BY ORDER OF THE COMMANDER
US AIR FORCES IN EUROPE (USAFE)

UNITED STATES AIR FORCES IN EUROPE
INSTRUCTION 32-1007

2 OCTOBER 2012

Civil Engineering

AIRFIELD AND HELIPORT PLANNING AND DESIGN

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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RELEASABILITY: There are no releasability restrictions on this publication.

OPR: HQ USAFE/A7PPP

Certified by: HQ USAFE/A7P
(Col Richard Jarvis)

Supersedes: USAFEI32-1007, 23 June 2005

Pages: 181

This publication implements Air Force Policy Directive (AFPD) 32-10, *Installations and Facilities*. This instruction provides standardized airfield, heliport and airspace criteria for the geometric layout, design, and construction of runways, helipads, taxiways, aprons, and related permanent facilities to meet sustained operations in the European theater. It applies to United States Air Forces in Europe (USAFE). Host nation, International Civil Aviation Organization (ICAO), North Atlantic Treaty Organization (NATO), and Standardization Agreements (STANAGS) and is consolidated in this document. **This publication does not apply to the Air National Guard (ANG) and the Air Force Reserve Command (AFRC) and their units.** Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using the Air Force (AF) Form 847, *Recommendation for Change of Publication*; route AF Forms 847 from the field through the appropriate functional's chain of command. Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with Air Force Manual (AFMAN) 33-363, *Management of Records* and disposed of in accordance with the Air Force Records Information Management System (AFRIMS) Records Disposition Schedule (RDS) located at: **https://www.my.af.mil/gcss-af61a/afrims/afrims/**. See **Attachment 1** for glossary of references and supporting information.

SUMMARY OF CHANGES

This publication has been substantially revised and must be completely reviewed to reflect United States Air Force (USAF) airfield criteria, found in Unified Facilities Criteria (UFC) 3-260-01, *Airfield and Heliport Planning and Design*; ICAO Standards Annex 14, *Aerodrome*

Design and Operations; STANAG 7174, Edition 1, *Airfield Clearance Planes*; German Nachrichten für Luftfahrer (NfL) 191/99, 327/01, and 328/01; German Air Traffic Act Permits (ATAP); and NATO criteria into a common document for USAFE.

1. Changes include a complete update to the following Chapters: **Chapter 1**, "General Requirements", **Chapter 3**, "Runways (fixed-wing) and Imaginary Surfaces", **Chapter 5**, "Taxiways",**Chapter 6**, "Aprons and Pavements", **Attachment 2**, "USAFE Airfield Waiver Program", **Attachment 3**, "Operational Risk Management (ORM) for Airfield Obstructions and Waiver Requests", **Attachment 4**, "Land Use Compatibility Guidelines for Clear Zone and USAFE Priority Areas (PAs)", **Attachment 5**, "Civil Engineer's Role in the Air Traffic System Evaluation Program (ATSEP)", **Attachment 6**, "Airfield Criteria and Waiver Processing Procedures for German Main Operating Bases (MOBs)".

2. Deletions include the following former attachments. The criteria for these topics can be found in UFC 3-260-01, *Airfield and Heliport Planning and Design,* and other sources referenced throughout this instruction. Deviations from Criteria for Air Force Airfield Support Facilities, Navigational Aids (NAVAIDS) Design and Support, Guidelines for Establishing the Building Restriction Line at USAFE Bases, Airfield Obstruction Reduction Program, Wind Coverage Studies, Aircraft Characteristics for Airfield-Heliport Design and Evaluation, Jet Blast Effects and Jet blast Deflectors, Explosives On or Near Airfields, Compass Calibration Pad (CCP) Magnetic Survey, Tie Downs, Mooring, and Grounding Points, Construction Phasing Plan and Operational Safety On the Airfield During Construction, Air Traffic Control Tower (ATCT) Siting Criteria, Aircraft and Trim Pad and Thrust Anchor for Up To 267 KiloNewtons (60,000 lbs) Thrust. 3. All other chapters remain unchanged or have been replaced with specific references to other appropriate guidance documents.

Chapter 1

GENERAL REQUIREMENTS

1.1. Purpose. This instruction provides standardized airfield, heliport, and airspace criteria for the geometric layout, design, and construction of runways, helipads, taxiways, aprons, and related permanent facilities to meet sustained operations.

1.2. Scope. This instruction prescribes dimensional and geometric layout criteria for safe standards for airfields, landing zones (LZ), heliports and helipads, related permanent facilities, as well as the navigational airspace surrounding these facilities. Criteria in this instruction, which are a compilation of North Atlantic Treaty Organization (NATO), International Civil Aviation Organization (ICAO), and Department of Defense (DoD) Unified Facility Code (UFC) 3-260-01, *Airfield and Heliport Planning and Design* criteria, pertain to United States Air Forces in Europe (USAFE) airfields within the European Command (EUCOM) Area of Responsibility (AOR). Criteria within this instruction should be applied to the maximum extent practicable. If a written agreement exists between a host nation and DoD that requires application of other standards, those standards shall apply. Procedures for pavement structural design and pavement marking and lighting are beyond the scope of this instruction.

1.2.1. **USAFE Host Nation Agreement Policy.** If a USAFE airfield follows a host nation agreement that stipulates standards other than standards in this instruction, the installation shall maintain official and written documentation of that agreement. Written agreements shall be furnished to USAFE/A7 upon request. Failure to produce written documented proof of criteria in violation of these standards shall result in non-compliance of that airfield for each standard within this instruction that is not met.

1.2.2. **Terminal Instrument Procedures (TERPS or PANSOPS).** In addition to a local Terminal Instrument Procedures (TERPS) review, modifications to existing facilities, temporary construction, airfield surface modifications, maintenance or construction requiring equipment on or near the airfield flying environment, and construction of new facilities must be closely coordinated with Air Operations Command and Control (HQ USAFE/A3Y) to determine the impact to existing and planned instrument approach and departure procedures. The criteria in this instruction do not address instrument flight procedures. TERPS evaluations and processes are described in Air Force Instruction (AFI) 11-230, *Instrument Procedures*; Air Force Manual (AFMAN) (I) 11-226, *United States Standard for Terminal Instrument Procedures (TERPS).* TERPS criteria shall be considered when designing or modifying airfields and facilities on airfields that are used under Instrument Flight Rules (IFR). For main operating bases (MOBs) in Germany, a PANSOPS review by host nation air forces Amt für Flugsicherung der Bundeswehr (AFSBw) is required for new construction of facilities that might impact the Air Traffic Act Permit (ATAP).

1.2.3. **Objects Affecting Navigable Airspace.** Modifications to existing facilities and construction of new facilities must consider navigable airspace and may require coordination with host nation civil, military or construction authorities. The criteria for determining obstructions to navigable airspace have been identified in this instruction. The designer must consult this instruction during the design process to identify obstructions to airspace. Designers will coordinate with the airfield manager (AFM) and safety officer, and then host

nation civil, military or construction authorities, as required. If the criteria in this instruction are more stringent than host nation criteria, this instruction should be used to the maximum extent practical.

1.2.4. **Navigational Aids (NAVAIDS) and Lighting.** Navigational Aids (NAVAIDS) and airfield lighting are integral parts of an airfield and must be considered in the planning and design of airfields and heliports. NAVAID location, airfield lighting, and the grading requirements of a NAVAID must be considered when locating and designing runways, taxiways, aprons and other airfield facilities. Refer to UFC 3-260-01, Table B16-1 in Appendix B Section 16, *Navigation Aids Design and Support*, for a list of design documents governing NAVAIDS and lighting and the agency where siting and design information can be obtained.

1.2.5. **Vertical/Short Take-off and Landing (V-STOL) Aircraft (V-22 Osprey).** At shore establishments, the V-22 will be considered a fixed-wing aircraft, and the runway planned according to critical field length. If operational requirements allow for reduced loads and a vertical takeoff pad is desired, contact the appropriate agency aviation office that can provide airfield safety waivers. V-22 apron requirements are provided in **Chapter 6**. Information on the V-22 aircraft may be obtained by contacting:

NAVFAC Atlantic Lc Eng 6506 Hampton Blvd Norfolk, VA 23508-	OR	COMNAVAIRSYSCOM 22145 Arnold Circle 1278 Building 404, Suite 101 Patuxent River, MD 20670-1541

1.3. References. **Attachment 1**, *Glossary of References and Supporting Information* contains a list of documents referenced in this instruction.

1.4. Application of Criteria:

1.4.1. **Existing Facilities.** The criteria in this instruction are not intended to apply to existing facilities located or constructed under previous standards. This includes cases where runways may lack paved shoulders or other physical features because they were not previously required or authorized. Existing airfield facilities need not be modified or upgraded to conform to the criteria in this instruction if these facilities meet current mission requirements. If a change in mission necessitates reconstruction, an upgrade to current standards shall be accomplished where practical. Once a facility has reached the end of its useful life, it will not be renovated. The facility must be replaced with a facility that meets the requirements in this instruction. Upgraded facilities must be maintained at a level that will sustain compliance with current standards.

1.4.2. **Modification of Existing Facilities.** When existing airfield facilities are modified, construction must conform to the criteria established in this instruction unless waived in accordance with **paragraph 1.6**. Modified portions of facilities must be maintained at a level that will sustain compliance with current standards. Modification of an existing facility, which alters the exterior dimensions of a facility, must be coordinated with Logistics, Installations and Mission Support Directorate, Programs Division (HQ USAFE/A7P) to determine if an airfield waiver is required. For additional requirements, see **Attachment 2**,

United States Air Forces in Europe (USAFE) Airfield and Airspace Waiver Program, **paragraph A2.1**.

1.4.3. **New Construction.** The criteria established within this instruction apply to all new facility construction unless the appropriate waivers are obtained, as outlined in **Attachment 2**. New facilities must be maintained at a level that will sustain compliance with current standards.

1.4.4. **Metric Application.** Geometric design criteria established in this instruction are expressed in the International System of Units (SI) units. These metric values are based upon aircraft specific requirements rather than direct conversion and rounding. This results in apparent inconsistencies between metric and inch-pound (English) dimensions. For example, 150-foot-wide runways are shown as 46 meters (m), 150-foot-wide aircraft wash racks are shown as 45 m. Runways need the extra meter in width for aircraft operational purposes; wash racks do not. SI dimensions apply to new airfield facilities, and where practical, to modification of existing airfield facilities, unless waived in accordance with **paragraph 1.6**. Inch-pound measurements are included in the tables and figures in this instruction only to permit reference to the previous standards. To avoid changes to existing airfield obstruction maps and compromises to flight safety, airfield and heliport imaginary surfaces and safe wingtip clearance dimensions are shown as a direct conversion from inch-pound to SI units.

1.5. Integration of Security Measures into Design. Protective features such as barriers, fences, lighting, access control, intrusion detection and assessment must be integrated into the airfield planning and design process to minimize problems with aircraft operations and safety requirements. The protective measures should be included in the design based on risk and threat analysis, and should comply with security-related requirements. Detailed discussion of security-related requirements, such as Anti-Terrorism and Force Protection, is beyond the scope of this instruction. Designers should refer to the applicable security regulations in **Table 1.1**. for planning and design guidance.

1.6. Waivers to Criteria. Waivers to the criteria contained in this instruction will be processed in accordance with **Attachment 2**. If a waiver affects instrument approach and departure procedures as defined in TERPS (AFMAN (I) 11-226) or PANSOPS, the DoD Service component processing the waiver must also coordinate its action with the applicable TERPS/PANSOPS approving authority. PANSOPS applies to German MOBs only. Approval authority for PANSOPS review is AFSBw.

1.7. Notice of Construction. Notify your host nation, NATO or ICAO construction authority so an assessment of impact to civil aviation may be performed. For German MOBs, this authority is AFSBw.

1.8. Zoning. Existing facilities should be modified, and new facilities should be sited and constructed in a manner that is compatible with flight operations as defined in Department of Defense Instruction (DoDI) 4165.57, *Air Installation Compatible Use Zone (AICUZ) Program.*

1.9. Construction Phasing Plan. A construction phasing plan, as discussed in UFC 3-260-01, Appendix B, Section 14, *Construction Phasing Plan and Operational Safety on Airfields During Construction*, shall be included in the contract documents. This is a mandatory requirement whether work will be accomplished by contract or in-house (see UFC 3-260-01, Section 14). Also see the procedures for obtaining temporary waivers for construction in **Attachment 2.**

1.10. Associated Design Manuals. The planning and design of airfields and heliports is intricate and may require additional criteria, such as pavement design and pavement marking, not addressed in this instruction. Additional manuals, which the designer/planner may need to consult, are listed in **Table 1.1**.

1.11. Use of Terms. The following terms, when used in this instruction, indicate the specific requirements:

Will, Shall or Must – A mandatory and required action.
Should – A recommended, advisory or desirable action.
May or Can – A permissible action.

Table 1.1. Associated Design Manuals and Regulations.

Pavement Design, General	
USAF	UFC 3-260-02, *Pavement Design for Airfields*
FAA	AC 150/5320-6E, *Airport Pavement Design and Evaluation*
Rigid Pavement Design	
USAF	UFC 3-260-02, *Pavement Design for Airfields*
FAA	AC 150/5320-6E, *Airport Pavement Design and Evaluation*
Flexible Pavement Design	
USAF	UFC 3-260-02, *Pavement Design for Airfields*
FAA	AC 150/5320-6E, *Airport Pavement Design and Evaluation*
Subsurface Drainage	
USAF	UFC 3-230-06A, *Subsurface Drainage*
FAA	AC 150/5320-5C, *Surface Drainage Design*
ICAO	ICAO Annex 14, Vol 1, *Aerodrome Design and Operations*
Airfield Lighting	
USAF	UFC 3-535-01, *Visual Air Navigation Facilities*
USAF	ETL 09-12, *Use of Light-Emitting Diode (LED) Fixtures in Airfield Lighting Systems on Air Force Installations and Expeditionary Locations*
FAA	AC 150/5300-13, *Airport Design*
NATO	BI-MNCD 85-5, *NATO Approved Criteria and Standards for Airfields*
	STANAG 3316, Edition 10 , *Airfield Lighting*
ICAO	ICAO Annex 14, Vol 1, *Aerodrome Design and Operations*
Explosives	
USAF	AFMAN 91-201, *Explosive Safety Standards*
Pavement & Obstruction Marking	

USAF	AFI 32-1042, *Standards for Marking Airfields*
	ETL 04-2, *Standard Airfield Pavement Marking Schemes*
FAA	AC 150/5340-1J, *Standards for Airport Markings*
ICAO	ICAO Annex 14, Vol 1, *Aerodrome Design and Operations*
NATO	STANAG 3158, Edition 8, Day *Marking of Airfield, Runways, and Taxiways*
	STANAG 3346, *Marking and Lighting of Airfield Obstructions, Edition 6*
Subsurface Drainage	
USAF	UFC 3-230-06A, *Subsurface Drainage*
FAA	AC 150/5320-5C, *Surface Drainage Design*
ICAO	ICAO Annex 14, Vol 1, *Aerodrome Design and Operations*
Surface Drainage and Erosion Control Structures	
USAF	AC 150/5320-5C, *Surface Drainage Design*
Theater of Operations	
USAF	USAF ETL 97-9, *Criteria and Guidance for C-17 Contingency Operations on Semi-Prepared Airfields*
	USAF ETL 09-6, *C-130 and C-17 Landing Zone (LZ) Dimensional, Marking, and Lighting Criteria*
Area Lighting	
FAA	IESNA Lighting Handbook, *Illuminating Engineering Society of North America*
Security	
USAF	AFI 31-101, *The Air Force Installation Security Program*
	OPNAVINST 5513.14B, *Physical Security and Loss Prevention*
	MIL HDBK 1013/1, *Design Guidelines for Physical Security of Facilities*
	MIL HDBK 1013/10, *Design Guidelines for Security Fencing, Gates, Barriers and Guard Facilities*
	(U)AR 50-51, *Nuclear Weapons Security (Confidential)*
	AR 190-11, *Physical Security of Arms, Ammunition and Explosives*
	AR 190-51, *Security of Unclassified Army Property (Sensitive and Nonsensitive)*
	DA PAM 190-51, *Risk Analysis for Army Property*
	EUCOM OP ORD 01-01, *Physical Security*
Airbase Planning	
USAF	*Base Comprehensive Planning Handbook, Planning Airbases for Combat Effectiveness*, Headquarters Air Force Center for Engineering and the Environment (HQ AFCEE) December 1993

Chapter 2

AVIATION FACILITIES PLANNING

2.1. Applicability. Aviation facilities planning in United States Air Forces in Europe (USAFE) shall follow the criteria of Chapter 2 of the UFC 3-260-01, *Airfield and Heliport Planning and Design,* with the following variations**:**

2.1.1. **Air Installation Compatible Use Zone (AICUZ) Programs.** AICUZ programs are only required within base boundaries of USAFE installations. Lands outside of the installation boundary are exempt from AICUZ.

2.1.2. **Accident Potential Zones (APZ).** APZ do not apply in USAFE when they extend outside of the installation boundary.

2.1.3. **Environmental Studies.** Section 2-4.3 of the UFC 3-260-01 does not apply. At USAFE installations, environmental studies are conducted in accordance with Air Force Instruction (AFI) 32-7061, *The Environmental Impact Analysis Process*, and USAFE Supplement 1 to AFI 32-7061.

Chapter 3

RUNWAYS (FIXED-WING) AND IMAGINARY SURFACES

3.1. Contents. This chapter presents design standards and considerations for fixed-wing runways and associated imaginary surfaces.

3.2. Requirements. The landing and take-off design considerations for an airfield include mission requirements, expected type and volume of air traffic, traffic patterns such as the arrangement of multidirectional approaches and takeoffs, ultimate runway length, runway orientation required by local wind conditions, local terrain, restrictions due to airspace obstacles or surrounding community, noise impact and aircraft accident potential.

3.3. Runway Classification. Runways are classified as either Class A or Class B, based on aircraft type as shown in **Table 3.1**. This table uses the same runway classification system established by the office of the Secretary of Defense as a means of defining accident potential zones (APZ) for the Air Installation Compatible Use Zone (AICUZ) program. These runway classes are not to be confused with aircraft approach categories and aircraft wingspan in other Department of Defense (DoD), International Civil Aviation Organization (ICAO), North Atlantic Treaty Organization (NATO), or Federal Aviation Administration (FAA) documents, aircraft weight classifications or pavement traffic areas. The aircraft listed provide examples of aircraft that fall into these classifications and may not be all-inclusive.

3.3.1. **Class A Runways.** Class A runways are primarily intended for small light aircraft. These runways do not have the potential or foreseeable requirement for development use by high-performance and large heavy aircraft. Ordinarily, these runways are less than 2,440 meter (m) (8,000 ft) long and have less than 10 percent of their operations that involve aircraft in the Class B category. However, this is not intended to limit the number of C-130 and C-17 operations conducted on any Class A airfield.

3.3.2. **Class B Runways.** Class B runways are primarily intended for high performance and large heavy aircraft, as shown in **Table 3.1**.

3.3.3. **Rotary-Wing and Vertical/Short Take-off and Landing (V-STOL)** Aircraft. Runways for Rotary-wing and V-STOL (V-22) aircraft are not addressed in this chapter. Design standards and considerations for rotary-wing aircraft runways and landing lanes are found in Chapter 4 of the UFC 3-260-01, *Airfield and Heliport Planning and Design*. Information on the design standards and considerations for the V-STOL aircraft may be obtained from:

NAVFAC Atlantic Cl Eng
6506 Hampton Blvd
Norfolk, VA 23508-1278

Table 3.1. Runway Classification by Aircraft Type.

Class A Runways		Class B Runways		
C-1	OV-1	A-4	E-3	RQ-1
C-2	OV-10	A-6	E-4	S-3
C-12	T-3	EA-6B	E-6	SR-71
C-20	T-28	A-10	E-8	T-1
C-21	T-34	AV-8	R/F-4	T-2
C-22	T-41	B-1	F-5	T-6
C-23	T-44	B-2	F-14	T-37
C-26	U-21	B-52	F-15	T-38
C-32	UV-18	C-5	F-16	T-39
C-37	V-22	C-9	F/A-18	T-42
C-38	DASH-7	KC-10	F-22	T-43
E-1	DASH-8	C-17	FB-111	T-45
E-2		C-130	F-117	TR-1
		C-135	JSF (F-35)	U-2
		C-137	P-3	VC-25
		C-141		

Notes:

1. Only symbols for basic-mission aircraft or basic mission aircraft plus type are used. Designations represent entire series. Runway classes in this table are not related to aircraft approach categories, aircraft weight, aircraft wingspan or to pavement design classes or types.

2. These are examples of aircraft, which fall into these classifications and may not be all-inclusive.

3. Rotary aircraft are not addressed in this table.

4. V-22 aircraft is a rotary aircraft, which operates as a rotary-wing aircraft on a Class A runway and operated as either fixed-wing or rotary-wing aircraft on taxiways associated with Class A runways.

5. For unmanned aircraft refer to Engineering Technical Letter (ETL) 09-1: Airfield Planning and Design Criteria for Unmanned Aircraft Systems (UAS)

3.4. Short Fields and Training Assault Landing Zones (LZ). Short Fields and Training Assault LZs are special use fields. Design criteria are found in AF Engineering Technical Letter (ETL) 09-6, *C-130 and C-17 Landing Zone (LZ) Dimensional, Marking, and Lighting Criteria*, and Chapter 7 of the UFC 3-260-01.

3.5. Runway Systems. Runway systems are selected based on local wind patterns and mission needs.

3.5.1. **Single Runway.** A single runway is the least flexible and lowest-capacity system. The capacity of a single runway system will vary from approximately 40 to 50 operations per

hour under Instrument Flight Rules (IFR) conditions, up to 75 operations per hour under VFR conditions.

3.5.2. **Parallel Runways.** Parallel runways are the most commonly used system for increased capacity. In some cases, parallel runways may be staggered with the runway ends offset from each other and with terminal or service facilities located between the runways. When parallel runways are separated by less than the distance shown in Item 15 of **Table 3.2**, the second runway will increase capacity at the airfield under VFR conditions, but due to the close distance, capacity at the airfield will not be increased under IFR conditions.

3.5.3. **Crosswind Runways.** Crosswind runways may be either the open-V or the intersecting type of runway. The crosswind system is adaptable to a wider variety of wind conditions than the parallel system. When winds are calm, both runways may be used simultaneously. An open-V system has a greater capacity than the intersecting system.

3.6. Runway Orientation and Wind Data. Runway orientation is the key to a safe, efficient and usable aviation facility. Orientation shall be based on an analysis of wind data, terrain, local development, operational procedures and other pertinent data. Procedures for analysis of wind data to determine runway orientation are further discussed in UFC 3-260-01, Appendix B, Section 4, *Wind Coverage Studies*.

Table 3.2. Runways.

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
1	Length	**See Remarks**	**See Remarks**	New or substantially modified runway length will be determined by the Headquarters of the United States Air Forces in Europe (HQ USAFE) for the most critical aircraft in support of the mission.
2	Width	30 m (100 ft)	46 m (150 ft)	Airfields, not otherwise specified.
		N/A	90 m (300 ft)	B-52 aircraft. Air Force Instruction (AFI) 11-202 V3, *General Flight Rules*, allows B-52 aircraft to routinely operate on 60 m (200 ft) wide runways.
3	Total width of shoulders (paved and unpaved)	15 m (50 ft)	60 m (200 ft)	7.5m (Class A) or 30-m (100-ft) wide (Class B) anti-foreign object damage (FOD) shoulder is required for each side of the runway. At minimum, a 3-m (10-ft) wide shoulder must be load bearing.

4	Paved load bearing shoulder width	7.5 m (25 ft)	7.5 m (25 ft)	For AF funded projects. NATO funded projects require a 3 m (10 ft) wide load bearing shoulder.
		N/A	3 m (10 ft)	Airfields designed for Trainer, Fighter and B-52 aircraft. This assumes a 90 m (300 ft) wide runway; otherwise use 7.5 m (25 ft).
5	Longitudinal grades of runway and shoulders	Max 1.0%		Grades may be both positive and negative but must not exceed the limit specified.
6	Longitudinal runway grade changes	No grade change is to occur less than 300 m (1,000 ft) from the runway end	No grade change is to occur less than 900 m (3,000 ft) from the runway end	Where economically feasible, the runway will have a constant centerline gradient from end to end. Where terrain dictates the need for centerline grade changes, the distance between two successive points of intersection (PI) will be not less than 300 m (1,000 ft) and two successive distances between PIs will not be the same. **Note**: slope change between two consecutive slopes should not exceed 1.5%.
7	Rate of longitudinal runway grade changes	Max 0.1% per 30 linear meters (100 linear ft) of runway		Maximum rate of longitudinal grade change is produced by vertical curves having 180 m (600 ft) lengths for each percent of algebraic difference between the two grades.
8	Longitudinal sight distance	Min 1,500 m (5,000 ft) for runways 3,000 m (10,000 ft) and shorter		Any two points 2.4 m (8 ft) above the pavement must be mutually visible (visible by each other) for the distance indicated. For runways shorter than 1,500 m (5,000 ft), height above runway will be reduced proportionally.
		Min half the length of the runway for runways longer than 3,000 m (10,000 ft)		Any two points 3 m (10 ft) above the pavement must be mutually visible (visible by each other) for the distance indicated.
9	Transverse grade of runway	Min 1.0% Max 1.5%		New runway pavements will be centerline crowned. Existing runway pavements with insufficient transverse gradients for rapid drainage should provide increasing gradients when overlaid or reconstructed.

			Slope pavement downwards from centerline of runway. 1.5% slope is optimum transverse grade of runway. Selected transverse grade is to remain constant for length and width of runway, except at or adjacent to runway intersections where pavement surfaces must be warped to match abutting pavements.
10	Transverse grade of paved shoulder	2% Min 2.5% Max	Paved portion of shoulder. Shoulder should be flush with runway surface and slope downward from runway.
11	Transverse grade of unpaved shoulder	(a) 40-mm (1.5-in) drop-off at edge of paved shoulder, +/- 13 mm (0.5 in) (b) 2% Min, 4% Max.	Unpaved Portion of Shoulder. Slope downward from shoulder pavement. For additional information, see **Figure 3.2.**
12	Runway lateral clearance zone	150 m (492 ft)	
			The runway lateral clearance zone's lateral limits coincide with the limits of the primary surface (See **Figure 3.1**). The ends of the lateral clearance zone coincide with the runway ends. The ground surface within this area must be clear of fixed or mobile objects and graded to the requirements of **Table 3.2.**, Items 13 and 14. Measure the zone width perpendicularly from the centerline of the runway and begins at the runway centerline.

			(1) Fixed obstacles include manmade or natural features such as buildings, trees, rocks, terrain irregularities and any other features constituting possible hazards to moving aircraft. Navigational aids (NAVAIDS) and meteorological equipment will be sited within these clearances where essential for their proper functioning. This area needs to be clear of all obstacles except for the permissible deviations noted in UFC 3-260-01, Appendix B, Section 13, *Deviation from Criteria for Air Force Airfield Support Facilities*, provided they are correctly sited.
			(2) Mobile obstacles include parked aircraft, parked and moving vehicles, railroad cars and similar equipment. Taxiing aircraft, emergency vehicles and authorized maintenance vehicles are exempt from this restriction.
			(3) The centerline of a parallel taxiway, including parallel taxiways used as emergency runways, may be located at the lateral clearance distance (thus allowing a portion of the taxiway pavement to be within the primary surface). Ideally parallel taxiways (exclusive of shoulder width) will be located beyond the lateral clearance distances (primary surface). This distance also applies to Alternate Launch Recovery Surface (ALRS) or Emergency Landing Surface (ELS). See **Chapter 5**.
			(4) For Class A runways above ground drainage structures, including head walls, are not permitted within 76.2 m (250 ft) of the runway edge. For Class B runways above ground drainage structures, including head walls are not permitted within 114.3 m (375 ft) of the runway centerline. Drainage slopes of up to a 10 to 1 ratio are permitted for all runway classes, but swales with more gentle slopes are preferred.

			(5) Distance from runway centerline to helipads is discussed in **Table 3.2,** Item 15. Additional reference can be found in Chapter 4 of UFC 3-260-01.
13	Longitudinal grades within runway lateral clearance zone	Max 1.5%	Exclusive of pavement, shoulders and cover over drainage structures. Slopes are to be as gradual as practicable. Avoid abrupt changes or sudden reversals. Rough grade and construct clearance zones to the extent necessary to minimize damage to aircraft in the event of an aircraft running off the runway.
14	Transverse grades within runway lateral clearance zone (in direction of surface drainage)	Min 2%, Max 5% for first 3 m (10 ft) Max 2.5% beyond 3 m (10 ft)	Exclusive of pavement, shoulders and cover over drainage structures. Slopes are to be as gradual as practicable. Avoid abrupt changes or sudden reversals. Rough grade and construct clearance zones to the extent necessary to minimize damage to aircraft in the event of an aircraft running off the runway.
15	Distance between centerlines of parallel runways	210 m (689 ft)	VFR without intervening parallel taxiway between the parallel runways. One of the parallel runways must be a VFR only runway.
		915 m (3,000 ft)	VFR with intervening parallel taxiway.
		760 m (2,493 ft)	IFR using simultaneous operation (Depart-Depart) (Depart-Arrival).
		1035 m (3,396 ft)	IFR using simultaneous approaches.
			For separation distance between fixed wing runways and rotary wing facilities, see Table 4.1 of UFC 3-260-01.
16	Distance between centerlines of runway and parallel taxiway /emergency runway	190 m (623 ft)	NATO Alternate Launch Recovery Surface (ALRS) clearances. USAFE Parallel Taxiway/Emergency Runway

17	Width of USAF Mandatory Zone of Frangibility	300 m (1,000 ft)	Centered on the runway centerline. 150 m (500 ft) on each side of centerline. Items sited within this area must be frangible except those noted in UFC 3-260-01, Appendix B, Section 13.
18	Length of USAF Mandatory Zone of Frangibility	Length is equal to the length of the Clear Zone (see **Table 3.4.** Items 1A and 1B)	Extending outward from the runway threshold. All items sited within this area to the ends of the Clear Zone must be frangible.

NOTES:

1. Geometric design criteria in this instruction are based on aircraft-specific requirements and are not direct conversions from inch-pound (English) dimensions. Inch-pound units are included only to permit reference to the previous standard.

2. Airfield and heliport imaginary surfaces and safe wingtip clearance dimensions are direct conversions from inch-pound to SI units.

3. Metric units apply to new airfield construction and where practical, to modifications to existing airfields and heliports, as discussed in **paragraph 1.4.4.**

3.7. Additional Considerations for Runway Orientation. In addition to meteorological and wind conditions, the following factors must be considered:

3.7.1. **Obstructions.** A specific airfield site and the proposed runway orientation must be known before a detailed survey can be made of obstructions, which affect aircraft operations. Runways should be so oriented that approaches necessary for the ultimate development of the airfield are free of all obstructions.

Figure 3.1. Runway and Primary Surface Boundaries.

