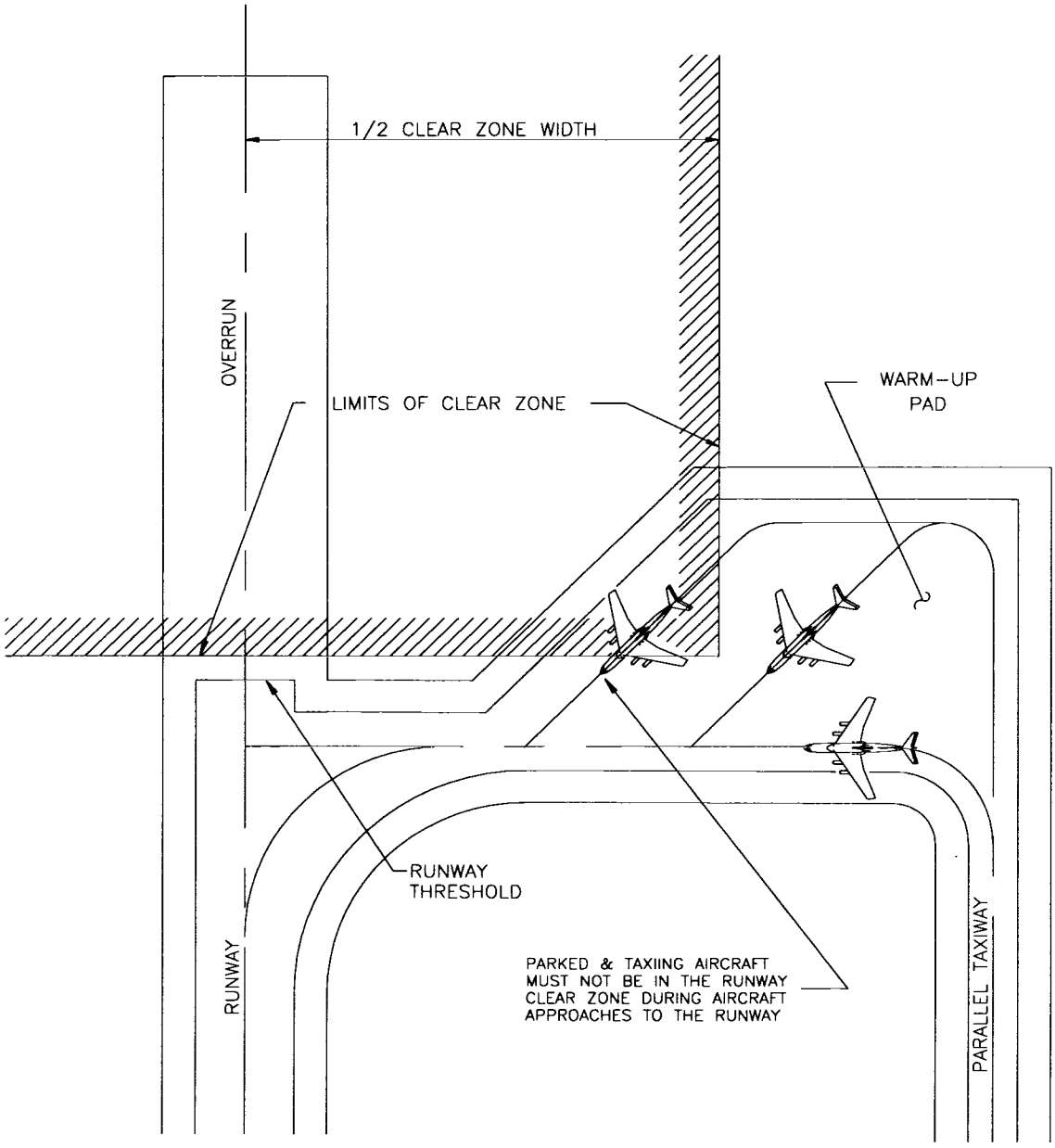


6.8.3. Siting Considerations.

6.8.3.1. End of Runway. Locate a warm-up pad as close to the runway as possible.

6.8.3.2. Clear Zone. As discussed in Chapter 3, a Clear Zone is an area on the ground which must be free of obstructions. Aircraft holding in or taxiing through a clear zone are considered a mobile obstruction and are not allowed in the clear zone when aircraft are on final approach to the runway. This is illustrated in Figure 6.11.

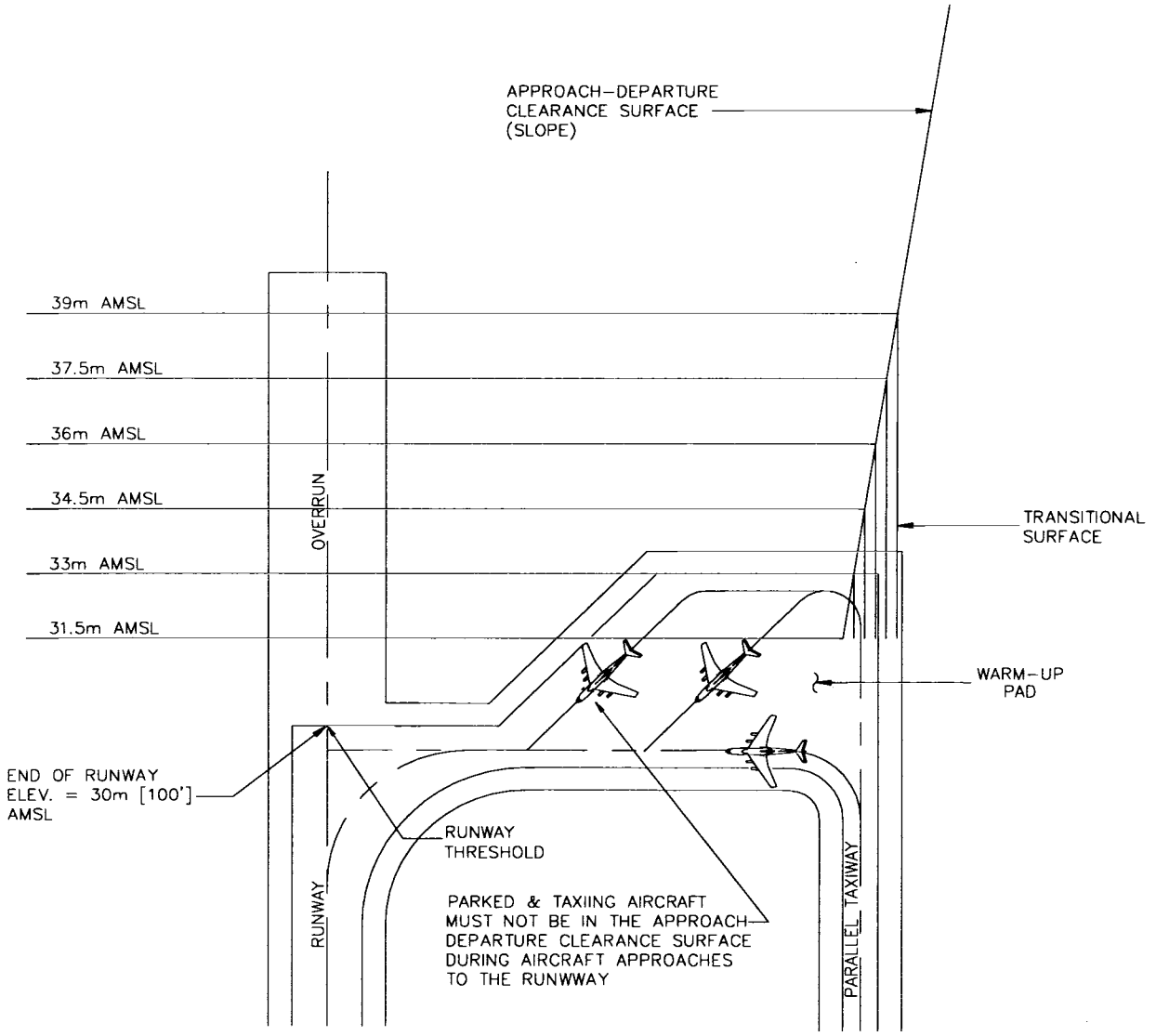
Figure 6.11. Warm-Up Pad Located in Clear Zone.



6.8.3.3. Airspace Imaginary Surfaces. As discussed in Chapter 3, an obstruction to air navigation occurs when the imaginary surfaces are penetrated. Aircraft on the warm-up pad could possibly penetrate the airspace imaginary surfaces. Aircraft penetrations may require

revisions to TERPS procedures and instrument approach procedures. This is illustrated in Figure 6.12.

Figure 6.12. Warm-Up Pad Located in Approach-Departure Clearance Surface.



6.8.3.4. Navigational Aids (NAVAIDS). Warm-up pads must be located so they do not interfere with the operation of NAVAIDS, including ILS equipment and PAR facilities. To eliminate interference of the ILS signal by holding aircraft; holding aircraft, on or off a warm-up pad, must be outside the critical areas. The critical area for ILS equipment is illustrated in Figures 6.13, 6.14, and 6.15. Additional discussion on ILS critical areas is found in TM 5-823-4, *Marking of Army Airfield-Heliport Operational and Maintenance Facilities,* AFI 13-203, *Air Traffic Control,* and Air Force Engineering Technical Letter (ETL) 94-01, *Standard Airfield Pavement Marking Schemes.*

6.8.4. Warm-Up Pad Size. The size of the warm-up pad will be such to allow accommodating two of the largest aircraft assigned to the facility simultaneously. Wingtip clearances required by the clear distance information presented in Table 6.1.

Figure 6.13. Warm-Up Pad/Localizer Critical Area.

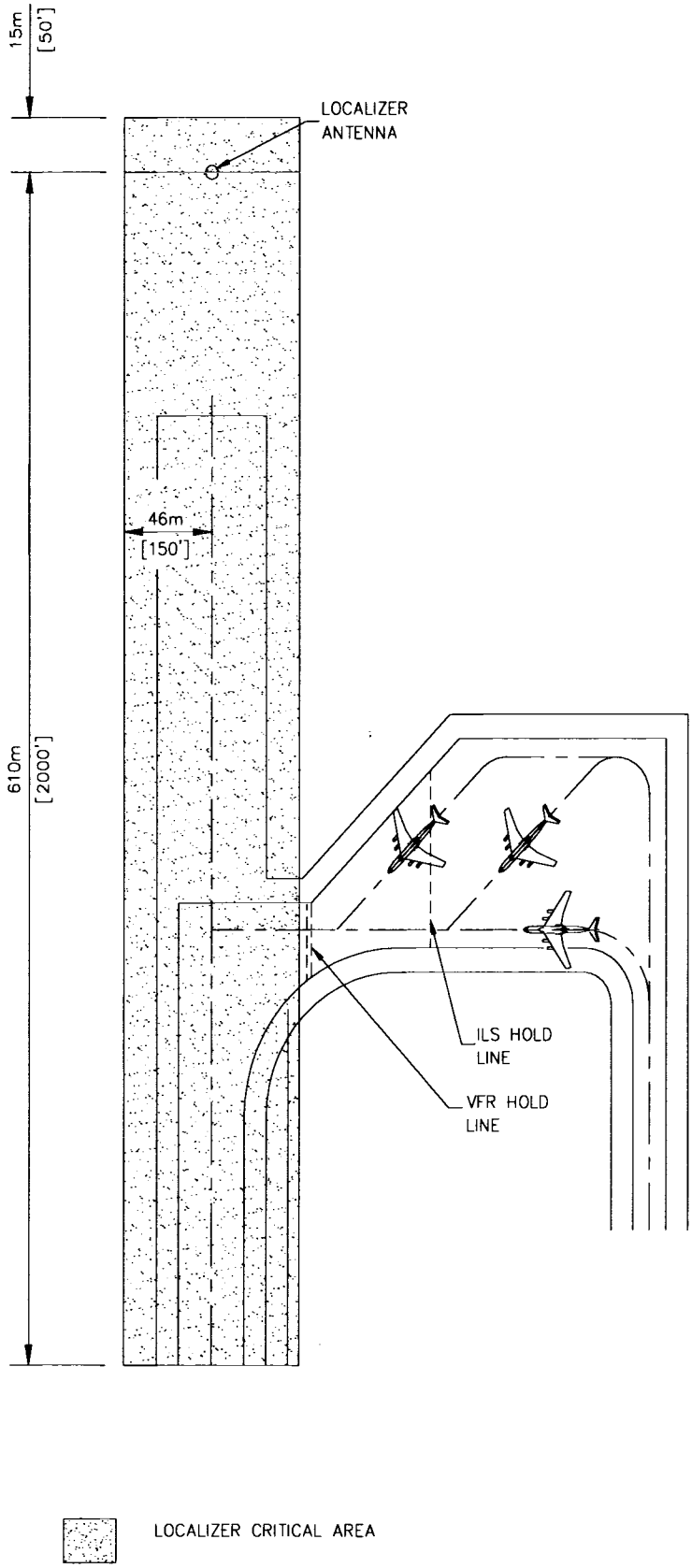


Figure 6.14. Air Force Warm-Up Pad/Glide Slope Critical Area.

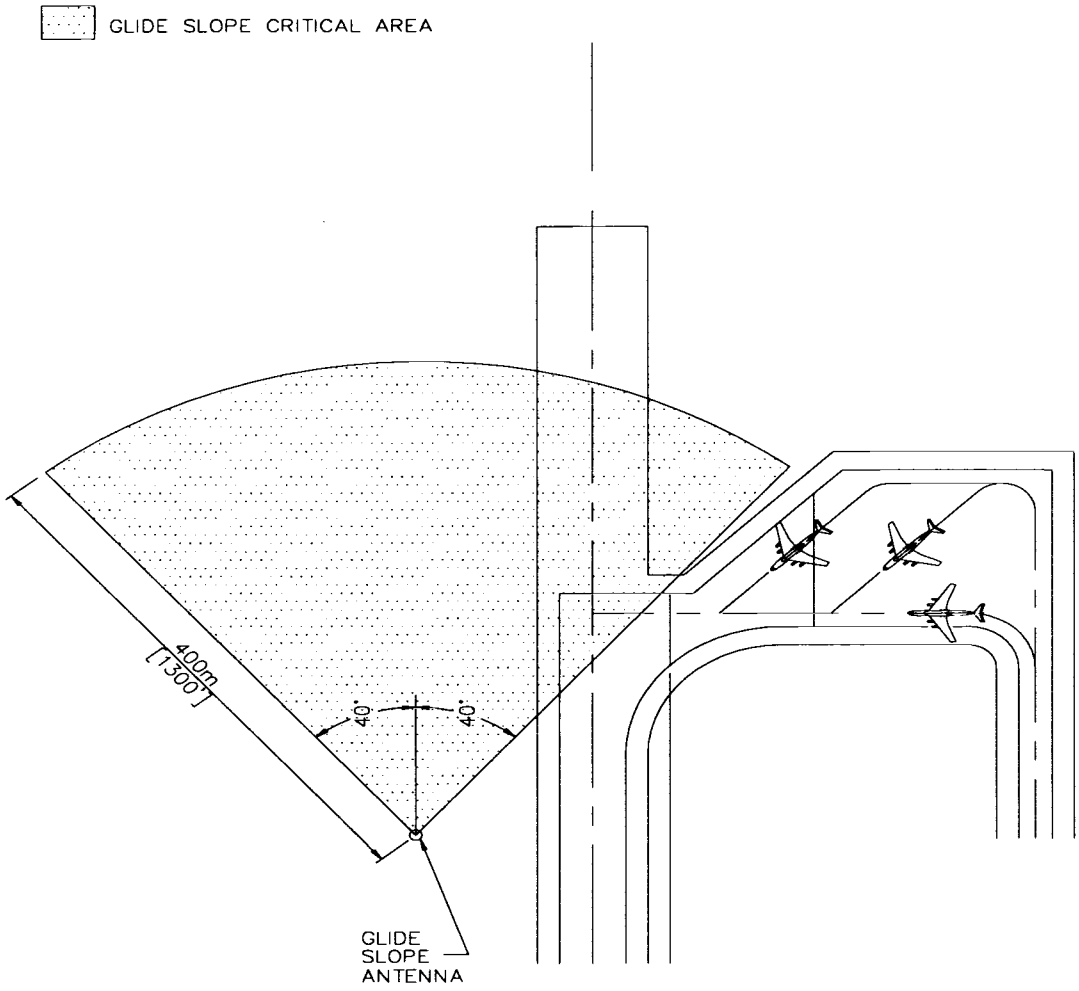
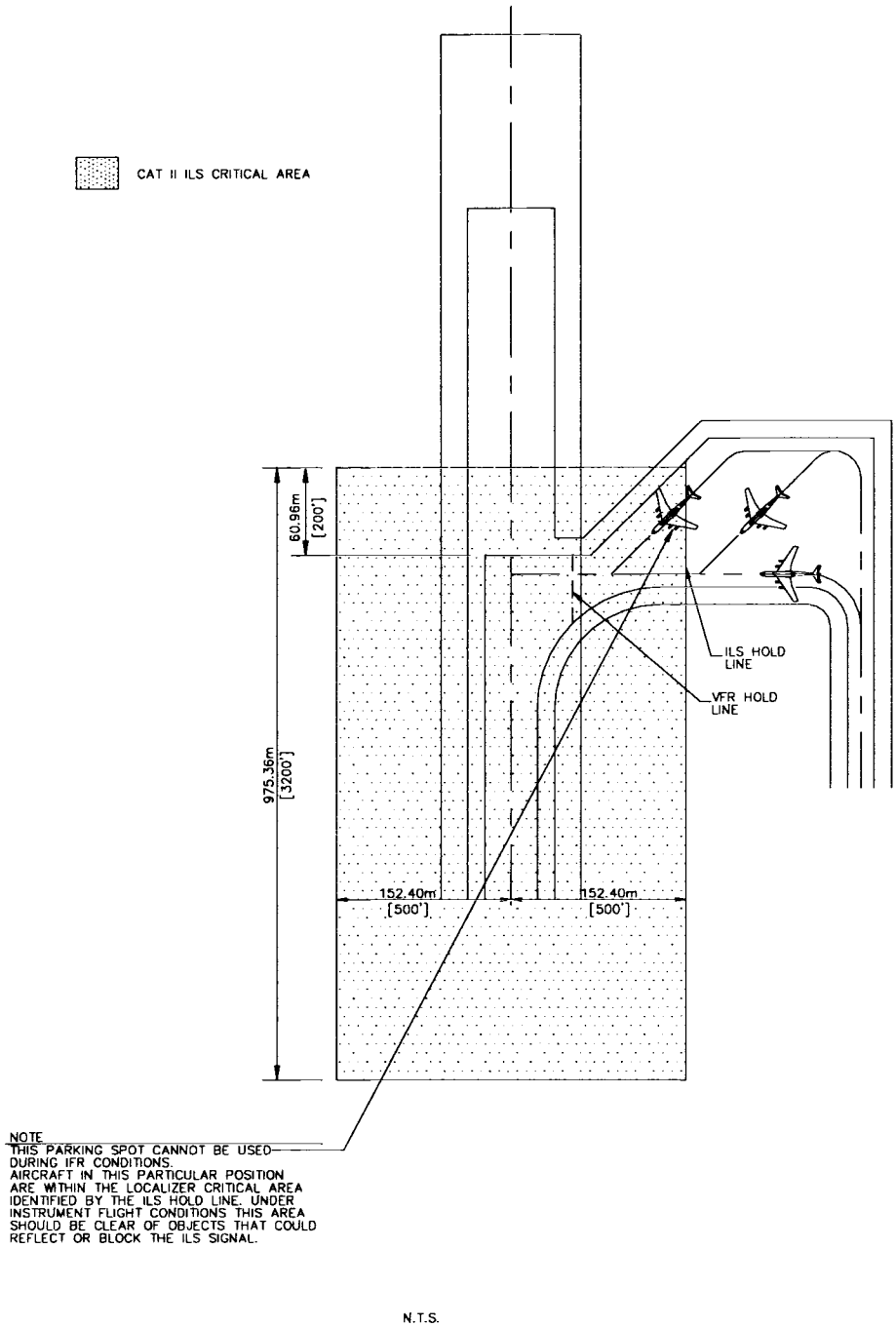


Figure 6.15. Warm-Up Pad/CAT II ILS Critical Area.



6.8.5. Taxi-In/Taxi-Out Capabilities. The parking locations will have taxi-in/taxi-out capabilities to allow aircraft to taxi to their warm-up position under their own power, as shown in Figure 6.16.

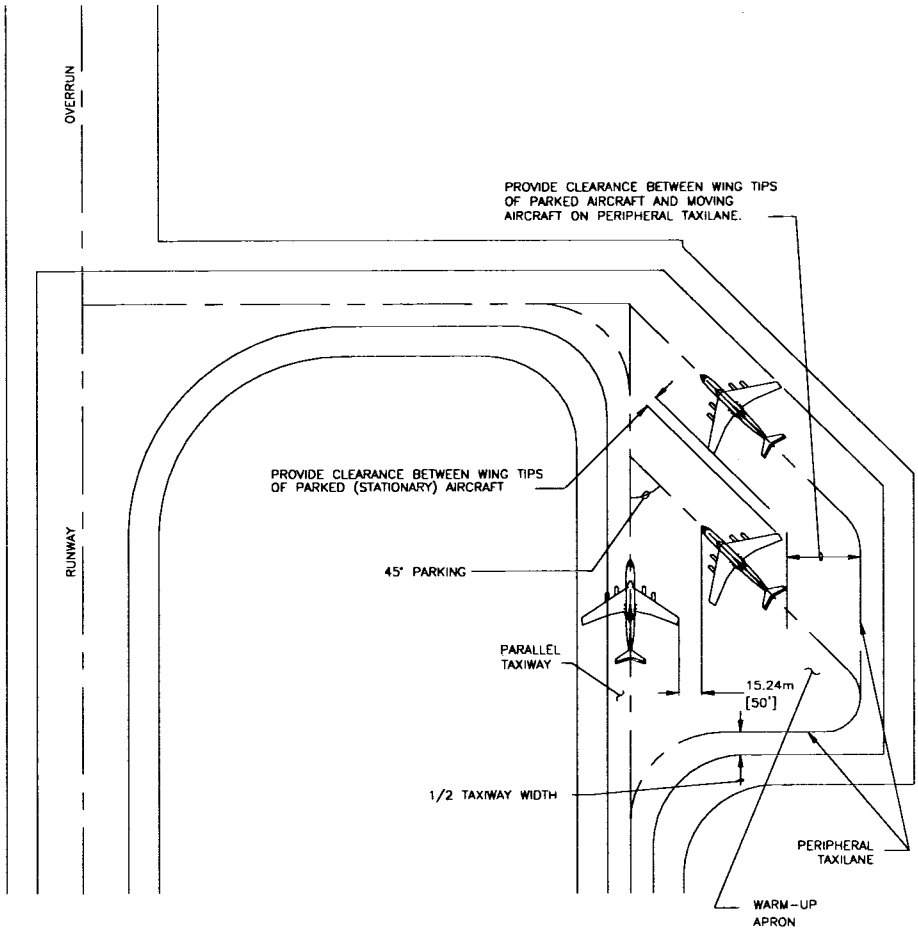
6.8.6. Parking Angle. Aircraft should be parked at a 45 degree (45°) angle to the parallel taxiway to divert the effects of jet blast away from the parallel taxiway. This is shown in Figure 6.16.

6.8.7. Turning Radius. The turning radius on warm-up pads will be designed to provide the minimum allowable turn under power for the largest aircraft assigned to the base.

6.8.8. Taxilanes on Warm-Up Pads. Taxilanes on the warm-up pad will meet the lateral clearance requirements discussed in Table 6.1. Lateral and wingtip clearance for a taxilane on a warm-up pad is illustrated in Figure 6.16.

6.8.9. Tie-Downs and Grounding Points. Tie-downs, mooring points and grounding points are not required on warm-up pads.

Figure 6.16. Warm-Up Pad Taxiing and Wingtip Clearance Requirements.



N.T.S.

6.9. Power Check Pad. An aircraft power check pad is a paved area, with an anchor block in the center, used to perform full-power engine diagnostic testing of aircraft engines while the aircraft is held stationary.

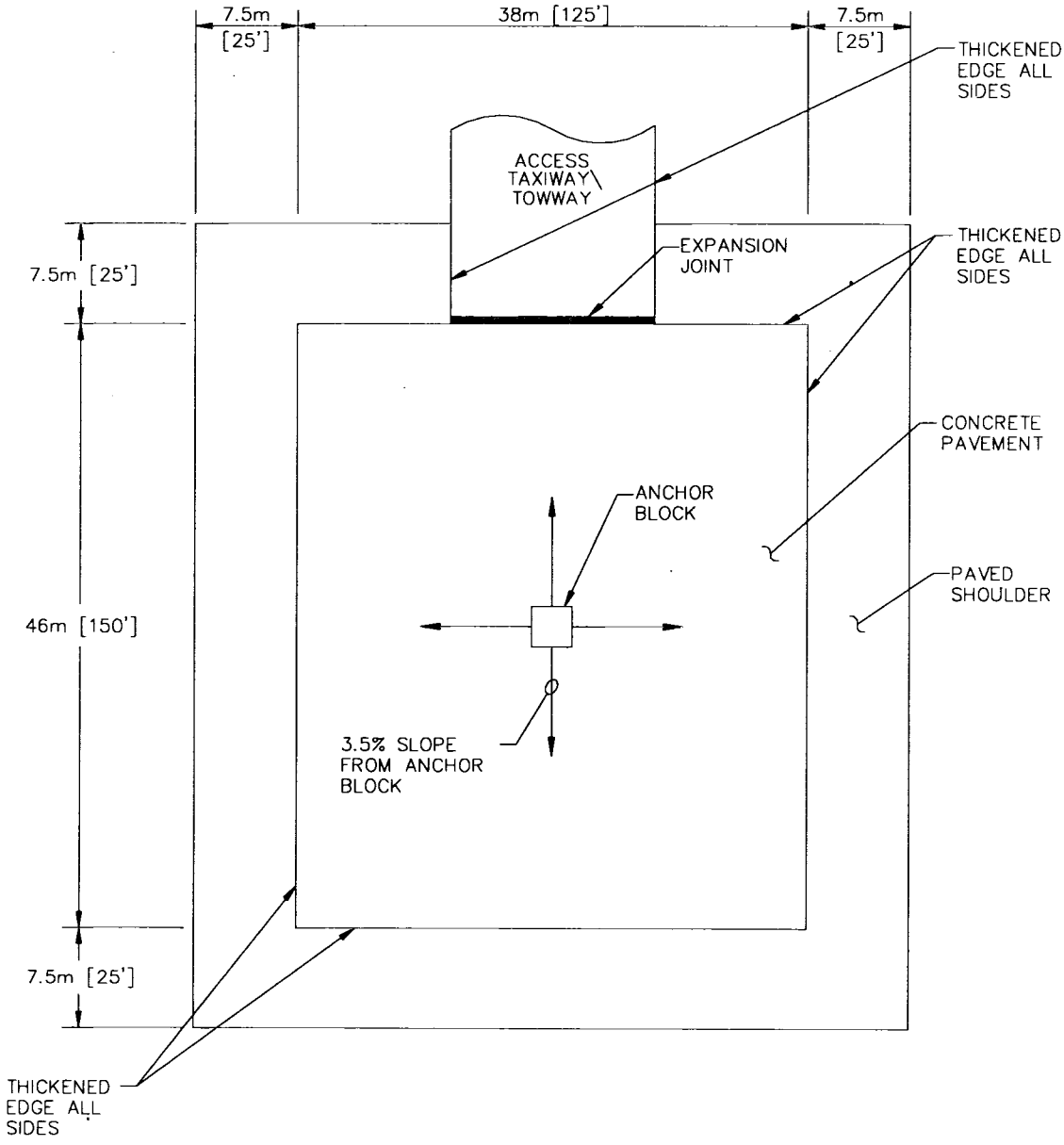
6.9.1. Location and Siting Considerations. Unsuppressed power check pads should be located near maintenance hangars, but at a location where full power engine diagnostic testing of jet engines can be performed with minimal noise exposure to inhabited area's on and off the base.

6.9.2. Unsuppressed Power Check Pad Layout. Power check pads may either be rectangular, square or circular shaped.

6.9.2.1. Army and Air Force. Power check pad layouts for Army and Air Force aviation facilities are shown in Figures 6.17, 6.18 and 6.19.

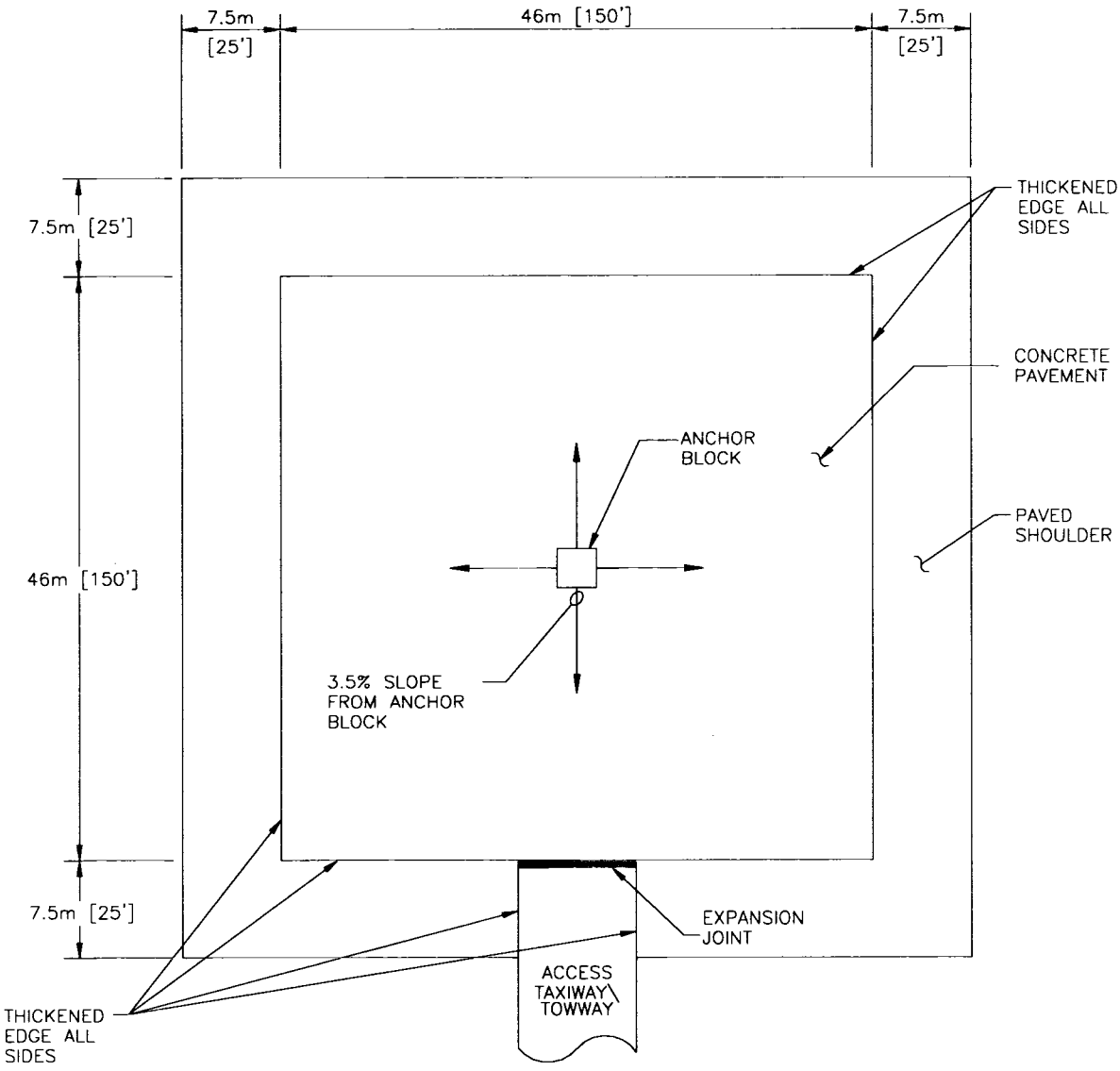
6.9.2.2. Navy and Marine Corps. Power check pad layout for Navy and Marine Corps aviation facilities are found in NAVFAC Drawings 1404838-1404857.