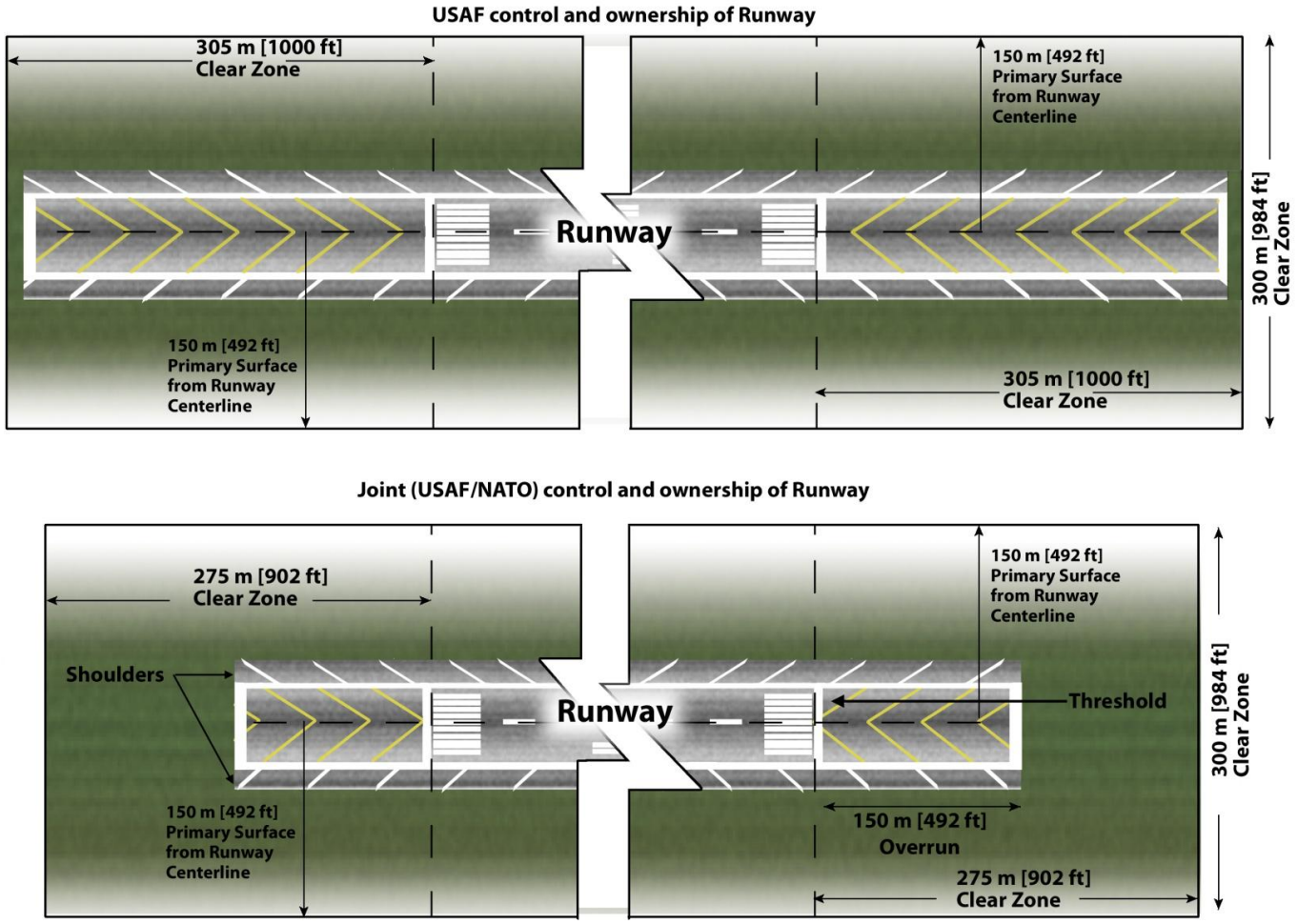
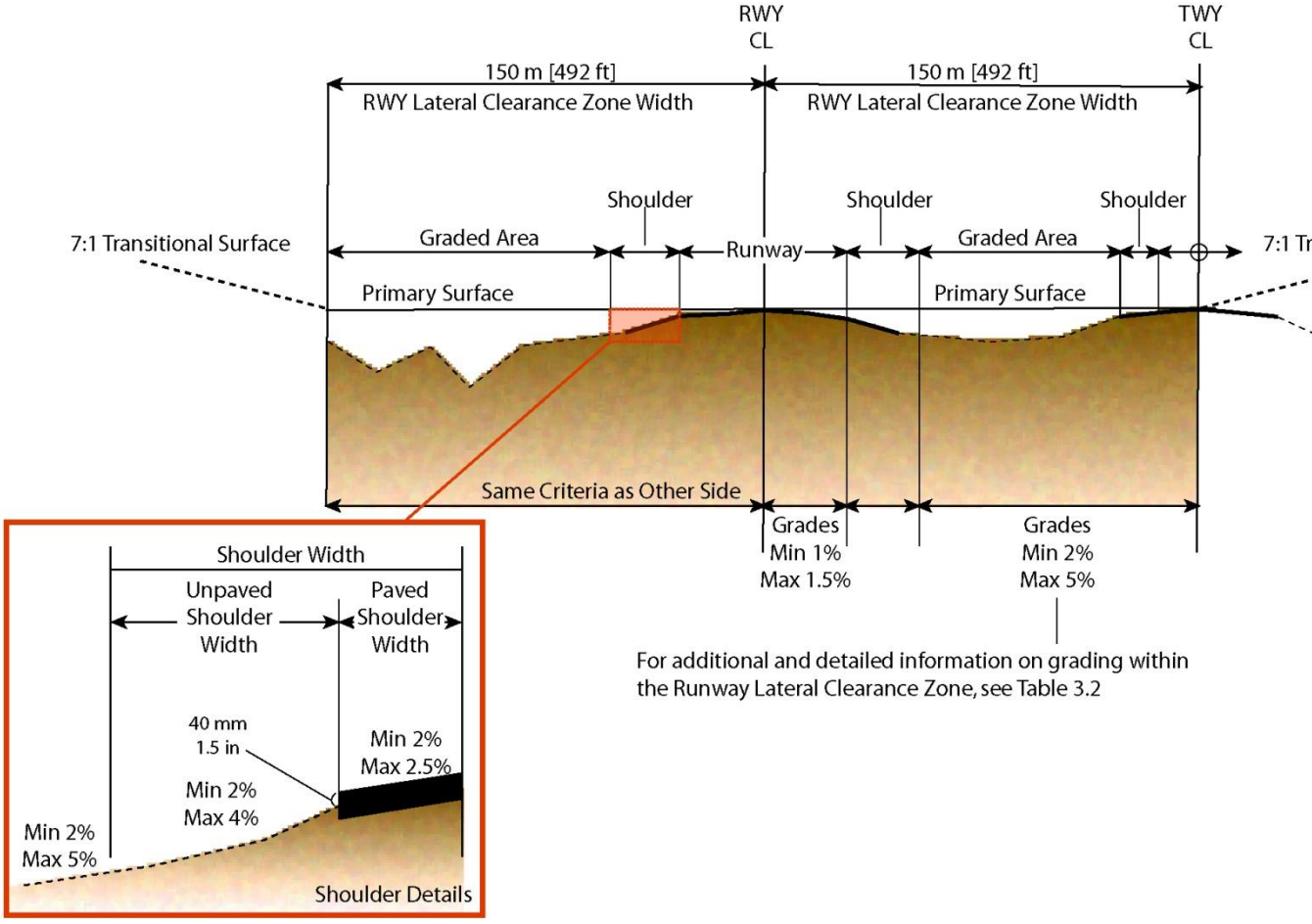


Figure 3.2. Runway and Primary Surface Transverse .



3.7.2. **Restricted Airspace.** Airspace through which aircraft operations are restricted, and possibly prohibited, are shown on sectional and local aeronautical charts. Runways should be so oriented that their approach and departure patterns do not encroach on the restricted areas.

3.7.3. **Built-Up Areas.** Airfield sites and runway alignment will be selected and the operational procedures adopted which will least impact local inhabitants. Additional guidance for facilities is found in DoD Instruction 4165.57, *Air Installation Compatible Use Zone (AICUZ).*

3.7.4. **Neighboring Airports.** Existing aircraft traffic patterns of airfields in the area may affect runway alignment.

3.7.5. **Topography.** Avoid sites which require excessive cuts and fills. Evaluate the effects of topographical features on: airspace zones, grading, drainage and possible future runway extensions.

3.7.6. **Soil Conditions.** Evaluate soil conditions at potential sites to minimize settlement problems, heaving from highly expansive soils, high groundwater problems and construction costs.

3.7.7. **Noise Analysis.** Noise analyses should be conducted to determine noise impacts to local communities and identify noise sensitive areas.

3.8. Runway Designation. Runways are identified by the whole number nearest one-tenth (1/10) the magnetic azimuth of the runway centerline. The magnetic azimuth of the runway centerline is measured clockwise from magnetic north when viewed from the direction of approach. For example, where the magnetic azimuth is 183 degrees, the runway designation marking would be 18; and for a magnetic azimuth of 117 degrees, the runway designation marking would be 12. For a magnetic azimuth ending in the number 5, such as 185 degrees, the runway designation marking can be either 18 or 19. Supplemental letters, where required for differentiation of parallel runways, are placed between the designation numbers and the threshold or threshold marking. For parallel runways, the supplemental letter is based on the runway location, left-to-right, when viewed from the direction of approach: for two parallel runways - "L", "R"; for three parallel runways – "L," "C," and "R."

3.9. Runway Dimensions. The following paragraphs and tables present the design criteria for runway dimensions at all aviation facilities except Short Fields and Training Assault LZs.

3.9.1. **Runway Dimension Criteria, Except Runway Length**. **Table 3.2** presents all dimensional criteria, except runway length, for the layout and design of runways used primarily to support fixed-wing aircraft operations.

3.9.2. **Runway Length Criteria.** HQ USAFE will determine the length of new or substantially modified Class A and Class B runways.

3.9.3. **Layout**. Typical sections and profiles for runways and the associated airspace surfaces are in **Figures 3.1 through 3.11**

3.10. Shoulders. Unprotected areas adjacent to runways and overruns are susceptible to erosion caused by jet blast. Shoulders reduce the probability of serious damage to an aircraft to a minimum in the event that the aircraft runs off the runway pavement. The shoulder width, shown in Item 3 of **Table 3.2**, includes both paved and unpaved shoulders. Paved shoulders are required adjacent to all runways. The minimum paved shoulder width, shown in **Table 3.2**, allows the runway edge lights to be placed within the paved portion of the shoulder and to reduce foreign object damage (FOD) to aircraft. The unpaved shoulder should be graded to prevent water from ponding on the adjacent paved area (shoulder and runway). The drop-off next to the paved area prevents turf (which may build up over the years) from ponding water. Manholes, hand holes, and drainage structures constructed within these areas should, at a minimum, be designed as provided in this section (**NOTE**: These requirements do not apply to projects already under design prior to the publication date of this manual). Beyond the shoulders, sub-grade structures are not designed to support aircraft wheel loads. The top surface of foundations, manhole covers, hand hole covers, and frames should be flush with the grade. Maintenance action is required if the drop-off at the top edge of the foundation exceeds 76 millimeters (mm) (3 inches (in)).

3.10.1. **Paved Shoulder Areas.**

3.10.1.1. For structures with their shortest span equal to or less than 0.6 m (2 ft), design based on a wheel load of 34,000 kilograms (kg) (75,000 pounds (lb)) at a contact pressure of 1,724 kilopascals (kPa) (250 lb per square inch (psi)).

3.10.1.2. For structures with their shortest span greater than 0.6 m (2 ft), design based on the maximum number of wheels that can fit onto the span, considering the most critical assigned aircraft operating at its maximum gross weight. In no case, however, should the design be based on computed stress conditions less than those created by a wheel load of 34,000 kg (75,000 lb) at a contact pressure of 1,724 kPa (250 psi).

3.10.2. **Unpaved Shoulder Areas.**

3.10.2.1. For structures with their shortest span equal to or less than 0.6 m (2 ft), design based on a wheel load of 22,667 kg (50,000 lb) at a contact pressure of 1,724 kPa (250 psi).

3.10.2.2. For structures with their shortest span greater than 0.6 m (2 ft), design based on the maximum number of wheels that can fit onto the span, considering the most critical assigned aircraft operating at its maximum gross weight. In no case, however, should the design be based on computed stress conditions less than those created by a wheel load of 22,667 kg (50,000 lb) at a contact pressure of 1,724 kPa (250 psi).

3.11. Runway Overruns. Runway overruns keep the probability of serious damage to an aircraft to a minimum in the event that the aircraft runs off the runway end during a takeoff or landing, or lands short during a landing. Overruns are required for the landing and takeoff areas. **Table 3.3** shows the dimensional requirements for overruns. Additionally, manholes, hand holes, and drainage structures constructed within this area should, at a minimum, be designed as provided in this section. (**NOTE**: These requirements do not apply to projects already under design prior to the publication date of this instruction.) The top surface of foundations should be flush with the grade. Sub-grade structures are not designed to support aircraft wheel loads beyond the paved and unpaved areas of the overrun. Maintenance action is required if the drop-off at the top edge of the foundation exceeds 76 mm (3 in).

Table 3.3. Overruns.

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
1	Length	60 m (200 ft)	300 m (1,000 ft)	Airfields where USAF controls/owns the entire clear zone (USAFE Overrun) The USAFE overrun dimensions must be applied whenever land is available and the USAF controls/owns the entire clear zone.

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
		60 m (200 ft)	150 m (492 ft)	Airfields where USAF does not control/own the entire clear zone. NATO runways equipped with overrun aircraft arresting systems must have an overrun of at least 290 m (950 ft) for minimal cable runout. For installations with clear zones containing land not under USAF control, the NATO clear zone can be applied. Although, the USAFE overrun shall be applied whenever possible.
2	Total Width of Overrun (Paved and Unpaved)	Sum of runway and shoulder widths		
3	Paved Overrun Width	Same as width of runway		Center overrun pavement along the extended runway centerline
4	Unpaved Width of Overrun	Same width as runway shoulder		The outside edges of the overrun equal in width to the runway shoulder, is graded as overrun, but not paved.
5	Longitudinal Centerline Grade	Same as last 300 m (1,000 ft) of runway: Max 1.25%	First 90 m (300 ft) same as last 900 m (3,000 ft) of runway. Remainder: Max 1.25%	To avoid abrupt changes in grade between the first 90 m (300 ft) and remainder of overrun of a Class B runway, the maximum change of grade is 0.1% per 30 linear meters (100 linear feet). See **Figure 3.3.**
6	Transverse Grade	Min 1.0% Max 1.5%		From centerline of overrun. Transition from the runway and runway shoulder grades to the overrun grades to be made within the first 45 m (150 ft) of overrun.
NOTE: Geometric design criteria in this instruction are based on aircraft-specific requirements and are not direct conversions from inch-pound (English) dimensions. Inch-pound units are included only to permit reference to the previous standard.				

3.11.1. **The Paved Portion of the Overrun.**

3.11.1.1. For structures with their shortest span equal to or less than 0.6 m (2 ft), design based on a wheel load of 34,000 kg (75,000 lb) at a contact pressure of 1,724 kPa (250 psi).

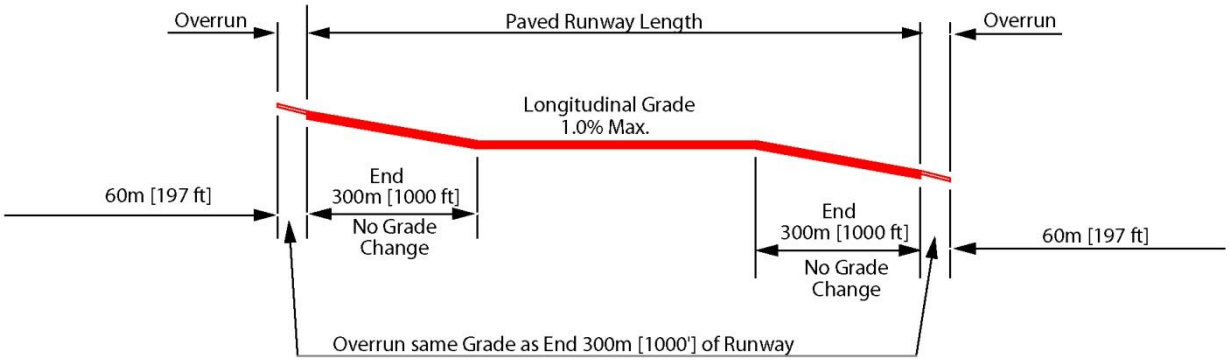
3.11.1.2. For structures with their shortest span greater than 0.6 m (2 ft), design based on the maximum number of wheels that can fit onto the span, considering the most critical assigned aircraft operating at its maximum gross weight. In no case, however, should the design be based on computed stress conditions less than those created by a wheel load of 34,000 kg (75,000 lb) at a contact pressure of 1,724 kPa (250 psi).

3.11.2. **The Unpaved Portion of the Overrun.**

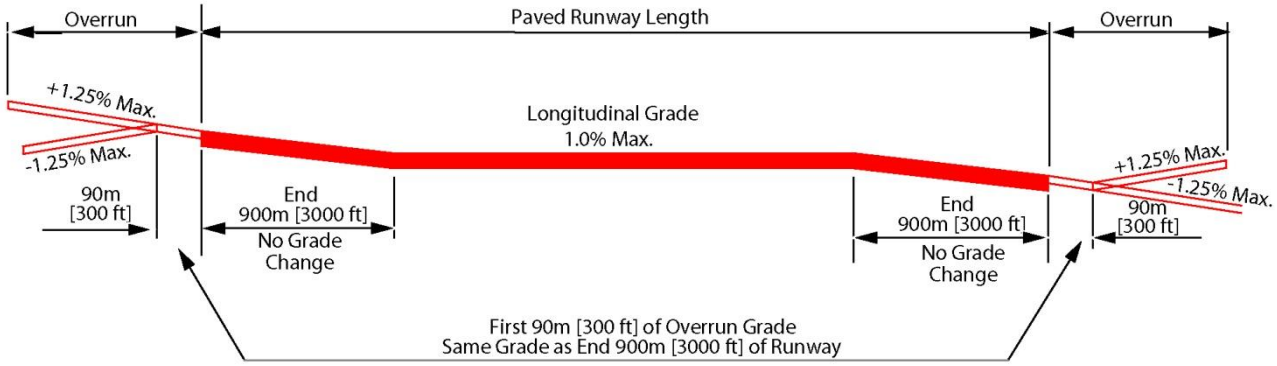
3.11.2.1. For structures with their shortest span equal to or less than 0.6 m (2 ft), design based on a wheel load of 22,667 kg (50,000 lb) at a contact pressure of 1,724 kPa (250 psi).

3.11.2.2. For structures with their shortest span greater than 0.6 m (2 ft), design based on the maximum number of wheels that can fit onto the span, considering the most critical assigned aircraft operating at its maximum gross weight. In no case, however, should the design be based on computed stress conditions less than those created by a wheel load of 22,667 kg (50,000 lb) at a contact pressure of 1,724 kPa (250 psi). Overrun profiles are shown in **Figure 3.3** and an overrun layout is shown in **Figures 3.5 and 3.6**

Figure 3.3. Runway and Overrun Longitudinal Profile.



CLASS A RUNWAY
N.T.S.



CLASS B RUNWAY
N.T.S.

3.12. Runway Clear Zones. Runway Clear Zones are areas on the ground, located at the ends of each runway. They possess a high potential for accidents and their use is restricted to be compatible with aircraft operations. In USAFE, Clear Zones are only delineated and protected when they lie within the installation perimeter. **Table 3.4** shows the dimensional requirements for runway clear zones. Layout of the clear zones is shown in **Figures 3.4 through 3.6**

3.12.1. **The Mandatory Frangibility Zone (MFZ)**. The MFZs includes the Clear Zone and Primary surface. Items that must be sited in the clear zone or primary surface within the base boundary due to their function must be made frangible, see UFC 3-260-01, Appendix B, Section 13. Items that cannot be made frangible (such as highway guard rails), but must be located within this area for urgent and compelling reasons, must be waived by HQ USAFE before they are constructed. This is to ensure all alternatives are considered before non-frangible structures are sited within this area, see **Figures 3.1 and 3.13**

Table 3.4. Clear Zone.

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
1A	Length	305 m (1,000 ft)	305 m (1,000 ft)	Airfields where USAF controls/owns the entire clear zone (USAFE Clear Zone). The USAFE Clear Zone dimensions are to be applied whenever land is available and USAFE controls/owns the entire clear zone. Measured along the extended runway centerline beginning at the runway end, see **Note 2**. Clearing and grading of the entire area is required. For grading requirements, see **Table 3.4.,** Items 3 and 4**.**
1B		275 m (902 ft)	275 m (902 ft)	Airfields where **USAF does not control/own** the entire clear zone. NATO runways equipped with overrun aircraft arresting systems must have an overrun of at least 290 m (950 ft) for minimal cable runout. For installations with clear zones containing land not under USAF control, the NATO clear zone can be applied. However, the USAFE Clear Zone shall be applied whenever practical. Measured along the extended runway centerline beginning at the runway end, see **Note 2**. Clearing and grading of the entire area is required. For grading requirements, see **Table 3.4.,** Items 3 and 4**.**
2	Width of Clear Zone (adjacent to the runway)	300 m (984 ft)	300 m (984 ft)	Clearing and grading of the entire area is required. For grading requirements, see **Table 3.4.,** Items 3 and 4.
		See Remarks		Width of the clear zone is centered on and measured at right angles to the extended runway centerline. Exceptions to these widths are permissible based on individual service analysis of highest APZ for specific runway use and acquisition constraints.

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
3	Longitudinal grade of area to be graded	Max 5.0% (downward)		The area to be graded is 300 m (1,000 ft) in length by the established width of the primary surface. Grades are exclusive of the overrun, but are to be shaped into the overrun grade. The maximum longitudinal grade change cannot exceed + 2.0 % per 30 m (100 ft). Grade restrictions are also exclusive of other pavements and shoulders. Where other pavements cross the graded area, comply with grading requirements for the specific pavement design (tow ways, taxiways, or aprons as applicable), but hold grade changes to the minimum practicable to facilitate drainage. The graded area is to be cleared and grubbed of stumps and free of abrupt surface irregularities, ditches and ponding areas. No aboveground structures (see **Note 3**) objects or roadways are permitted in the area to be graded (except air traffic control (ATC)) controlled service roads to arresting gear or NAVAIDs), but gentle swales, subsurface drainage, covered culverts and underground structures are permissible. No part of either area must penetrate the approach or departure clearance surfaces. For policy regarding permissible facilities, geographical features and land use in the remainder of the clear zone, refer to guidance furnished by HQ USAFE, and DoD Air Installations Compatible Use Zone (AICUZ) guidelines for Clear Zones and USAFE Priority Areas (PAs), see **Attachment 4**, *Land Use Combatability Guidelines for Clear Zone and USAFE Priority Areas (PAs)*

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
4	Transverse grade of area to be graded (in direction of surface drainage prior to channelization)	Min 2.0% Max 5.0%		See Remarks for Item No. 3 above.
5	Width of USAF Mandatory Zone of Frangibility	300 m (984 ft)		150 m on each side of the extended center line. All items sited within this area must be frangible, see UFC 3-260-01, Appendix B, Section 13.
6	Length of USAF Mandatory Zone of Frangibility	Lesser of 305 m (1,000 ft) from runway end and the installation boundary		Centered on the extended runway centerline. All items sited within this area must be frangible, see UFC 3-260-01, Appendix B, Section 13.

NOTES:

1. For the definition of runway end, refer to the glossary.

2. Essential NAVAID structure exceptions are discussed in UFC 3-260-01, Appendix B, Section 13.

3. Airfield and heliport imaginary surfaces and safe wingtip clearance dimensions are direct conversions from inch-pound to SI units.

4. Metric units apply to new airfield construction, and where practical, to modifications to existing airfields and heliports, as discussed in **paragraph 1.4.4.**

Figure 3.4. Clear Zone Transverse .

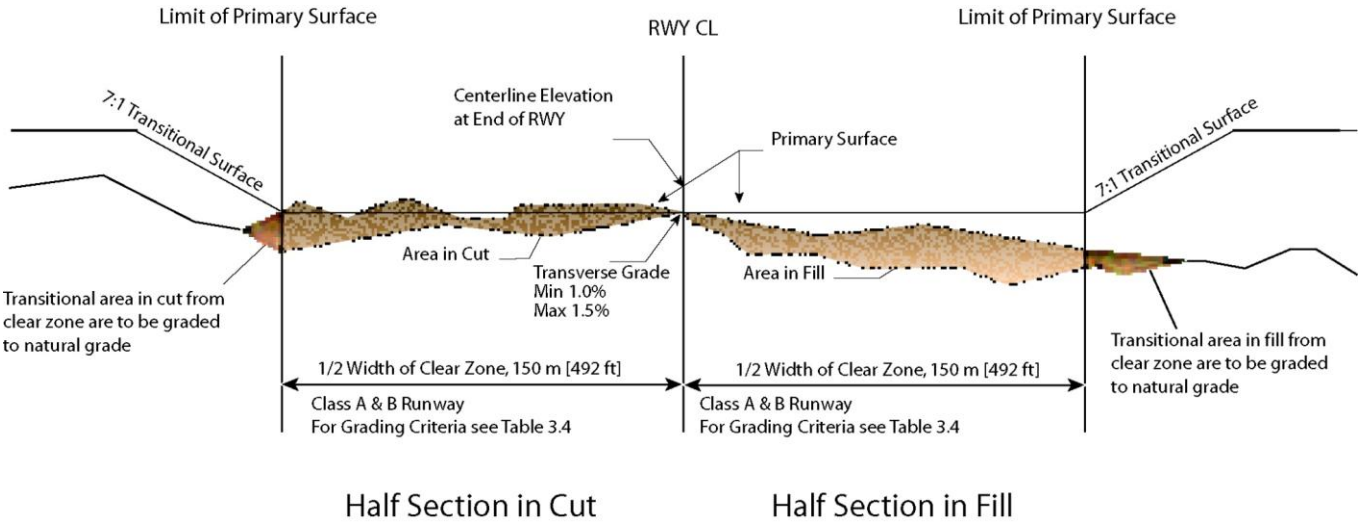


Figure 3.5. Class B Runway Primary Surface End and Clear Zone Details.

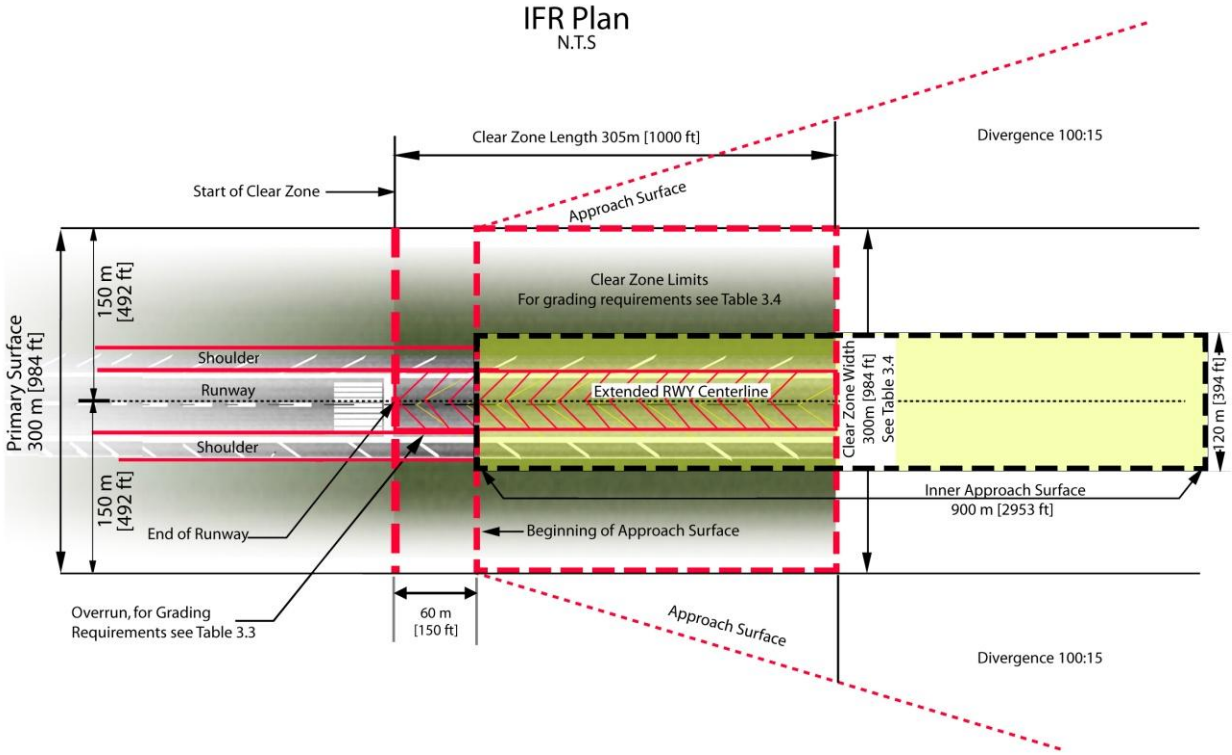
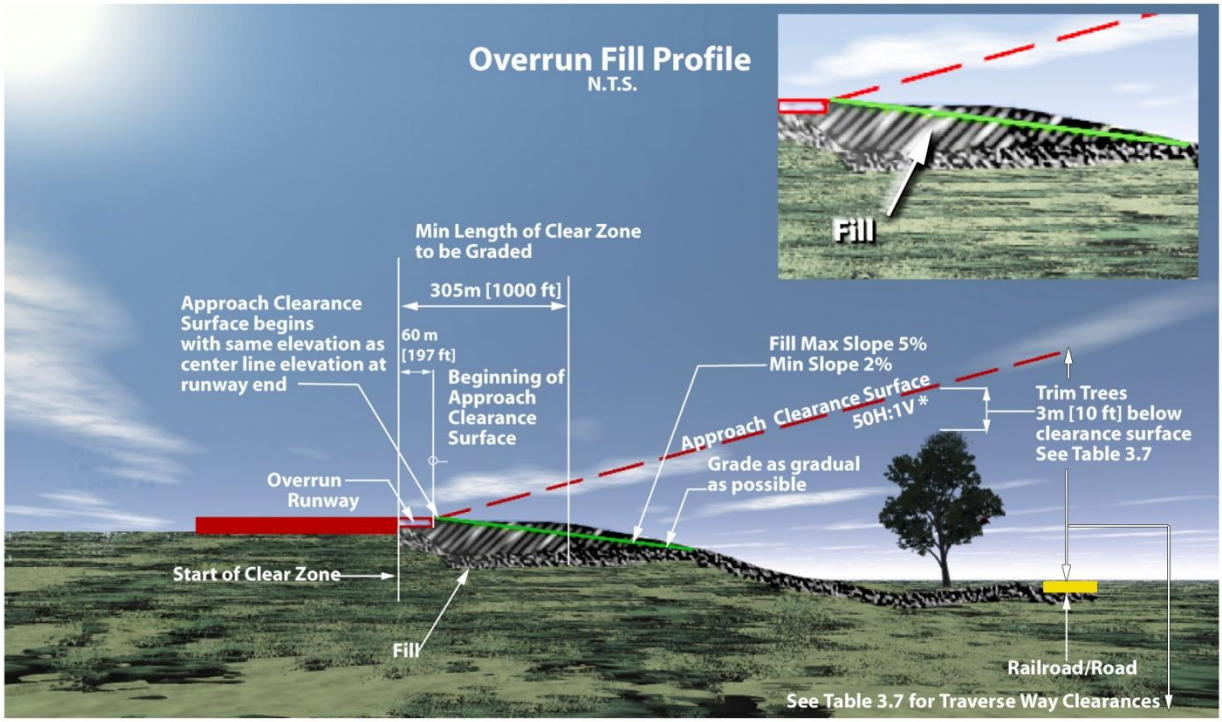
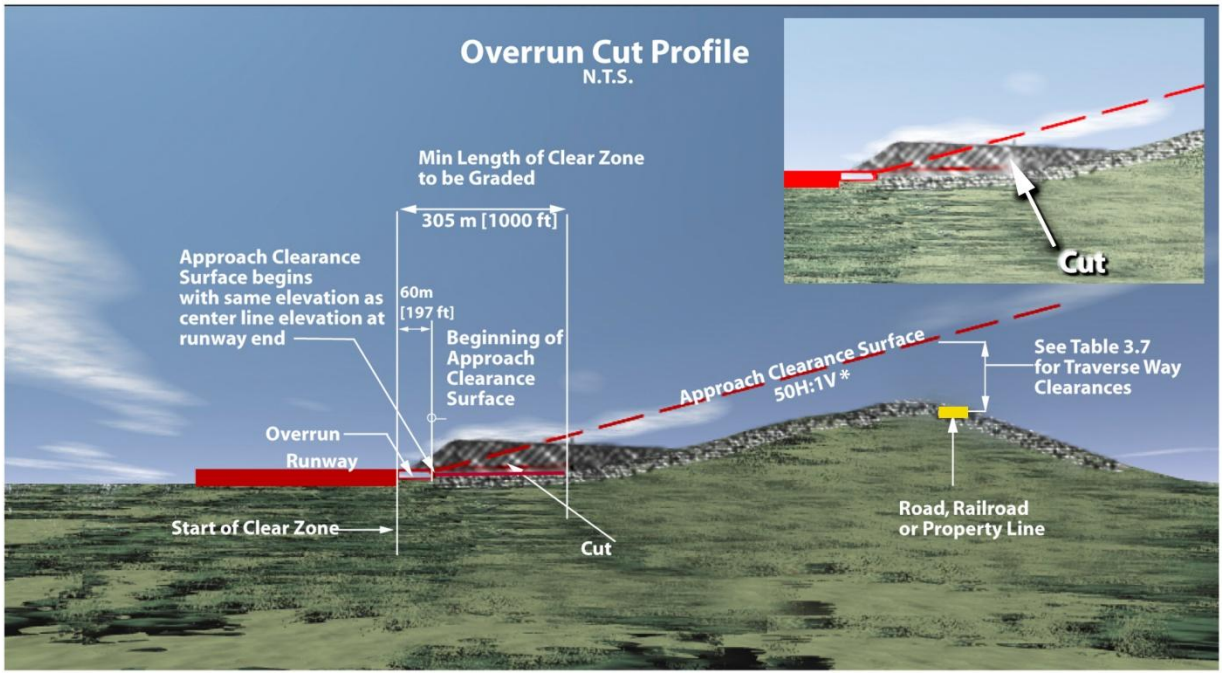


Figure 3.6. Class B IFR Runway End and Clear Zone Details.





3.13. Accident Potential Zones (APZs). APZs are areas on the ground located beyond the clear zone of each runway. They possess a potential for accidents, and their use is restricted in accordance with DoDI 4165.57. **Table 3.5** shows the dimensional requirements for runway APZs. Land use guidelines within the clear zone and APZs are provided in AFI 32-7063, *Air*

Installation Compatible Use Zone (AICUZ) Program, and AFH 32-7084, *AICUZ Program Manager's Guide*. However, APZs in Europe are not required outside of the installation boundary and only need to be managed within the fenceline.

Table 3.5. Accident Potential Zone (APZ).

Item Description	Class A Runway	Class B Runway	
	Requirement		Remarks
APZ Length	762.00 m (2,500 ft) or to the installation boundary, whichever is closer to the end of the clear zone	1,524.00 m (5,000 ft) or to the installation boundary, whichever is closer to the end of the clear zone	APZ starts at the end of the Clear Zone, and is centered and measured on the extended centerline. Modifications will be considered if: - The runway is infrequently used. - Prevailing wind conditions are such that a large percentage (that is, over 80 %) of the operations are in one direction. - Local accident history indicates consideration of different areas. - Other unusual conditions exist.
APZ Width	300 m (984 ft)	300 m (984 ft)	

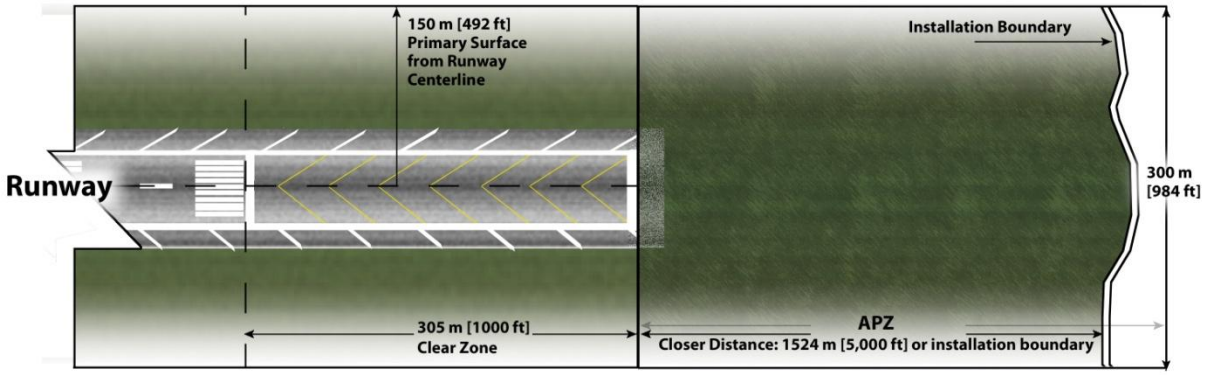
NOTES:

1. See **Attachment 4** for guidance on land use within the USAFE APZs. See also AFI 32-7063 and AFH 32-7084, as they apply to APZ I. Due to land use restrictions within USAFE, no APZ equivalents to APZ II exist.

2. Metric units apply to new airfield construction, and where practical, to modifications to existing airfields and heliports, as discussed in **paragraph 1.4.4.**

3. Airfield and heliport imaginary surfaces and safe wingtip clearance dimensions are shown as a direct conversion from inch-pound to SI units.

Figure 3.7. USAFE APZ.