Figure 6.17. Geometry for Rectangular Power Check Pad.



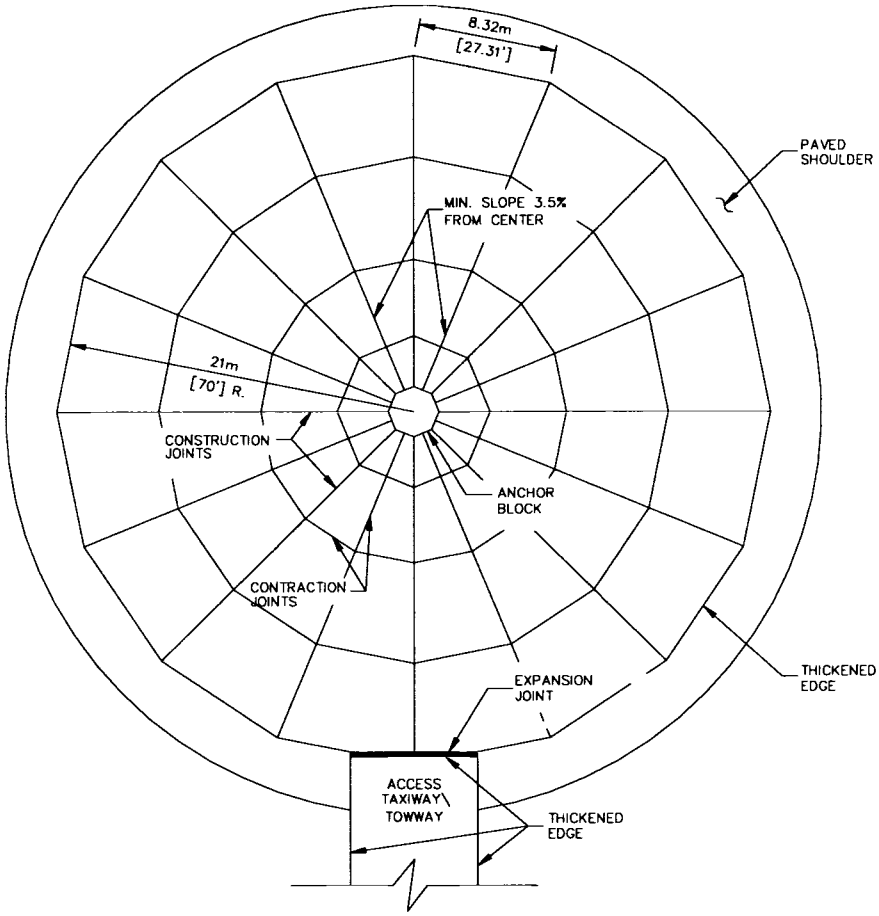
N.T.S.

Figure 6.18. Geometery for Square Power Check Pad.



N.T.S.

Figure 6.19. Geometry for Circular Power Check Pad.



6.9.3. Access Taxiway/Towway. An access taxiway will be provided for access from the primary taxiway to the power check pad. Since the aircraft may be towed to the unsuppressed power check pad, the access taxiway must be designed as a towway. Taxiway and towway design requirements are presented in Chapter 5.

6.9.4. Grading. The surface of the unsuppressed power check pad must slope 3.5 percent in all directions from the anchor block to pavement edge to divert the effect of jet blast away from the concrete surfaces and pavement joints.

6.9.5. Tiedowns/Mooring Points. Tiedowns (Air Force)/mooring points (Army)/tiedown mooring eyes (Navy and Marine Corps) are required on unsuppressed power check pads. Tiedowns/mooring points/tiedown mooring eyes layouts are interdependent of joint spacing and the two should be coordinated together.

6.9.5.1. Army and Air Force. Power check pad mooring point/tiedowns for Army and Air Force aviation facilities are found in Attachment 16.

6.9.5.2. Navy and Marine Corps. Power check pad tiedown mooring eye for Navy and Marine Corps aviation facilities are found in NAVFAC Drawings 1404838-1404857.

6.9.6. Anchor Blocks. All unsuppressed power check pads have a thrust anchor block installed in the center of the power check pad to anchor the aircraft during engine testing. Anchor blocks are

structurally designed for each individual aircraft. The designer must verify structural adequacy of the anchor block for the mission aircraft and engine type.

6.9.6.1. Army and Air Force. Thrust anchor blocks for Army and Air Force aviation facilities are found in Attachment 16.

6.9.6.2. Navy and Marine Corps. Thrust anchor blocks for Navy and Marine Corps aviation facilities are found in NAVFAC Drawings 1404838-1404857.

6.9.7. Power Check Pad Facilities.

6.9.7.1. Required Facilities. The unsuppressed power check pad should consist of the following required items:

6.9.7.1.1. Paved surface.

6.9.7.1.2. Tiedowns.

6.9.7.1.3. Paved shoulders.

6.9.7.1.4. A thrust anchor or anchors for aircraft serviced at the pad.

6.9.7.1.5. Blast deflectors if required to protect the surrounding area from jet blast damage.

6.9.7.2. Optional Facilities. The unsuppressed power check pad may include the following items:

6.9.7.2.1. Floodlighting for night operations.

6.9.7.2.2. Water supply to wash down fuel spills.

6.9.7.2.3. Oil separators, holding tanks, and fuel treatment to address fuel spillage prior to discharge into sanitary or storm sewer.

6.9.7.2.4. Communication link with the maintenance control room.

6.9.7.2.5. Fire hydrants.

6.9.7.2.6. A paved roadway to the unsuppressed power check pad for access by fire fighting, towing and aircraft maintenance support vehicles.

6.9.8. Noise Considerations. The noise level at unsuppressed power check pads may exceed 115 dB(a) during power-up engine tests. Caution signs should be placed around the power check pad indicating both the presence of hazardous noise levels and the need for hearing protection.

6.10. Arm/Disarm Pads. The arm/disarm pad is used for arming aircraft immediately before takeoff and for disarming (safing) weapons retained or not expended upon their return.

6.10.1. Navy and Marine Corps Requirements. Navy and Marine Corps requirements for arm/disarm pads are found in P-80 and MIL-HDBK-1021/1, *General Concepts for Airfield Pavement Design*.

6.10.2. Location. Air Force arm/disarm pads should be located adjacent to runway thresholds and sited such that armed aircraft are oriented in the direction of least populated areas or towards revetments.

6.10.3. Siting Considerations:

6.10.3.1. Aircraft Heading. The criteria for establishing the exact heading of the parked aircraft depends on the type of aircraft and associated weapons. This information is contained within the

classified portion of the aircraft manuals. The most economical means of parking aircraft on the arm/disarm pads is at 45 degrees (45°) to the taxiway. However, because of the requirement to orient armed aircraft away from populated areas, this angle may vary.

6.10.3.2. Inhabited Building Distance Clear Zone. As a general rule, an "inhabited building distance clear zone" of plus or minus 5 degrees (±5°) of arc on each side of the heading of the parked aircraft and 8.5 kilometers [5 miles] in the front of the parked aircraft, both measured from the aircraft's nose, should be maintained. This means that no occupied building will be in this clear zone. In addition, it is good practice to keep all buildings out of this clear zone to prevent damage from accidental weapon firing. This "inhabited building distance clear zone" may cross a runway, taxiway, or runway approach as long as the landing and taxiing aircraft can be seen by the arm/disarm quickcheck crews and the arming/disarming operations can cease for the period in which the aircraft passes. Parked aircraft or parked vehicles must not be located in the "inhabited building distance clear zone." If this clear zone cannot be obtained, earth revetments should be used as a barrier.

6.10.3.3. Electromagnetically Quiet Location. Prior to construction of any pad, local field measurements must be taken to ensure that the location is electromagnetically quiet. To avoid potential electromagnetic interference from taxiing aircraft, pads should be located on the side of a runway opposite the parallel taxiway. Navy and Marine Corps aviation facilities must have an EMC background study by NISE EASE CHSN, as described in NAVAIR 16-1-529, *Electromagnetic Radiation Hazards.*

6.10.4. Arm/Disarm Pad Size. Each arm/disarm pad should be capable of servicing four or six aircraft at a time. The dimensions of the pad may vary with the length and wingspan of the aircraft to be served. Typical layout of arm/disarm pads are shown in Figures 6.20, 6.21, 6.22 and 6.23.

6.10.5. Taxi-In/Taxi-Out Capabilities. The parking locations should have taxi-in/taxi-out capabilities to allow aircraft to taxi to their arm/disarm location under their own power.

6.10.6. Parking Angle. The parking angle is dependent on the type of aircraft, type of weapons and the associated "uninhabited clear zone" location.

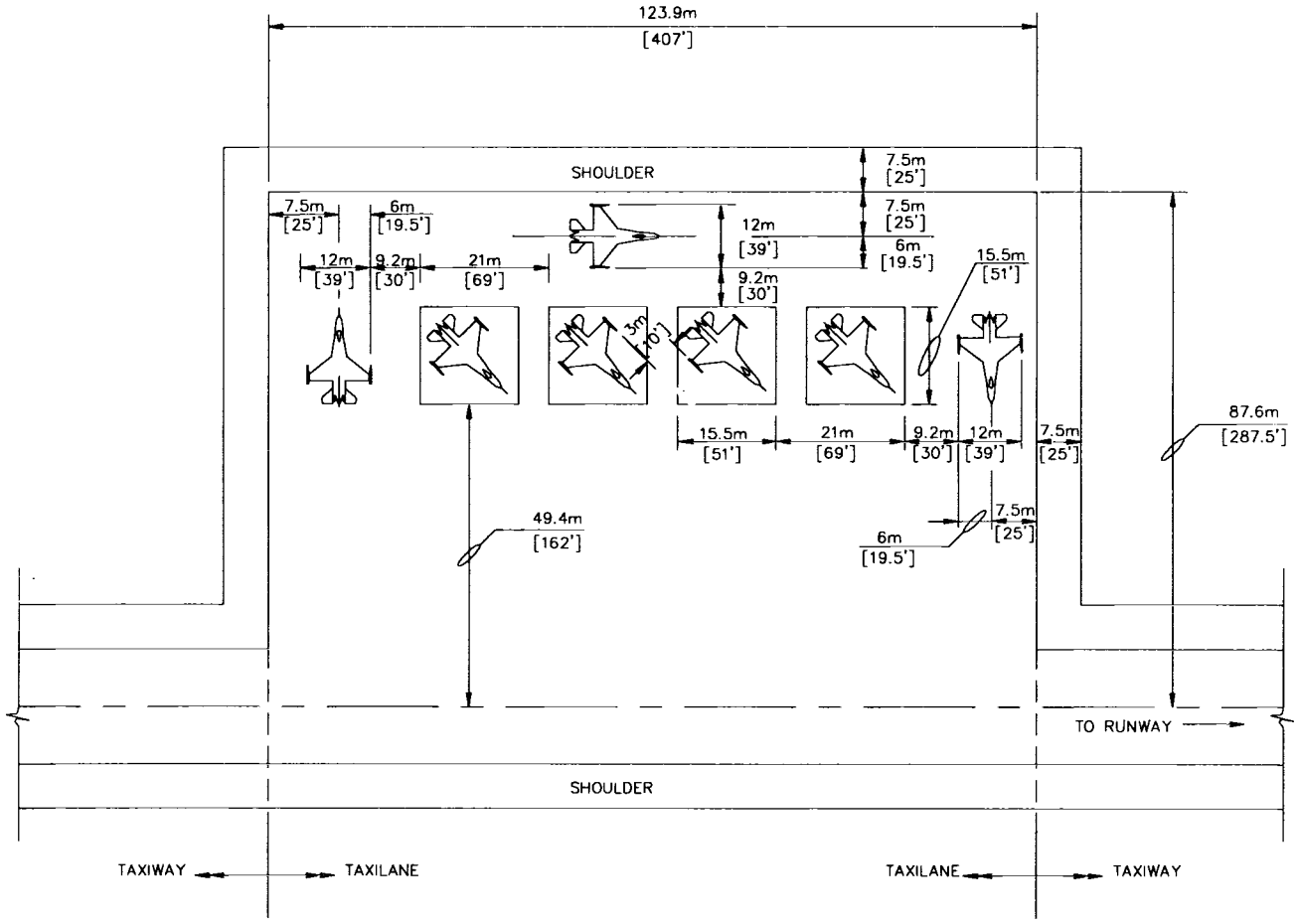
6.10.7. Turning Radius. The turning radius for taxilanes on arm/disarm pads should be designed to provide the minimum allowable turn under power of the largest aircraft which will use the arm/disarm pad.

6.10.8. Access Road. An all-weather access road should be constructed to the arm/disarm pad outside the airfield's taxiway and runway clearance areas. Design of this road will be in accordance with AFM 88-7/TM 5-822-2, *General Provisions and Geometric Design for Roads, Streets and Open Storage Areas,* Chapters 3 and 5, and AFM 88-7/TM 5-822-6, *Pavement Design for Roads, Streets, and Open Storage Areas,* Chapter 1.

6.10.9. Tiedowns and Grounding Points. Tiedowns and mooring points are not required on arm/disarm pads. See Attachment 12 for grounding requirements.

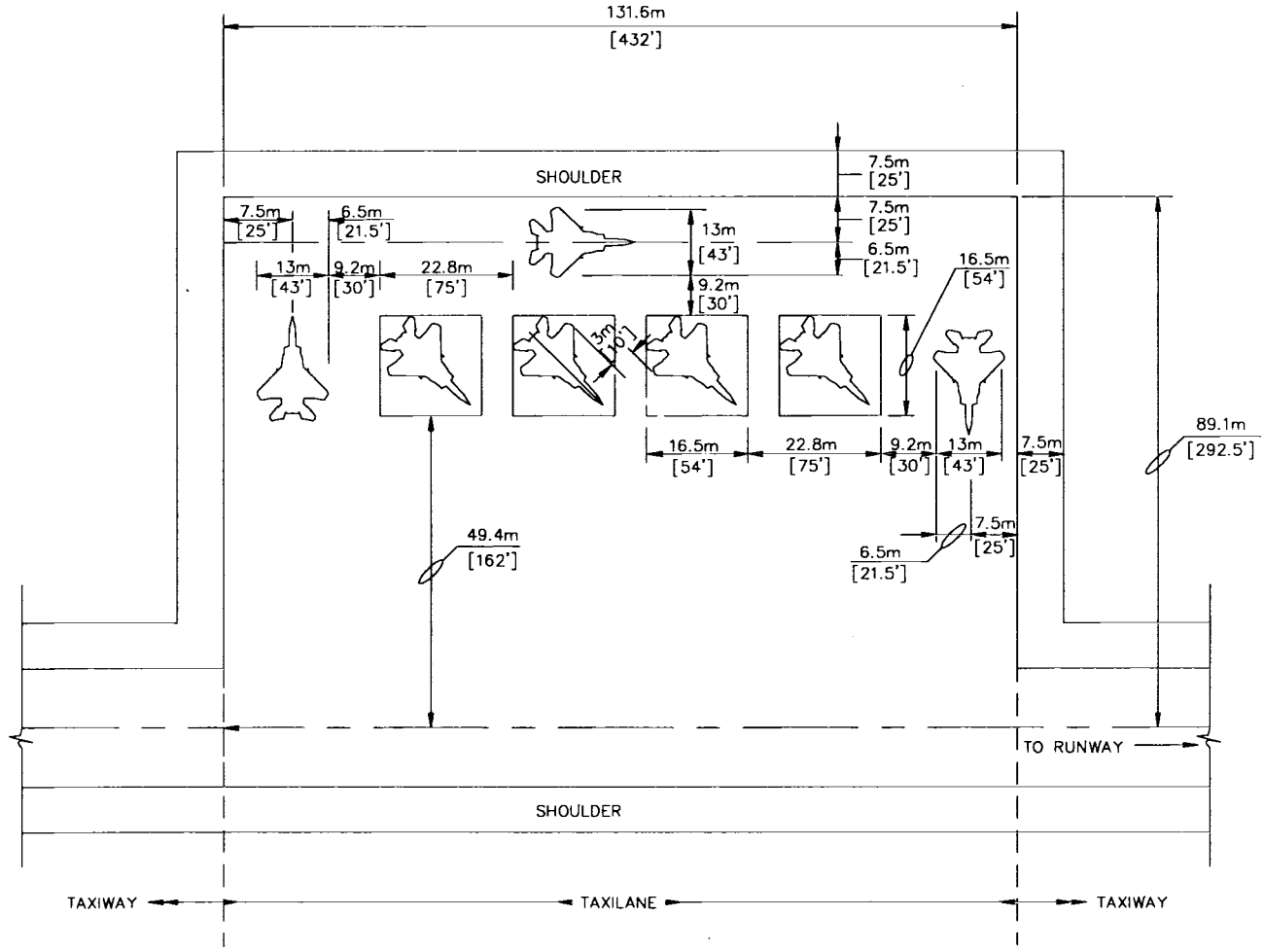
6.10.10. Ammunition and Explosives Safety Standards. Ammunition and explosive safety standards are discussed in Attachment 10.

Figure 6.20. Arm-Disarm Pad for F-4 Fighter.



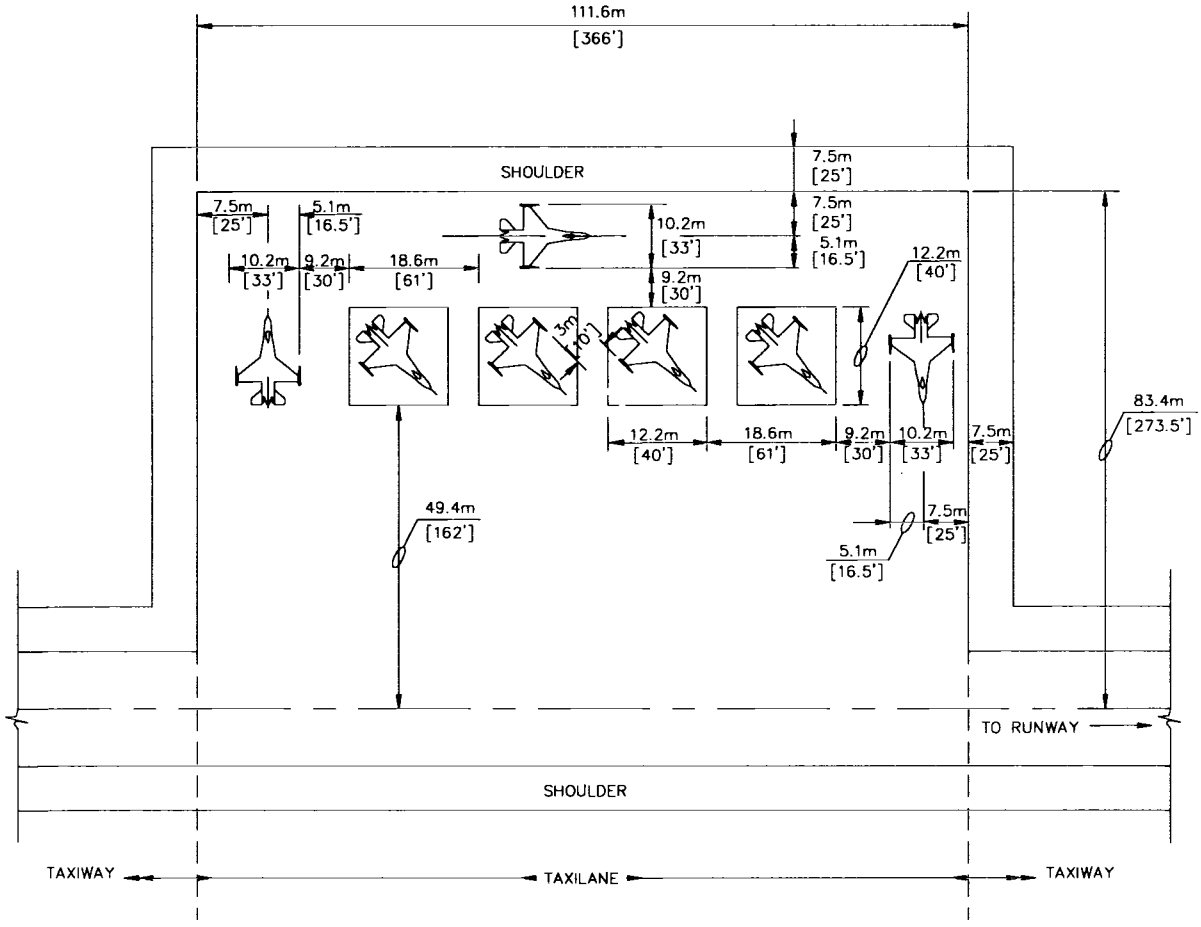
N.T.S.

Figure 6.21. Arm-Disarm Pad for F-15 Fighter.



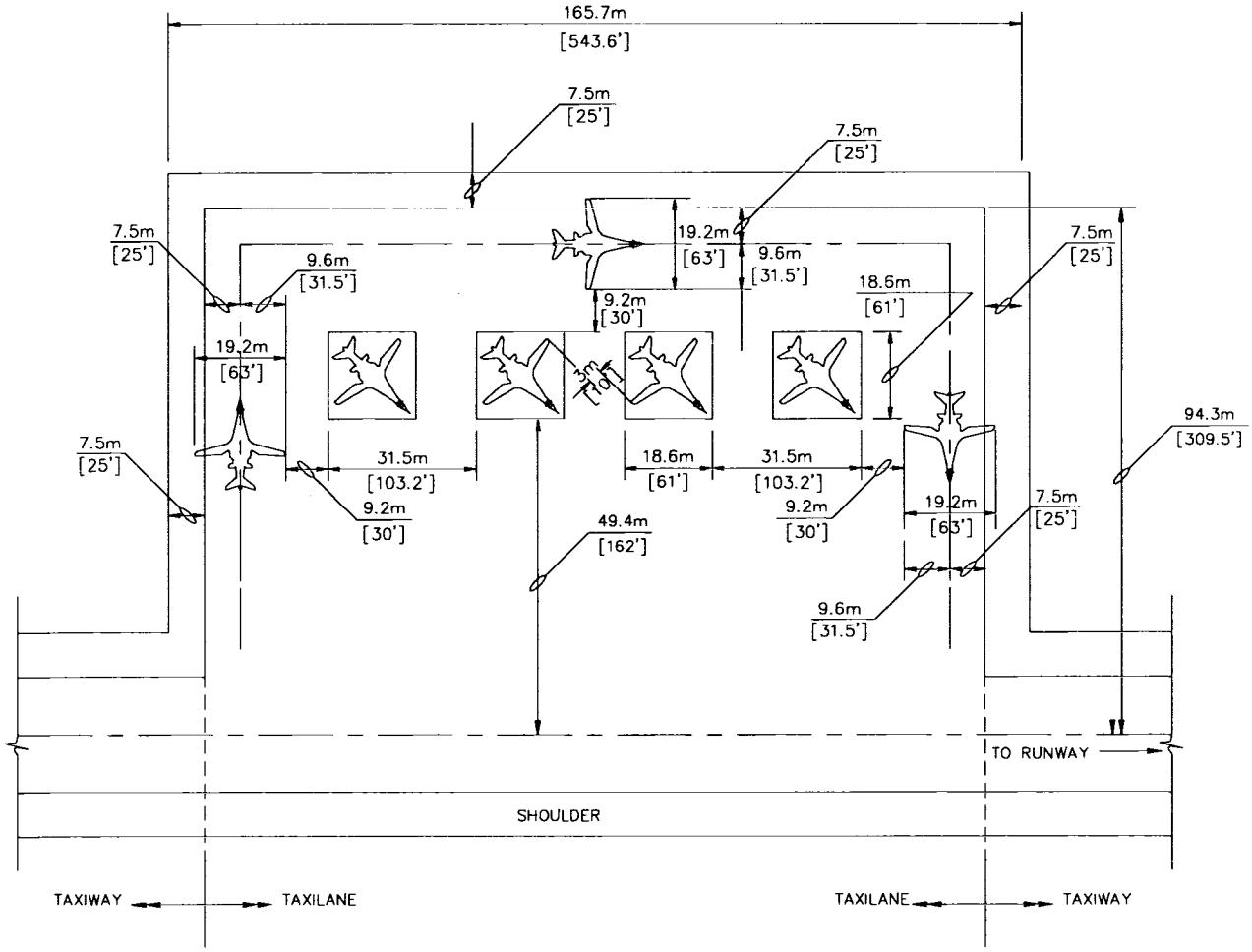
N.T.S.

Figure 6.22. Arm-Disarm Pad for F-16 Fighter.



N.T.S.

Figure 6.23. Arm-Disarm Pad for F-111 Fighter.



N.T.S.

6.11. Compass Calibration Pad (CCP). An aircraft compass calibration pad is a paved area in a magnetically quiet zone where an aircraft's compass is calibrated.

6.11.1. Air Force. The Air Force has the option of using the criteria presented here or using the criteria provided within Federal Aviation Administration (FAA) Advisory Circular 150/5300-13, Appendix 4. A current copy of the FAA AC 150/5300-13, *Airport Design)*, Appendix 4, can be obtained from HQ AFCESA/CESC. For compass calibration pad marking requirements, use the controlling aircraft Technical Order or use the information within FAA AC 150/5300-13 for general purpose compass calibration pads.

6.11.2. Navy and Marine Corps. Prior to construction or major repair of a compass calibration pad, a validation of need shall be filed through the maintenance department to the Naval Air Systems Command for approval. Navy and Marine Corps requirements for Compass Calibration Pads are found in P-80, *Facility Planning Factor Criteria for Navy and Marine Corps Shore Installations*, and MIL-HDBK-1021/1.

6.11.3. Location. The compass calibration pad should be located off the side of a taxiway at sufficient distance to satisfy the runway and taxiway lateral clearance distance and airspace criteria discussed in Chapters 3, 4, and 5.

6.11.4. Siting Consideration:

6.11.4.1. Separation Distances. To meet the magnetically quiet zone requirements and prevent outside magnetic fields from influencing the aircraft compass calibration, efforts must be taken to make sure that the center of the pad meets the minimum separation distances listed below:

6.11.4.1.1. Army and Air Force:

6.11.4.1.1.1. 68.6 meters [225 feet] to underground metal conduits or metal piping, including reinforced concrete pipe (RCP).

6.11.4.1.1.2. 83.8 meters [275 feet] from the edge of the nearest taxiway; to the edge of the nearest roadway traffic lane or vehicle driveway; and to the edge of aircraft or vehicle parking apron.

6.11.4.1.1.3. 152.4 meters [500 feet] to underground alternating current (ac) power lines including runway/taxiway edge lighting.

6.11.4.1.1.4. 182.9 meters [600 feet] to overhead steam lines; to overhead conduits or metal piping; to overhead a.c. power lines; to any ac equipment; to the nearest edge of any railroad track; to the nearest fire hydrant; and to the nearest portion of any building.

6.11.4.1.1.5. 304.8 meters [1,000 feet] to any direct current (dc) power line or equipment including underground and above ground telephone lines.

6.11.4.1.2. Navy and Marine Corps. Criteria for separation distances for Navy and Marine Corps compass calibration pad is given in MIL-HDBK-1021/1.

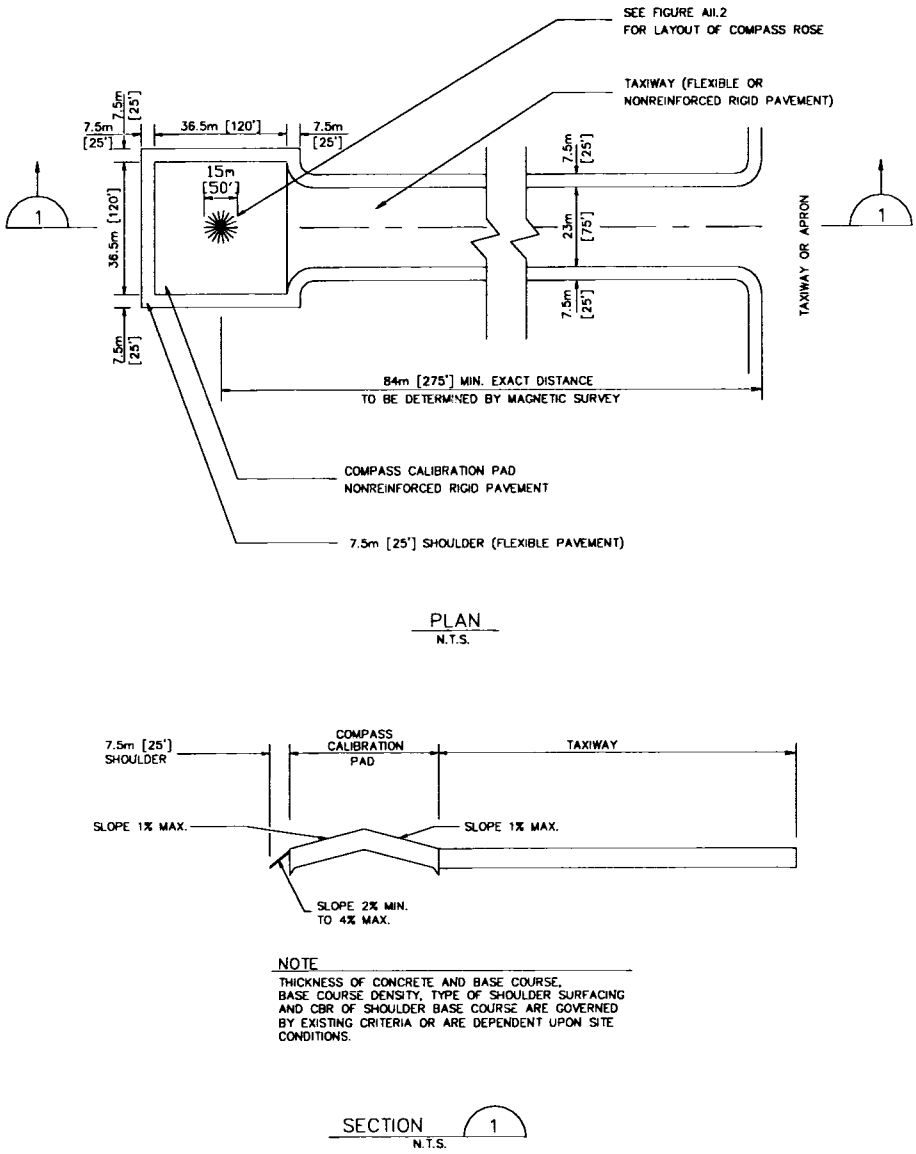
6.11.4.2. Preliminary Survey. During the site selection process, the proposed sites for compass calibration pads must be checked for magnetic influences to insure that the area is magnetically quiet regardless of adherence to separation distances. A preliminary survey as described in Attachment 11 must be conducted to determine if the proposed site is magnetically quiet. A survey, similar to the preliminary survey, must be conducted after construction of any new item, building, within or near the separation distances of the pad. This will assure that the newly constructed item has not created new magnetic influences in the magnetically quiet zone.