3.14. Airspace Imaginary Surfaces:

3.14.1. **Types of Airspace Imaginary Surfaces**. At fixed-wing DoD facilities, the following types of airspace imaginary surfaces may be found:

3.14.1.1. Class A VFR Runway.

3.14.1.2. Class A IFR Runway.

3.14.1.3. Class B IFR Runway.

3.14.2. **Imaginary Surfaces**. The area surrounding a runway that must be kept clear of objects that might damage an aircraft is bounded by imaginary surfaces that are defined in this instruction. An object, either man-made or natural, which projects above an imaginary surface, is an obstruction. Imaginary surfaces for fixed-wing airfields are shown in **Figures 3.5 through 3.13** and are defined in **Attachment 1**, *Glossary of References and Supporting Information*. The applicable dimensions and slopes are provided in **Table 3.6**. These imaginary surfaces include:

3.14.2.1. Primary Surface (Runway Strip).

3.14.2.2. Clear Zone.

3.14.2.3. Inner Approach Surface.

3.14.2.4. Approach Surface.

3.14.2.5. Departure Surface

3.14.2.6. Inner Horizontal Surface.

3.14.2.7. Outer Horizontal Surface.

3.14.2.8. Conical Surface.

3.14.2.9. Transitional Surface.

3.14.2.10. Inner Transitional Surface.

3.14.2.11. Balked Landing Surface.

NOTE: Metric units apply to new airfield construction, and where practical, to modifications to existing airfields and heliports, as discussed in **paragraph 1.4.4.**

Table 3.6. Air Space Imaginary Surfaces.

Item No.	Item Description	Legend	Class A Runway Requirement		Class B Runway Requirement		Remarks
			VFR	IFR	VFR	IFR	
1	Primary Surface Width	A	300 m (984 ft)				
			See **Remarks**				Centered on the runway centerline. Differences in elevation between paved surfaces (including equipment foundations) and grade cannot exceed 7.62 cm (3 in).
2	Primary Surface Length	A	Runway Length + 60 m (197 ft) at each end				Primary surface extends 60 m (197 ft) beyond the threshold of the runway. Differences in elevation between paved surfaces (including equipment foundations) and grade cannot exceed 7.62 cm (3 in).
3	Primary Surface Elevation	A	The elevation of any point on the primary surface is the same as the elevation of the nearest perpendicular point on the runway centerline.				Differences in elevation between paved surfaces (including equipment foundations) and grade cannot exceed 7.62 cm (3 in).
4	Clear Zone Surface	B	Also see **Table 3.4.**				All of the USAFE Clear Zone is treated as a Graded Area.
5	Start of Approach Surface	C	60 m (197 ft)				Measured from the threshold of the runway.
6	Approach Surface Beginning Width	C	300 m (984 ft)				The Approach Clearance Surface starting width is equal to the Primary Surface width at 60 m (200 ft) from the threshold.

Item No.	Item Description	Legend	Class A Runway Requirement		Class B Runway Requirement		Remarks
			VFR	IFR	VFR	IFR	
7	Approach Surface Divergence	C	10:1	100:15	10:1	100:15	The Approach surface flares outward from the extended runway centerline. See **Figures 3.8. through 3.11.**
8	Length of Approach Surface First Section	C	3,000 m (9,842.5 ft)				Measured Horizontally.
9	Slope of Approach Surface First Section	C	40:1	50:1	50:1	50:1	Slope ratio is horizontal: vertical. Example: 50:1 is 50 m (ft) horizontal to 1 m (ft) vertical. For clearances over highway and railroads, see **Table 3.7.**
10	Length of Approach Surface Second Section	C	--	3,600 m (11,811 ft)	--	3,600 m (11,811 ft)	Measured Horizontally.
11	Slope of Approach Surface Second Section	C	--	40:1	--	40:1	Slope ratio is horizontal: vertical. ***EXAMPLE:*** 40:1 is 40 m (ft) horizontal to 1 m (ft) vertical.
12	Length of Approach Surface Horizontal Section	D	--	8,400 m (27,560 ft)	--	8,400 m (27,560 ft)	Measured horizontally.
13	Total Length of the Approach Surface		3,000 m (9,843 ft)	15,000 m (49,213 ft)	3,000 m (9,843 ft)	15,000 m (49,213 ft)	Measured horizontally.

Item No.	Item Description	Legend	Class A Runway Requirement		Class B Runway Requirement		Remarks
			VFR	IFR	VFR	IFR	
14	Inner Horizontal Surface Height	E	45 m (150 ft)				Above the established airfield elevation. For German Main Operating Bases (MOBs) this is defined as the runway reference point in the Air Traffic Act Permits (ATAP).
15	Inner Horizontal Surface Radius	E	4,000 m (13,123 ft)				An imaginary surface constructed by scribing an arc with a radius of 4,000 m (13,123.4 ft) about the centerline at the midpoint of the runway.
16	Conical Surface Slope	F	20:1				Slope ratio is horizontal: vertical. ***EXAMPLE:*** 20:1 is 20 m (ft) horizontal to 1 m (ft) starting at the outer edge of the inner horizontal surface terminating at a height of 150 m (328 ft).
17	Conical Surface Height	F	150 m (492 ft)				Above the established airfield elevation.
18	Start of Inner Approach Surface	G	--	60 m (197 ft)	--	60 m (197 ft)	Measured from the threshold of the runway.
19	Width of Inner Approach Surface	G	--	120 m (394 ft)	-	120 m (394 ft)	Centered on the runway centerline. For runways supporting aircraft with wingspans greater than 65 m (213 ft), the width for IFR inner approach surfaces shall be extended to 155 m (509 ft).
20	Length of Inner Approach Surface	G	--	900 m (2,953 ft)	--	900 m (2,953 ft)	Measured horizontally.

Item No.	Item Description	Legend	Class A Runway Requirement		Class B Runway Requirement		Remarks
			VFR	IFR	VFR	IFR	
21	Slope of Inner Approach Surface	G	--	50:1	--	50:1	Slope ratio is horizontal: vertical. ***EXAMPLE:*** 50:1 is 50 m (ft) horizontal to 1 m (ft) vertical. For clearances over highway and railroads, see **Table 3.7.**
22	Start of Transitional Surface	H	150 m (492 ft)				The beginning of the Transitional Surface corresponds with the outer edge of the Primary Surface.
23	End of Transitional Surface	H	320 m (1050 ft) parallel to edge of primary surface. See **Remarks**				The Transitional Surface ends at the Inner Horizontal Surface, Conical Surface or at an elevation of 45 m (150 ft).
24	Slope of Transitional Surfaces	H	7:1				Slope ratio is horizontal: vertical. 7:1 is 7 m (ft) horizontal to 1 m (ft) vertical. Vertical height of vegetation and other fixed or mobile obstacles and/or structures will not penetrate the transitional surface. Taxiing aircraft are exempt from this requirement. ATCT is exempt from this requirement if the height will not affect Terminal Instrument Procedures (TERPS) criteria.
25	Slope of Inner Transitional Surfaces **	I	--	3:1	--	3:1	

Item No.	Item Description	Legend	Class A Runway Requirement		Class B Runway Requirement		Remarks
			VFR	IFR	VFR	IFR	
26	Length of Inner Edge of Balked Landing Surface **	J	--	120 m (394 ft)	--	120 m (394 ft)	For runways supporting aircraft with wingspans greater than 65 m (213 ft), the length for IFR balked landing surfaces shall be extended to 155 m (509 ft).
27	Balked Landing Surface Distance from Threshold **	J	--	1800 m (5,905 ft)	--	1800 m (5,905 ft)	The distance from the threshold is the lesser of 1,800 m (5,905 ft) or the end of the runway.
28	Balked Landing Surface Divergence **	J	--	10%	--	10%	
29	Balked Landing Surface Slope **	J	--	30:1	--	30:1	
30	Start of Departure Surface	K	60 m (197 ft)				Measured from the threshold of the runway.
31	Departure Surface Beginning Width	K	300 m (984 ft)				The Departure Surface starting width is equal to the Primary Surface width at 60 m (200 ft) from the threshold.
32	Departure Surface Divergence	K	8:1				The Departure surface flares outward from the extended runway centerline.
33	Length of Departure Surface	K	15,000 m (49,213 ft)				Measured horizontally
34	Departure Surface Final Width	K	1,200 m (3,940 ft)				

Item No.	Item Description	Legend	Class A Runway Requirement		Class B Runway Requirement		Remarks
			VFR	IFR	VFR	IFR	
35	Slope of Departure Surface	K	50:1				Slope ratio is horizontal: vertical. ***EXAMPLE:*** 50:1 is 50 m (ft) horizontal to 1 m (ft) vertical.
36	Outer Horizontal Surface Height	L	150 m (328 ft)				Above the established airfield elevation. Surface starts at outer edge of Conical Surface at an elevation of 150 m (328 ft). See **Figures 3.8. and 3.9.**
37	Distance to the Outer Edge of the Outer Horizontal Surface	L	15,000 m (49,213 ft)				An imaginary surface constructed by scribing an arc with a radius of 15,000 m (49,213 ft) about the centerline at the midpoint of the runway.

NOTES:

1. Approach Surfaces are based on Instrument Approach-Departure procedures. Verify Instrument Approach procedures with AF Flight Standard Agency or Host Nation Civil or Military Aviation Authority, as appropriate, prior to using this table.

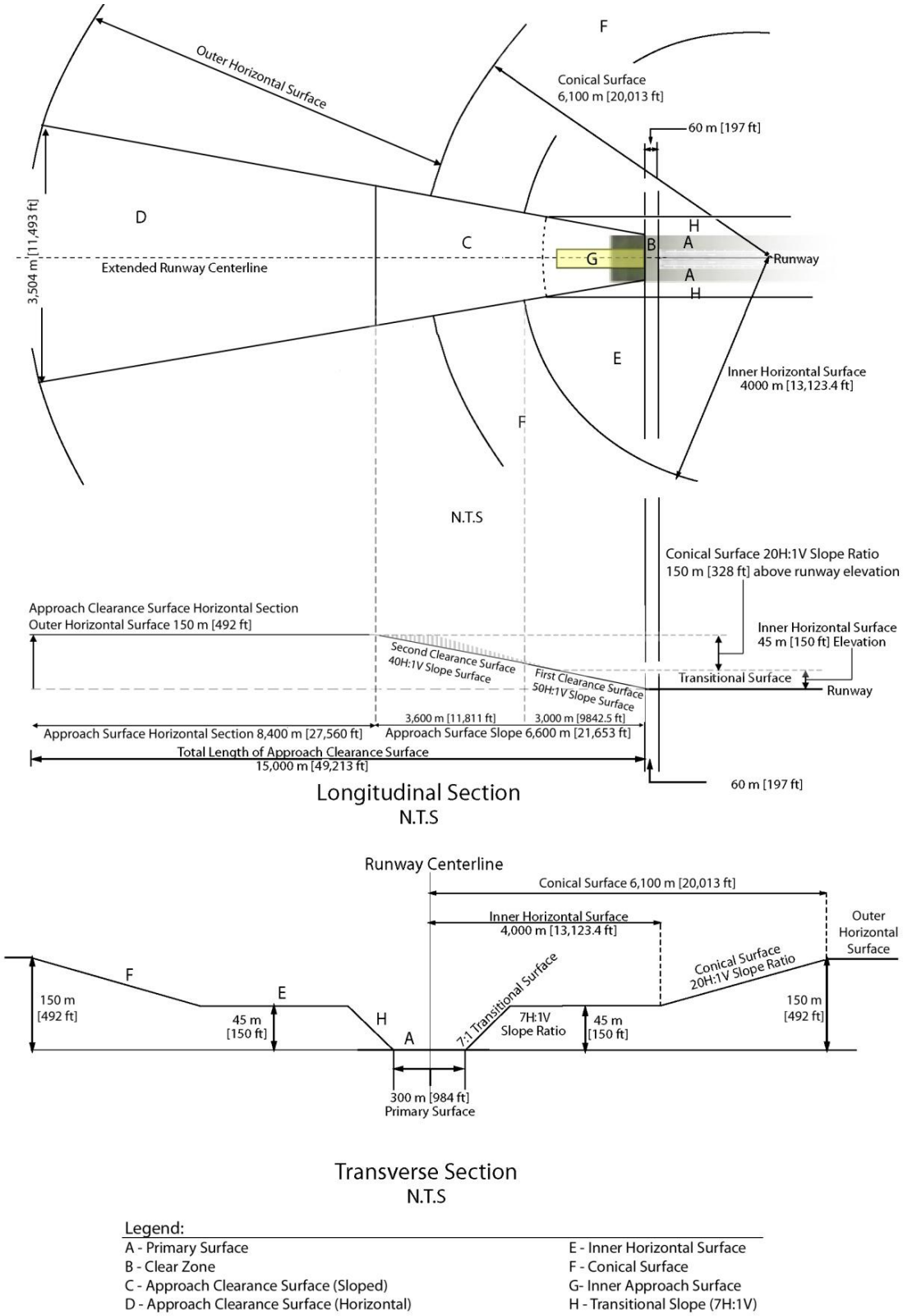
2. Airfield and heliport imaginary surfaces and safe wingtip clearance dimensions are shown as a direct conversion from inch-pound to SI units.

3. USAFE does not operate any Class A runways. The Class A runway information in this table is presented for reference only.

4. All USAFE installations can operate as a Class B IFR runway. Class B IFR imaginary surfaces are the most protective. Therefore all USAFE runway systems must be established based upon Class B IFR criteria presented in this table.

** These criteria only apply if the host nation requires them as part of a written agreement or through ratification of NATO Standardization Agreement (STANAG) 7174, Edition 1, *Airfield Clearance Planes*.

Figure 3.8. Class B IFR Runway Plan and Profile Airspace Imaginary Surfaces.



Legend:

A - Primary Surface	E - Inner Horizontal Surface
B - Clear Zone	F - Conical Surface
C - Approach Clearance Surface (Sloped)	G- Inner Approach Surface
D - Approach Clearance Surface (Horizontal)	H - Transitional Slope (7H:1V)

Figure 3.9. Class B IFR Runway Airspace Imaginary Surfaces.

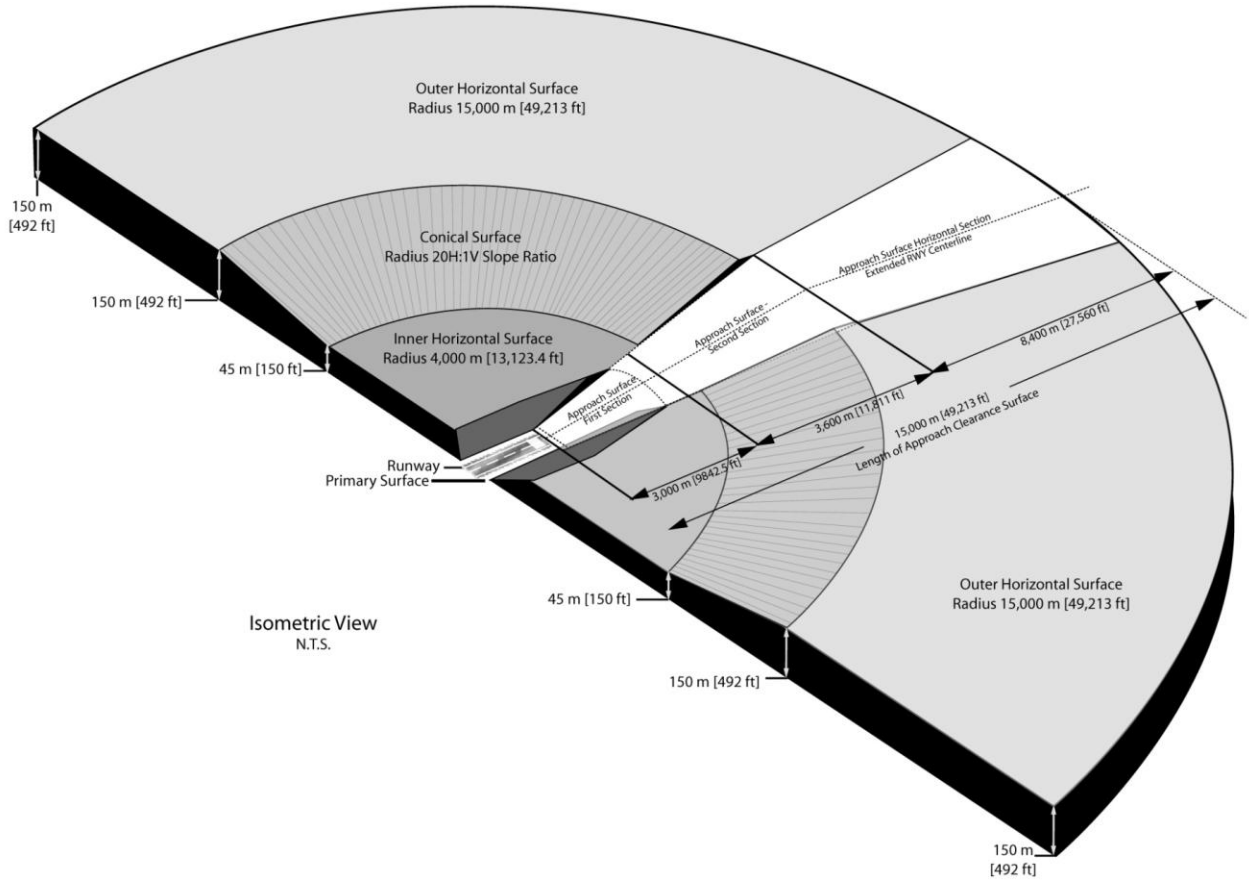
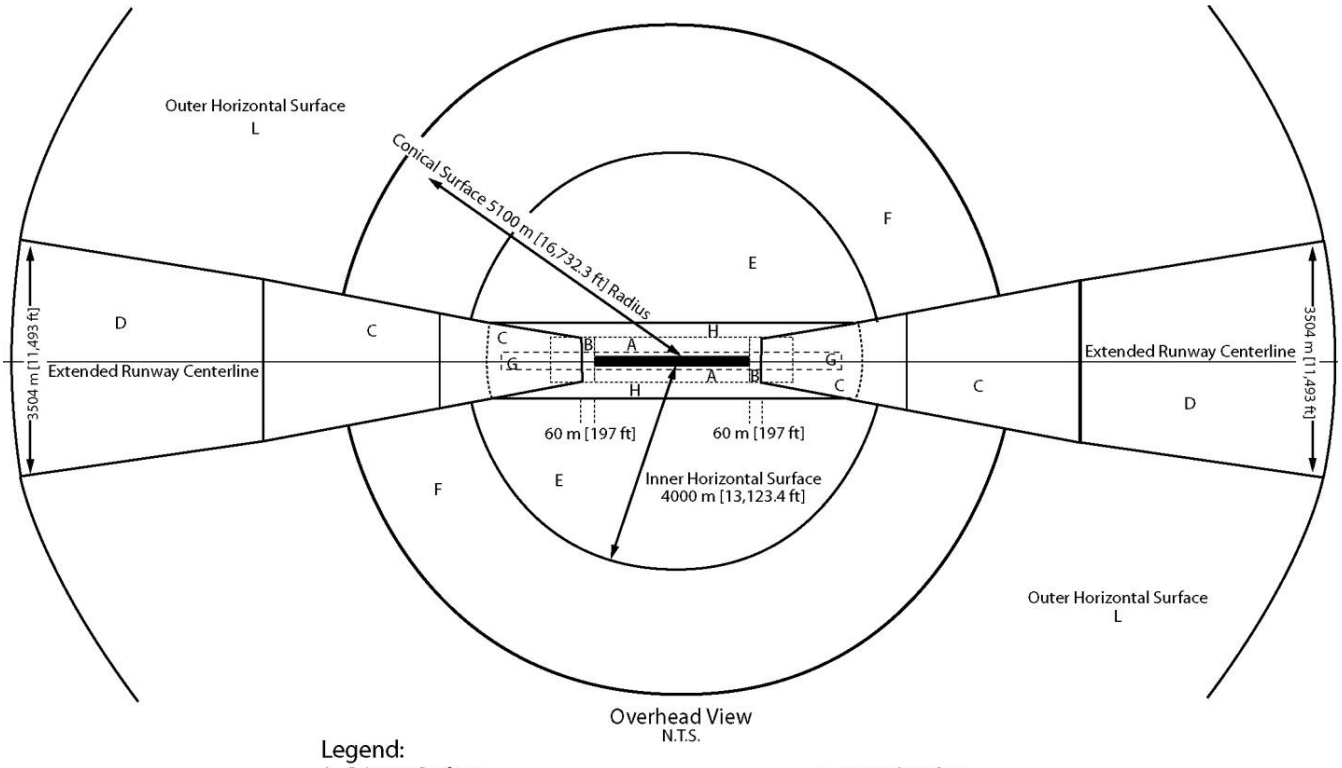


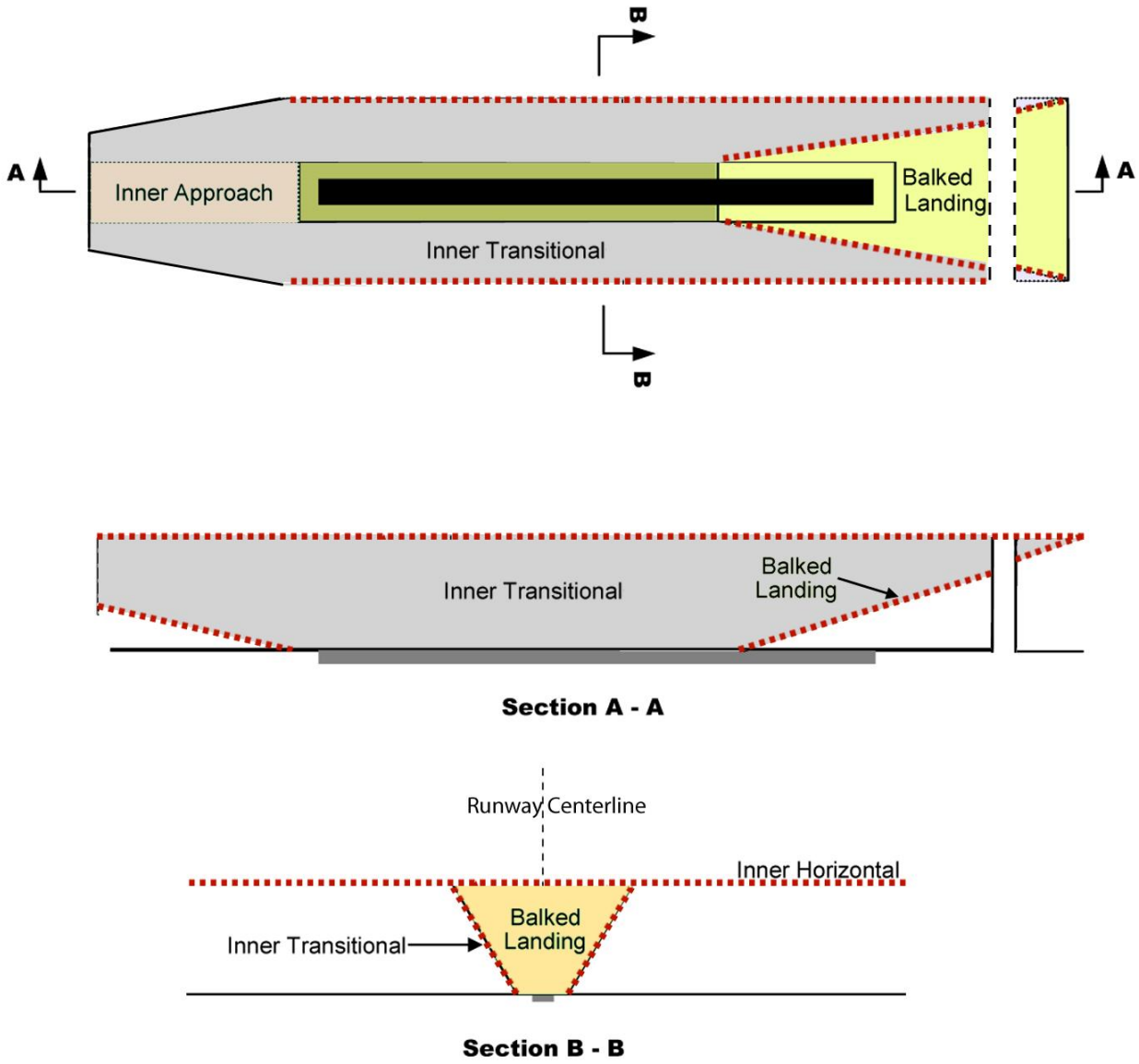
Figure 3.10. USAFE IFR Obstacle Limitation Surfaces.



Legend:

A - Primary Surface
B - Clear Zone
C - Approach Clearance Surface (Sloped)
D - Approach Clearance Surface (Horizontal)
E - Inner Horizontal Surface
F - Conical Surface
B - Clear Zone
G - Inner Approach Surface
H - Transitional Slope (7H:1V)
L - Outer Horizontal Surface

Figure 3.11. Balked Landing Zone (LZ).



3.15. Obstructions to Air Navigation. An existing object (including a mobile object) is, and a future object would be, an obstruction to air navigation if it is higher than any of the heights or surfaces listed in Federal Aviation Regulations (FAR) Part 77, *Objects Affecting Navigable Airspace*, and the surfaces described in this instruction.

3.15.1. **Aircraft Movement Area**. No part of the aircraft movement area itself will be considered an obstruction if applicable grading criteria are met. (See the glossary in **Attachment 1** for the definition of the Aircraft Movement Area, as used in this instruction).

3.15.2. **Determining Obstructions.** For USAFE airfields, an obstruction to air navigation is determined in accordance with either host nation standards, or USAFE standards, whichever is more stringent.

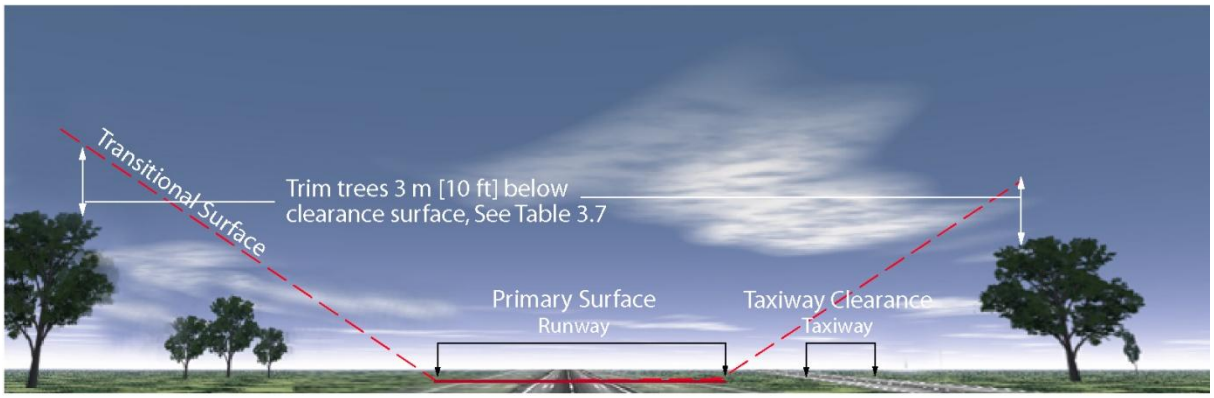
3.15.3. **Trees**. Trees are permitted near an airfield provided they are naturally occurring and are not located in the clear zone, primary surface, PA 2, and taxiway or apron clearance criteria. Trees cannot penetrate the transitional slope (7:1) or the approach clearance surface (50:1), or the departure clearance surface (40:1). Trees are permitted in PA 3 provided they do not present a hazard to aircraft operations, attract birds or interfere with NAVAIDS. Trees, which project into the imaginary surfaces must be removed or lowered to a distance below the imaginary surface, as shown in **Table 3.7**., see **Figure 3.12**.

Table 3.7. Imaginary surfaces Minimum Clearances over Highway, Railroad, Waterway and Trees.

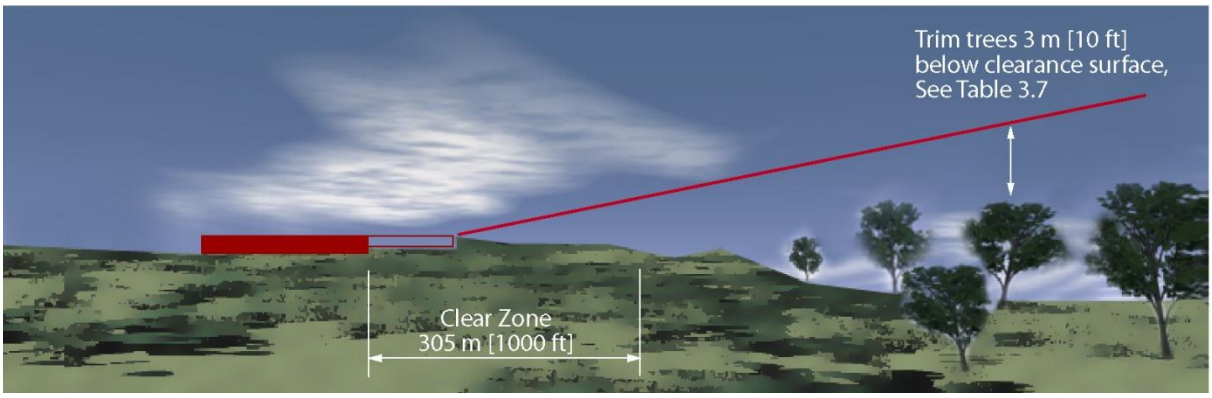
Item No.	Item Description	Traverse Way/Objects	Class A and Class B Runways
			Dimensions
1	Minimum vertical clearance between established imaginary surfaces and traverse ways/objects (measured from the highest and nearest elevation of the traverse ways/objects).	Interstate highway that is part of the National System of Military and Interstate Highways.	5.18 m (17 ft)
2		Other public highways not covered in item 1.	4.8 m (15.75 ft)
3		Private or military road.	4.8 m (15.75 ft) unless under the control of the tower, at which the limit is 3.05 m (10 ft) minimum or height of highest mobile object that would usually traverse them, whichever is greater.
4		Railroad	7.01 m (23 ft)
5		Waterway or traverse way, not previously covered.	A distance equal to the height of the highest mobile object that usually would traverse them.
6		Trees 1	3 m (10 ft)
NOTE*:* Trees will be removed or topped the distance shown below the applicable imaginary surface. Always consult with your TERPS office to determine if trees violate TERPS criteria.			

Figure 3.12. Trees Near the Airfield.

Trees Near the Airfield
(Transverse)
N.T.S.



Trees Near the Airfield
(Profile)
N.T.S.



NOTES:
1. For object clearance requirements, see **Table 3.7.**
2. Only naturally occurring or environmental compensatory trees permitted.

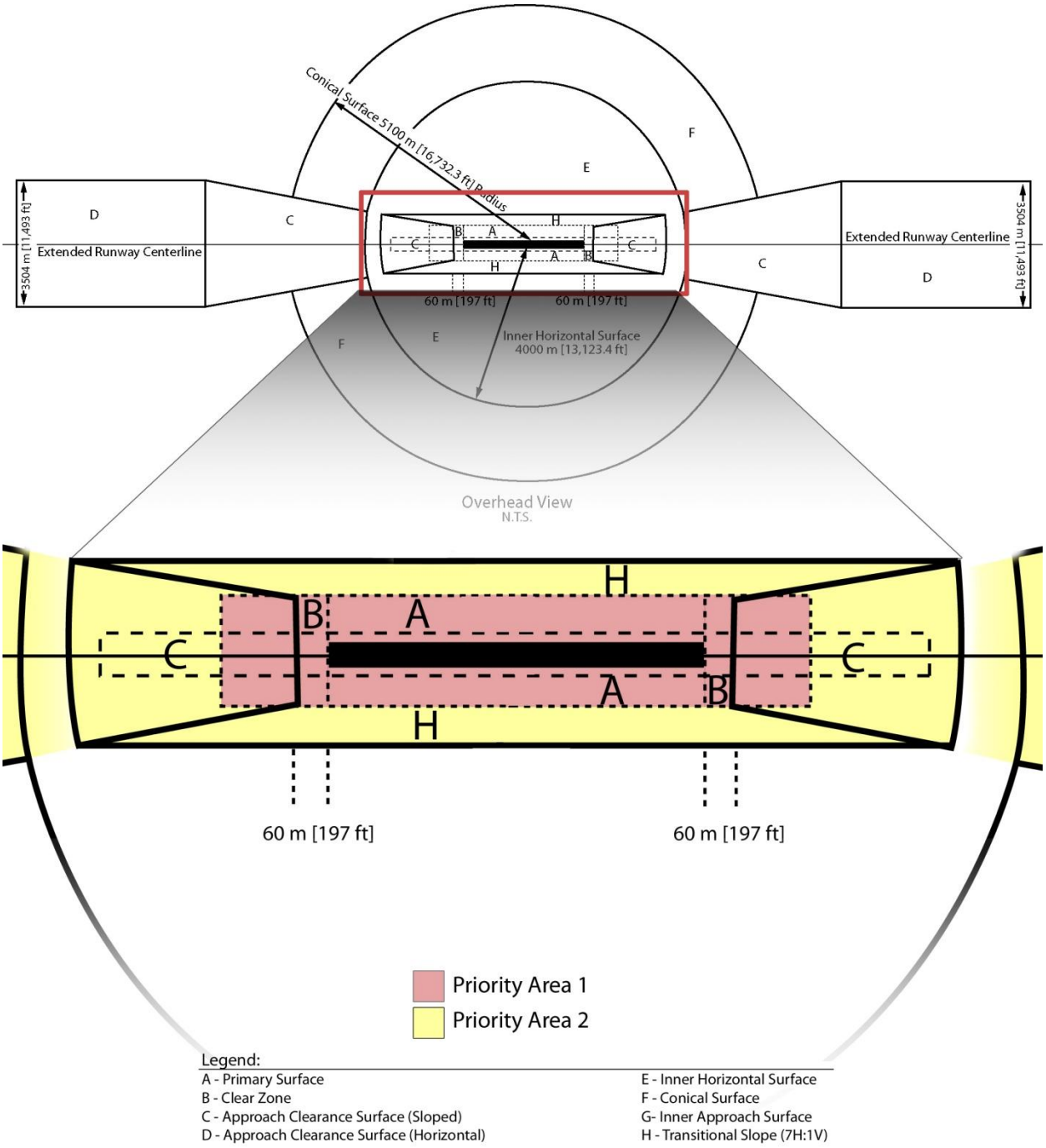
3.16. USAFE PAs. USAFE PAs are treated as land-control surfaces that restrict development near the airfield. PAs are used to determine funding priority to correct or remove airfield obstructions, with PA 1 receiving highest funding priority, and PA 3 the lowest funding priority. **Figure 3.13** provides an example of the PAs at a USAFE installation.