6.11.4.3. Magnetic Survey. The magnetic survey for the compass calibration pad is an airfield engineering survey that is conducted at the completion of the pad to assure that the area is magnetically quiet, to determine the magnetic declination of the area, and to layout the markings for the pad. Engineering surveys are also required every five (5) years for Army and Air Force compass calibration pads and every year for Navy and Marine Corps compass calibration pads. This cycle is operationally important as the magnetic north not only varies at different locations on the earth, but physically changes as a function of time. It is an operational requirement to calibrate the aircraft's compass correction factor on a regular basis because of these changes in the earth's magnetic pole. In addition, the magnetic survey validates that the compass calibration pad is in a magnetically quiet zone; thus insuring proper compass calibration. The magnetic survey for compass calibration pads should be performed in accordance with Attachment 11.

6.11.5. Compass Calibration Pad Size:

6.11.5.1. Army and Air Force. Army and Air Force compass calibration pad size is shown in Figure 6.24.

Figure 6.24. Army and Air Force Compass Calibration Pad.



6.11.5.2. Navy and Marine Corps. Navy and Marine Corps compass calibration pad size is provided in MIL-HDBK-1021/1.

6.11.6. Access Taxiway/Towway. An access taxiway will be provided for access from the primary taxiway to the compass calibration pad. The access taxiway must be oriented to facilitate moving the aircraft onto the compass calibration pad on a magnetic north heading. At Army and Air Force aviation facilities, if the aircraft should be towed to the compass calibration pad, the access taxiway must be designed as a towway. At Navy and Marine Corps facilities, the taxiway should be designed as a taxiway. Taxiway and towway design requirements are presented in Chapter 5.

6.11.7. Grading. Compass calibration pads will be graded as follows:

6.11.7.1. Perimeter Elevation. The elevation of the perimeter of the pad will be the same elevation around the entire perimeter.

6.11.7.2. Cross-slope:

6.11.7.2.1. Army and Air Force. The compass calibration pad should be crowned in the center of the pad with a constant cross slope of 1 percent in all directions to provide surface drainage while facilitating alignment of the aircraft pad.

6.11.7.2.2. Navy and Marine Corps. Grading criteria for compass calibration pads is found in MIL-HDBK-1021/1.

6.11.8. Tiedowns/Mooring Points. No aircraft tiedown/mooring points/tiedown mooring eyes, or any static grounding points must be placed in the compass calibration pad pavement.

6.11.9. Embedded Material. Due to the influence of ferrous metal on a magnetic field, the PCC pavement for the compass calibration pad and access taxiway must not contain any embedded ferrous metal items such as dowels bars, reinforcing steel, steel fibers, or other items. In addition, ferrous metal must not be placed in or around the compass calibration pad site.

6.11.10. Control Points. A control point will be set in the center of the compass calibration pad. This point will consist of a brass pavement insert into which a bronze marker is grouted in accurate alignment. This point will be stamped with "Center of Calibration Pad." The layout of the control points is further discussed in Attachment 11.

6.12. Hazardous Cargo Pads. Hazardous cargo pads are paved areas for loading and unloading explosives and other hazardous cargo from aircraft. Hazardous cargo pads are required at facilities where the existing aprons cannot be used for loading and unloading hazardous cargo.

6.12.1. Navy and Marine Corps Requirements. Hazardous cargo pads are not normally required at Navy and Marine Corps facilities. However, where operations warrant or there is an Air Force hazardous cargo aircraft continuously present, they can be justified with proper documentation.

6.12.2. Siting Criteria. Hazardous cargo pads require explosives site planning as discussed in Attachment 10.

6.12.3. Hazardous Cargo Pad Size:

6.12.3.1. Circular Pad. At aviation facilities used by small cargo aircraft, the hazardous cargo pad is a circular pad as shown in Figure 6.25.

6.12.3.2. Semi-Circular Pad. At aviation facilities used by large cargo aircraft and Aerial Ports of Embarcation (APOE) and Aerial Ports of Debarcation (APOD), the hazardous cargo pad is a semi circular pad as shown in Figure 6.26. The semi-circular pad is adequate for aircraft up to and including the dimensions of the C-5.

6.12.3.3. Other Pad Size. The hazardous cargo pad geometric dimensions as shown in Figures 6.25 and 6.26 are minimum requirements. Hazardous cargo pads may be larger than these dimensions if the design aircraft cannot maneuver on the pad. Sources for obtaining information concerning minimum turning radii for various aircraft is presented in Army ETL 1110-3-394, *Aircraft Characteristics for Airfield-Heliport Design and Evaluation.*

6.12.4. Access Taxiway. An access taxiway will be provided for access from the primary taxiway to the hazardous cargo pad. The taxiway should be designed for the aircraft to taxi into the hazardous cargo pad under its own power.

6.12.5. Tiedown and Grounding Points. Tiedowns/mooring points/tiedown mooring eyes must be provided on each hazardous cargo pad. Grounding points must be provided on each hazardous cargo pad. Tiedown and grounding points are further discussed in Attachment 12.

Figure 6.25. Hazardous Cargo Pad Other Than APOE/Ds.

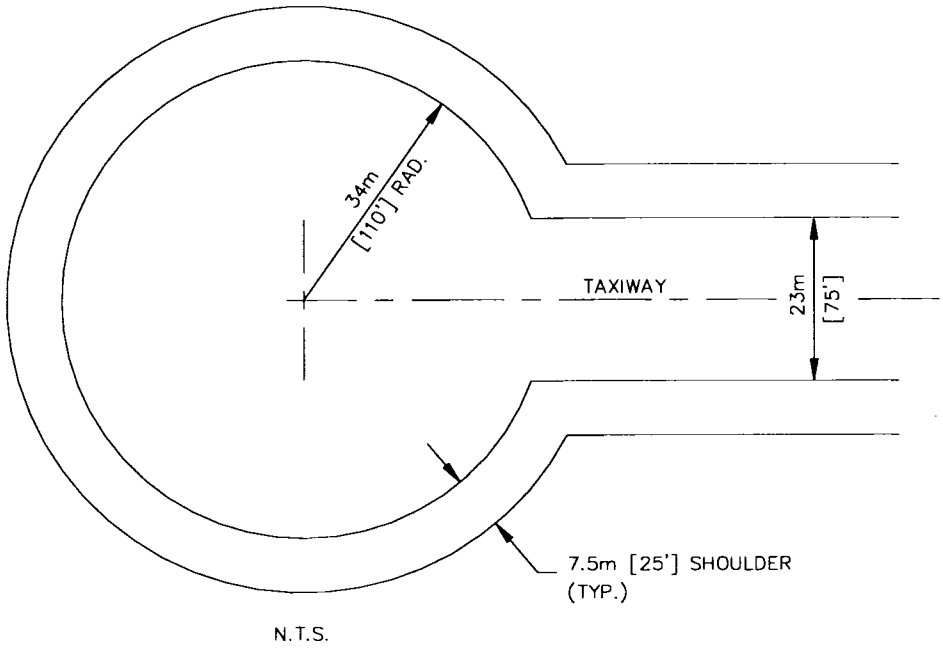
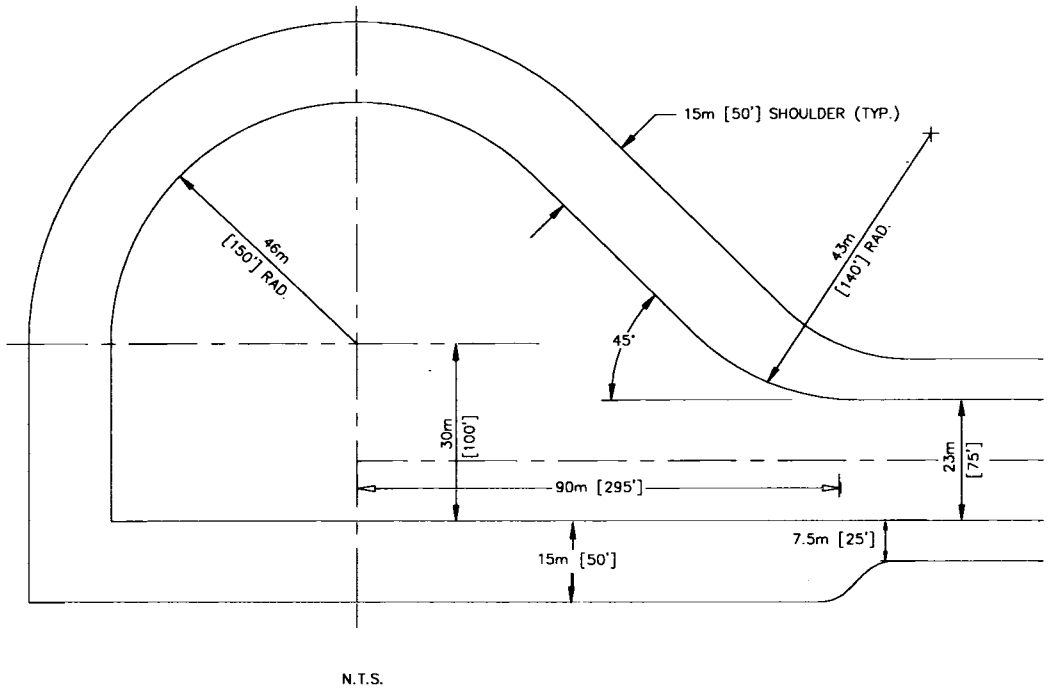


Figure 6.26. Typical Hazardous Cargo Pad for APOE/Ds.



NOTE
THIS HAZARDOUS CARGO PAD IS ADEQUATE FOR AIRCRAFT UP TO AND INCLUDING THE C-5. THE DIMENSIONS MAY BE ADJUSTED TO ACCOMMODATE LIMITING CONSTRAINTS AT INDIVIDUAL FACILITIES.

6.12.6. Miscellaneous Considerations. The following items need to be considered for hazardous cargo pads:

6.12.6.1. Utilities. Telephone service, apron lighting, airfield lighting and water/fire hydrants are required for safety.

6.12.6.2. Access Road. Consideration should be given to providing a paved roadway to the hazardous cargo pad for access by trucks and other vehicles.

6.13. Alert Pad. An alert pad, often referred to as an alert apron, is an exclusive paved area for armed aircraft to park and have immediate, unimpeded access to a runway. In the event of a declared alert, alert aircraft must be on the runway and airborne in short notice. This chapter will refer to both alert aprons and alert pads as "alert pads." An alert apron is shown in Figure 6.27. An alert pad is shown in Figure 6.28.

Figure 6.27. Typical Alert Apron for Bombers and Tanker Aircraft.

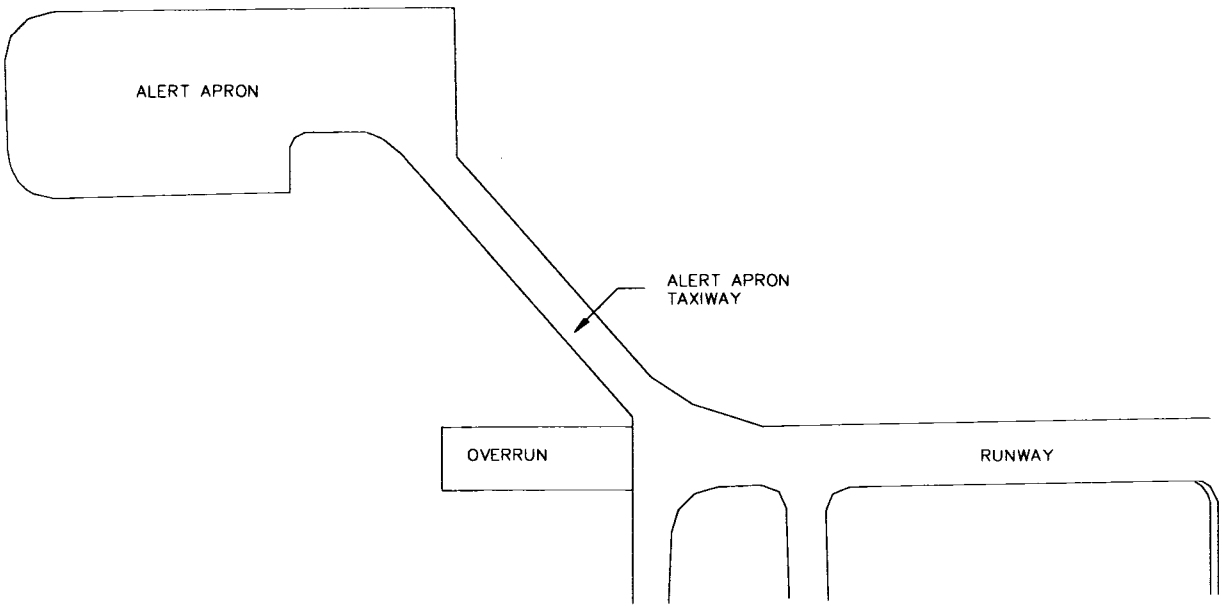
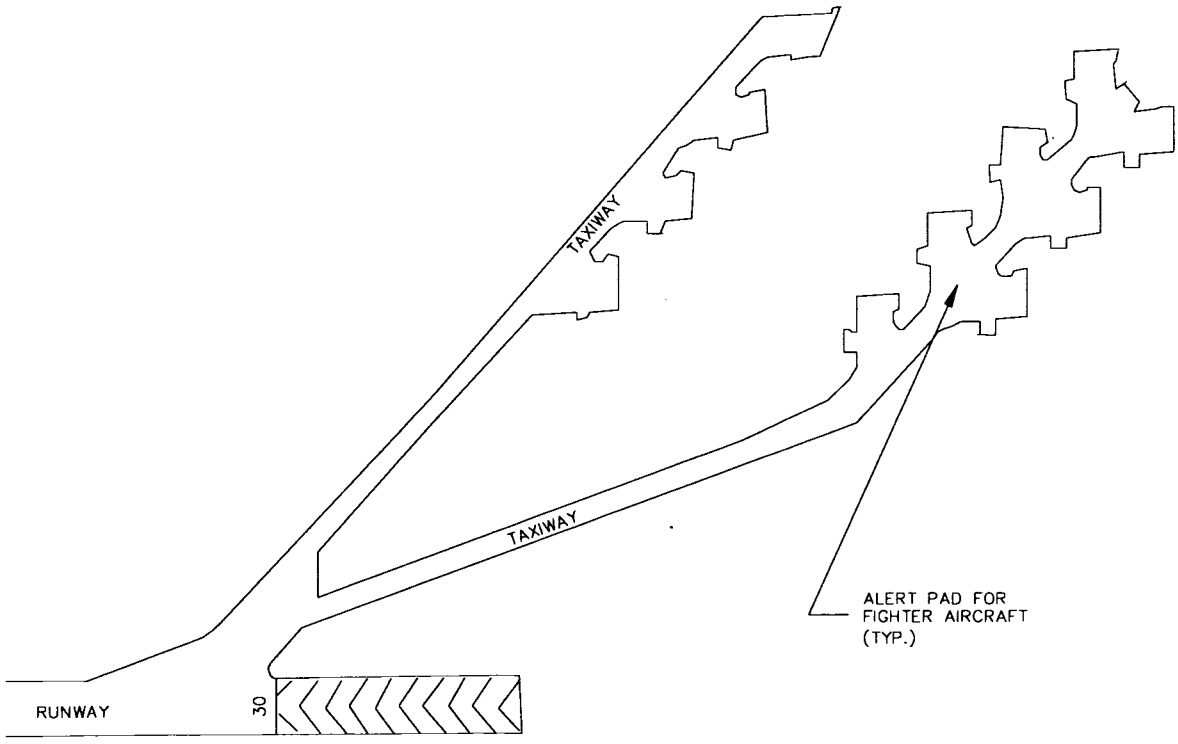


Figure 6.28. Typical Alert Pad for Fighter Aircraft.