3.16.1. PA 1. PA 1 includes Clear Zone and Primary Surface.

3.16.2. PA 2. PA 2 includes the APZ, Transitional Surface (7:1 Slope), the Approach Surface, and the Departure Surface within installation boundaries.

3.16.3. PA 3. PA 3 includes other areas such as Conical Surface.

Figure 3.13. USAFE Airfield Clearance Surfaces (Example).



3.17. Aircraft Arresting Systems. Aircraft arresting systems consist of engaging devices and energy absorbers. Engaging devices are net barriers, disc supported pendants (hook cables), and cable support systems, which allow the pendant to be raised to the battery position or retracted below the runway surface. Energy absorbing devices are ship anchor chains, textile braking system, rotary friction brakes, such as the BAK-12. The systems designated "Barrier, Arresting Kit" (BAK) are numbered in the sequence of procurement of the system design. There is no connection between the AF designations of these systems and their function. The equipment is

government furnished equipment, as discussed in AFI 32-1043 USAFE Sup1, *Managing Aircraft Arresting Systems*. Other designations such as E-5 are US Navy designations. The USAFE systems in use today are as follows: E-5; BAK-12; BAK-14; mobile aircraft arresting system (MAAS); and Textile Brake system.

3.17.1. **Requirements, Installation, Design and Repair Considerations**. The BCE's representative processes new requirements received from the Operations Group Commander (OG/CC) or Air Expeditionary Group Commander by first coordinating with the USAFE Power Production functional manager and 435 CTS/CEXD. The USAFE functional manager and 435 CTS/CEXD coordinate the new requirement with the USAFE A3O, SEF, and A7P, and responds to the base request. Once command endorsement is received, the base representative submits an AFEMS request to the Base Equipment Management Office (BEMO). Further information on the planning, installing and repairing of an arresting system or arresting system complex is found in AFI 32-1043. During the planning, installation and repair process, the following items will be given consideration.

3.17.1.1. Configuration and Location. The configuration and location of arresting system installations will be determined in accordance with AFI 32-1043. Design will conform to the criteria within Section 3 of the appropriate 35E8 series Technical Order (T.O.) and the typical installation drawings. Both may be obtained from:

579 CBSS/GBLA
295 Byron Street
Robins AFB, GA 31098-1611

3.17.1.2. Runway Pavement. The 60 m (200 ft) of pavement on both the approach and departure sides of the arresting system pendant is a critical area. Protruding objects and undulating surfaces are detrimental to successful tail-hook engagements and are not allowable. The maximum permissible longitudinal surface deviation in this area is plus or minus 3.0 mm (0.13 in) in 3.6 m (12 ft). Saw-cut grooves in runway pavement to improve surface drainage and surface friction characteristics in accordance with UFC 3-260-02, *Pavement Design for Airfields* are not considered protruding objects or undulations; however, the pavement shall not be grooved within the first 3.0 m (10 ft) on either side of the arresting system cables. For USAF facilities, changes in pavement type or an interface between rigid and flexible pavements are not permitted within the center 23 m (75 ft) of the runway for 60 m (200 ft) in either direction from the arresting system cables. Sacrificial panels installed beneath arresting system cables in accordance with AFI 32-1043 are not considered a change in pavement type or an interface between rigid and flexible pavements. The prohibition on changes in surface pavement type is not applicable to emergency aircraft arresting systems located in overruns. Portland cement concrete (PCC) foundations designed in accordance with USAF Typical Installation Drawing 67F2011A, *BAK-12*, are required for aircraft arresting system cable tie-downs and are also exempt from the prohibition on changes in surface pavement type.

3.17.1.3. Repair of Bituminous Pavements. Rigid inlays will not be used as a surface repair material beneath the cable in a flexible runway system. This type of repair causes

high hook skip potential when the flexible pavement consolidates, exposing the leading edge of the rigid pavement. However, rigid pavement must be used as a foundation for sacrificial pads installed beneath aircraft arresting system cables. No part of the foundation for the panels shall be used as a surface pavement in a flexible runway pavement.

3.17.2. **Joint-Use Airfields**. Arresting systems installed on joint-use civil/military airfields to support military aircraft are sited in accordance with the military rights agreement with the host government. If a separate agreement is specifically required for installation of a system, the Installation Commander shall coordinate with HQ USAFE/A7. HQ USAFE/A7 will coordinate any necessary agreements with the host nation.

Chapter 4

ROTARY WING RUNWAYS, HELIPADS, LANDING LANES AND HOVERPOINTS

4.1. Criteria for Rotary Wing Runways, Helipads, Landing Lanes, and Hoverpoints in United States Air Forces in Europe (USAFE) shall follow the criteria of Chapter 4 of the UFC 3-260-01, *Airfield and Heliport Planning and Design*, with the following variations:

4.1.1. Air Installation Compatible Use Zone (AICUZ) programs are only required within base boundaries of USAFE installations. Lands outside of the installation boundary are exempt from AICUZ.

4.1.2. Accident Potential Zones (APZ) do not apply in USAFE when they extend outside of the installation boundary.

Chapter 5

TAXIWAYS

5.1. Contents. This chapter presents design standards and considerations for fixed- and rotary-wing taxiways.

5.2. Taxiway Requirements. Taxiways provide for ground movement of fixed- and rotary-wing aircraft. Taxiways connect the runways of the airfield with the parking and maintenance areas and provide access to hangars, docks and various parking aprons and pads.

5.3. Taxiway Systems.

5.3.1. **Basic**. The basic airfield layout consists of a taxiway connecting the center of the runway with the parking apron. This system limits the number of aircraft operations at an airfield. Departing aircraft must taxi on the runway to reach the runway threshold. When aircraft are taxiing on the runway, no other aircraft is allowed to use the runway. If runway operations are minimal or capacity is low, the basic airfield layout with one taxiway may be an acceptable layout.

5.3.2. **Parallel Taxiway**. A taxiway parallel for the length of the runway, with connectors to the end of the runway and parking apron, is the most efficient taxiway system. Aircraft movement is not hindered by taxiing operations on the runway and the connectors permit rapid entrance and exit of traffic.

5.3.3. **High Speed Taxiway Turnoff**. High-speed taxiway turnoffs are located intermediate of the ends of the runway to increase the capacity of the runway. The high-speed taxiway turnoff enhances airport capacity by allowing aircraft to exit the runways at a faster speed than turnoff taxiways allow.

5.3.4. **Additional Types of Taxiways**. Besides the types of taxiways discussed above, there are other taxiways at an airfield. Taxiways are often referred to based on their function. Common airfield taxiways and their designations are shown in **Figure 5.1**.

5.3.5. **Taxilanes**. A taxi route through an apron is referred to as a taxilane. See **Chapter 6** for more information on taxilanes.

5.3.6. **Taxitracks**. A taxi route connecting a dispersed parking platform (e.g. a fighter loop) to a taxiway or runway is referred to as a taxitrack. Dispersed parking platform and taxitrack use are generally limited to fighter aircraft only. Use of taxitracks by tactical transport aircraft is permitted provided minimum clearances established in **Table 5.7** are met.

5.3.7. **Taxiway Layout**. The following should be considered when planning and locating taxiways at an airfield:

5.3.8. **Efficiency**. Runway efficiency is enhanced by planning for a parallel taxiway.

5.3.9. **Direct Access**. Taxiways should provide as direct an access as possible from the runway to the apron. Connecting taxiways should be provided to join the runway exit points to the apron.

5.3.10. **Simple Taxiing Routes.** A sufficient number of taxiways should be provided to prevent complicated taxiing routes. Turning from one taxiway on to another often creates

confusion and may require additional airfield signs and communication with the air traffic control tower (ATCT).

5.3.11. **Delay Prevention.** A sufficient number of taxiways should be provided to prevent capacity delays that may result when one taxiway must service more than one runway.

5.3.12. **Runway Exit Criteria.** The number, type, and location of exits are a function of runway length, as shown in **Figure 5.2** and as discussed in Chapter 2 of UFC 3-260-01, *Airfield and Heliport Planning and Design*.

5.3.13. **Taxiway Designation.** Use letters of the alphabet for designating taxiways. Optimally, designation of the taxiways should start at one end of the airport and continue to the opposite end, e.g., east to west or north to south (see UFC 3-535-01, V*isual Air Navigation Facilities*). Designate all separate, distinct taxiway segments. Do not use the letters I, O, or X for taxiway designations.

5.3.14. **Deconflict and, or Restrict Vehicle Access.** Comply with local Airfield Driving Instructions.

Figure 5.1. Common Taxiway Designations.

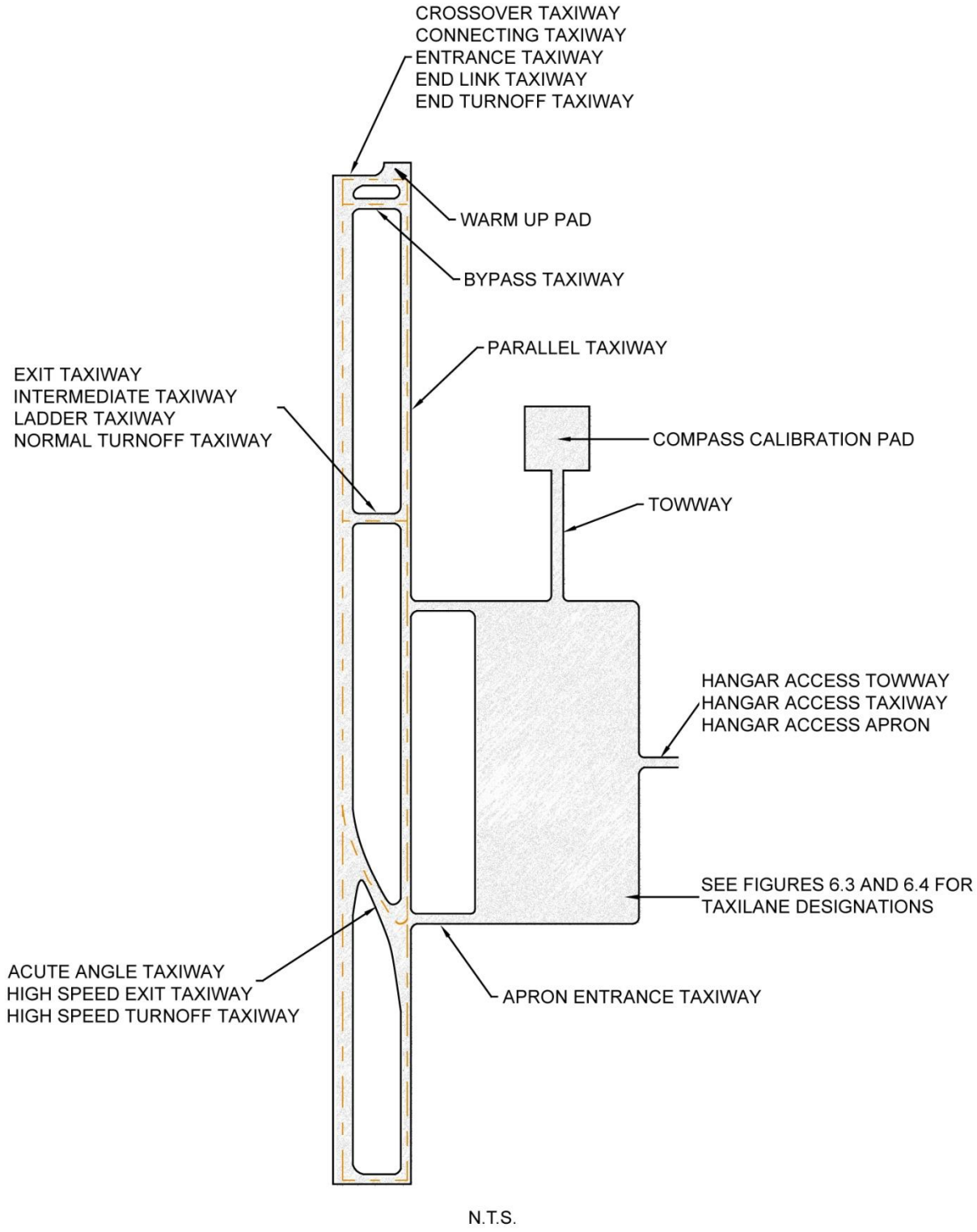
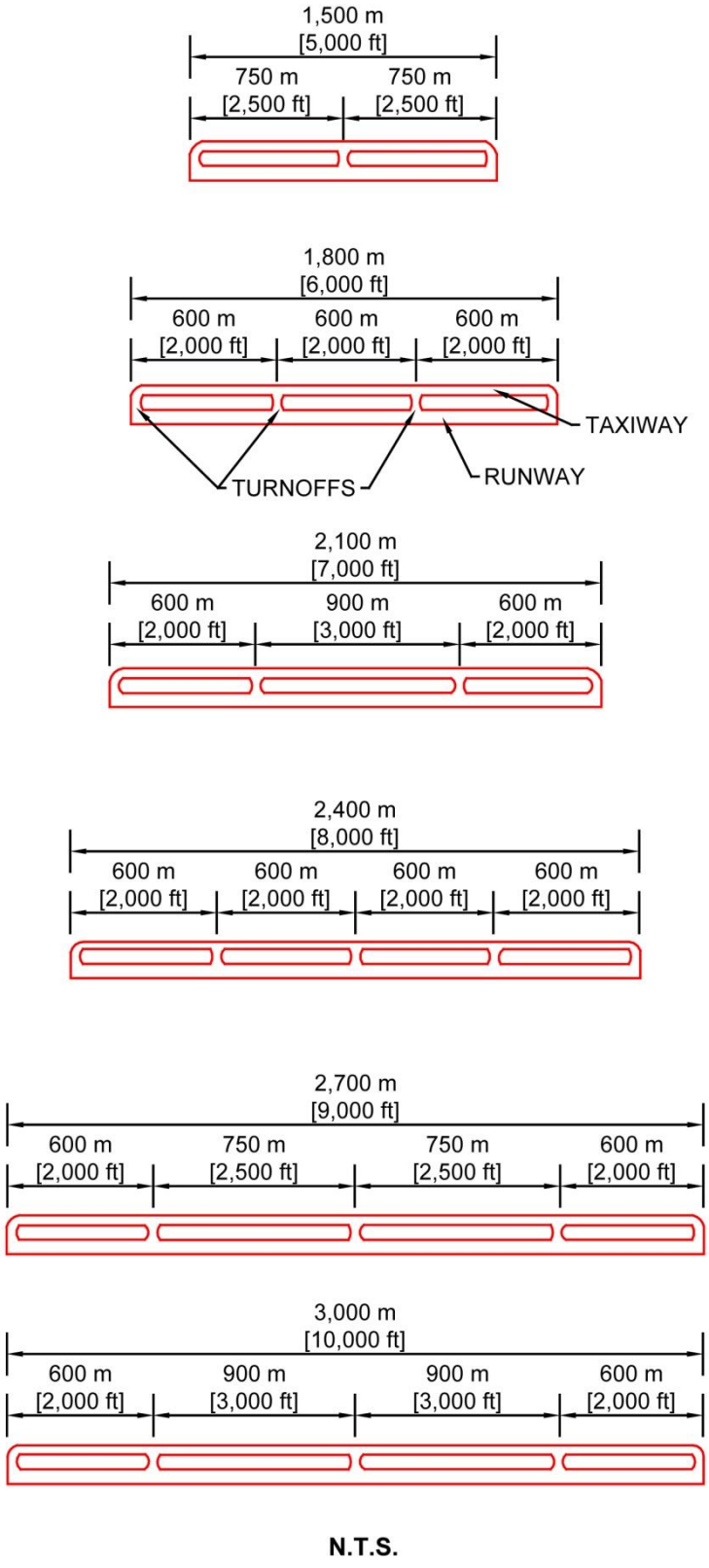


Figure 5.2. Spacing Requirements - Normal Taxiway Turnoffs.



N.T.S.

5.4. Fixed-Wing Taxiway Dimensions. Taxiway dimensions are based on the class of the runway served.

5.4.1. Criteria.

Table 5.1. presents the criteria for fixed-wing taxiway design, including clearances, slopes and grading dimensions.

5.4.2. **Transverse Cross-Section.** A typical transverse cross-section of a taxiway is shown in **Figure 5.3**

Table 5.1. Fixed-Wing Taxiways.

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
1	Width	15 m (50 ft)	22.5 m (75 ft)	
		See **Remarks**		May be modified for particular mission requirements (special taxiways such as high speed and end turn-off).
2	Total Width of Shoulders (paved and unpaved)	7.5 m (25 ft)	15 m (50 ft)	
3	Paved Shoulder Width	7.5 m (25 ft)	7.5 m (25 ft)	All airfields except as noted below. Also see **Note 3**.
		N/A	3 m (10 ft)	Airfields for fighter and trainer aircraft. A paved shoulder up to 7.5 m (25 ft) is allowed on the outside of taxiway turns of 90 degrees (90º) or more.
		N/A	15 m (50 ft)	Airfields for B-52 Aircraft. Also see **Note 3**.
4	Longitudinal Grade of Taxiway and Shoulders	Max 3.0%		

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
5	Rate of Longitudinal Grade Change	Max 1.0% per 30 m (100 ft)		The minimum distance between two successive points of intersection (PI) is 150 m (500 ft). Changes are to be accomplished by means of vertical curves. Up to a 0.4 % change in grade is allowed without a vertical curve where non-high speed taxiways intersect runways.
6	Longitudinal Sight Distance	Min 300 m (1,000 ft) Any two points 3 m (10 ft) above the pavement must be mutually visible for the distance indicated.		
7	Transverse Grade of Taxiway	Min 1.0% and Max 1.5% Min 1.5% and Max 2.0% for the North Atlantic Treaty Organization (NATO) projects		New taxiway pavements will be centerline crowned. Slope pavement downward from centerline of taxiway. When existing taxiway pavements have insufficient transverse gradients for rapid drainage, provide for increased gradients when the pavements are overlaid or reconstructed. The transverse gradients requirements are not applicable at or adjacent to intersections where pavements must be warped to match abutting pavements. Grading can follow NATO criteria only if NATO project strictly requires such grading. Otherwise, follow standard grading.
8	Transverse Grade of Paved Shoulders	Min 2.0% and Max 4.0%		All USAFE airfields, not otherwise specified.

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
		N/A	Min 1.5% and Max 2.0% Max 3% for NATO	Taxiway designed for B-52 aircraft. Grading can be increased to 3% maximum only if NATO project strictly requires such grading. Otherwise, follow standard grading (1.5 to 2%).
9	Transverse Grade of Unpaved Shoulders	a) 40 mm (1.5 in) drop-off at edge of pavement +/- 13 mm (0.5 in) (b) Min 2.0%, Max 4.0%		For additional information, see **Figure 5.3**. Unpaved shoulders shall be graded to provide positive surface drainage away from paved surfaces.
10	Clearance from Taxiway Centerline to Fixed or Mobile Obstacles (taxiway clearance line)	Min 50 m (164 ft) Max 60.96 m (200 ft)		Items within the taxiway clearance zone are required to be frangible, see **Table 5.1.**, Item 13 for specific requirements. **Note**: Installations in Germany shall follow the clearances required in **Attachment 6,** *Airfield Criteria and Waiver Processing Procedures For German Main Operating Bases (MOBs)*.
		See **Remarks**		See **Table 3.2.**, Item No. 12 for obstacle definition.
11	Distance Between Taxiway Centerline and Parallel Taxiway/Taxi-lane Centerline	53 m (175 ft)	72.4 m (237.5 ft) or wingspan + 15.3 m (50 ft), whichever is greater	

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
12	Grade of area between taxiway shoulder and taxiway clearance line	Min of 2.0% prior to channelization Max 10.0%[2]		Airfields, except as noted below. For additional information, see **Figure 5.3**. Unpaved areas shall be graded to provide positive surface drainage away from paved surfaces. For cases where the entire shoulder is paved (Class A airfields and taxiways designed for B-52 aircraft), provide a 40 mm (1.5-in) drop-off at pavement edge, +/- 13 mm (0.5 in).
13	Mandatory Zone of Frangibility for Taxiways	Min 50 m (164 ft) Max 60.96 m (200 ft)		Centered on the Taxiway centerline. All items in this area are required to be frangible (see UFC 3-260-01, Appendix B, Section 13, *Deviation from Criteria for Air Force Airfield Support Facilities*).

NOTES:

1. N/A = Not Applicable

2. Bed of channel may be flat. When drainage channels are required, the channel bottom cross section may be flat but the channel must be sloped to drain.

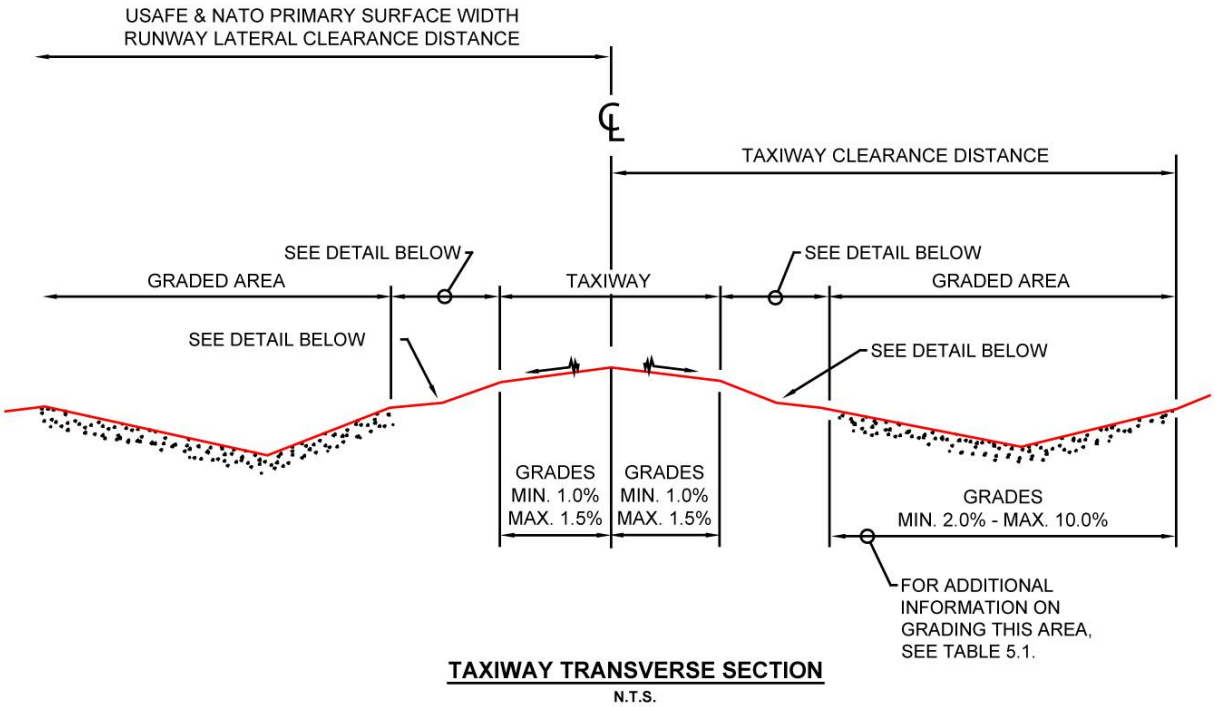
3. A 15 m (50 ft) paved shoulder is allowed for C-5, E-4, and 747 aircraft where vegetation cannot be established. Transverse grade of paved shoulder is 2% minimum to 4% maximum.

4. Metric units apply to new airfield construction and where practical, to modification of existing airfields and heliports, as discussed in **paragraph 1.4.4.**

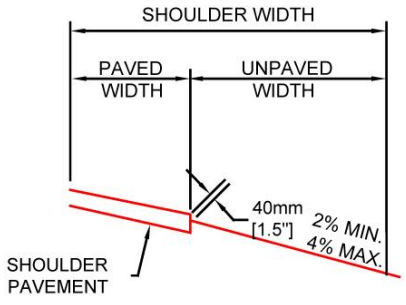
5. The criteria in this instruction are based on aircraft specific requirements and are not direct conversions from inch-pound (English) dimensions. Inch-pound units are included only as a reference to the previous standard.

6. Airfield and heliport imaginary surfaces and safe wingtip clearance dimensions are shown as a direct conversion from inch-pound to SI units.

Figure 5.3. Taxiway and Primary Surface Transverse Sections.

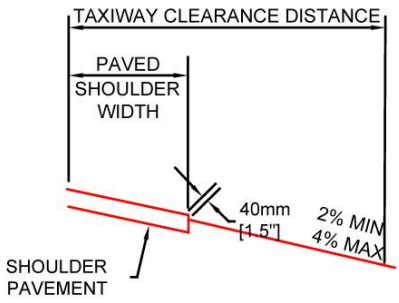


TAXIWAY TRANSVERSE SECTION
N.T.S.



SEE TABLE 5.1 FOR PAVED AND
UNPAVED SHOULDER WIDTHS

EDGE OF TAXIWAY FOR CLASS B RUNWAYS EXCEPT AS NOTED IN TABLE 5.1
N.T.S.



SEE TABLE 5.1 FOR PAVED AND
UNPAVED SHOULDER WIDTHS

EDGE OF TAXIWAY FOR CLASS A RUNWAYS AND CLASS B RUNWAYS FOR B-52 AIRCRAFT
N.T.S.

NOTES:

1. For B-52 aircraft, transverse grade of paved shoulders is 1.5% minimum to 2% maximum.

2. For all other cases, transverse grade of paved shoulder is 2% minimum to 4% maximum

5.5. Rotary-Wing Taxiway Dimensions. Rotary-wing taxiways are either paved or unpaved. Wheel-gear configured rotary wing aircraft require a paved surface on which to taxi. Skid-gear configured rotary-wing aircraft taxi by hovering along a paved or unpaved taxiway. **Table 5.2** presents the criteria for rotary-wing taxiway design, including taxiway widths, clearances, slopes and grading dimensions.

5.6. Taxiways at Dual Use (Fixed- and Rotary-Wing) Airfields:

5.6.1. **Criteria.** For taxiways at airfields supporting both fixed- and rotary-wing aircraft operations, the appropriate fixed-wing criteria will be applied, except as noted for shoulders.

5.6.2. **Taxiway Shoulders**. A paved shoulder will be provided at dual use airfields. Shoulder widths may be increased beyond the requirement presented in **Table 5.3**, when necessary, to accommodate dual operations with fixed-wing aircraft.

5.7. Taxiway Inter. To prevent the main gear of an aircraft from becoming dangerously close to the outside edge of the taxiway during a turn, fillets and lead-in to fillets are provided at taxiway intersections. When an aircraft turns at an intersection, the nose gear of the aircraft usually follows the painted centerline marking. The main gear, located to the rear of the nose gear, do not remain a constant distance from the centerline stripe during the turn due to the physical design of the aircraft. The main gear pivot on a shorter radius than the nose gear during a turn. Intersections should be designed to ensure that the main gear wheels stay a minimum of 3 m (10 ft) from the pavement edge. Intersection geometry can be determined using wheel-tracking simulation tools, or using the criteria described in **paragraph 5.7.1**.

Table 5.2. Rotary-wing Taxiways.

Item No.	Item Description	Requirement	Remarks
1	Width	Min. 15 m (50 ft)	Basic width applicable to taxiways that support helicopter operations only.
2	Longitudinal Grade	Max 2.0%	
3	Transverse Grade	Min 1.0% Max 1.5%	
4	Rate of Longitudinal Grade Change	Max 2.0 % per 30 m (100 ft)	Longitudinal grade changes are to be accomplished using vertical curves.
5	Paved Shoulders		See **Table 5.3.**
6	Clearance from Centerline to Fixed and Mobile Obstacles (taxiway clearance line)	Min 30.48 m (100 ft)	Basic helicopter clearance. Increase as appropriate for dual use taxiways. See **Table 3.2.**, Item No. 12 for definitions of fixed and mobile obstacles.
7	Grades Within the Clear Area	Max 5.0%	Clear area is the area between the taxiway shoulder and the taxiway clearance line.

Table 5.3. Rotary-wing Taxiway Shoulders.

Item No.	Item Description	Requirement	Remarks
1	Total Width of Shoulder	7.5 m (25 ft)	May be increased when necessary to accommodate dual operations with

Item No.	Item Description	Requirement	Remarks
	(Paved and Unpaved)		fixed-wing aircraft.
2	Paved Shoulder Width Adjacent to All Operational Pavements	7.5 m (25 ft)	May be increased when necessary to accommodate dual operations with fixed-wing aircraft.
3	Longitudinal Grade	Variable	Conform to the longitudinal grade of the abutting primary pavement.
4	Transverse Grade	2.0% Min 4.0% Max	Slope downward from edge of pavement.
5	Grade (adjacent to paved shoulder)	(a) 40 mm (1½ in) drop-off at edge of paved shoulder. (b) 2% Min; 5% Max	Slope downward from edge of shoulder. For additional grading criteria in primary surface and clear area, see **Chapter 3** for fixed-wing facilities and Chapter 4 of UFC 3-260-01 for rotary-wing facilities.

5.7.1. **Fillet Only Dimensions.** Only fillets (not lead-ins to fillets) are required at runway-taxiway and taxiway-taxiway intersections. Fillets at runway-taxiway intersections are arcs installed in accordance with **Table 5.4 and Figure 5.4**. Fillets at taxiway-taxiway intersections are installed in accordance with **Table 5.5 and Figure 5.5**. Centerline and fillet radii used for these figures and tables are based on a 45.72 m (150 ft) centerline turning radius for runway/taxiway intersections and a 38.1 m (125 ft) centerline turning radius for taxiway/taxiway intersections using the geometry of the C-5 aircraft and a taxiway width of 22.9 m (75 ft). Larger centerline turning radii, other aircraft, or narrower taxiways may require larger fillets; therefore, the designer must consider the most demanding situation.

Table 5.4. Runway/Taxiway Inter Radii

Runway/Taxiway Intersection Fillet Radii			
Runway Width W	**Fillet Radius R1**	**Fillet Radius R2**	**Fillet Radius R3**
More than 22.86 m (75 ft), but less than 45.72 m (150 ft)	45.72 m (150 ft)	38.1 m (125 ft)	76.2 m (250 ft)
45.72 m (150 ft) or more	38.1 m (125 ft)	38.1 m (125 ft)	76.2 m (250 ft)

Table 5.5. Taxiway/Taxiway Inter Taxiway Turns Fillet Radii

Runway/Taxiway Intersection Fillet Radii			
Runway Width W	**Fillet Radius R4**	**Fillet Radius R5**	**Fillet Radius R6**
22.86 m (75 ft)	45.72 m (150 ft)	38.1 m (125 ft)	76.2 (250 ft)

Figure 5.4. Runway/Taxiway Inter

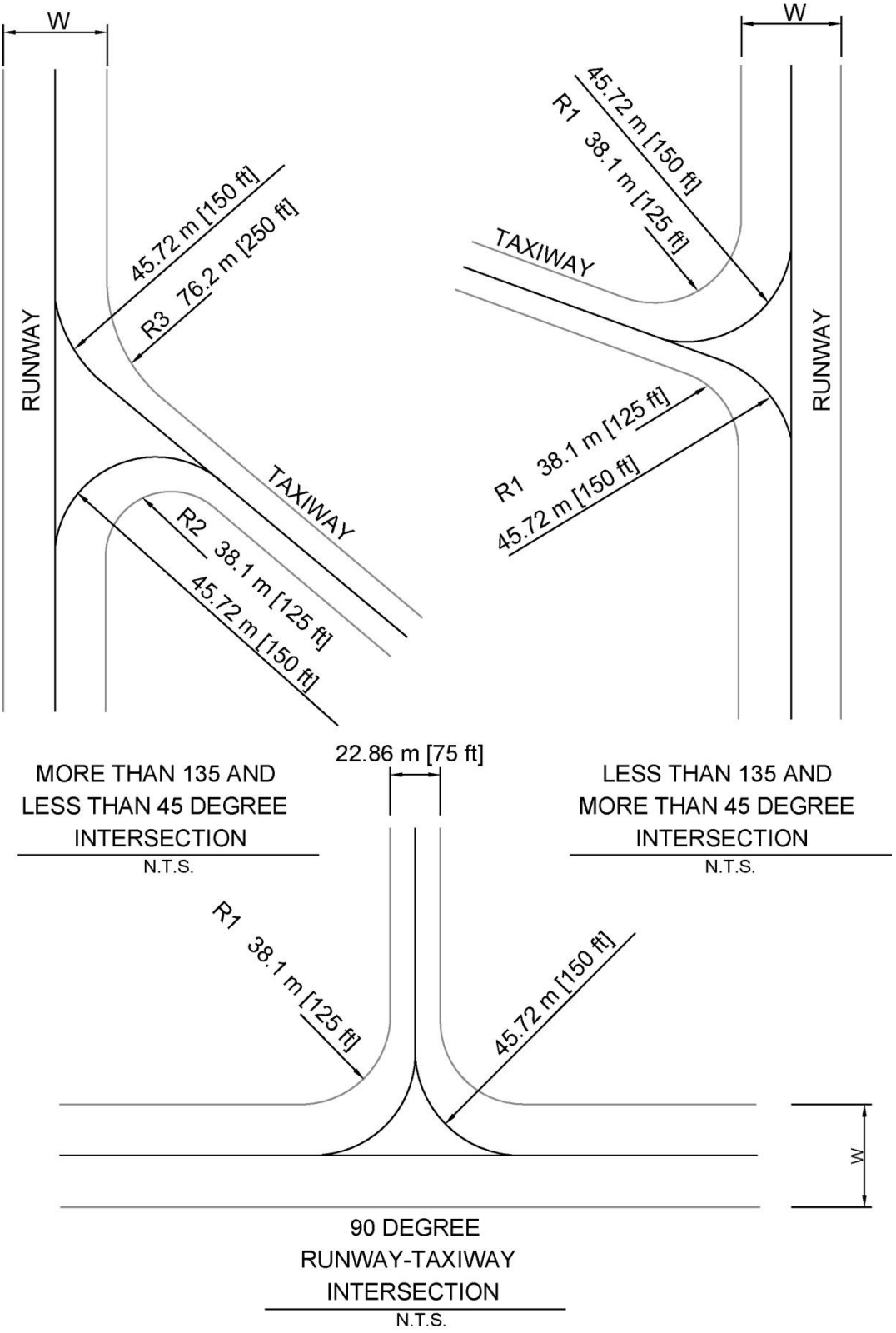
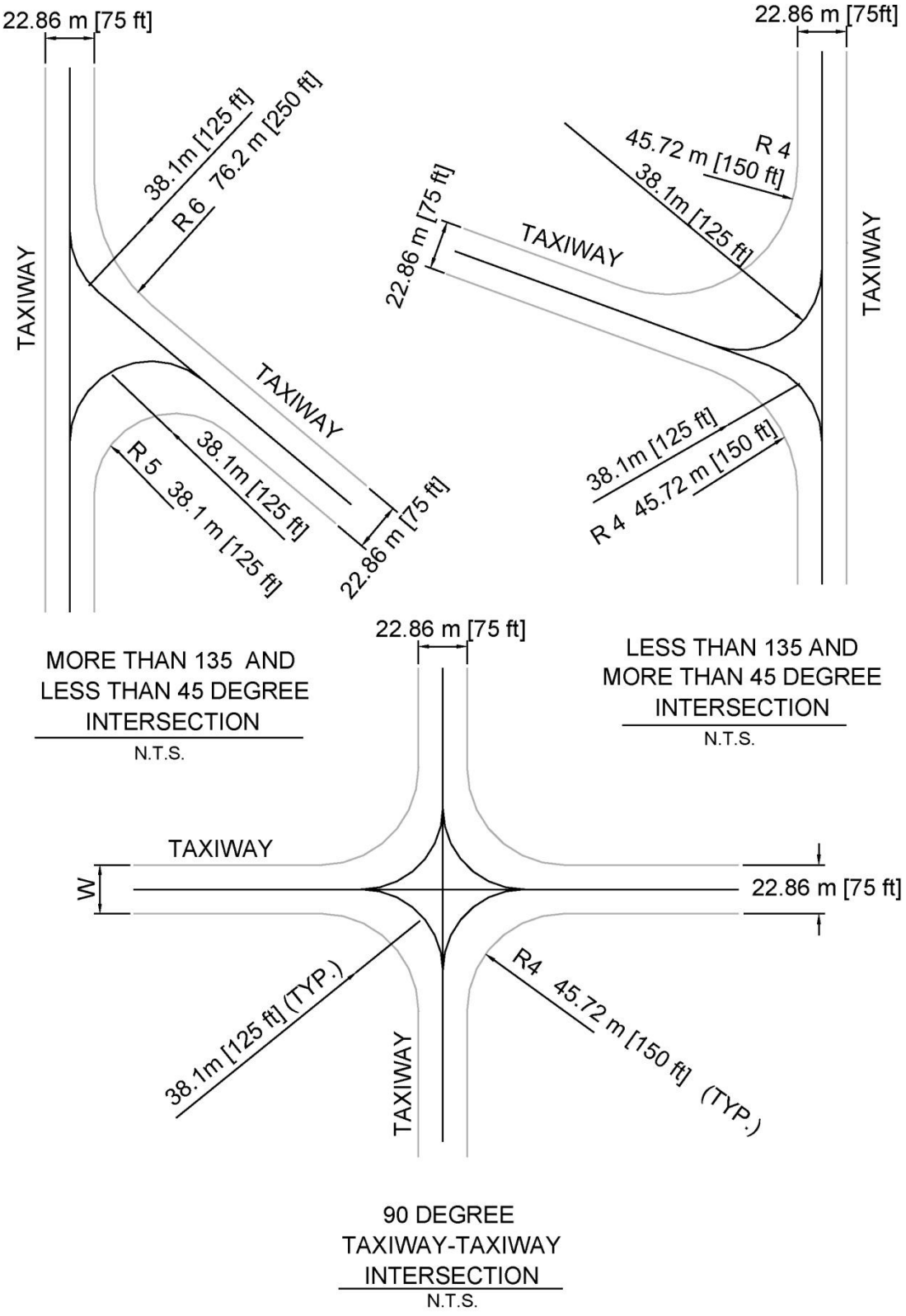


Figure 5.5. Taxiway/Taxiway Intersection Fillets.