6.13.1. Navy and Marine Corps Requirements. Alert Pads are not normally required at Navy and Marine Corps facilities. When justified, this criterion will be used.

6.13.2. Location. Locating the alert pad adjacent to a runway end will allow alert aircraft to proceed directly from the apron to the runway threshold without interruptions from other traffic. Alert pads must be located close to the runway threshold to allow alert aircraft to be airborne within the time constraints stipulated in their mission statements. The preferred location of alert pads is on the opposite side of the runway, away from normal traffic patterns to allow aircraft on the alert pad direct, unimpeded access to the runway.

6.13.3. Siting Criteria:

6.13.3.1. Clear Zone. As discussed in paragraph 6.8.3.2, alert pads must not be located within the runway clear zone.

6.13.3.2. Airspace Imaginary Surfaces. As discussed in paragraph 6.8.3.3, aircraft parked on the alert pads must not project into airspace imaginary surfaces.

6.13.3.3. Explosives Consideration. Aircraft on alert pads loaded with explosives should be located to minimize the potential for explosive hazards. Explosives safety site plans must be prepared for explosive loaded alert aircraft. See Attachment 10.

6.13.4. Alert Pad Size. Alert pads should be sized to park all of the aircraft on alert. The dimensions of the pad should vary with the length and wingspan of the aircraft to be served and the explosives on the aircraft. Wingtip clearances, presented in Table 6.3, are minimum separation distances to be observed at all times.

Table 6.3. Minimum Separation Distance on Bomber Alert Aprons from the Centerline of a Through Taxilane to a Parked Aircraft.

AIRCRAFT	Standard (Meters)	Standard (Feet)	Minimum (Meters)	Minimum (Feet)
B-52 or B-52 Mixed Force B-1 B-2	45.72	150	38.10	125
KC-135 or KC-135 and FB-111 Mixed Force	38.10	125	30.48	100
KC-10 FB-111 Only	30.48	100	22.86	75

For additional discussion on separation distances, see paragraph 6.14.4.

6.13.4.1. Air Force Waivers:

6.13.4.1.1. Wingtip Clearances. The MAJCOM may grant waivers to the 15.24 meters [50 feet] wingtip clearance requirement when sufficient ramp area is not available. In no case will the wingtip clearance be waived to less than 9.14 meters [30 feet].

6.13.4.1.2. Wingtip Clearances Based on Taxilane Width. When the minimum separation distance between a taxilane centerline and the nose/tail of a parked aircraft is reduced below the distance shown in Table 6.1, the minimum waiver wingtip clearance distance of 9 meters [30 feet] must be increased 0.3 meters [1 foot] for each 0.3 meter [1 foot] reduction in separation distance. Example: B-52 nose to taxilane centerline 43 meters [140 feet] - minimum waiver wingtip distance 12 meters [40 feet]; nose to centerline distance 40 meters [130 feet] or less - no waiver permitted, comply with 15 meter [50 foot] minimum wingtip clearance.

6.13.5. Design Aircraft. To facilitate flexibility in future operations, new alert ramp construction should conform to B-52 standards. Aircraft parked in shelters are exempt from the above parking separation criteria.

6.13.6. Alert Aircraft Parking Arrangements:

6.13.6.1. Fighter Arrangements. Fighter aircraft are parked at 45-degree angles to dissipate the heat and velocity of jet blast.

6.13.6.2. Non-Fighter Arrangements. Non-fighter aircraft should be parked in rows.

6.13.7. Jet Blast Distance Requirements. Jet blast safe distances should be considered when planning and designing parking locations on alert pads. Safe distance criteria are presented in Attachment 8.

6.13.8. Taxi-In/Taxi-Out Capabilities. Alert aprons and pads should be designed either for taxi-in/taxi-out parking or for push-back parking. Taxi-in/taxi-out parking, shown in Figure 6.29, is preferred since alert aircraft can be quickly taxied into position under their own power. Back-in parking, shown in Figure 6.30, requires less paved area.

Figure 6.29. Alert Apron Taxi-In/Taxi-Out Parking.

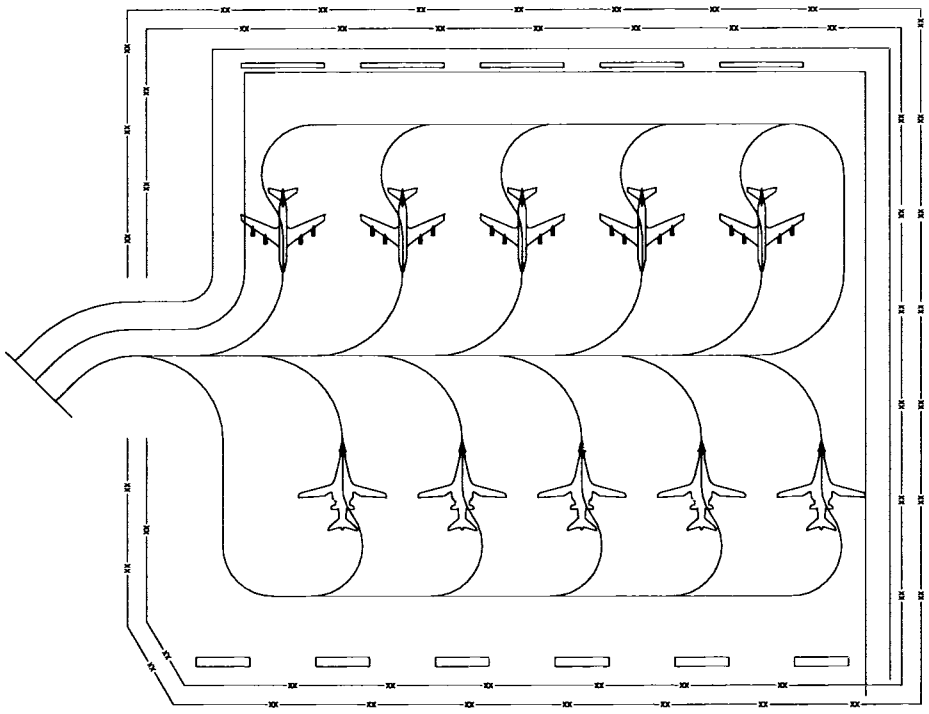
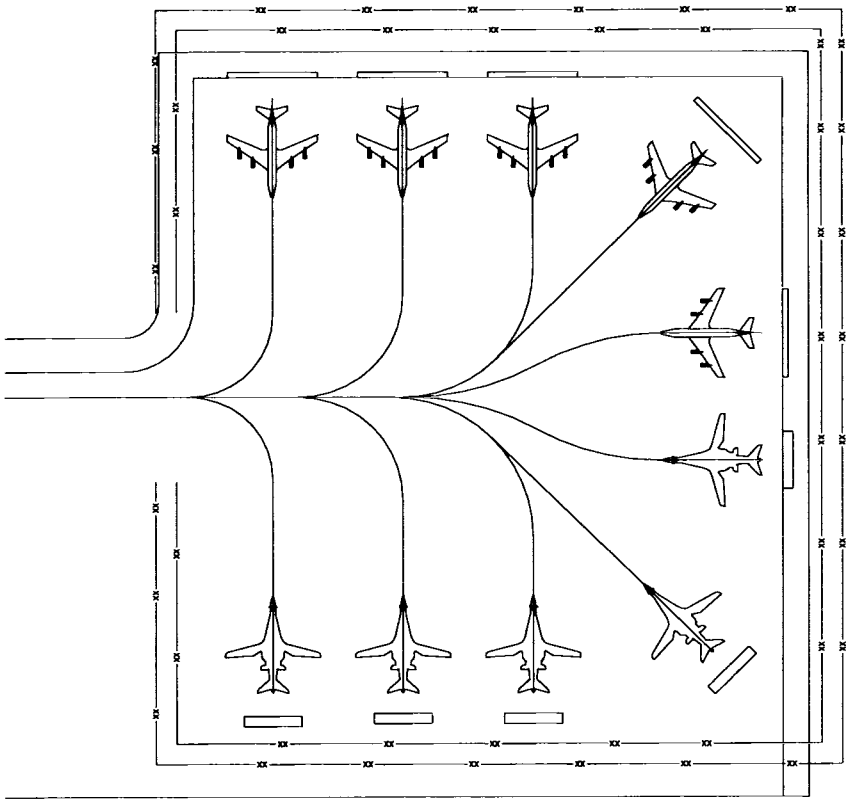


Figure 6.30. Alert Apron Back-In Parking.



6.13.9. Turning Radius. The turning radius on the alert pad taxilanes will be designed to provide the minimum allowable turn under power of the largest aircraft which will use the alert pad. In no case will the initial turnout from the alert apron parking space to the through taxilane exceed 90 degrees. For Air Force alert pad for bombers and tankers, the initial turn from the parking space will have a turn equal to the distance from the taxilane centerline to the nose of the aircraft. This is shown in Table 6.1.

6.13.10. Dedicated Access Taxiway. At alert pads, provide a single dedicated taxiway from the alert pad to the runway for aircraft to progress directly without traffic interruptions. Having no other taxiways intersect the dedicated taxiway is the ideal way to ensure the dedicated taxiway is not obstructed.

6.13.11. Tiedowns and Grounding Points. Tiedowns/mooring points/tiedown mooring eyes and grounding points will be provided at each aircraft parking location, as discussed in Attachment 12.

6.14. Aircraft Wash Racks. Aircraft wash racks are paved areas provided at all facilities to clean aircraft in conjunction with periodic maintenance and to prevent corrosion.

6.14.1. Location. Covered and uncovered aircraft wash racks should be located adjacent to the hangar area or maintenance facilities and contiguous to aircraft parking or access aprons. Existing pavements can be used where curbing can be installed, drainage adjusted as necessary, and other required facilities such as utilities, can be provided to make a usable wash rack. Where possible, wash racks should be located near existing facilities where existing utility and pollution control systems are accessible. In siting wash racks, support facilities such as pump houses and tanks should be located either outside apron clearance distances or below grade.

6.14.2. Wash Rack Size. The size and configuration of an aircraft wash rack is determined by the type of mission aircraft expected to use it. The dimensions of the largest aircraft plus the clearances shown in Table 6.4 determine the minimum wash rack pavement dimensions. At mixed mission facilities, it may be possible to accommodate several smaller (fighter) aircraft on one larger aircraft wash rack pavement.

Table 6.4. Wash Rack Clearances From Aircraft to Curb.

Aircraft	From	To	Direction	Distance (Meters)	Distance (Feet)
Heavy Bomber, Medium Bomber, and Cargo	Wingtip	Curb	Horizontally	4.6	15
	Tail	Curb	Horizontally	4.6	15
	Nose	Curb	Horizontally	4.6	15
Fighter	Wingtip	Curb	Horizontally	3.1	10
	Tail	Curb	Horizontally	3.1	10
	Nose	Curb	Horizontally	3.1	10
Helicopter	Rotor-tip	Curb	Horizontally	See note 1.	See note 1.
	Tail	Curb	Horizontally	See note 2.	See note 2.
	Nose	Curb	Horizontally	See note 3.	See note 3.

Notes:

1. For light to medium helicopter (UH-60 baseline), width of wash rack is based on the addition of 3.1 m [10-feet] buffers to the rotor diameter. For heavy helicopter (CH-47 Baseline), width of wash rack is based on the addition of 3.1 m [10-feet] buffers to the rotor diameter. For wash racks servicing multiple aircraft a 6.1 m (20-feet) buffer is required between rotor-tips.
2. 3.1 m [10-feet] for light and medium helicopter (UH-60 baseline). 10.4 m [34-feet] for heavy helicopter (CH-47 baseline).
3. 6.7 m [22-feet] for light and medium helicopter (UH-60 baseline). 10.4 m [34-feet] for heavy helicopter (CH-47 baseline).

6.14.2.1. Army and Air Force. Typical wash rack layouts for heavy bomber, medium bomber, cargo aircraft, fighter aircraft, and helicopters are shown in Figures 6.31 through 6.36.

6.14.2.2. Navy and Marine Corps. Typical type "A" and type "B" wash rack layouts for Navy and Marine corps aircraft are shown in Figures 6.34 and 6.35 and on NAVFAC drawing 1291729.

6.14.3. Wash Rack Facilities. The wash rack should consist of the following required items:

6.14.3.1. Paved surface.

6.14.3.2. Concrete curbs.

6.14.3.3. Paved shoulder (for rotary-wing only).

6.14.3.4. In-pavement structures.

6.14.3.5. Wastewater collection.

6.14.3.6. Wastewater treatment.

6.14.3.7. Utility control building.

6.14.3.8. Utilities.

Figure 6.31. Wash Rack for Mixed Mission Facility.

A = WINGSPAN OF MEDIUM BOMBER OR WINGSPAN OF TWO FIGHTERS WITH WINGTIP SEPARATION PLUS WINGTIP CLEARANCE TO CURB

B = AIRCRAFT LENGTH OF MEDIUM BOMBER OR LENGTH OF TWO FIGHTERS WITH SEPARATION PLUS NOSE AND TAIL CLEARANCES TO CURB

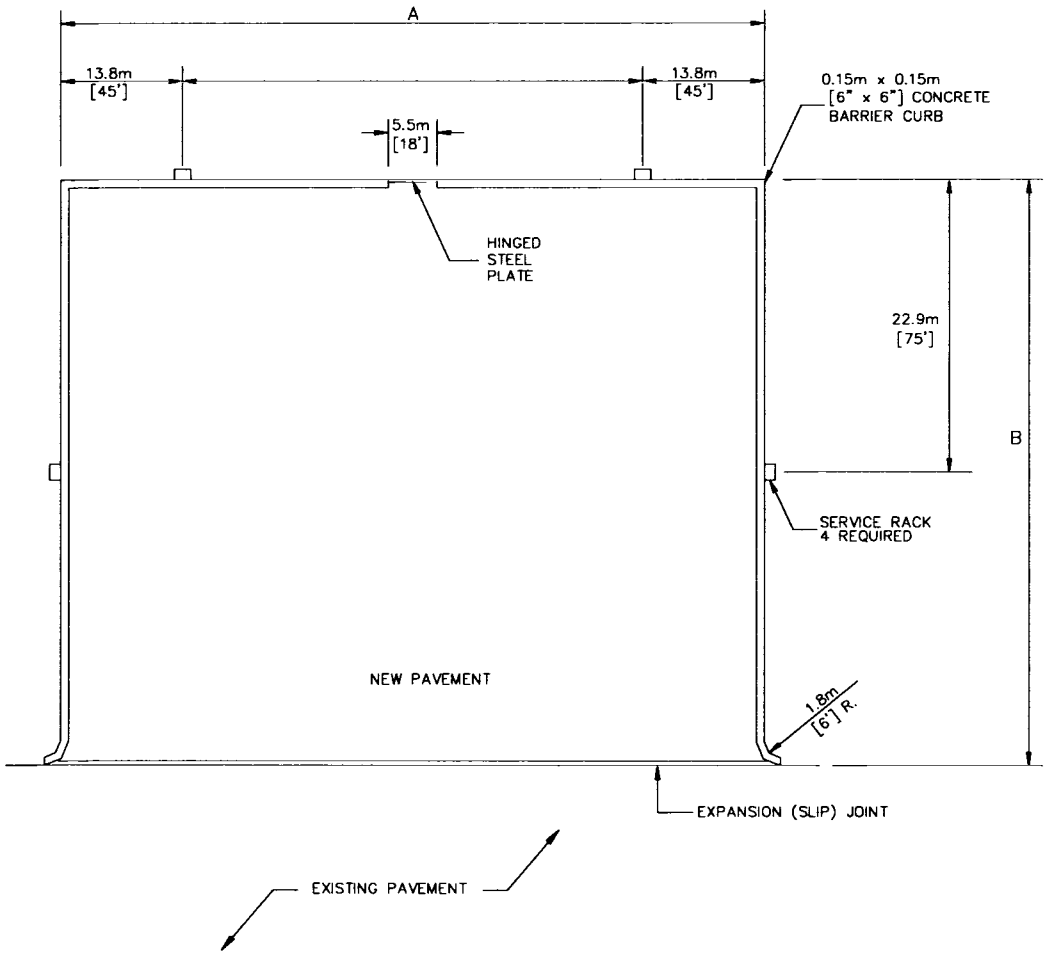


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Figure 6.32. Heavy Bomber Wash Rack (B-52 or B-1).