5.8. High-Speed Taxiway Criteria. If peak operations are expected to exceed 30 take-offs and landings per hour, aircraft may be required to exit runways at greater than normal taxi speeds to maintain airfield capacity. In these cases, an acute-angle exit taxiway may be required. BCE designated representative should contact Headquarters United States Air Forces in Europe Pavements Engineer (HQ USAFE/A7P) or Headquarters Air Force Civil Engineer Support Agency, Engineering Support Directorate (HQ AFCESA/CESC) for assistance.

5.9. Apron Access Taxiways. Apron access taxiways are provided for aircraft access onto an apron. The number of apron taxiways should allow sufficient capacity for departing aircraft. The apron access taxiways should be located to enhance the aircraft's departing sequence and route.

5.9.1. **Parking Aprons.** The minimum number of apron access taxiways for any parking apron will be two. The minimum may be one if a single access taxiway will not inhibit planned operations.

5.9.2. **Fighter Aircraft Aprons**. Three apron access taxiways should be provided for aprons with over 24-parked fighter aircraft. Four entrance taxiways should be provided for aprons with over 48-parked fighter aircraft.

5.10. Shoulders. Shoulders are provided along a taxiway to allow aircraft to recover if they leave the paved taxiway. Paved shoulders prevent erosion caused by jet blast, support an occasional aircraft, which may wander off the taxiway, support vehicular traffic, and reduce maintenance of unpaved shoulder areas.

5.10.1. **For Fixed-Wing Taxiways.** The shoulder for fixed-wing taxiways may be either paved or unpaved, depending on the class of runway and type of aircraft. Paved shoulder dimensions along fixed-wing taxiways are presented in **Table 5.1**. Criteria for fixed-wing taxiway shoulders, including widths and grading requirements to prevent the ponding of storm water, are presented in **Table 5.1**. Manholes, hand holes, and drainage structures constructed within these areas should, at a minimum, be designed as provided in this section. (**NOTE:** These requirements do not apply to projects already under design prior to the publication date of this manual.) Beyond the shoulders, sub-grade structures are not designed to support aircraft wheel loads. The top surface of foundations, manhole covers, hand hole covers, and frames should be flush with the grade. Maintenance action is required if the drop-off at the edge of the structure or foundation exceeds 76 mm (3 in).

5.10.1.1. Paved Shoulder Areas.

5.10.1.1.1. For structures with their shortest span equal to or less than 0.6 m (2 ft), design based on a wheel load of 34,000 kg (75,000 lb) at a contact pressure of 1,724 kilopascal (kPa) (250 lb per square inch (psi)).

5.10.1.1.2. For structures with their shortest span greater than 0.6 m (2 ft), design based on the maximum number of wheels that can fit onto the span, considering the most critical assigned aircraft operating at its maximum gross weight. In no case, however, should the design be based on computed stress conditions less than those created by a wheel load of 34,000 kg (75,000 lb) at a contact pressure of 1,724 kPa (250 psi).

5.10.1.2. Unpaved Shoulder Areas.

5.10.1.2.1. For structures with their shortest span equal to or less than 0.6 m (2 ft), design based on a wheel load of 22,667 kg (50,000 lb) at a contact pressure of 1,724 kPa (250 psi).

5.10.1.2.2. For structures with their shortest span greater than 0.6 m (2 ft), design based on the maximum number of wheels that can fit onto the span, considering the most critical assigned aircraft operating at its maximum gross weight. In no case, however, should the design be based on computed stress conditions less than those created by a wheel load of 22,667 kg (50,000 lb) at a contact pressure of 1,724 kPa (250 psi).

5.10.2. **For Rotary-Wing Taxiways.** Paved shoulders are required adjacent to rotary-wing taxiways to prevent blowing dust and debris due to prop-wash. The criteria for a rotary-wing taxiway shoulder layout, including shoulder width, cross slopes and grading requirements, are presented in **Table 5.3**

5.11. Towways. A towway is used to tow aircraft from one location to another or from an apron to a hangar.

5.11.1. **Dimensions.** **Table 5.6** presents the criteria for towway layout and design including clearances, slopes, and grading dimensions. When designing for access to a hangar, flare the pavement to the width of the hangar door from a distance beyond the hangar sufficient to allow maintenance personnel to turn the aircraft around.

5.11.2. **Layout.** A typical transverse cross-section of a towway is shown in **Figure 5.6**

5.11.3. **Existing Roadway.** When existing roads or other pavements are modified for use as towways, provide for necessary safety clearances, pavement strengthening (if required), and all other specific requirements set forth in **Table 5.6 and Figure 5.6**

Table 5.6. Towways.

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
1	Towway Width	Outside gear width of towed mission aircraft +3 m (10 ft)		1.5 m (5 ft) on each side of gear.
2	Total Width of Shoulders (paved and unpaved)	7.5 m (25 ft)		
3	Paved Shoulder Width	Not Required		
4	Longitudinal Grade of Towway	Max 3.0%		Grades may be both positive and negative but must not exceed the limit specified.

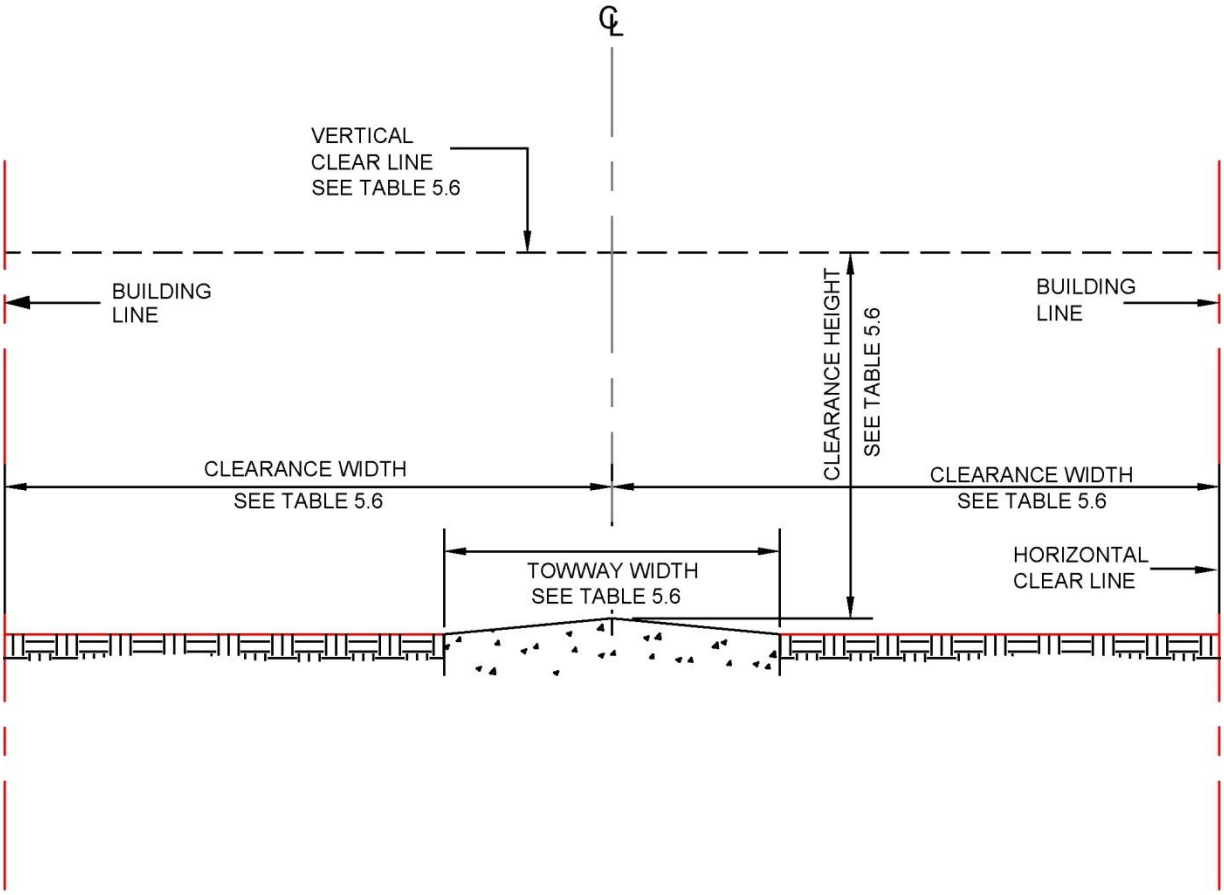
Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
5	Rate of Longitudinal Grade Change Per 30 m (100 ft)	Max 1.0%		The minimum distance between two successive points of intersection (PI) is 150 m (500 ft). Changes are to be accomplished by means of vertical curves.
6	Longitudinal Sight Distance	N/A		
7	Transverse Grade	Min 2.0% Max 3.0%		Pavement crowned at towway centerline. Slope pavement downward from centerline of towway.
8	Towway Turning Radius	46 m (150 ft) radius		Criteria presented here are for straight sections of towway. Pavement width and horizontal clearance lines may need to be increased at horizontal curve locations, based on aircraft alignment on the horizontal curve.
9	Fillet Radius at Intersections	30 m (100 ft) radius		
10	Transverse Grade of Unpaved Shoulder	(a) 40 mm (1.5 in) drop-off at edge of pavement, +/- 13 mm (0.5 in). (b) Min 2.0%, Max 4.0%		
11	Horizontal Clearance From Towway Centerline to Fixed or Mobile Obstacles	The greater of: (½ the wing span width of the towed mission aircraft + 7.6 m (25 ft)); or the minimum of 18.25 m (60 ft)		
12	Vertical Clearance From Towway Pavement Surface to Fixed or Mobile Obstacles	Height of towed mission aircraft + 3 m (10 ft)		

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
13	Grade (area between taxiway shoulder and taxiway clearance line)	Min of 2.0% prior to channelization, Max 10%. (See **Note 2**.)		

NOTES:

1. N/A = 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 instruction 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.

Figure 5.6. Towway Criteria.



5.12. Hangar Access. The pavement, which allows access from the apron to the hangar, is referred to as a hangar access apron and is discussed in more detail in **Chapter 6**.

5.13. Taxitracks.

5.13.1. Taxitracks connect dispersed parking platforms to taxiways that connect to the runway.

5.13.1.1. For tactical fighter aircraft ensure each dispersed parking platform is connected to a taxiway with two means of access to the runway.

5.13.1.2. For tactical transport and maritime patrol aircraft, ensure the dispersed parking area is connected to a taxiway system providing separate access to either end of the runway.

5.13.2. Taxitracks are 15 m (50 ft) wide and can be constructed of rigid or flexible pavement.

Table 5.7. Taxitracks.

Item No.	Item Description	Requirement	Remarks
1	Width	15 m (50 ft)	
2	Clearance from Taxitrack Centerline to Fixed or Mobile Obstacles	15 m (50 ft) tactical fighter (See **Note 1**) 35 m (115 ft) tactical transport (See **Notes 2 and 3**)	Refer to **Attachment 1**, *Glossary of References and Supporting Information*, for definitions of tactical fighter and tactical transport aircraft
Notes: 1. 17 m (55 ft) for A-10 aircraft 2. 20 m (65 ft) for C-20 aircraft 3. 21.5 m (70 ft) for C-21 aircraft			

5.14. Parallel Taxiway/Emergency Runway.

5.14.1. For USAFE, parallel taxiways used as emergency runways and emergency landing surfaces are all classified as emergency runways and are subject to this criteria. The purpose of the parallel taxiway and/or emergency runway is to provide aircraft pavement suitable for the dual function of transit to and/or from the runway and to provide an emergency runway for fighter aircraft only. The parallel taxiway and/or emergency runway is for operational redundancy.

5.14.2. Table 5.8. provides details for parallel taxiways/emergency runways.

Table 5.8. Parallel Taxiways Emergency Runways.

Item No.	Item Description	Class B Runway	Remarks
		Requirement	
1	Width	23 m (75 ft)	
		45m (147 ft)	Airfields with Strategic Airlift.
2	Total Width of Shoulders (paved and unpaved)	30 m (100 ft)	
3	Paved Shoulder Width	7.5 m (25 ft)	USAFE funded projects. NATO requires only 3m paved shoulder.
		3 m (10 ft)	Airfields for fighter and trainer aircraft.
		15 m (50 ft)	Airfields for B-52 Aircraft.

Item No.	Item Description	Class B Runway Requirement	Remarks
4	Longitudinal Grade of Taxiway and Shoulders	Max 1.5%	Grades may be both positive and negative but must not exceed the limit specified. For airfields other than multi-mission, a grade of 3.0% is permitted. A gradient exception of 5.0 % is also permitted for a distance of not more than 120 m (400 ft). The exception does not apply within 180 m (600 ft) of a runway entrance. Here the 3.0% maximum applies. For multi-mission airfields, the gradient is limited to 2%.
5	Rate of Longitudinal Grade Change	Max 1.0% per 30 m (100 ft)	The minimum distance between two successive PIs is 150 m (500 ft). Changes are to be accomplished by means of vertical curves.
6	Longitudinal Sight Distance	Min 300 m (1,000 ft). Any two points 3 m (10 ft) above the pavement must be mutually visible for the distance indicated.	
7	Transverse Grade of Taxiway	Min 1.0% Max 1.5%	New taxiway pavements will be centerline crowned. Slope pavement downward from centerline of taxiway. Existing taxiway pavements with insufficient transverse gradients for rapid drainage should provide for increased gradients when overlaid or reconstructed. The transverse gradients requirements are not applicable at or adjacent to intersections where pavements must be warped to match abutting pavements.
8	Transverse Grade of Paved Shoulders	Min 2.0%, Max 4.0% Max 3.0% for NATO	All airfields, not otherwise specified. Grading can be decreased to 3% maximum only if NATO project strictly requires such grading. Otherwise, follow standard grading.

Item No.	Item Description	Class B Runway Requirement	Remarks
9	Transverse Grade of Unpaved Shoulders	(a) 40 mm (1.5 in) drop-off at edge of pavement, +/- 13 mm (0.5 in). (b) Min 2.0%, Max 3.0% (c) Max 3.0% for NATO	For additional information, see **Figure 3.2.**
10	Distance Between Taxiway Centerline and Parallel Taxiway/Taxilane Centerline	100 m (328 ft)	
11	Grade (area between taxiway shoulder and taxiway clearance line)	Min of 2.0% prior to channelization Max 10.0%	For additional information, see **Figure 3.2.** Unpaved areas shall be graded to provide positive surface drainage away from paved surfaces.
12	Clearance from Taxiway Centerline to Fixed or Mobile Obstacles (taxiway clearance line)	100 m (328 ft)	Items within the taxiway clearance zone are required to be frangible, see **Table 5.1.**, item 13 for specific requirements.
13	Clear Zone Length	150 m (492 ft)	Clear zone starts at parallel taxiway threshold.
14	Clear Zone Width	200 m (656 ft)	Centered on parallel taxiway centerline.
15	Approach Departure Surface	Slope 50:1	50 horizontal units over one vertical unit.
16	Approach Departure Surface Beginning Width	200 m (656 ft)	Centered on parallel taxiway centerline.
17	Approach Departure Surface Length	2,500 m (8,202 ft)	From threshold.

Item No.	Item Description	Class B Runway Requirement	Remarks
18	Transitional Slope	Slope 7:1	The 7:1 transitional slope starts at the edge of the parallel taxiway's lateral clearance zone at the elevation nearest to the centerline of the parallel taxiway. The slope terminates at the runway's inner horizontal surface.

Figure 5.7. Parallel Taxiway Emergency Runway Imaginary Surfaces.

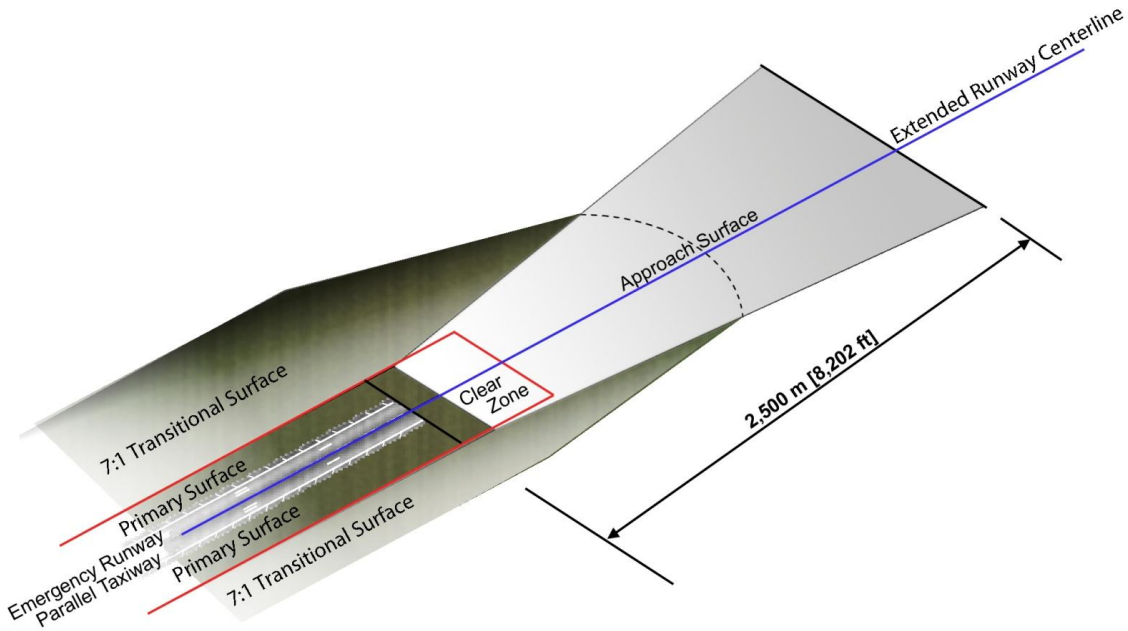
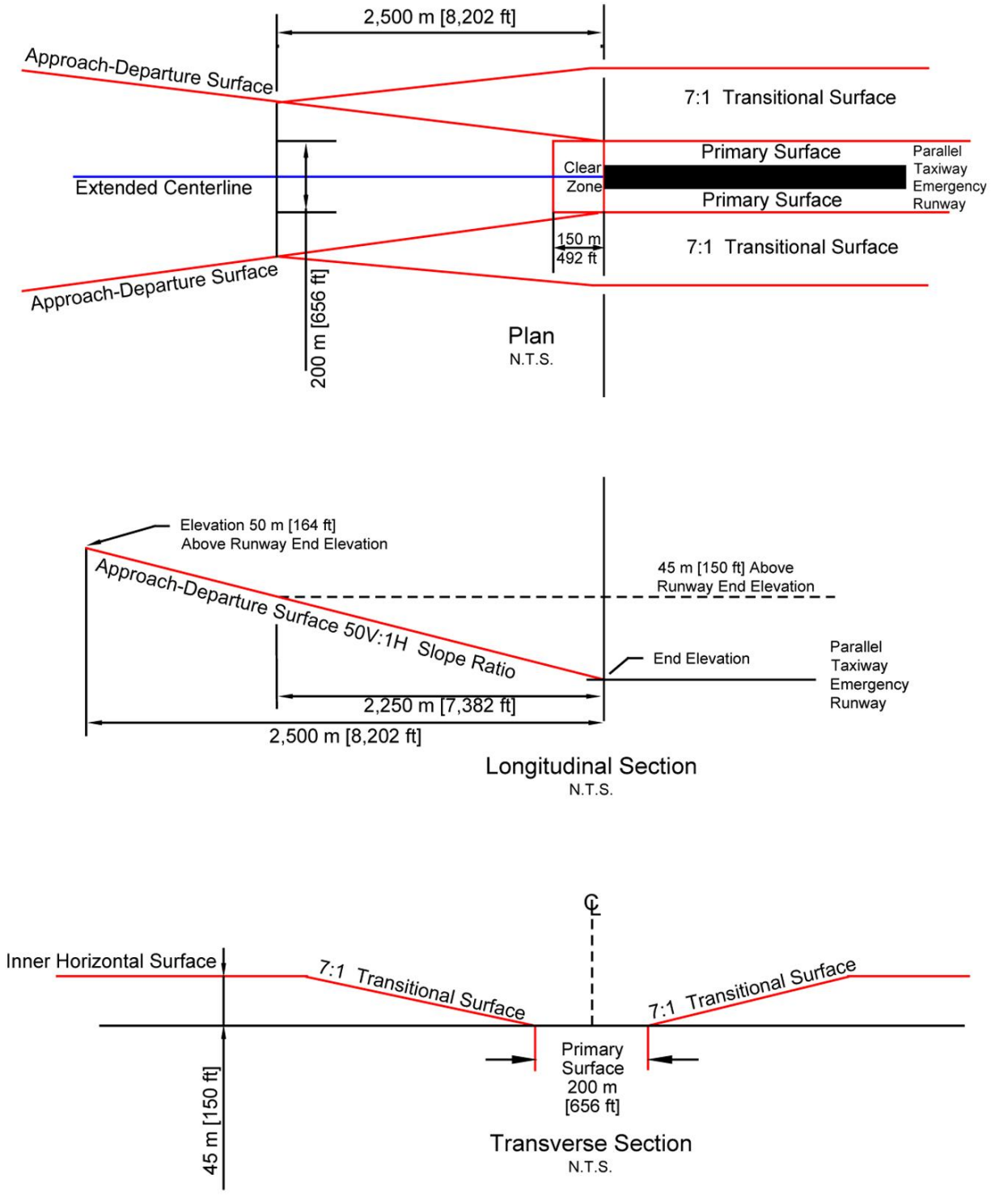


Figure 5.8. Parallel Taxiway Emergency Runway Clear Zone Details.



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.

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 AF aviation facilities are found in AFH 32-1084, *Facility Requirements*.

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 (U. S. Army Corps of Engineers (USACE)). Dimensional characteristics of various military, civil, and commercial fixed- and rotary-wing aircraft are available in U.S. Army Engineering Technical Letter (ETL) 1110-3-394, *Aircraft Characteristics for Airfield-Heliport Design and Evaluation*. This document can be located on the HQ USAFE/A7P Community of Practice site at the following address: **https://www.my.af.mil/afknprod/ASPs/docman/DOCMain.asp?Tab=0&FolderID=OO-EN-FE-08-8&Filter=OO-EN-FE-08.**

6.5. Parking Apron for Fixed-Wing Aircraft.

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 and transitional surfaces. A typical parking apron is illustrated in **Figure 6.3**

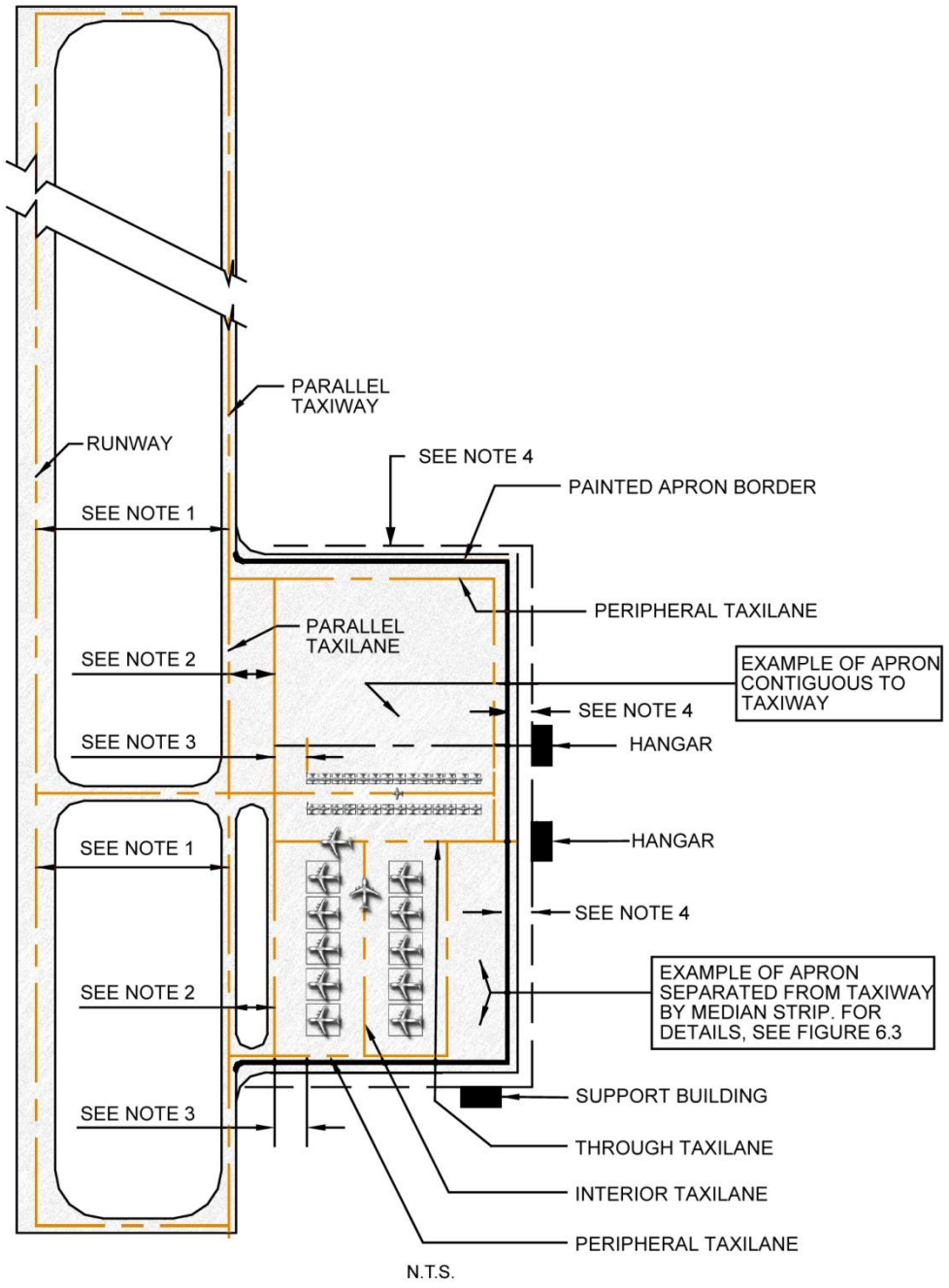
6.5.2. **Size.** As a general rule, there are no standard sizes for aircraft aprons. Aprons are individually designed to support aircraft and missions at specific facilities. Base the actual dimensions of an apron on the number and type of authorized aircraft, maneuvering space, and type of activity the apron serves. Allowances are provided in AFH 32-1084. The ideal apron size affords the maximum parking capacity with a minimum amount of paving. Generally, achieve this by reducing the area dedicated for use as taxi lanes by parking aircraft perpendicular to the long axis of the apron.

6.5.3. **Parking Apron Layout.** Parking apron dimensions for United States Air Forces in Europe (USAFE) facilities will be based on the specific aircraft assigned to the facility and the criteria presented in AFH 32-1084. A typical mass-parking apron should be arranged in rows, as shown in **Figure 6.3**

6.5.4. **Layout for Combined Army and AF Parking Aprons.** Parking apron dimensions for combined Army and AF facilities will be based on the largest aircraft assigned to the facility.

6.5.5. **Tactical/Fighter Parking Apron Layout.** The recommended tactical/fighter aircraft parking arrangement is to park aircraft at a 45-degree angle as discussed in AFH 32-1084. Arranging these aircraft at a 45-degree angle may be 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 (**Figure 6.4**). Jet blast relationships are discussed in Army ETL 1110-3-394.

Figure 6.1. Apron Nomenclature and Criteria.

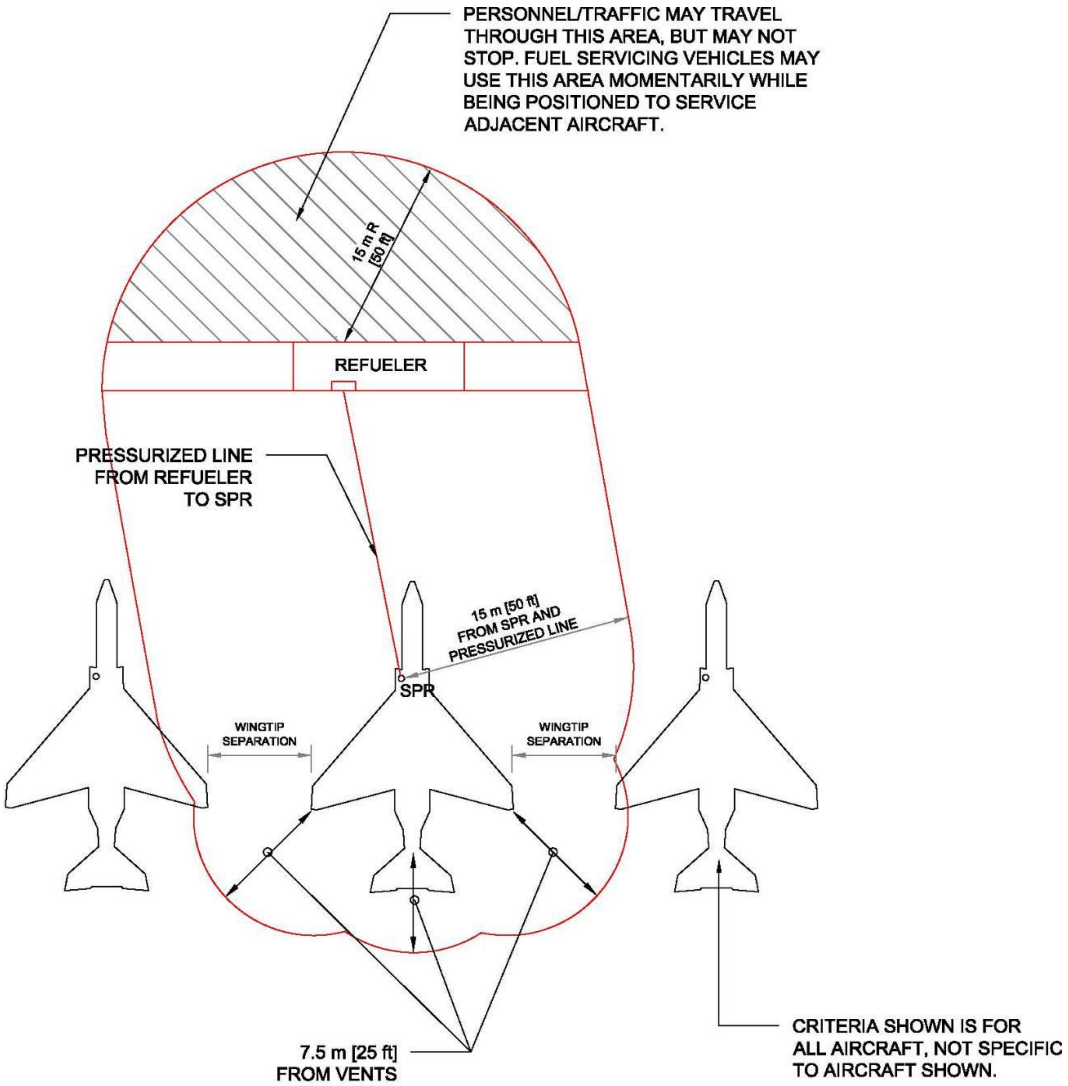


NOTES:

1. Runway Lateral Clearance distance, USAFE & North Atlantic Treaty Organization (NATO) criteria.
2. Distance between taxiway centerline and parallel taxiway and, or taxilane centerline.
3. One-half wingspan plus wingtip clearance.
4. Clearance from edge of apron to fixed or mobile objects.
5. See **Tables 3.2., 5.1.,** and **6.1.** for criteria.

6.5.6. **Refueling Considerations.** Refueling operations should not interfere with taxiing operations for other aircraft. Multiple 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 within the Fuel Servicing Safety Zone (FSSZ). An example of the refueling safety zone (RSZ) around a fixed-wing aircraft is shown in **Figure 6.2**. The safety zone is the area within 15 m (50 ft) 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 m (25 ft) around aircraft fuel vents. The FSSZ is established and maintained during pressurization and movement of fuel. For additional information, see AF Technical Order (T.O.) 00-25-172, *Ground Servicing of Aircraft and Static Grounding/Bonding*. Minimum requirements for the design and maintenance of the drainage system of aircraft fueling ramps are given in National Fire Protection Association (NFPA) 415, *Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways,* and UFC 3-460-01, *Petroleum Fuel Facilities*.

Figure 6.2. Truck Refueling Safety Zone (RSZ) Example.



6.5.7. Parking Dimensions. **Table 6.1**. presents minimum geometric criteria for fixed-wing apron design.

6.5.7.1. 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 and minimum standoff distance to edge of pavement are described in UFC 3-260-01, Appendix B, Sections 7 and 8, *Jet Blast Effects/Jet Blast Deflector*.

6.5.8. **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	Remarks
		Requirement		
1	Size and Configuration	Variable See **criteria listed below** and AFH 32-1084.		As a general rule there are no standard sizes for aprons; they should be individually designed to support specific aircraft uses. The dimensions are determined by the number and type of aircraft, 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		For CV-22 parking dimensions, see **Figure 6.9.**
3	Parking Space Length (“L”)	Design aircraft length		For CV-22 parking dimensions, see **Figure 6.9.**
4	Wingtip Clearance of Parked Aircraft (“P”)	3.1 m (10 ft)		Aircraft with wingspans up to 33.5 m (110 ft). For CV-22 wingtip clearances, see **Figure 6.9.**
		6.1 m (20 ft)		Aircraft with wingspans of 33.5 m (110 ft) or more except as noted below. See **Note 1**.
		7.7 m (25 ft)		Transient aprons (all aircraft except C-5, C-17, KC-10, and KC-135). See **Note 1**.
		15.3 m (50 ft)		C-5, C-17, KC-10 and KC-135 aircraft. See **Note 1** for allowable deviations for KC10 and KC-135.

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
5	Wingtip Clearance of Aircraft on Interior or Secondary Peripheral Taxi lanes (“I”)	6.1 m (20 ft)		Aircraft with wingspans up to 33.5 m (110 ft), except transient aprons. For CV-22 wingtip clearances, see **Figure 6.9. and Note 1**.
		7.7 m (25 ft)		Transient aprons. See **Note 1**. For CV-22 wingtip clearances, see **Figure 6.9.**
		9.2 m (30 ft)		Aircraft with wingspans of 33.5 m (110 ft) or more, see **Note 1**.
6	Wingtip Clearance of Aircraft on Through or Primary Peripheral Taxi lanes (“T”)	9.2 m (30 ft)		Aircraft with wingspans up to 33.5 m (110 ft). For CV-22 wingtip clearances, see **Figure 6.9. and Note 1**.
		15.3 m (50 ft)		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)		Designed for aircraft with wingspan up to 33.5 m (110 ft). For CV-22 wingtip clearances, see **Figure 6.9.** Also applies to taxi lanes for aircraft parking taxi lines and spots near the apron edge.
		11.5 m (37.5 ft)		Designed for aircraft with wingspan of 33.5 m (110 ft) and greater. Also applies to taxi lanes for aircraft parking spots near the apron edge.
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, *Ground Servicing of Aircraft and Static Grounding/ Bonding*.
		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.

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
9	Grades in the Direction of Drainage	Min 0.5%, Max 1.5% Min 1.0%, Max 1.5% for NATO		Avoid surface drainage patterns with numerous or abrupt grade changes. This can produce excessive flexing of aircraft and structural damage. Lateral and transverse slopes must be combined to derive maximum slope in the direction of drainage. (i.e., the square root of the transverse slope squared plus longitudinal slope squared is equal to the slope in the direction of drainage.) For the Air Force, no grade changes are allowed for individual parking positions within the aircraft block dimensions (not including clearance distances) of the design aircraft. Exceptions are allowed for fuel hydrant pits. Minimum grading can be increased to 1% maximum only if NATO project strictly requires such grading. Otherwise, follow standard grading (0.5 to 1.5%).
10	Width of Shoulders (Total Width Including Paved and Unpaved)	7.5 m (25 ft)	15 m (50 ft)	
11	Paved Width of Shoulders	7.5 m (25 ft)	7.5 m (25 ft)	Airfields not otherwise specified. For apron shoulders where fire hydrants must be installed, see **Note 5**. Also see UFC 3-260-01, Appendix B, Section 13, *Deviations from Criteria for Air Force Airfield Support Facilities*, for the minimum set back from the taxilane centerline.
		N/A	15 m (50 ft)	Airfields that accommodate B-52, C-5, E-4 and 747 aircraft. For apron shoulders where fire hydrants must be installed, see UFC 3-260-01, Appendix B, Section 13, for the minimum set back from the taxilane centerline.
12	Longitudinal Grade of Shoulders	Variable Min 1.0%, Max 1.5% for NATO		Conform to longitudinal grade of the abutting primary pavement. Follow NATO grading for NATO funded projects.

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
13	Transverse Grade of Paved Shoulder	Min 2.0%, Max 4.0% Min 1.0%, Max 1.5% for NATO		All airfields, except as noted below. Grading can be reduced to NATO criteria only if NATO project strictly requires such grading. Otherwise, follow standard grading.
		N/A	Min 1.5% Max 2.0%	Airfields that accommodate B-52 aircraft.
14	Transverse Grade of Unpaved Shoulders	2.0% min	(a) 40 mm (1.5 in) drop-off at edge of paved shoulder, +/- 13 mm (0.5 in). (b) 2.0% Min, 4.0% Max.	
15	Clearance from Apron Boundary Marking to Fixed or Mobile Obstacles	(a) 15 m (50 ft) tactical (non-transport) (b) 20 m (65 ft) tactical transport (c) 35 m (115 ft) strategic transport Refer to **Attachment 1**, *Glossary of References and Supporting Information*, for definitions of tactical (non-transport), tactical transport, and strategic transport aircraft		Clearance is taken from apron boundary marking, not centerline of taxilane. This distance to be clear of all fixed and mobile obstacles except those noted in UFC 3-260-01, Appendix B, Section 13. **Notes:** 1. Light poles are not allowed within this distance without waiver. 2. Implement operational controls to ensure that aircraft larger than the design aircraft do not use the apron without wing-walkers. 3. Submit a revised summary of airfield restrictions to allow update to the Air Mobility Command (AMC) Airfield Suitability and Restrictions Report. Send the revision to: HQ AMC/DOAS 402 Scott Drive Unit 3A1 Scott AFB, IL 62225-5302

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
16	Grades in Cleared Area Beyond Shoulders to Fixed or Mobile Obstacles	(a) 40 mm (1.5 in) drop-off at edge of paved shoulder, +/- 13 mm (0.5 in). (b) 2.0% Min, 10.0% Max.	Min 2.0% Max 10.0%	40-mm (1.5-in) drop-off (+/- 13 mm (0.5 in)) at edge of pavement when the entire shoulder is paved. When a slope reversal is required within this area, a flat bottom ditch that is graded to drain adequately shall be provided.

NOTES:

1. For day-to-day operations, wingtip clearances may be reduced to those allowed by AFI 11-218, *Aircraft Operation and Movement on the Ground*, with a waiver. For reduced wingtip clearances during contingency operations, see **Attachment 2,** *United States Air Forces in Europe (USAFE) Airfield and Airspace Waiver Program*.

2. Metric units apply to new airfield construction, and where practical, to modifications to existing airfields and heliports, as discussed in **paragraph 1.4.4.**

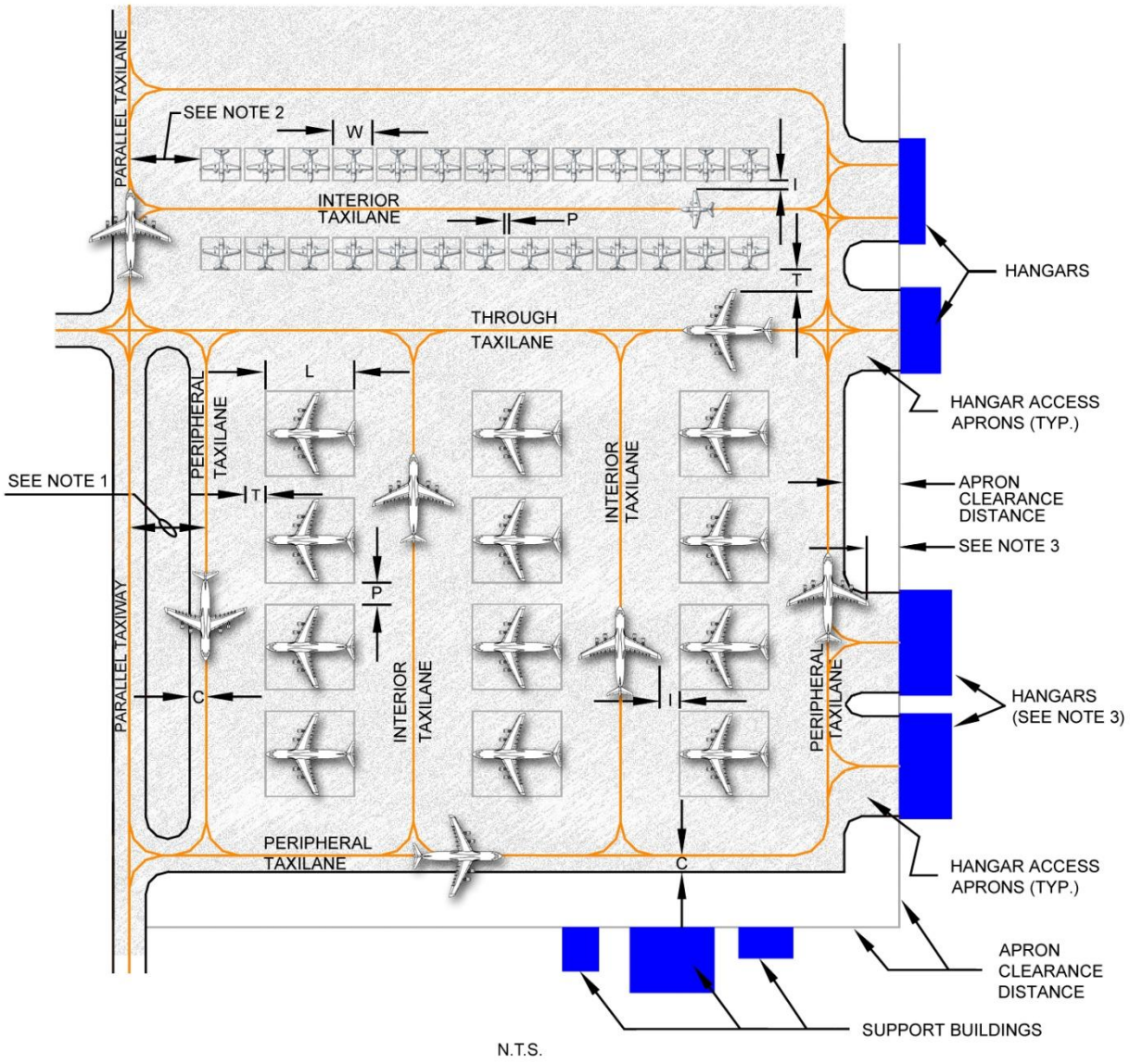
3. The criteria in this instruction are based on aircraft specific requirements and are not direct conversions from inch-pound (English) dimensions. Inch-pound units are included only as a reference to the previous standard.

4. Airfield and heliport imaginary surfaces and safe wingtip clearance dimensions are shown as a direct conversion from inch-pound to SI units.

5. For apron edges where fire hydrants must be installed, widen paved shoulders to within 4.6 m (15 ft) of the hydrants to allow paved access for firefighting vehicles.

6. N/A = not applicable

Figure 6.3. Typical Parking Plan.



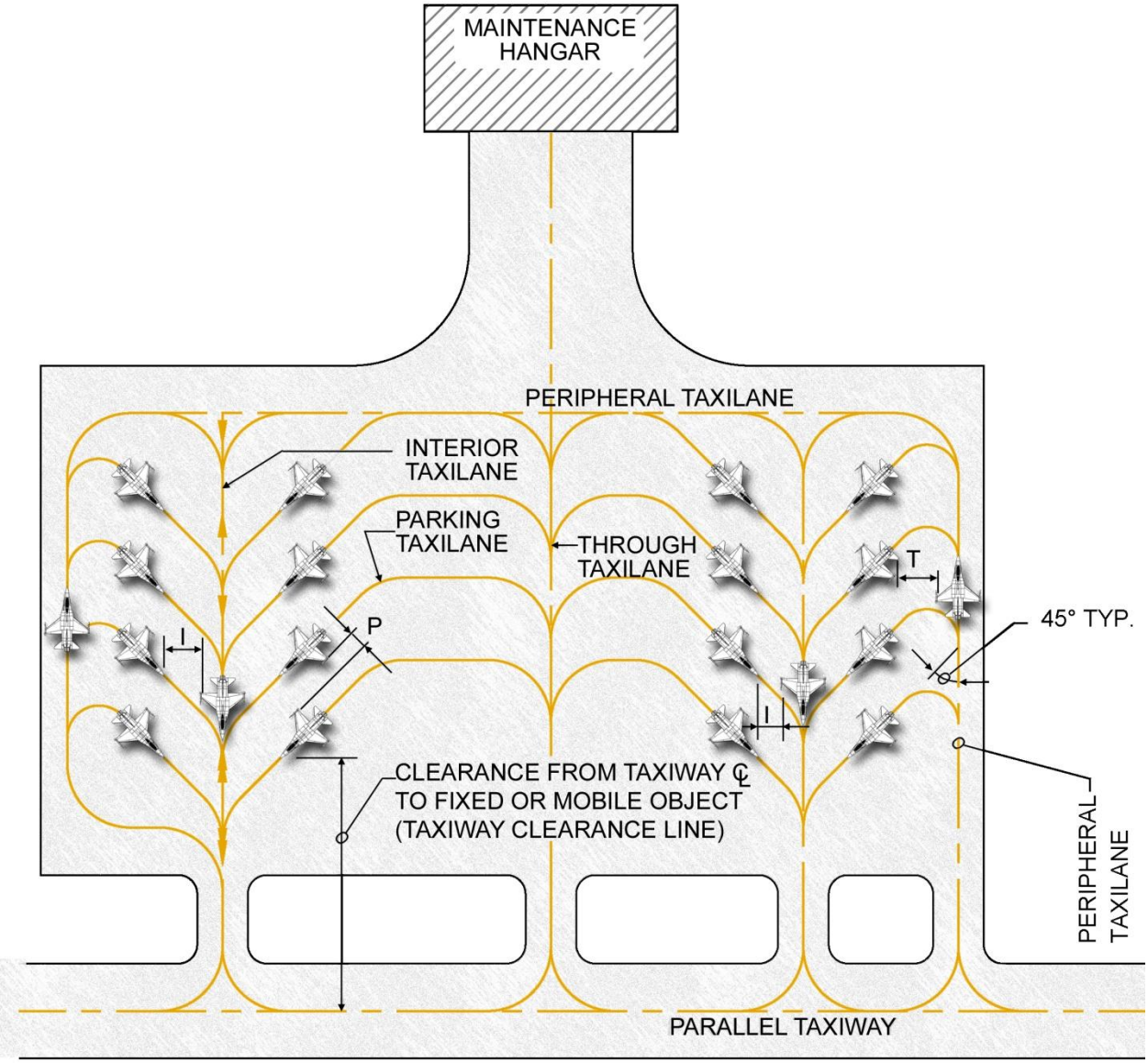
NOTES:

1. Taxiway Clearance distance at facilities with parallel taxiways; see **Table 5.1.**, Item 11.

2. See **Table 6.1.** for dimensional definitions.

3. Ensure minimum wingtip clearance is provided to hangars or other permissible deviations, see **Table 6.1.**, Items 6 and 15 and UFC 3-260-01, Appendix B, Section 13, *Deviations from Criteria for Air Force Airfield Support Facilities.*

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.

6.6. 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, 6.3, and 6.4**. Minimum wingtip clearances between parked and taxiing aircraft are listed in **Table 6.1**.and shown on **Figure 6.3**. AFI 11-218, *Aircraft Operation and Movement on the Ground*, provides authorization for operation of aircraft at reduced

clearances under certain circumstances with a USAFE/A3 approved waiver. 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**. Waivers should be pursued only when all avenues for compliance have been exhausted.

6.6.2. **Turning Capabilities (Aircraft Turning and Maneuvering Characteristics).** Army ETL 1110-3-394, provides sources for obtaining various turning diagrams for 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. For parking apron access taxiway requirements, see **Section 5.10**

6.6.4. **Minimum Standoff Distances from Edge Pavements**. See USAF ETL 01-5, *Jet Engine Thrust Standoff Requirements for Airfield Asphalt Edge Pavements*, and UFC 3-260-01, Appendix B, Sections 7 and 8 for information on minimum standoff distances from edge pavements.

6.7. Parking Apron for Rotary-Wing Aircraft. Mass parking of rotary-wing aircraft will require a designated apron. Transient rotary-wing aircraft may be parked on aprons designated 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 and Transitional Surfaces discussed in **Chapters 3** and **4**. 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 (observation helicopter (OH), utility helicopter (UH) and attack helicopter (AH)) should be separate from parking areas used by cargo helicopters (CH).

6.7.2. **Apron Size.** As with fixed-wing aircraft aprons, there is no standard size for rotary-wing aircraft aprons. Dimensions should be based on the number and type of aircraft, maneuvering space and type of activity the apron serves.

6.7.3. **Maneuverability.**

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

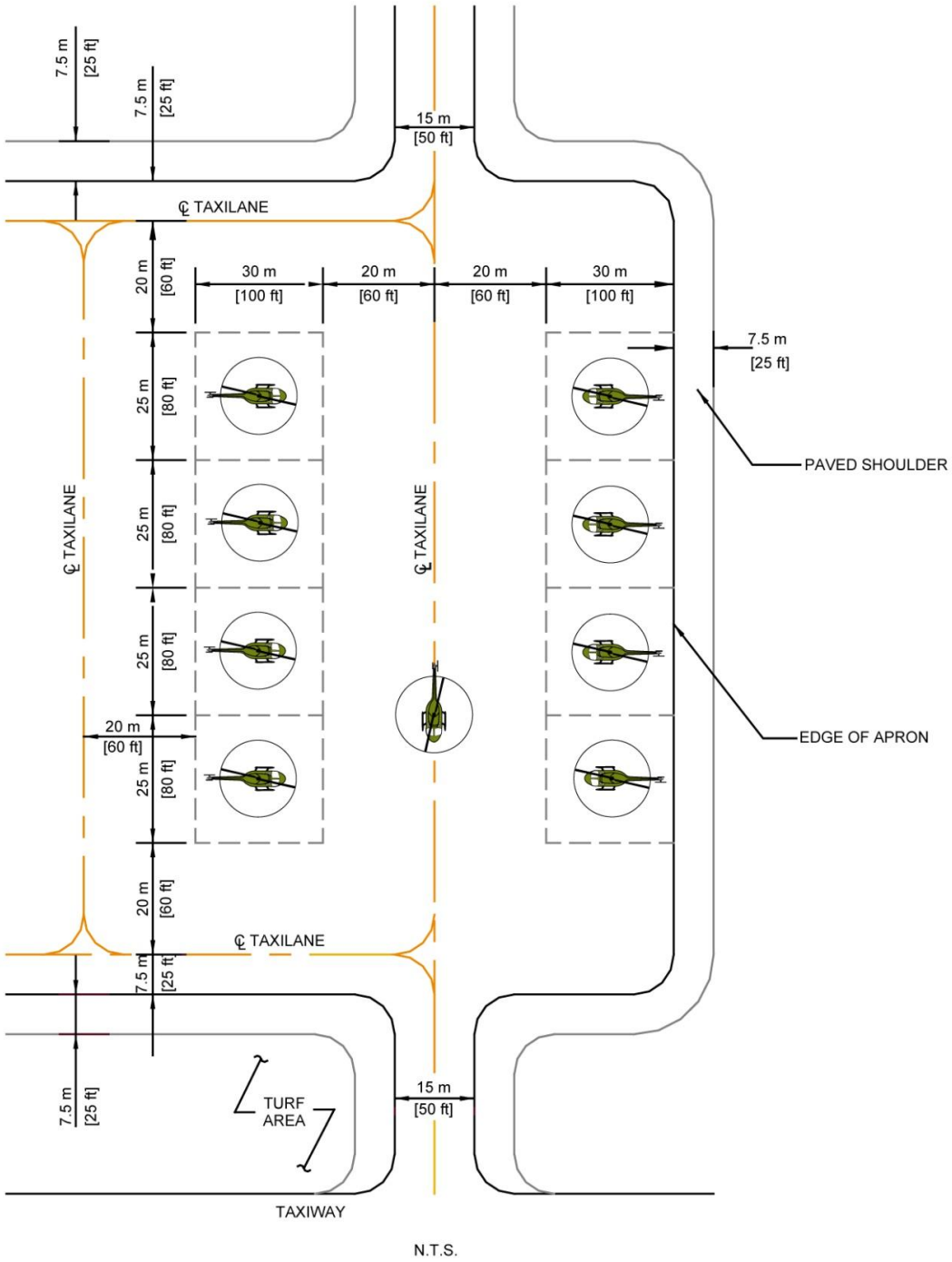
6.7.3.2. Undercarriage. Rotary-wing aircraft are equipped with either skid gear or wheel gear. Once on the ground, skid-gear equipped helicopters cannot be moved without the appropriate aerospace ground equipment (AGE). Wheeled rotary-wing aircraft can be moved on the ground.

6.7.4. **Parking Apron Layout.** Rotary-wing aircraft are parked in a layout similar to fixed-wing aircraft. Parking space, taxilane and clearance dimensions will be based on the rotor diameter of the specific aircraft assigned to the facility. Wingtip clearance criteria provided in Table 2.7 of AFH 32-1084 are preferred. **Note*:*** USAFE activities may use Army criteria presented in UFC 3-260-01 for rotary-wing aircraft except CH-53 and CH-54.

6.7.5. **Refueling Considerations.** As discussed in **paragraph 6.5.6**., 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 m (10 ft) greater than the area bounded by the blades and tail of the aircraft. For additional information, see AF T.O. 00-25-172.

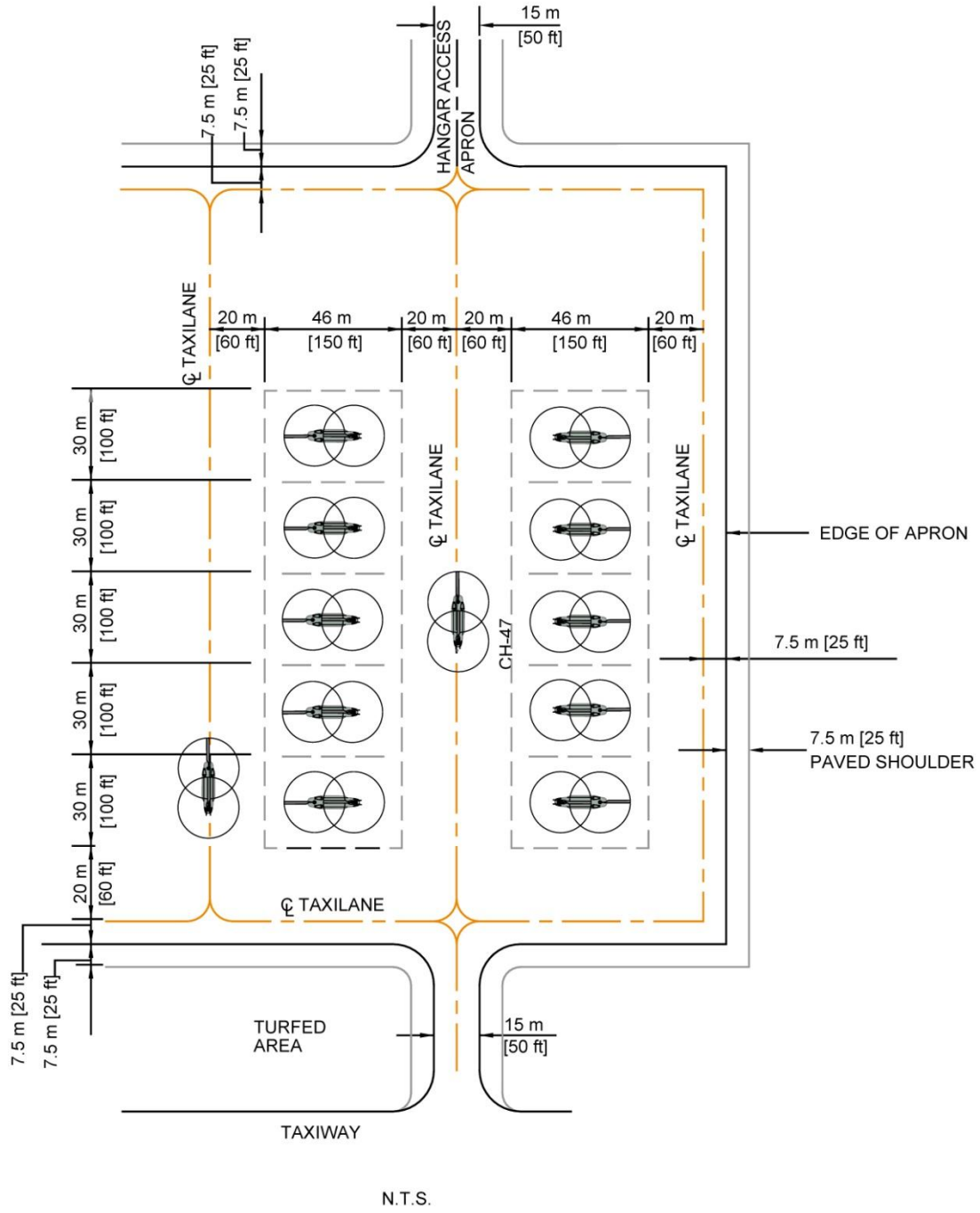
6.7.6. **Parking Dimensions.** Criteria for rotary-wing apron design are presented in AFH 32-1084.

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



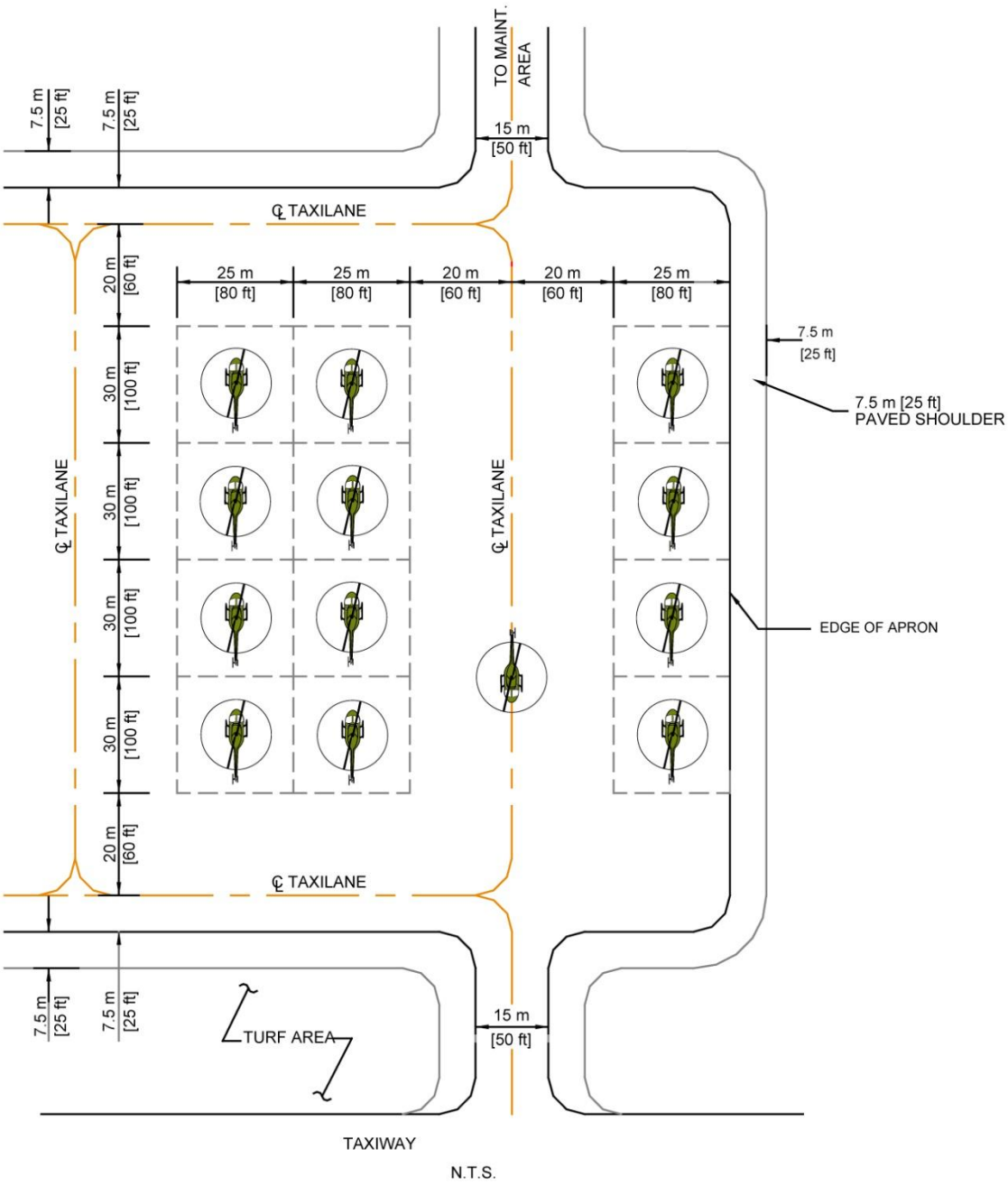
NOTE:
The dashed lines forming boxes around the parking positions show the limits of the safety zone around the parked aircraft. Aircraft are to be parked in the center of the box to provide proper taxiing clearances.

Figure 6.6. Type 1 Parking for CH-47.



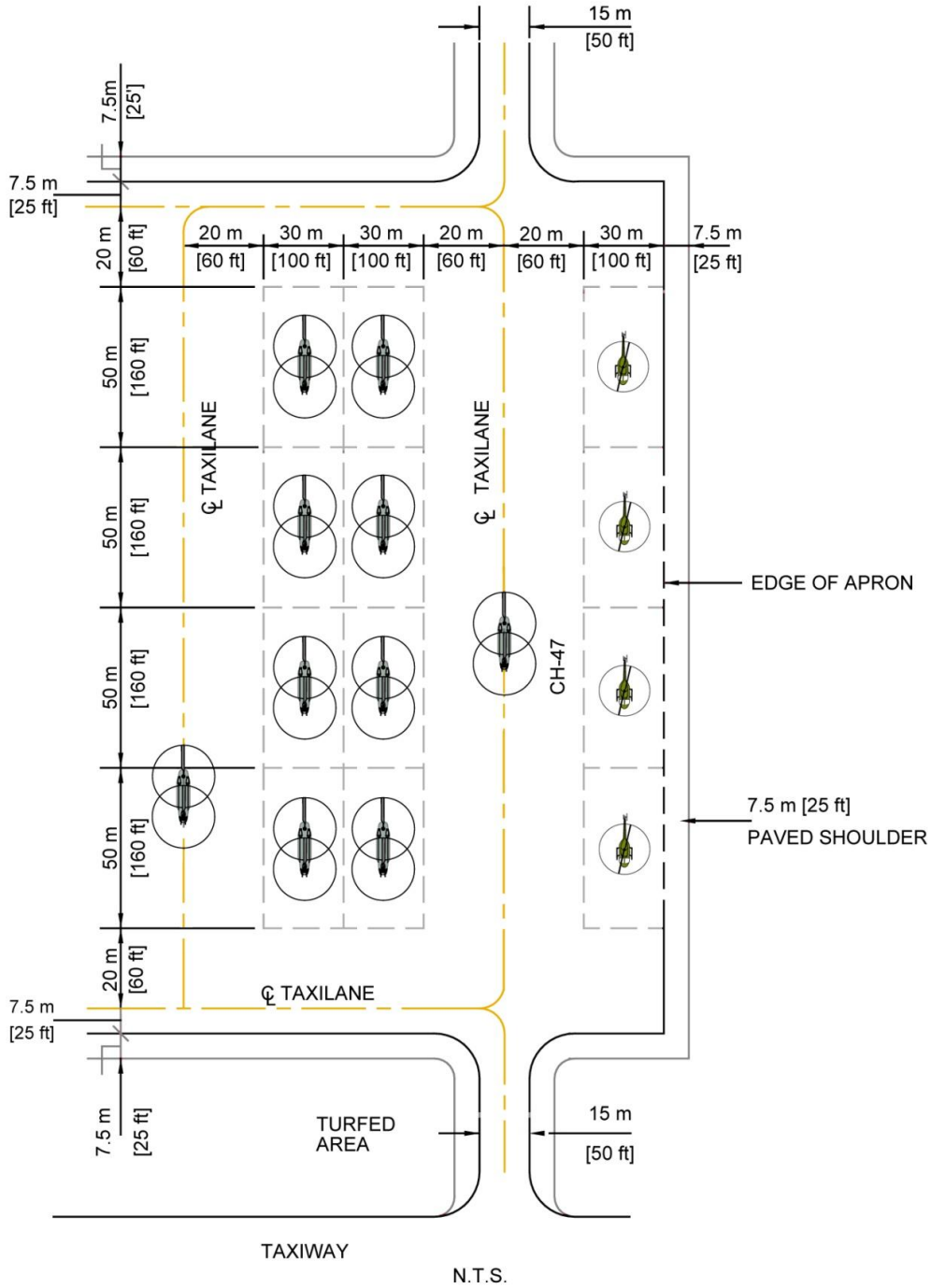
NOTE:
The dashed lines forming boxes around the parking positions show the limits of the safety zone around the parked aircraft. Aircraft are to be parked in the center of the box to provide proper taxiing clearances.