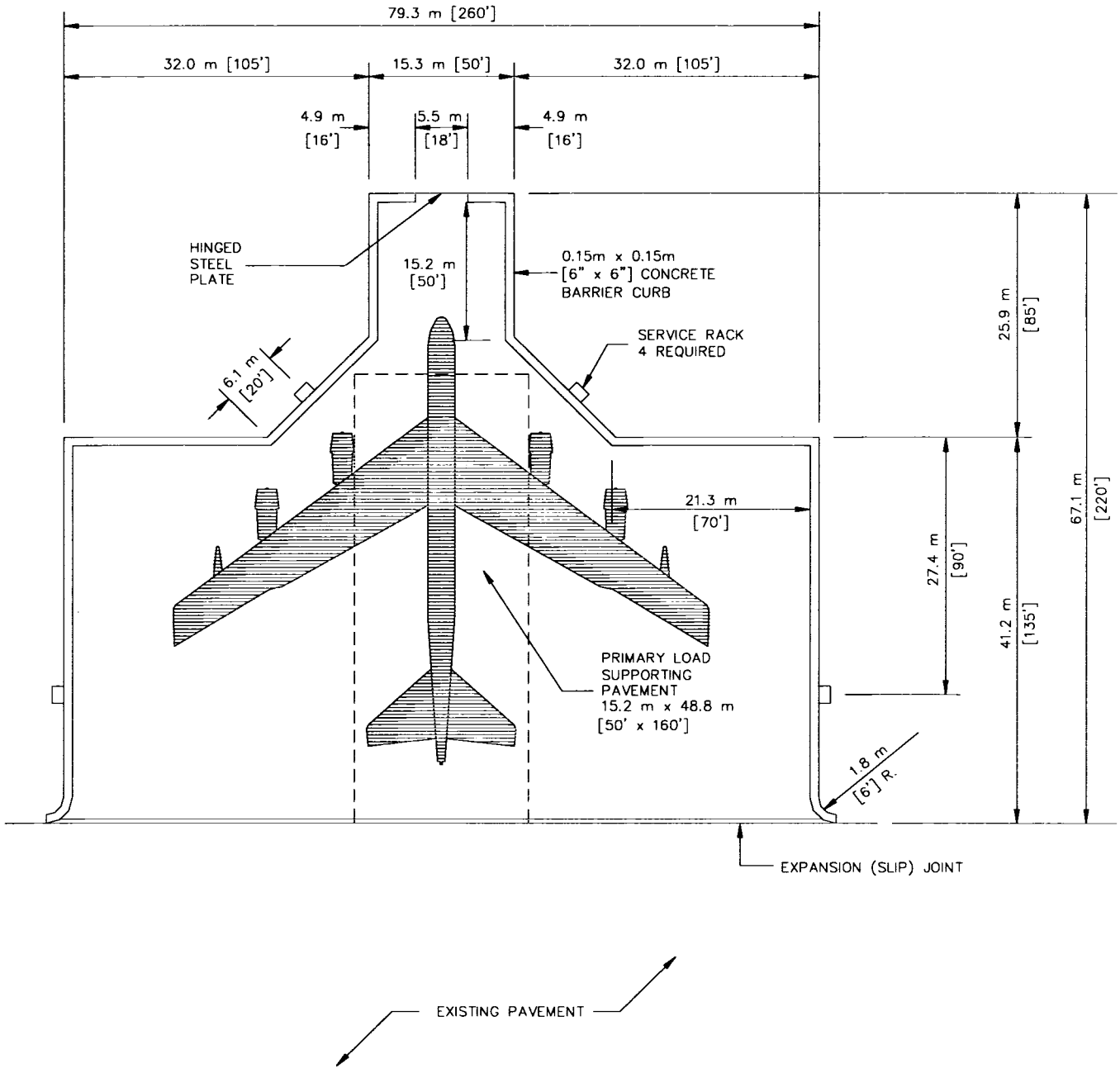

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Figure 6.33. Cargo Aircraft Wash Rack.

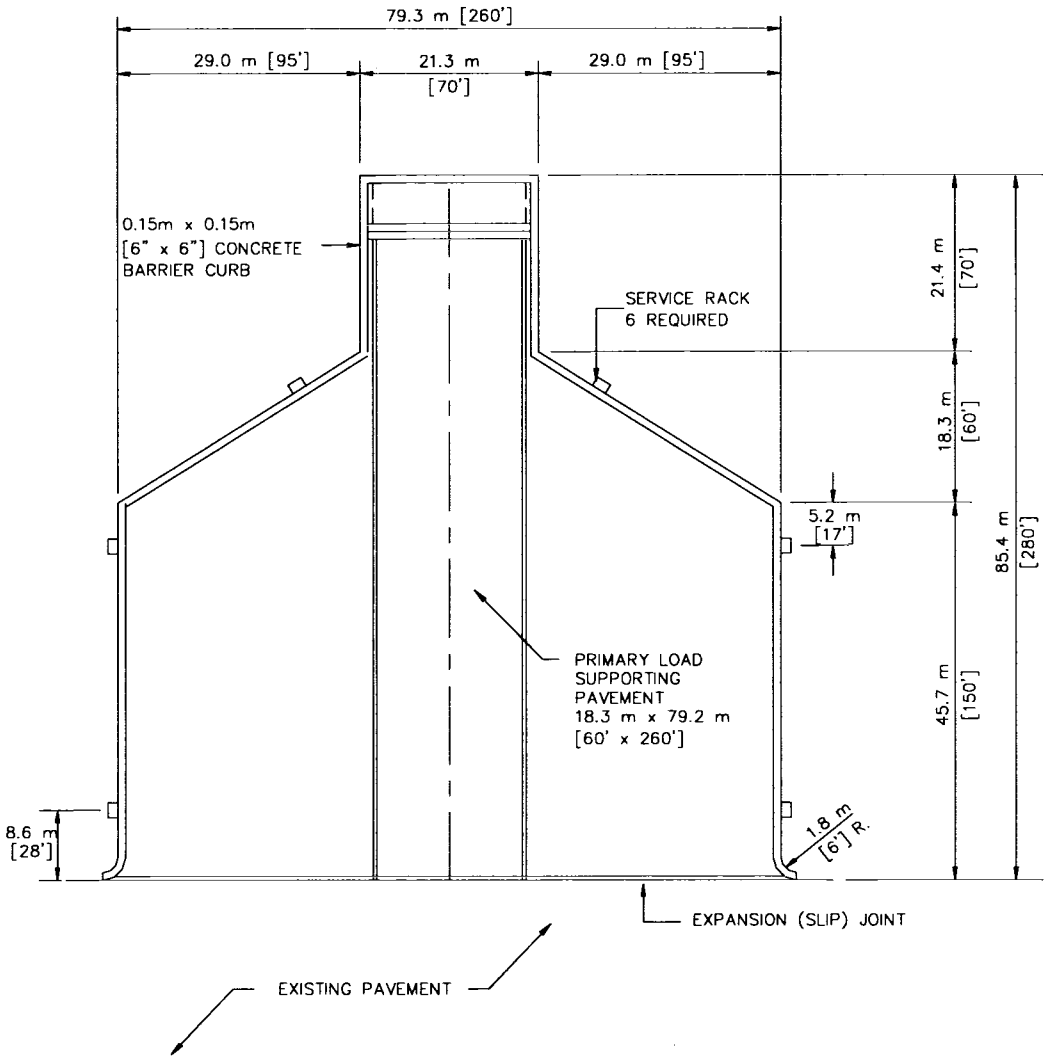

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Figure 6.34. Fighter Aircraft Wash Rack and Navy Type A Wash Rack.

A = WINGSPAN OF FIGHTER AIRCRAFT PLUS WINGTIP CLEARANCE TO CURB

26.0m [85'] FOR NAVY AIRCRAFT, EXCEPT:
30.5m [100'] FOR CH-53E AIRCRAFT

B = AIRCRAFT LENGTH PLUS NOSE AND TAIL CLEARANCE TO CURB

26.0m [85'] FOR NAVY AIRCRAFT, EXCEPT:
36.6m [120'] FOR CH-53E AIRCRAFT

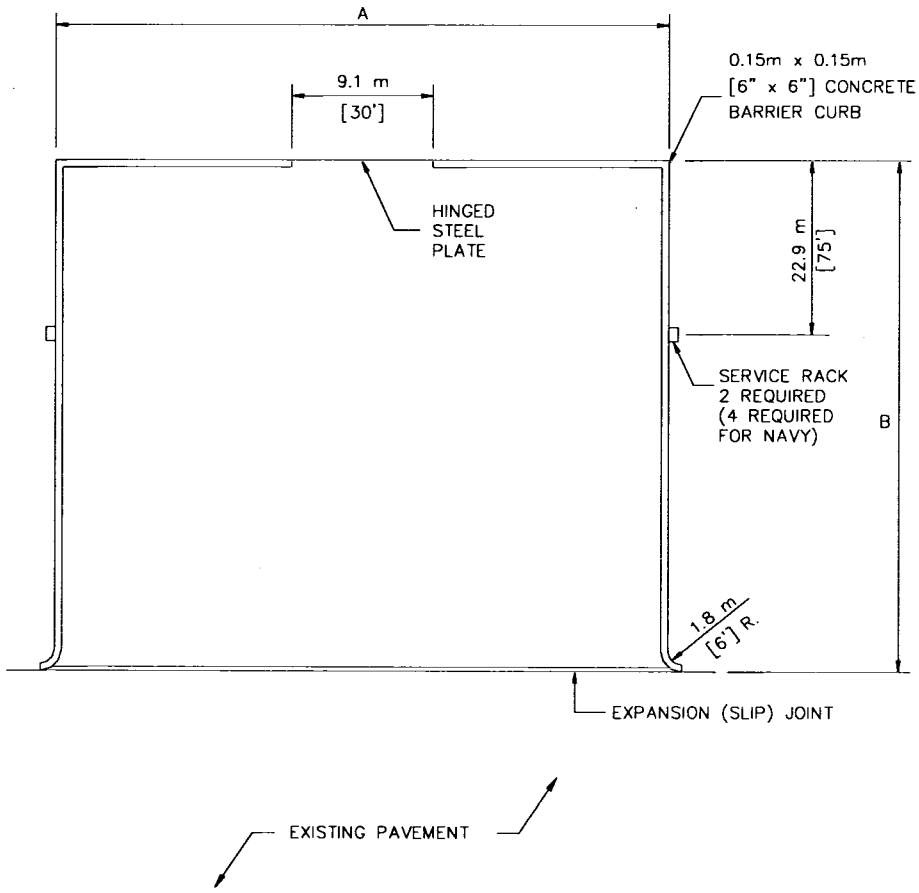

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Figure 6.35. Navy Type B Wash Rack.

DIMEN-SION	ALL NAVY AIRCRAFT EXCEPT E-6	E-6 AIRCRAFT
A	42.7m [140']	61m [200']
B	9.2m [30']	10.7m [35']
C	6.1m [20']	4.9m [16']
D	12.2m [40']	29.9m [98']
E	6.1m [20']	10.7m [35']
F	9.1m [30']	4.9m [16']
G	45.8m [150']	57.9m [190']
H	30.5m [100']	45.8m [150']
I	6.1m [20']	4.9m [16']
J	9.2m [30']	7.3m [24']

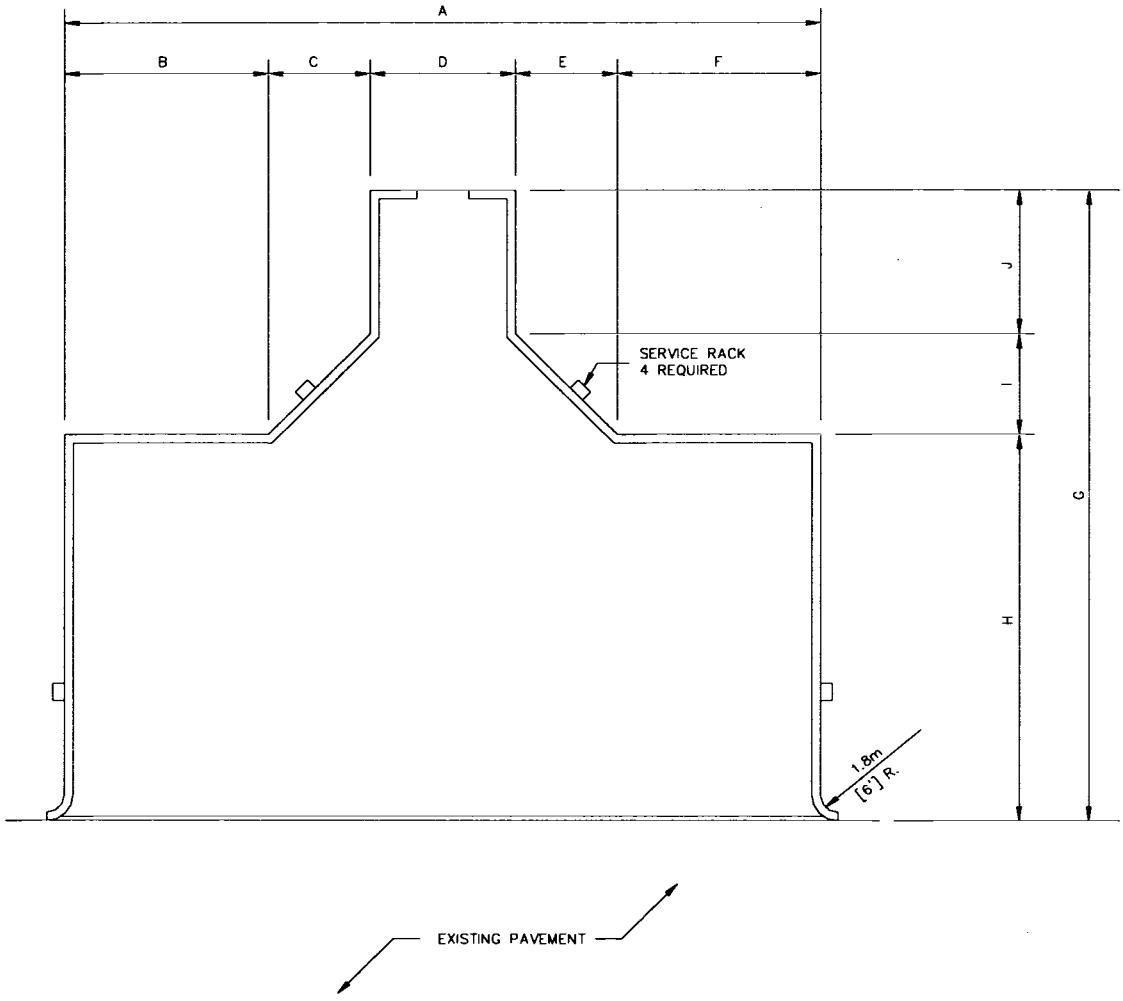

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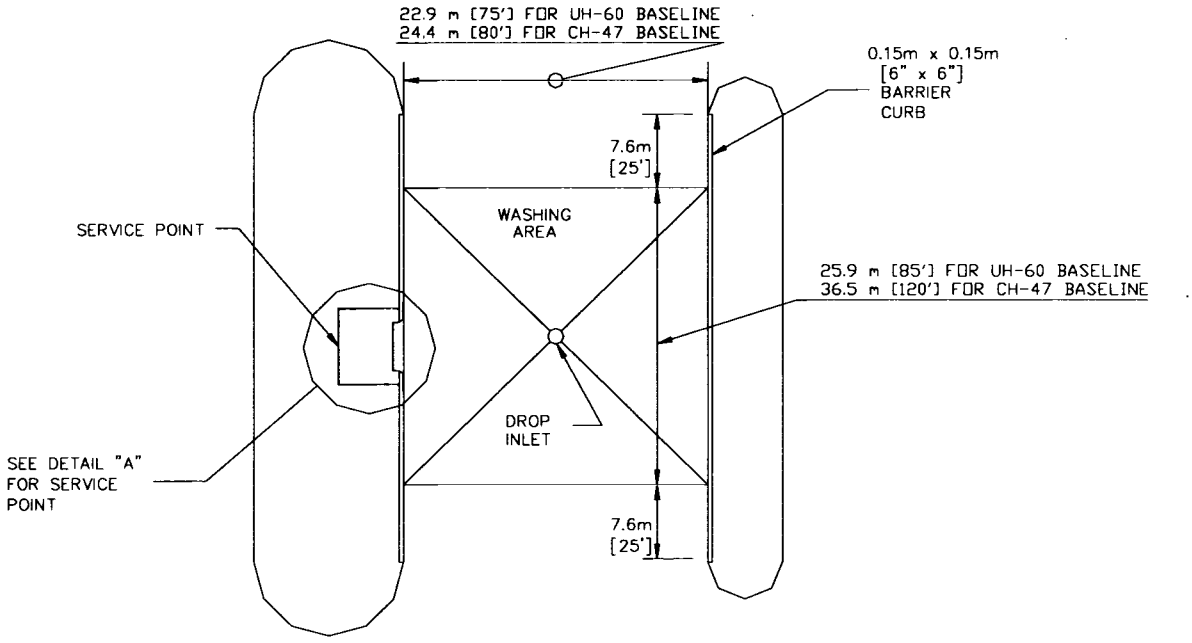
Figure 6.36. Helicopter Wash Rack (Single Helicopter).



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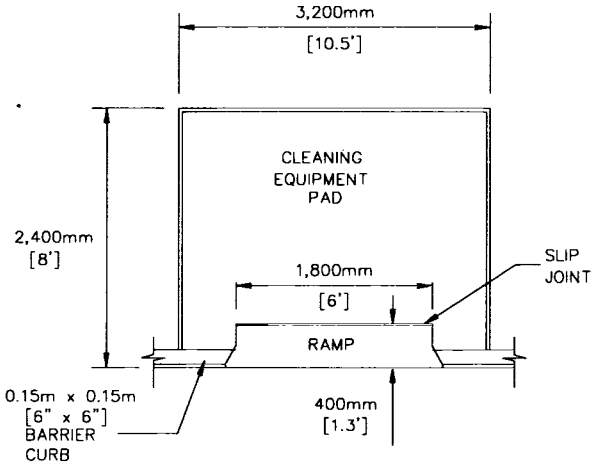

DETAIL A
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6.14.4. Wash Rack Grading. The pavement surface of the wash rack will be sloped at 1.5 percent (1.5%) to assure positive drainage to waste drains.

6.14.5. Tiedowns and Grounding Points. Tiedowns/mooring points/tiedown mooring eyes and grounding points are not required for wash racks.

6.14.6. Concrete Curb. Concrete curbs will be constructed on the perimeter of the wash rack pavement to confine waste water to the wash rack pavement.

6.14.7. Service Points:

6.14.7.1. Army and Air Force. Wash racks are designed with service points incorporated into the pavement floors. These items should be considered for wash rack pavement design. In-pavement structures are listed below. Typical locations for these structures are shown in Figure 6.37.

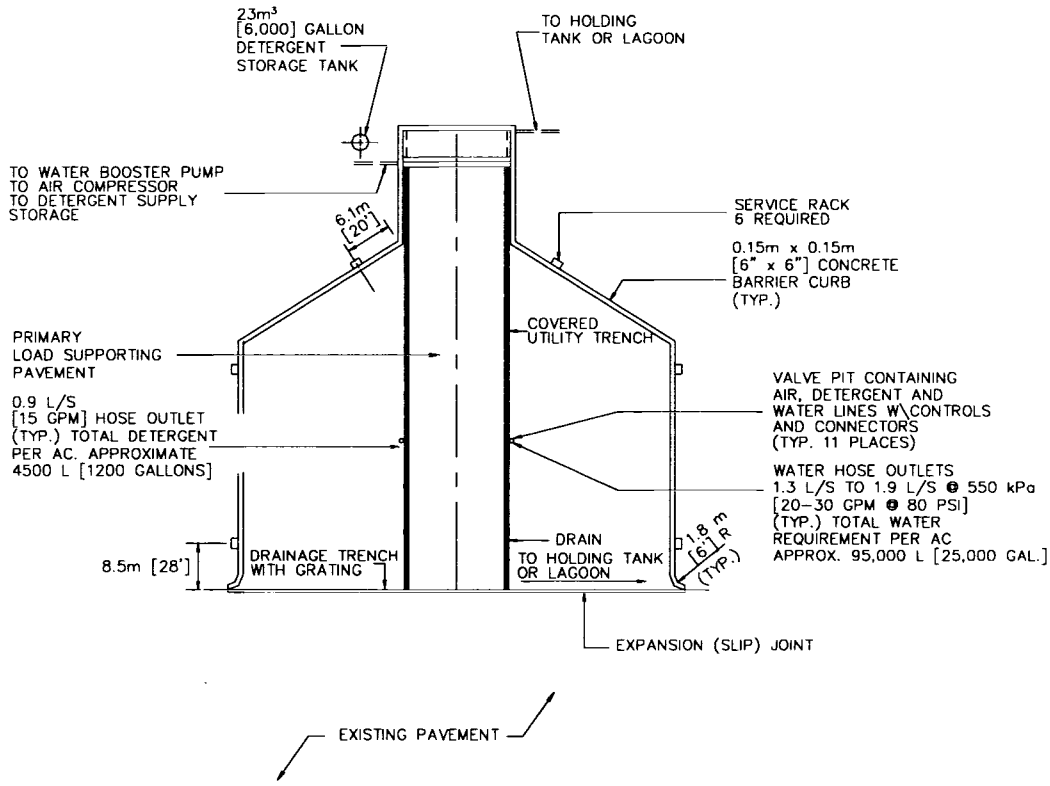
6.14.7.1.1. Valve pits containing air, detergent, and water lines with controls and connectors.

6.14.7.1.2. Water hose outlets.

6.14.7.1.3. Covered utility trench.

6.14.7.1.4. Service Rack.

Figure 6.37. Utilities and In-Pavement Structures.



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6.14.7.2. Navy and Marine Corps. Wash rack service points are required for the Navy and Marine Corps.

6.14.8. Wastewater Collection. Waste drains will be located in the center of the wash rack pavement to collect wash water contaminates (oils, alkaline, salts, and hydroxicles) generated from aircraft washing operations. Off-center waste and trench drains are permitted only where necessitated by the aircraft landing gear configuration or where the off-center drains reduce construction costs or suit existing conditions.

6.14.9. Wastewater Treatment. Sewers drain wastewater from waste drains to a 19 cubic meter [5,000 gallon] separator (holding tank). Due to the wash soap, the tanks will not act as oil water separators. Wastewater collection systems will be designed in accordance with AFM 88-11, *Sanitary and Industrial Wastewater Collection Gravity Sewers and Appurtenances,* and MIL-HDBK-1005/9, *Industrial and Oily Wastewater Control.* In no case will untreated waters be discharged directly into the sanitary sewer. Wastewater will be treated in accordance with the requirements of AFM 88-11 and MIL-HDBK-1005/9.

6.14.10. Utility Control Building. Wash racks are supported by an adjacent utilities control building. The building houses detergent make-up equipment, an air compressor, detergent mixing tank, water heater, utility controls, sanitary facilities for personnel, if required, and storage space for cleaning equipment. A detergent storage tank is located outside of the utilities control building and may be below ground. The utility control building should be located far enough from the wash rack to preclude fire hazards associated with heating and electrical equipment. Design of wash rack support facilities is not a part of airfield geometric design and has not been included in this manual.

6.14.11. Utilities. Aircraft wash racks contain utilities which are not normally considered in airfield geometric design; however, the designer may need to be aware that they are an integral part of the wash rack. Design guidance for these utilities has not been included in this manual. All utilities will emanate from the utility control building. These utilities are:

6.14.11.1. Cold water from base supply.

6.14.11.2. Detergent storage tank (often located in the utility building).

6.14.11.3. Compressed air system.

6.14.11.4. Portable hot water generating system (if required).

6.14.11.5. Electrical system.

6.14.11.6. Portable flood lighting, if night wash of aircraft is required.

6.14.11.7. Fire protection, including water supply.

6.15. Hangar Access Aprons. Hangar access aprons provide access to the hangars from the parking apron, and allow free movement of aircraft to the various hangar maintenance facilities. Hangar access aprons should be provided as a supporting item for each authorized hangar and should be sized for the type of hangar and aircraft to be accommodated.

6.15.1. Dimensions. Generally, hangar access aprons should be as wide as the hangar doors and extend from the edge of the apron to the hangar door. Hangar access apron dimension requirements are summarized in Table 6.5.

Table 6.5. Hangar Access Apron.

Item No.	Item Description	Class A Runway Requirement	Class B Runway Requirement	Remarks
1	Length	30 m [100 ft]	40 m [125 ft]	Army facilities for fixed-wing aircraft.
		40 m [125 ft]		Air Force facilities for fixed-wing aircraft.
		23 m [75 ft]		Army and Air Force facilities for rotary-wing aircraft, except as noted below.
		30 m [100 ft]		Army and Air Force facilities for rotary-wing aircraft, regularly servicing H-53 helicopters.
		15 m [50 ft]		Navy and Marine Corps facilities for fixed and rotary-wing aircraft.
		See Remarks		Access aprons are located between the apron and the front of the hangar. The hangar cannot be located within the apron clearance distance except for USAF facilities (see Table 6.1, Item 15).
2	Width	At least as long as the hangar door width.		Pavement should be sized for type of aircraft, number of hangar bays and location of hangar bays.
3	Grades in Direction of Drainage	Min ±0.5% Max ±1.5%		Avoid grades that prevent aircraft tail from clearing hangar doors.
		Min -1.0% first 15 m [50 ft] from hangar		NFPA 415 requires aircraft fueling ramps to slope away from terminal buildings, aircraft hangars, aircraft loading walkways, or other structures.
4	Width of Shoulders (Total Width Including Paved and Unpaved)	7.5 m [25 ft]		
5	Width of Paved Shoulders	Not Required		
6	Sight Distance	NA (See Note 1.)		
7	Transverse Grade of Unpaved Shoulder	(a) 40 mm [1-½"] dropoff at edge of pavement. (b) 5% slope first 3 m [10 ft] from edge of pavement. (c) Beyond 3 m [10 ft] from edge of pavement, 2.0% min, 4.0% max.		

8	Wingtip Clearance to Fixed or Mobile Obstacles	7.6 m [25 ft]	Along length of access apron. Wingtip clearance at entrance to hangar may be reduced to 1.52 m [5 ft].
9	Grade (Area Between Taxiway Shoulder and Taxiway Clearance Line)	Max 10.0% (See note 2.)	

Notes:
1. NA = not applicable
2. Bed of channel may be flat.
3. Metric units apply to new airfield construction and where practical modification to existing airfields and heliports, as discussed in paragraph 1.4.4.
4. The criteria in this manual are based on aircraft specific requirements and are not direct conversions from inch-pound (English) dimensions. Inch-pound units are included only as a reference to the previous standard.
5. Airfield and heliport imaginary surfaces and safe wingtip clearance dimensions are shown as a direct conversion from inch-pound to SI units.

6.15.2. Grades for Aircraft Fueling Ramps. Grades for hangar access ramps on which fueling of aircraft will occur must slope away from aircraft hangars in accordance with National Fire Protection Association (NFPA) Standard 415, *Aircraft Fueling Ramp Drainage*.

6.15.3. Grades for Aircraft Access into Hangars. The grades in front of the hangar must allow access into the hangar. When aircraft are backed into the hangar, a tug vehicle pushes the aircraft in, tail first. Due to the location of the aircraft gear and the slope of the hangar access apron, the tail of the aircraft may be higher than the top of the hangar door. The hangar access apron grades may require adjustment to allow the aircraft tail to clear the hangar door.

6.16. Taxiing Characteristics on Aprons for Rotary-Wing Aircraft:

6.16.1. Hoverlane/Taxilane. Taxi routes across parking aprons are marked to provide safe passage of the aircraft across the apron. A hoverlane is a designated aerial traffic lane used exclusively for the movement of helicopters. A taxilane is a designated ground traffic lane.

6.16.1.1. Army Facilities. At Army Facilities, the hoverlane/taxilane widths are fixed distances, based on type of aircraft, as noted in Table 6.2.

6.16.1.2. Air Force Facilities. At Air Force Facilities, the hoverlane/taxilane width is based on the rotor diameter of the largest helicopter generally using the apron.

6.17. Fixed-Wing and Rotary-Wing Grading Standards:

6.17.1. Fixed-Wing Aircraft. Grading standards for fixed-wing parking aprons and shoulders are presented in Table 6.1. All parking aprons, pads and miscellaneous pavements should follow these grading standards unless a particular mission requirement, such as a power check pad, dictates otherwise. Surface drainage patterns with numerous or abrupt grade changes can produce excessive pavement flexing and structural damage of aircraft and should be avoided.

6.17.2. Rotary-Wing Aircraft. Grading standards for rotary-wing parking aprons are presented in Table 6.2 for Army facilities and AFH 32-1084, *Standard Facility Requirements Handbook* for Air Force facilities.

6.17.3. Grades for Aircraft Fueling Ramps. Grades for ramps on which fueling of aircraft will occur should be in accordance with National Fire Protection Association (NFPA) Standard 415, *Aircraft Fueling Ramp Drainage*.

6.18. Shoulders. Paved shoulders are provided around the perimeter of an apron to protect against jet blast and FOD, to support blast deflectors, for support equipment storage, and to facilitate drainage. Criteria for apron shoulders are presented in Table 6.1 for fixed-wing aprons, Table 6.2 for Army rotary-wing aprons, and AFH 32-1084 for Air Force rotary-wing facilities. To prevent storm water from ponding on the outside edge of the shoulder, the turf adjacent to the paved shoulder should be graded to facilitate drainage.

6.19. Miscellaneous Apron Design Considerations. In addition to the apron design criteria, consideration should be given to providing room for support structures, equipment, and facilities.

6.19.1. Jet Blast Deflectors. Jet blast deflectors will substantially reduce the damaging effects of jet blast on structures, equipment, and personnel, as well as the related noise and fumes associated with jet engine operation. Additional information on jet blast deflectors is found in Attachment 9.

6.19.2. Line Vehicle Parking. Line vehicle parking areas are provided for parking of mobile station-assigned and squadron-assigned vehicles and equipment. Additional information on line vehicle parking is found in Attachment 13.

6.19.3. Utilities. The following items are normally found on parking aprons. These items are not a part of airfield geometric design. However, the designer needs to be aware that they are an integral part of a parking apron and should make provisions for them accordingly.

6.19.3.1. Storm water runoff collection system including inlets, trench drains, manholes, and pipe.

6.19.3.2. De-icing facilities and de-icing runoff collection facilities.

6.19.3.3. Apron illumination.

6.19.3.4. Fire hydrants.

6.19.3.5. Refueling facilities.

6.19.3.6. Apron edge lighting.

6.20. Jacking Considerations. Cribbing is required during jacking of aircraft on aprons during maintenance procedures. Supporting aircraft on jacks without cribbing can create stresses that exceed that which apron pavements were designed to support and can cause pavement failure. Aprons and hangar floors should not be designed to resist jacking forces applied without cribbing.