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



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 taxiing clearances.

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



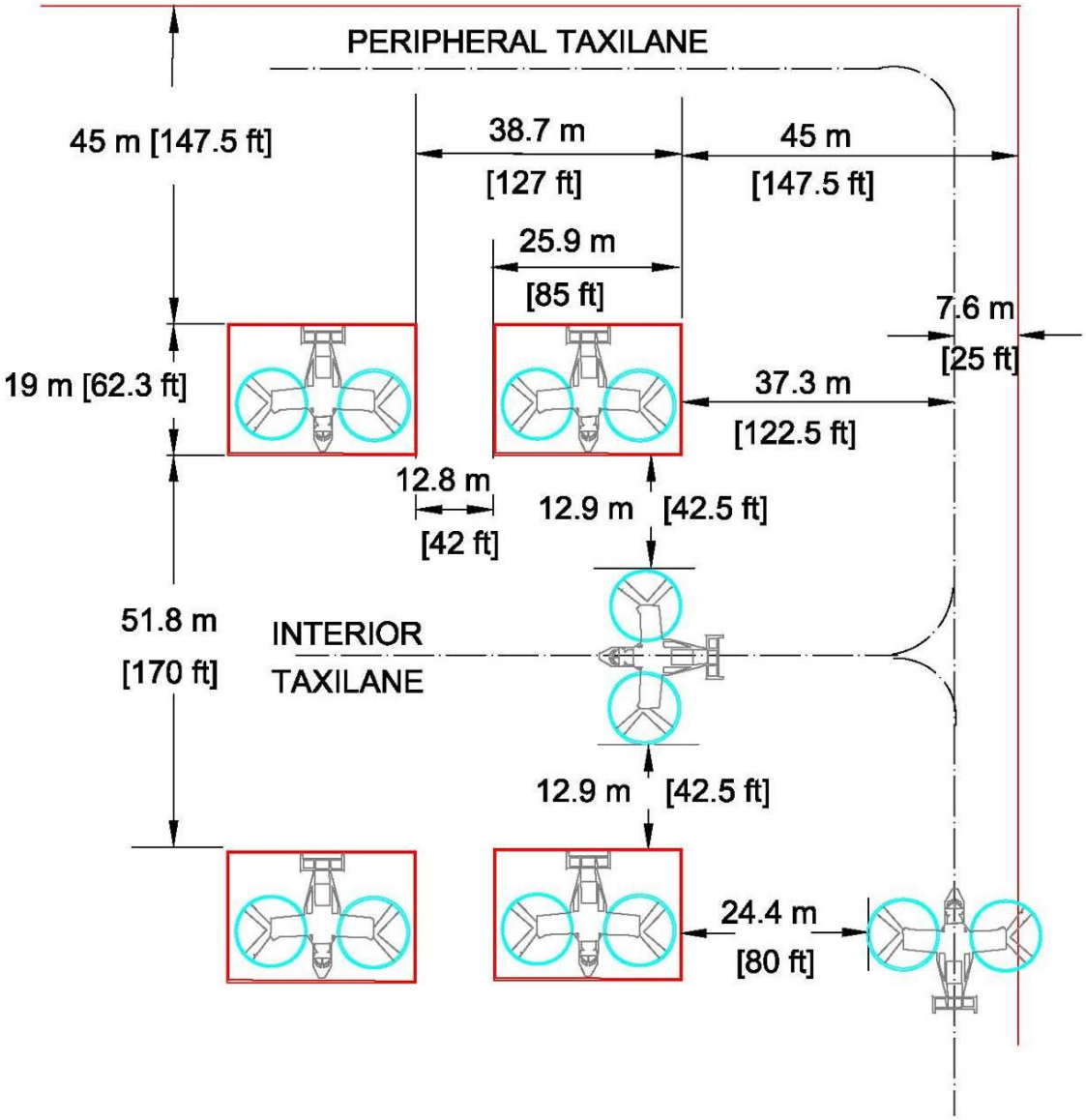
NOTES:

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 taxiing clearances.

2. Parking aprons accommodating both CH-47 aircraft and AH-64/UH-60 should allow for sufficient distance for safe taxiing operations.

6.7.7. CV-22 Apron Clearances. Figure 6.9. provides parking block dimensions as well as peripheral and interior taxilane clearance requirements.

Figure 6.9. CV-22 Apron Clearance Requirements.



NORMAL PARKING ARRANGEMENT
(INCLUDES FUEL PROBE FOR CV-22)

N.T.S.

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. Pads must be sized to provide a minimum of 7.62m (25 ft) of blast-resistant pavement behind the tail of an aircraft to prevent damage from jet blast.

6.8.1. Location.

6.8.1.1. 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 6.10** However, other design considerations such as navigational aids (NAVAIDS) may make this location undesirable. Do not site warm-up pads, other aprons, hot cargo spots, or taxiways in a way that will allow penetration of the approach or departure clearance surface.

6.8.1.2. Along Parallel Taxiway. If airspace and NAVAIDS 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 6.11**.

6.8.2. **Siting Considerations.**

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

6.8.2.2. Approach or Departure Clearance Surfaces. As discussed in **Chapter 3**, an obstruction to air navigation occurs when the imaginary surfaces are penetrated. Do not site warm-up pads, other aprons, hot cargo spots, or taxiways to these facilities in a way that will allow penetration of either the Approach or Departure Clearance Surfaces. Such aircraft penetrations may require revisions to TERPS procedures. Properly sited warm-up positions are illustrated in **Figure 6.13**.

6.8.2.3. NAVAIDS. Warm-up pads must be located so that holding aircraft do not interfere with the operation of NAVAIDS, including instrument landing system (ILS) equipment. The critical area for ILS equipment is illustrated in **Figures 6.14 through 6.16**. Additional discussion of ILS critical areas is provided in Technical Manual (TM) 5-823-4, *Marking of Army Airfield-Heliport Operational and Maintenance Facilities*, AFI 13-204, *Functional Management of Airfield Operations* and Air Force ETL 04-2, *Standard Airfield Pavement Marking Schemes*.

6.8.3. **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 are presented in **Table 6.1**. Additional clearances provide a minimum of 7.62 (25 ft) of blast-resistant pavement behind the tail of an aircraft to prevent damage from jet blast.

6.8.4. **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 6.17**

Figure 6.10. Warm-Up Pad at End of Parallel Taxiway.

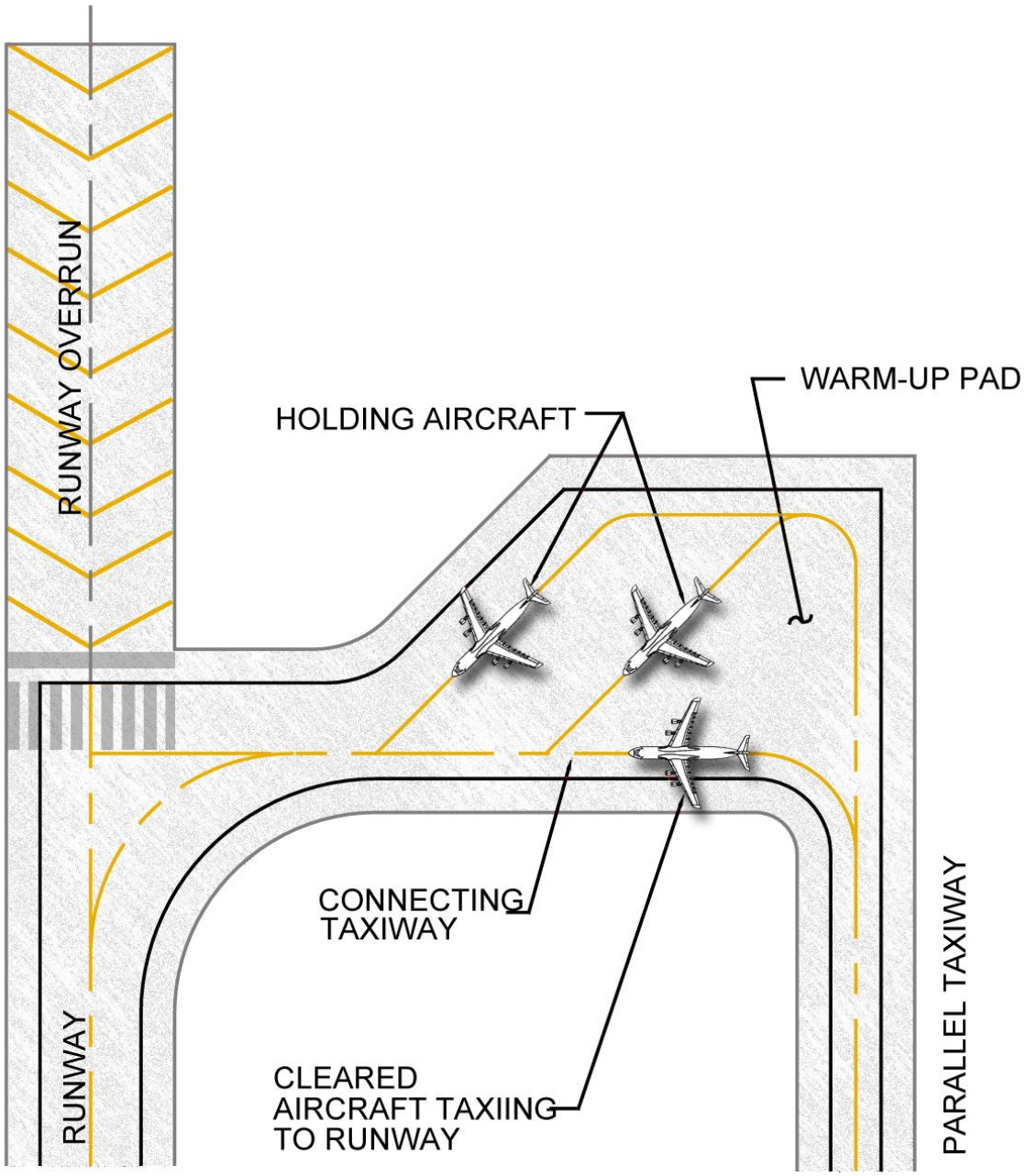


Figure 6.11. Warm-Up Pad Next to Parallel Taxiway.

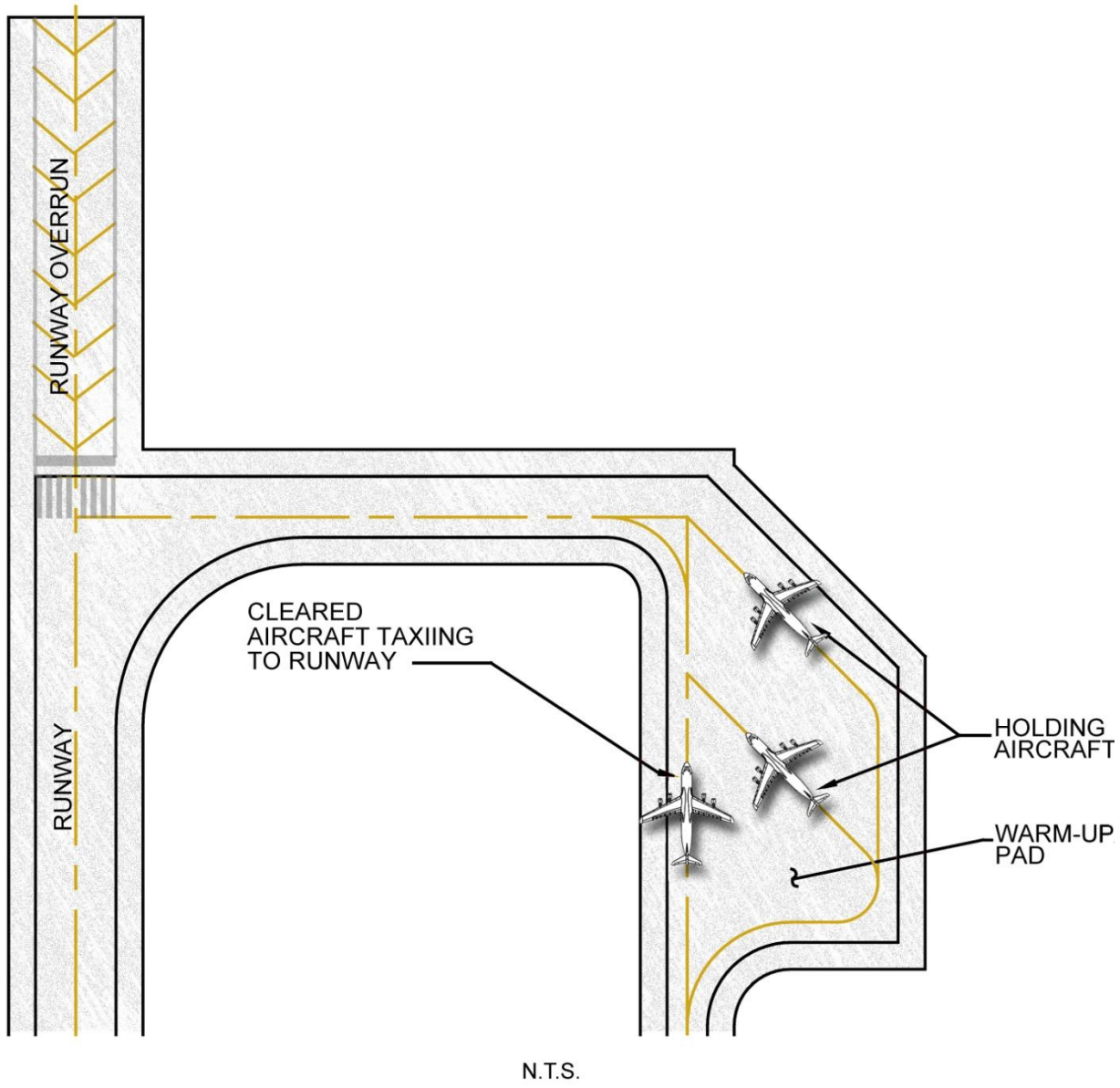


Figure 6.12. Warm-Up Pad Located in Clear Zone.

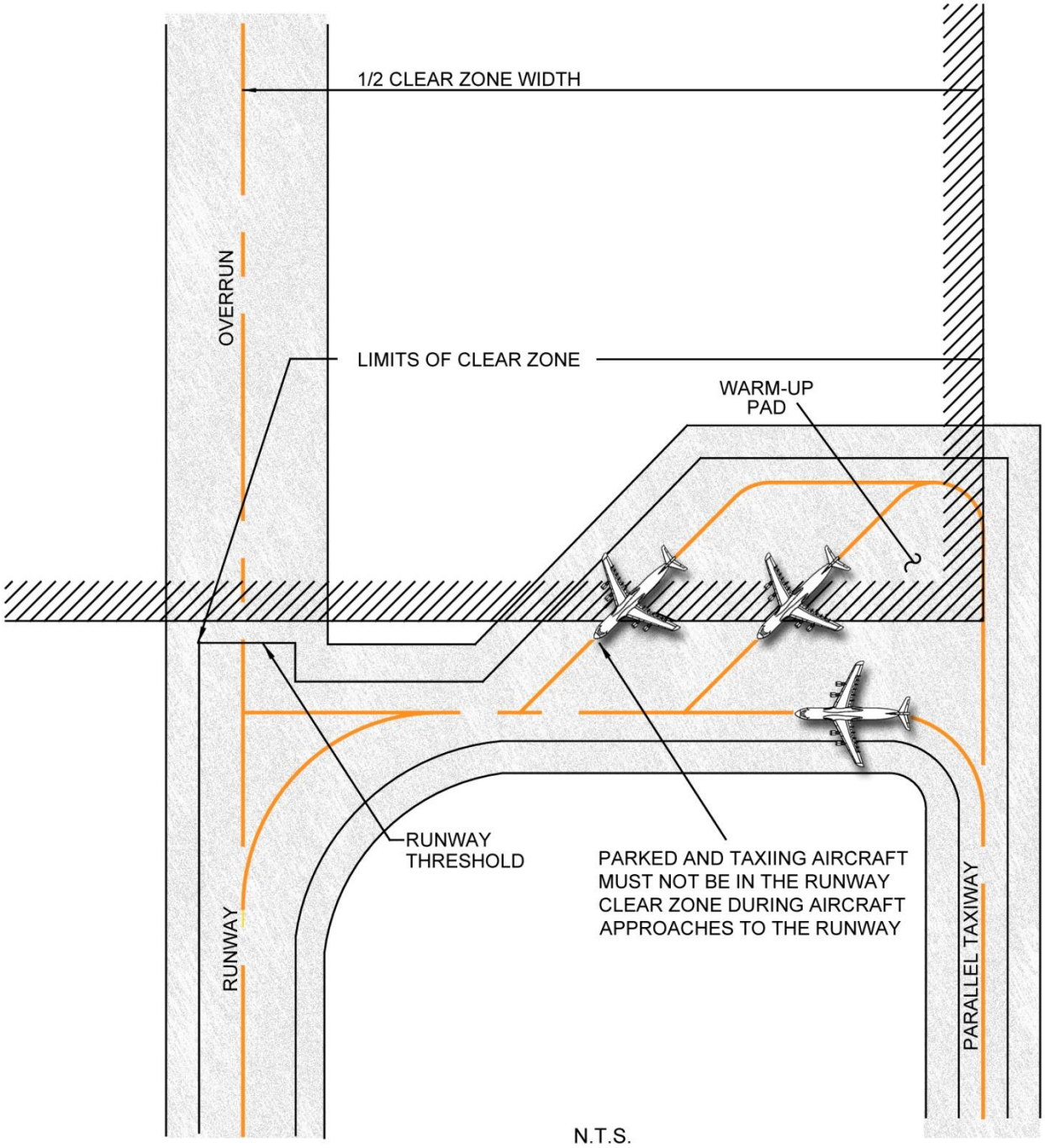
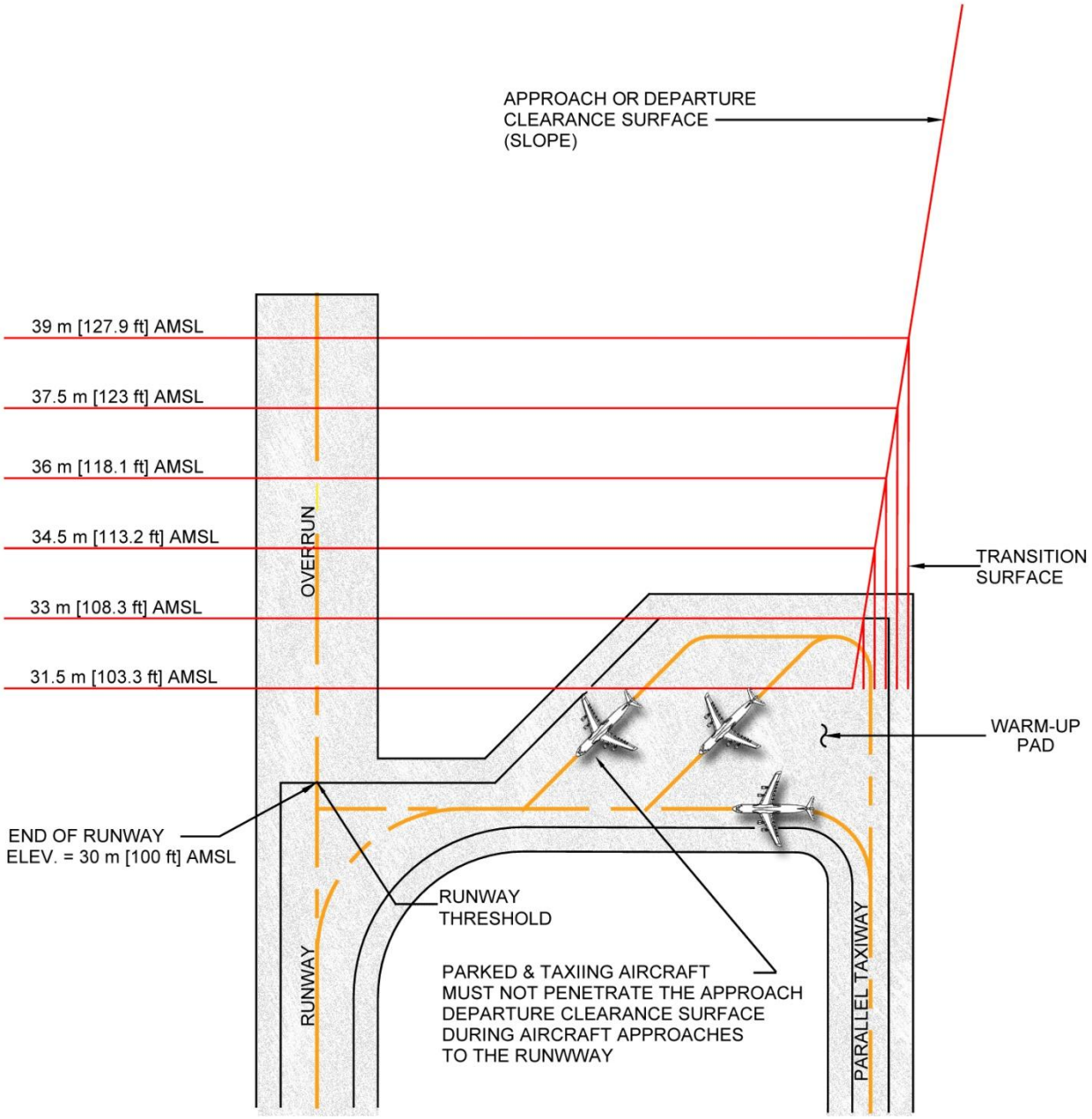


Figure 6.13. Warm-Up Pad Located in Approach or Departure Clearance Surface.



N.T.S.

Figure 6.14. Warm-Up Pad Localizer Critical Area.

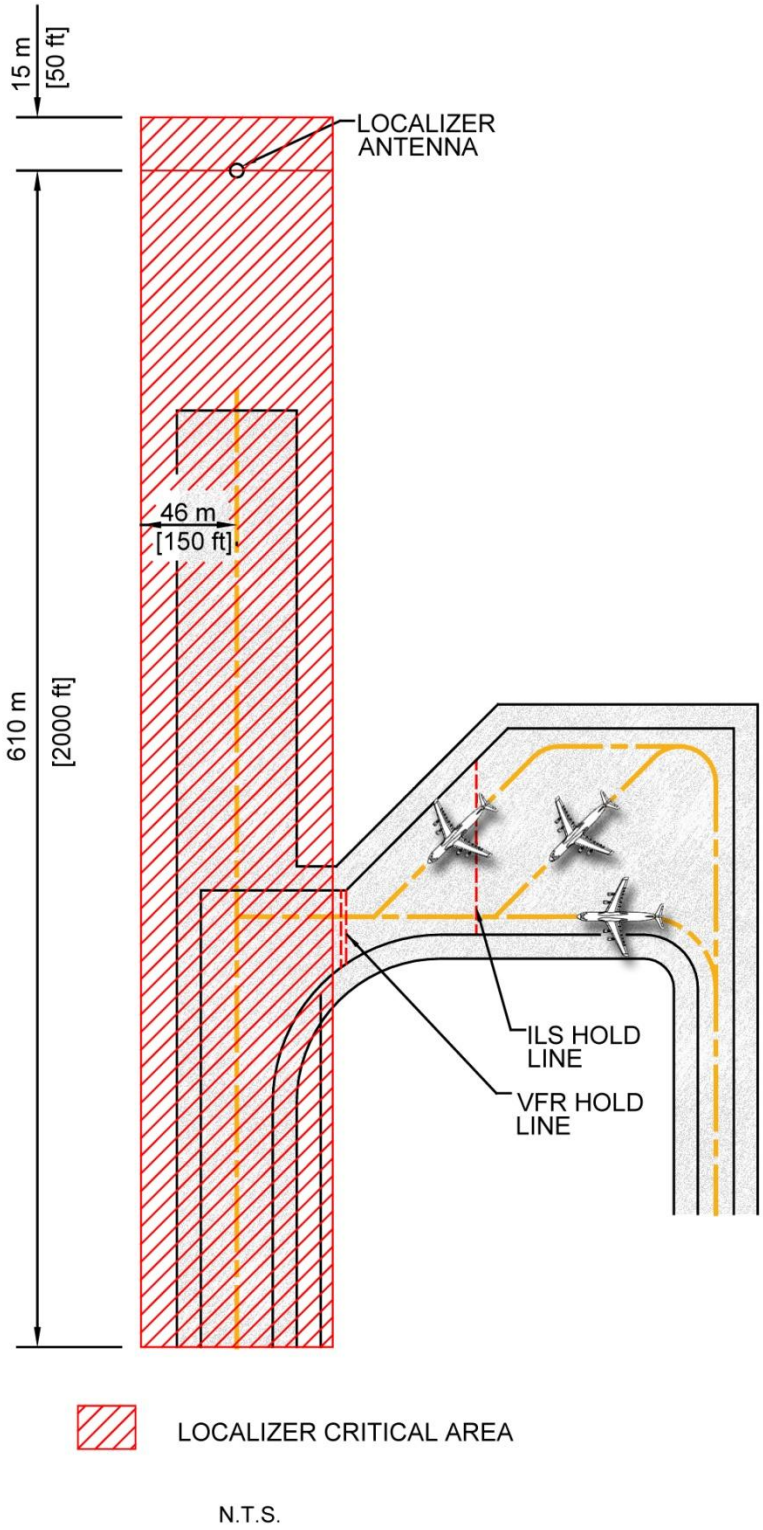


Figure 6.15. Air Force Warm-Up Pad Glide Slope Critical Area.

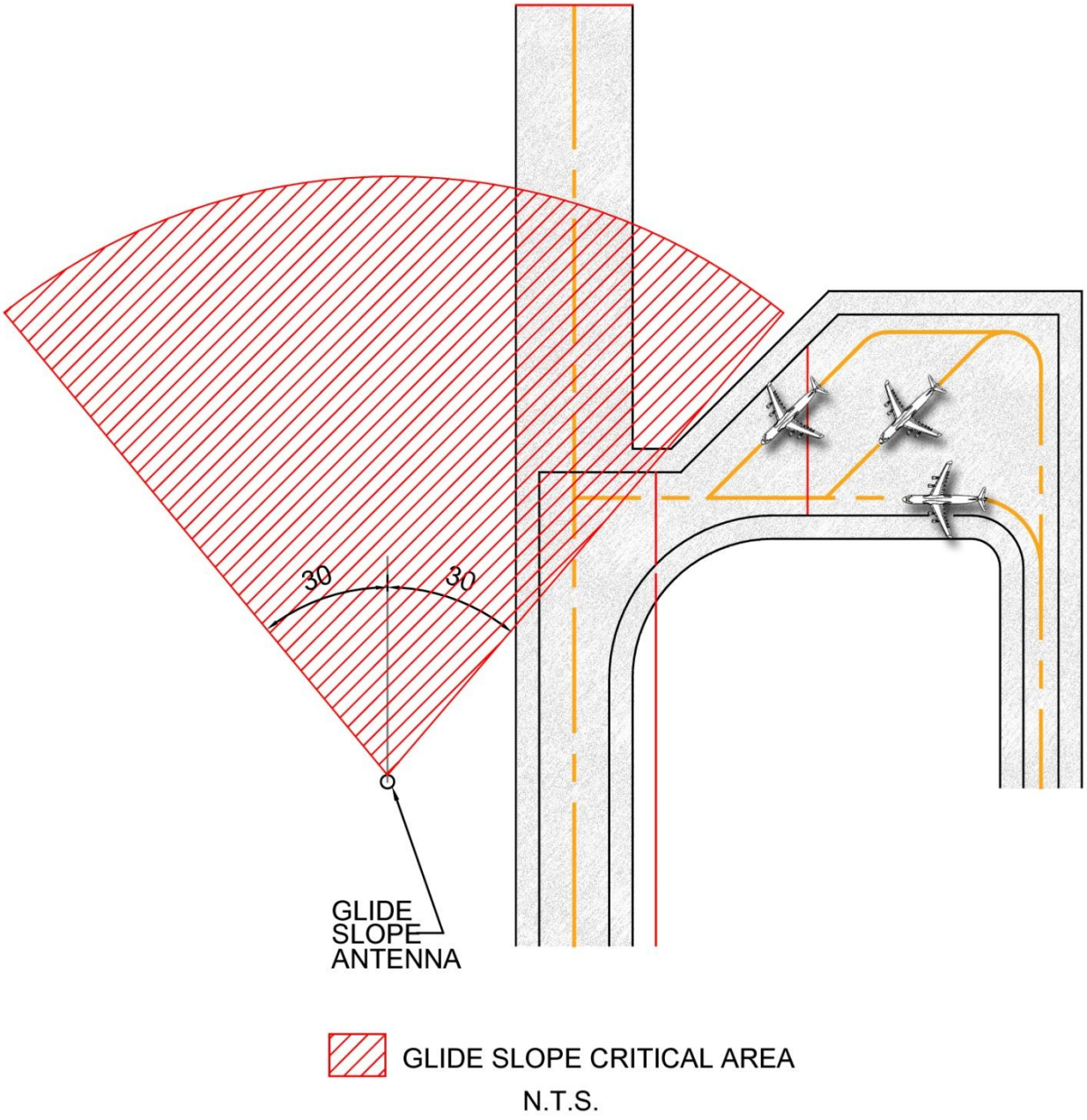
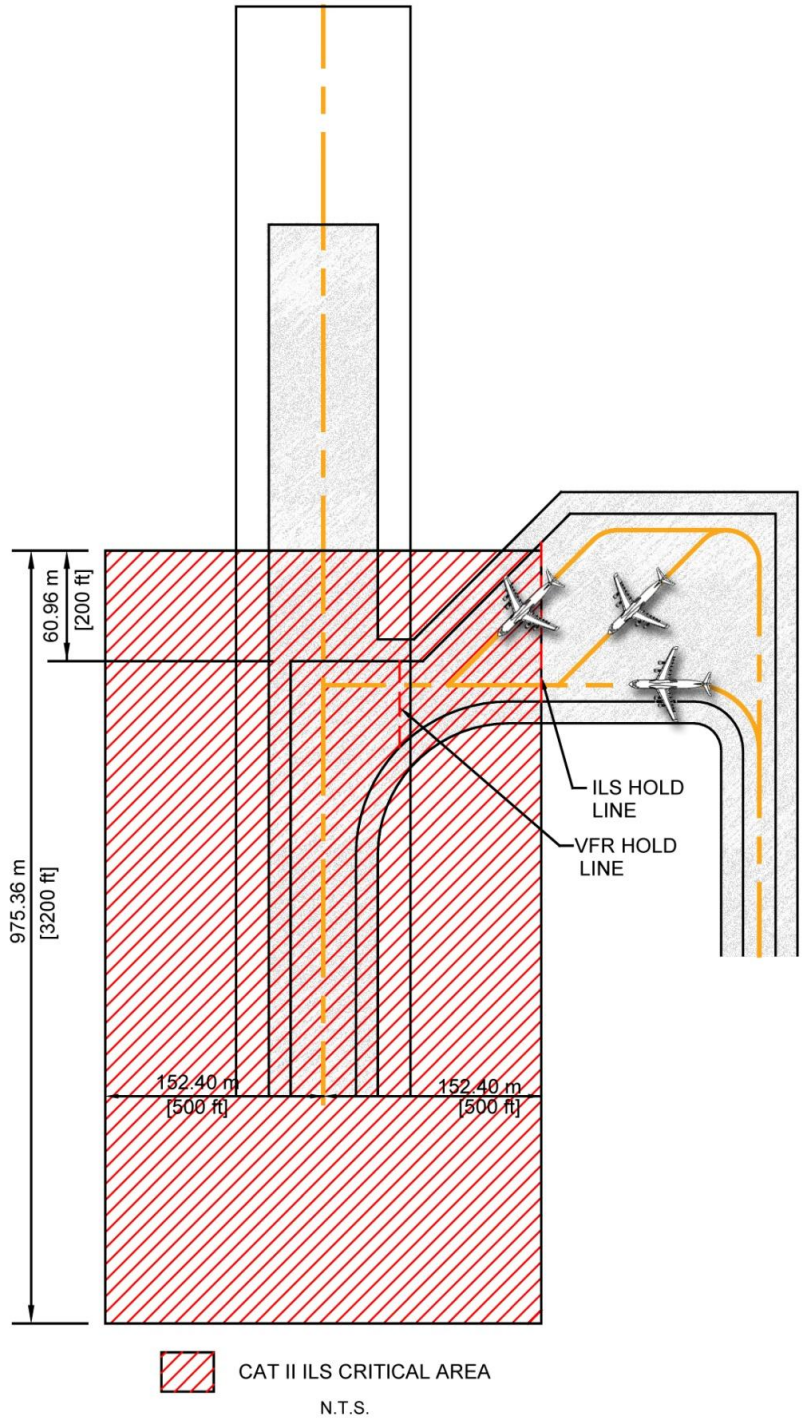
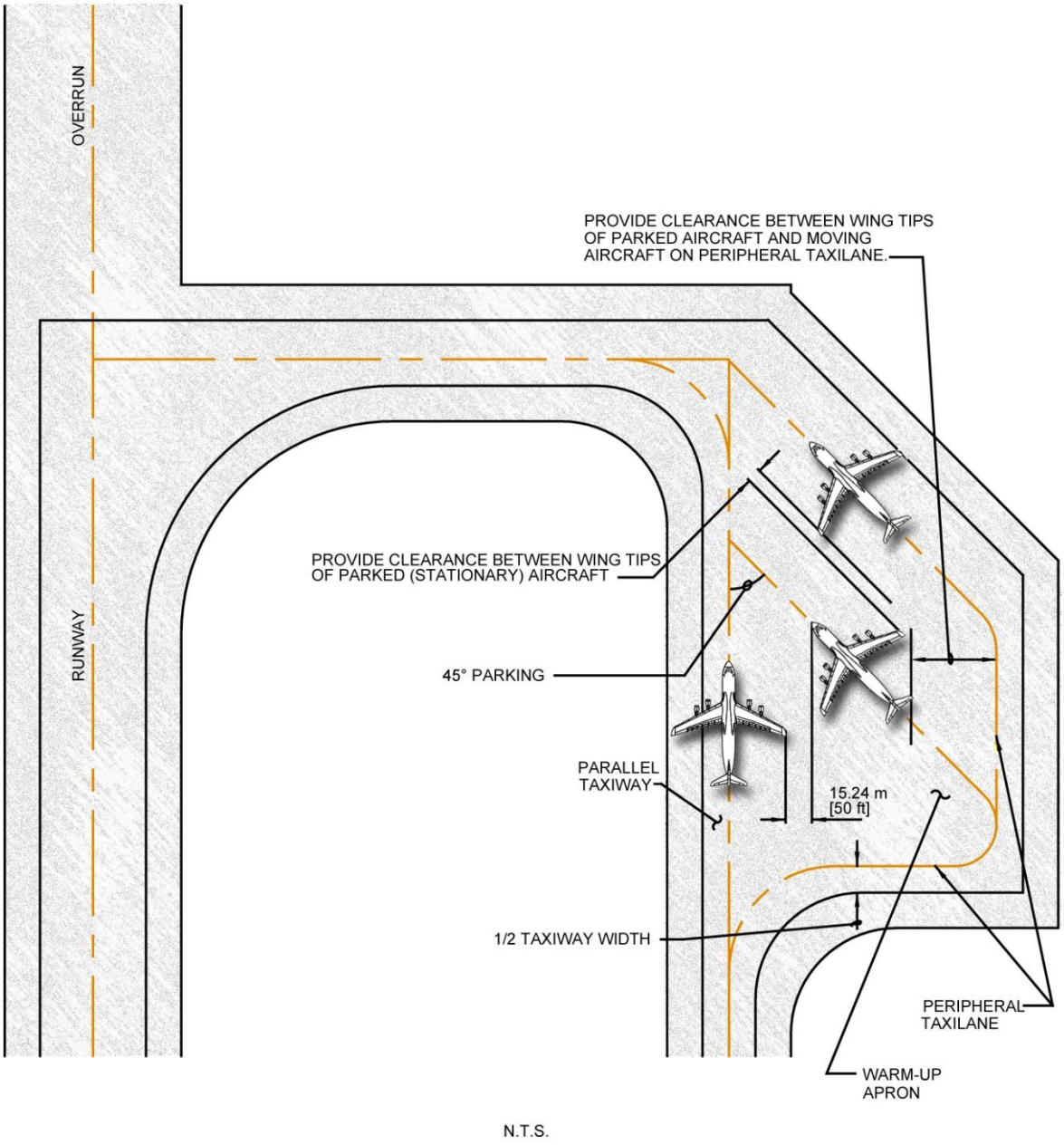


Figure 6.16. Warm-Up Pad CAT II ILS Critical Area.



NOTE:
The parking spot in the ILS critical area cannot be used during IFR conditions. Aircraft in this particular position are within the localizer critical area identified by the ILS hold line. Under instrument flight conditions, this area should be clear of objects that could reflect or block the ILS signal.

Figure 6.17. Warm-Up Pad Taxiing and Wingtip Clearance Requirements.



6.8.5. **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 (see UFC 3-260-01, Appenxix B, Sections 7 and 8) for minimum standoff distances). This is shown in **Figure 6.17**.

6.8.6. **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.

6.8.7. **Taxilanes on Warm-Up Pads.** Taxilanes on the warm-up pads will meet the lateral clearance requirements discussed in **Table 6.1**. Lateral and wingtip clearance for a taxilane on a warm-up pad are illustrated in **Figure 6.17**

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

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, and are illustrated in **Figures 6.18**, **6.19 and 6.20**

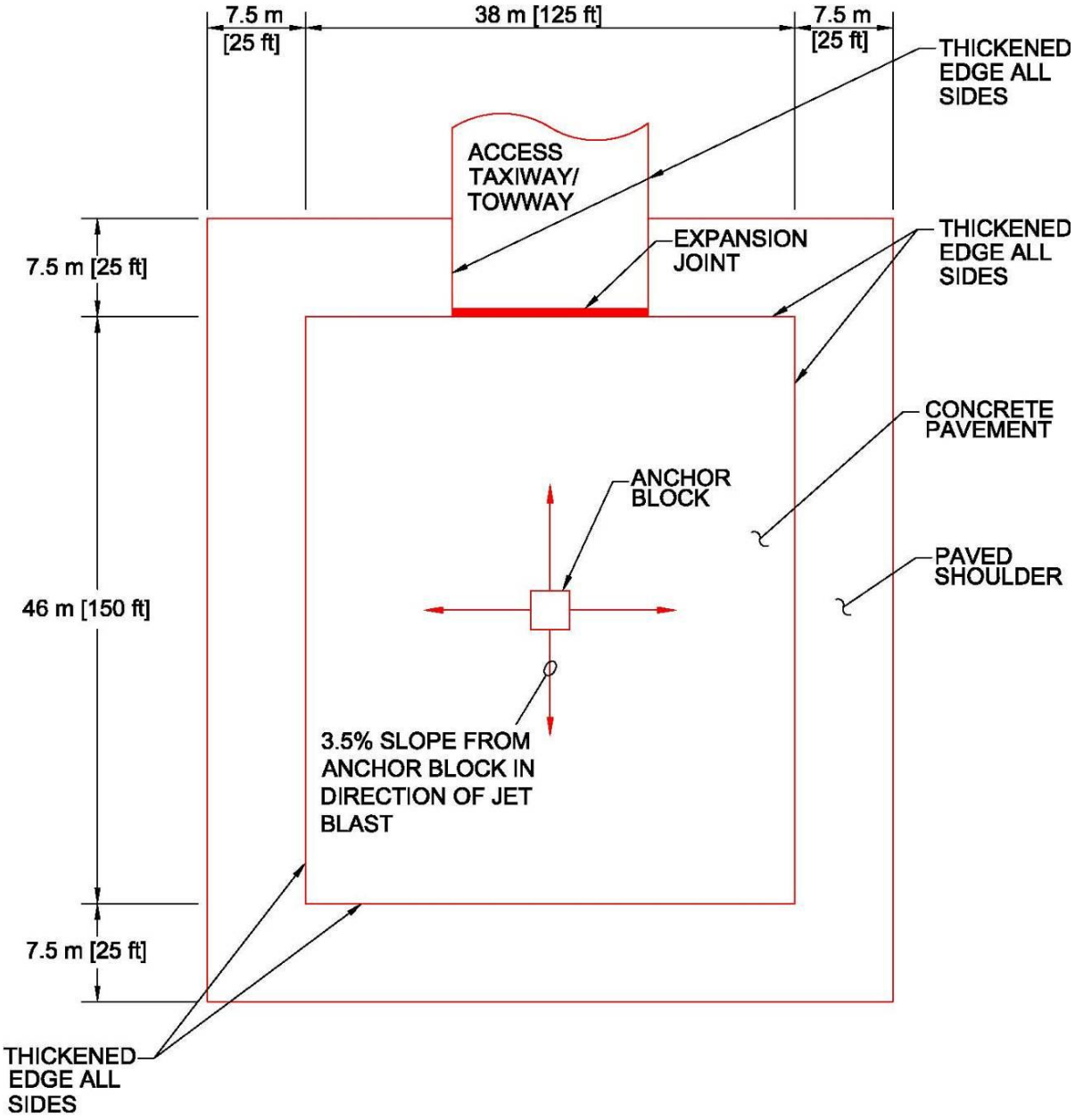
6.9.3. **Access Taxiway/Towway.** An access taxiway will be provided for access from the primary taxiway to the power check-pad. Since the aircraft may be towed to the unsuppressed power check-pad, the access taxiway must be designed as a towway. Taxiway and towway design requirements are presented in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

6.9.4. **Grading.** The surface of the unsuppressed power-check pad must slope 3.5% 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. **Thrust Anchors.** Thrust anchors are required on unsuppressed power check pads. Layouts for these anchors are interdependent of joint spacing and the two should be coordinated together.

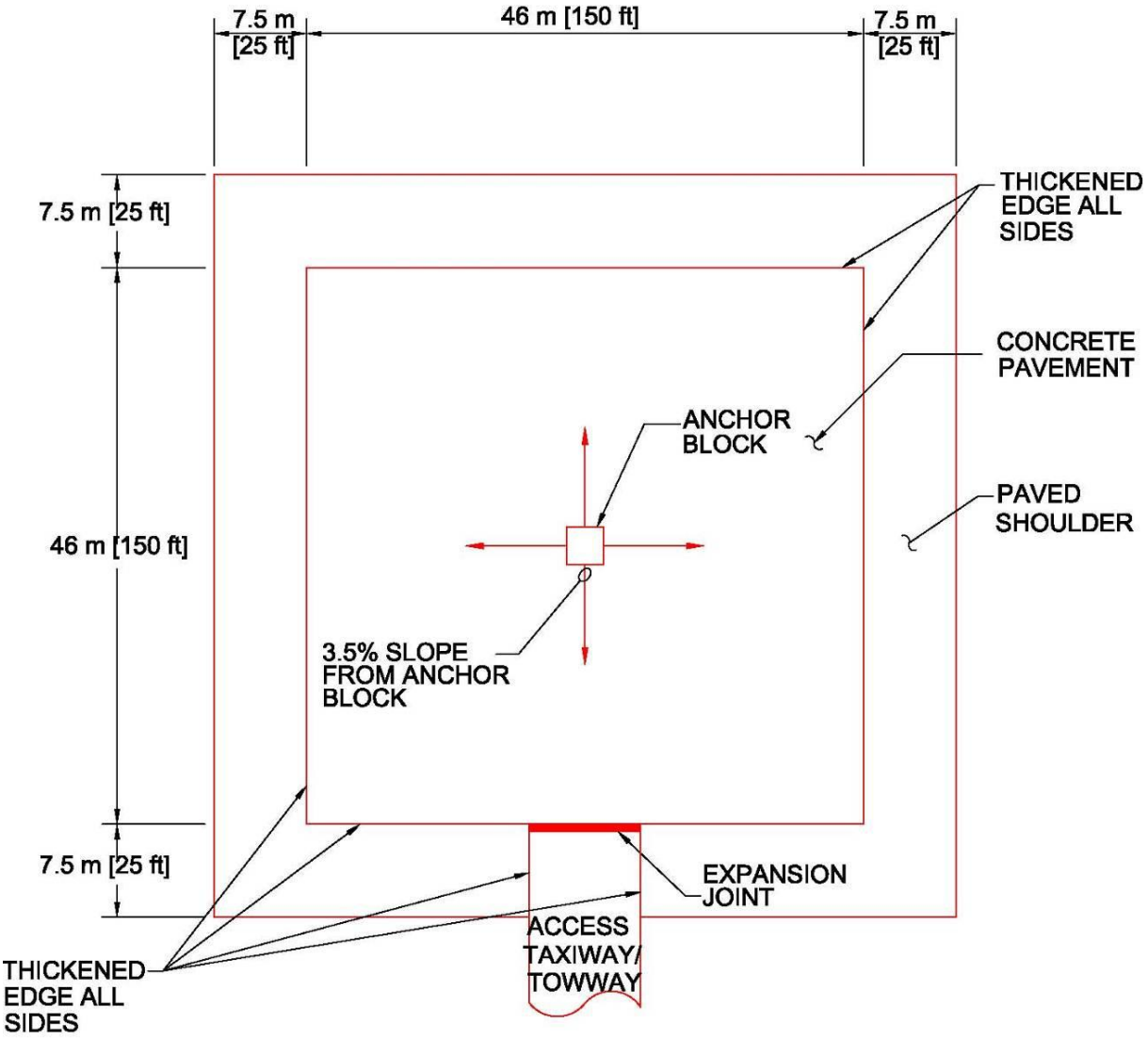
6.9.5.1. Power-check pads (thrust anchor) designed for up to 267 kN (60,000 lbs) are provided in UFC 3-260-01, Appendix B, Section 15, *Aircraft Trim Pad and Thrust Anchor For Up to 267 Kilonewtons (kN) (60,000 Pounds (lb)) Thrust*. High-capacity trim pad design (444.8 kN (100,000 lbs) is addressed in USAF ETL 01-10, *Design and Construction of High-Capacity Trim Pad Anchoring Systems*.

Figure 6.18. Geometry for Rectangular Power Check Pad.



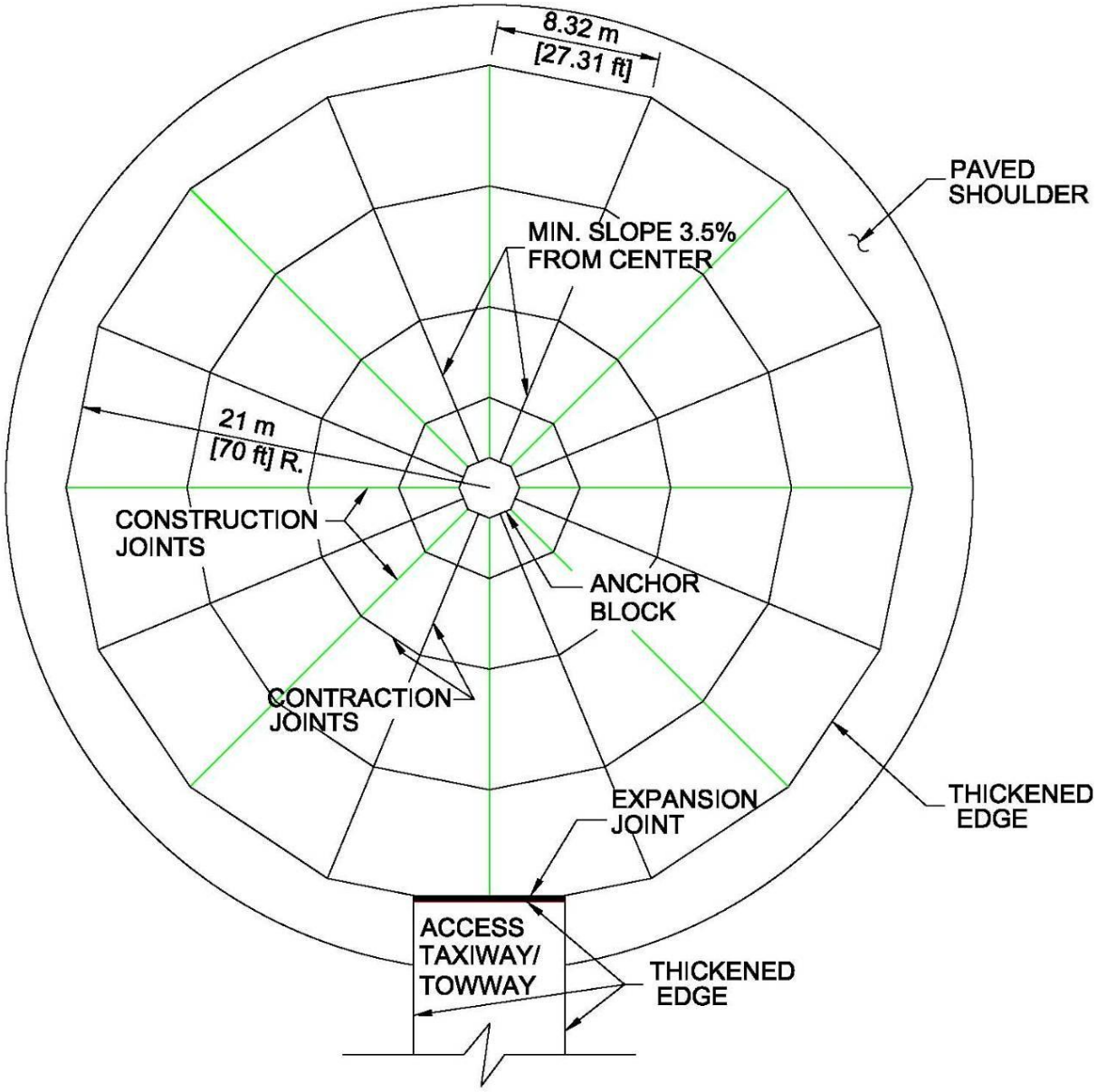
N.T.S.

Figure 6.19. Geometry for Square Power Check Pad.



N.T.S.

Figure 6.20. Geometry for Circular Power Check Pad.



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 all tactical (non-transport) aircraft in the USAF inventory. The designer must verify structural adequacy of the anchor block for the mission aircraft and engine types. Thrust anchor blocks for USAFE aviation facilities are found in UFC 3-260-01, Appendix B, Section 15.

6.9.7. **Power-Check Pad Facilities.**

6.9.7.1. Required Facilities. The unsuppressed power check pad should consist of:

6.9.7.1.1. Paved surface.

6.9.7.1.2. Paved shoulders (see UFC 3-260-01, Appendix B, Sections 7 and 8 for minimum standoff distances).

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

6.9.7.1.4. 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:

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 decibel (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. Do not site new warm-up pads, other aprons, hot cargo spots, or taxiways to these facilities in a way that will allow penetration of the approach or departure clearance surfaces.

6.10.1. **Location.** 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. For parallel taxiways used as emergency runways, arm/disarm pads should be located outside of the clearance surfaces show in **Table 5.8**, to the maximum extent possible.

6.10.2. **Siting Considerations:**

6.10.2.1. Aircraft Heading. The criteria for establishing the exact heading of the parked aircraft depend 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.

6.10.2.2. 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. The Air Force conducts electromagnetic radiation (EMR) surveys with regard to explosives safety in accordance

with Air Force manual (AFMAN) 91-201, Chapter 9. The specific information for each emitting device should be available through the installation communications squadron.

6.10.2.3. Inhabited Building Distance Clear Zone. As a general rule, an "inhabited building distance clear zone" of plus or minus 5 degrees of arc on each side of the heading of the parked aircraft and 8.5 km (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 quick check 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 must be used as a barrier.

6.10.3. **Arm/Disarm Pad Size**. Each arm/disarm pad should be capable of servicing four or six aircraft at a time. The dimensions may vary with the length and wingspan of the aircraft to be served. Jet blast must also be taken into account. Typical layout of arm/disarm pads are shown **in Figures 6.21, 6.22, 6.23 and 6.24**. Arm/Disarm pad size may be increased as mission requirements dictate.

6.10.4. **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.

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

6.10.6. **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.

6.10.7. **Access Road.** An all-weather access road should be constructed to the arm/disarm pad from outside the airfield's taxiway and runway clearance areas. Design this road in accordance with UFC 3-250-18FA, *General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas* and UFC 3-250-01FA, *Pavement Design for Roads, Streets, Walks, and Open Storage Areas*. Access roads must not encroach on taxiway clearances or taxilane wingtip clearance requirements (except at necessary intersections with these areas), nor shall any parking area associated with the access road be sited so that maintenance vehicles will violate the approach or departure clearance surfaces or any NAVAID critical area.

6.10.8. **Tie Downs and Grounding Points.** Tie downs and mooring points are not required on arm/disarm pads. See UFC 3-260-01, Appendix B, Section 11, *Tiedowns, Mooring, and Grounding Points*, for grounding requirements.

6.10.9. **Ammunition and Explosives Safety Standards.** Ammunition and explosive safety standards are discussed in UFC 3-260-01, Appendix B, Section 9, *Explosives On or Near Airfields* and AFMAN 91-201, *Explosive Safety Standards*.

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

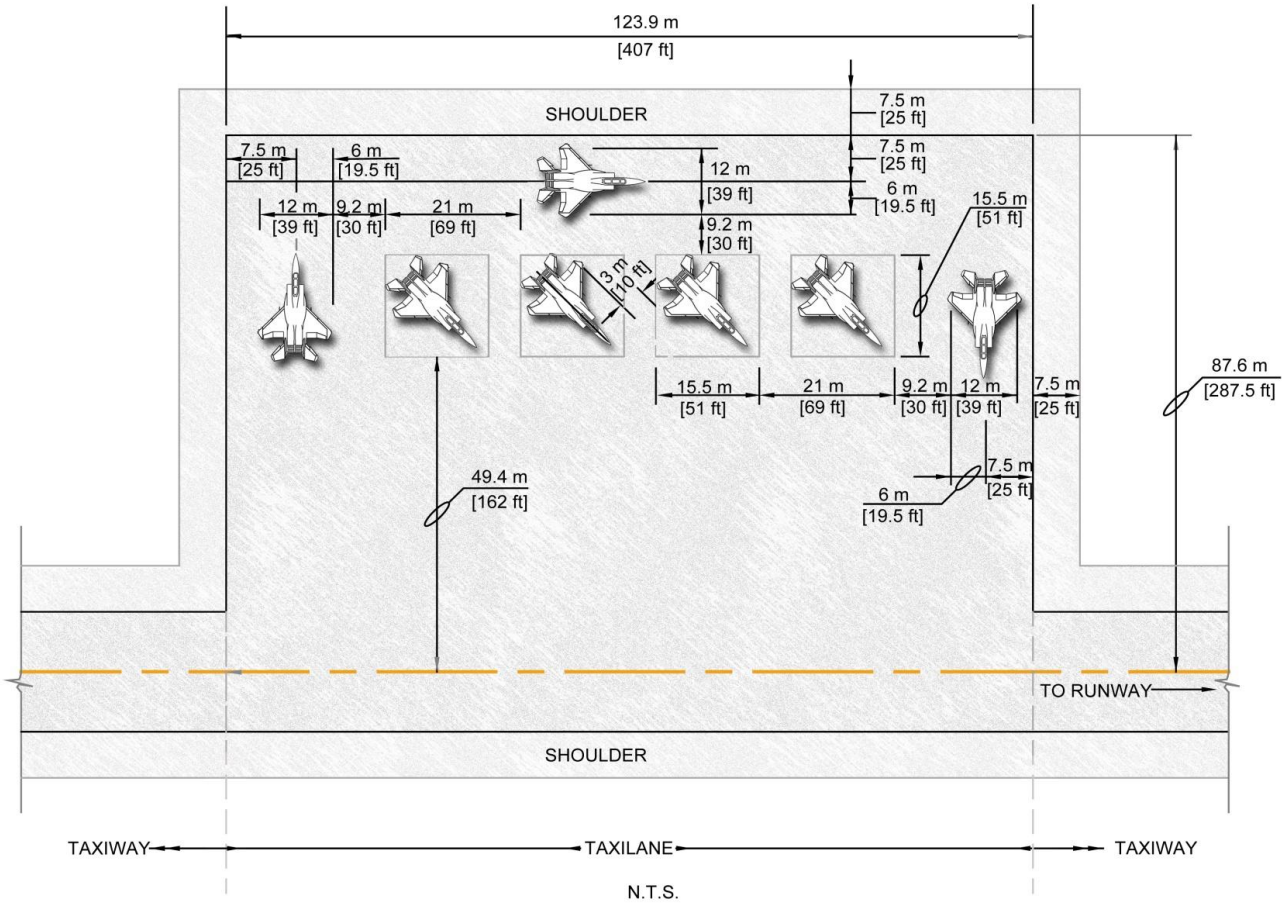


Figure 6.22. Arm/Disarm Pad for F-16 Fighter.

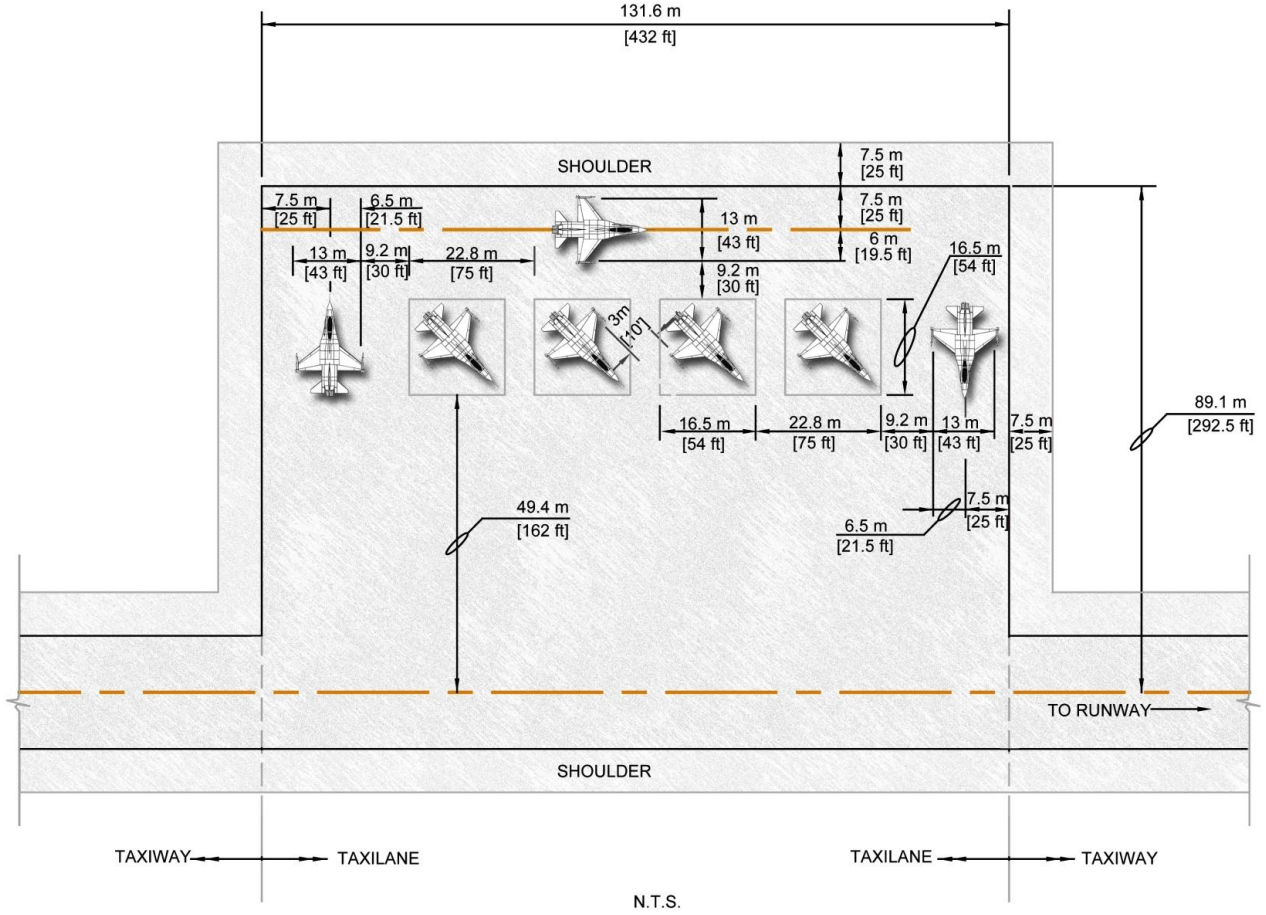


Figure 6.23. Arm/Disarm Pad for F-4 Fighter

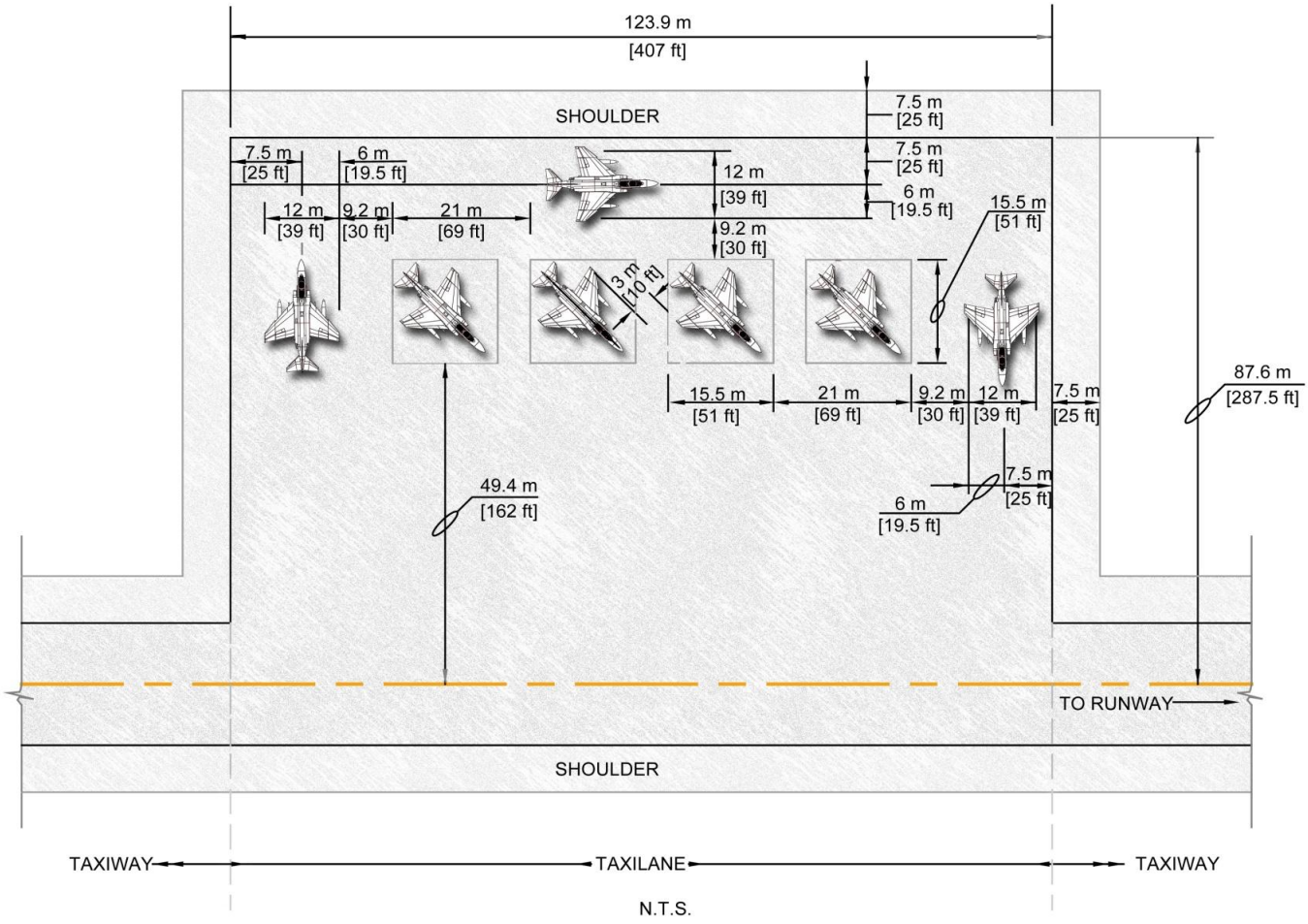
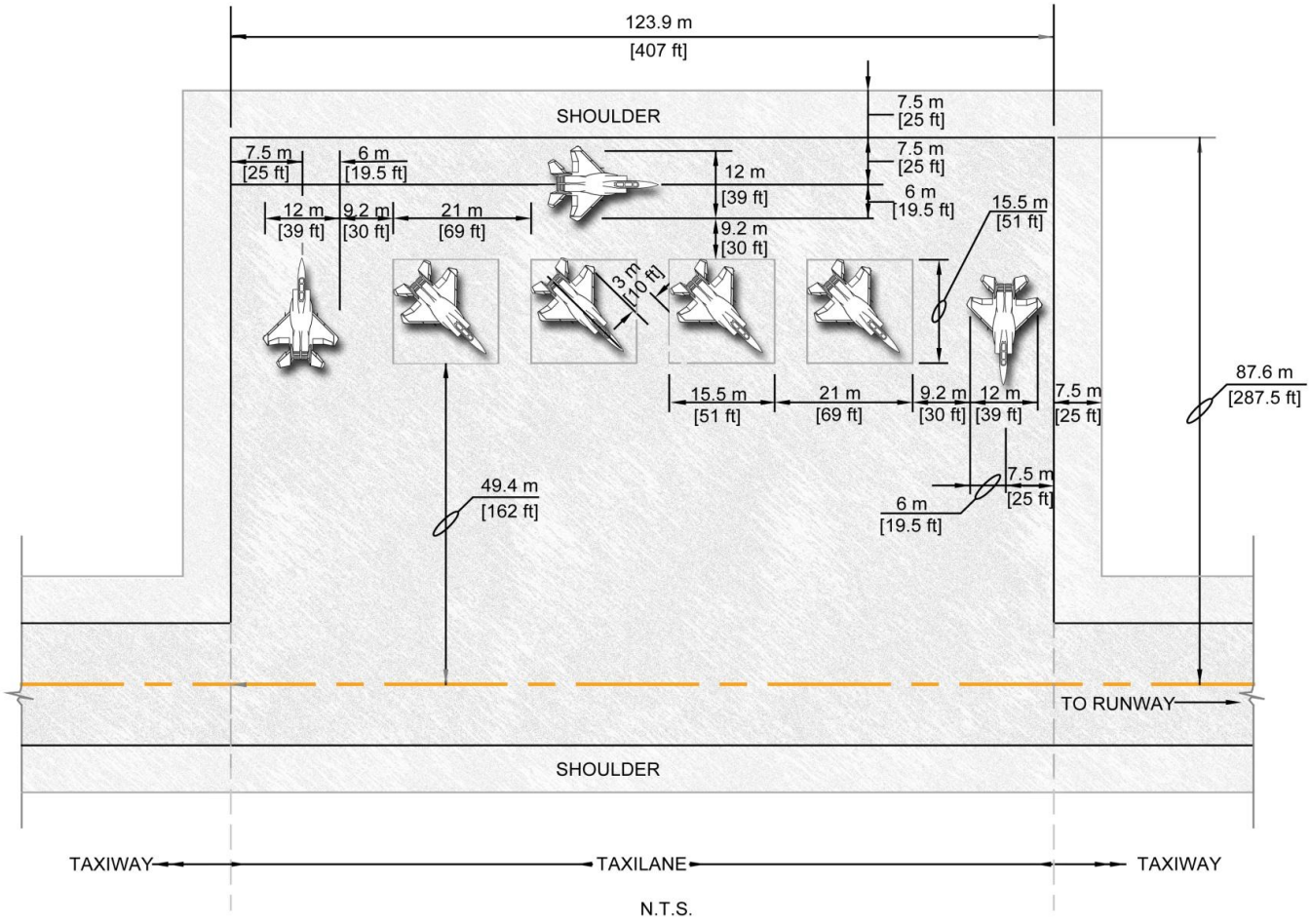


Figure 6.24. Arm/Disarm Pad for F-22 Fighter



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

6.11.1. USAFE Options. The Air Force has the option of using the criteria presented here or using the criteria provided in Appendix 4 of the Federal Aviation Administration Advisory Circular (FAA AC 150/5300-13, *Airport Design*. A current copy of FAA AC 150/5300-13 can be obtained from HQ AFCESA/CEOA. For CCP marking requirements, use the controlling aircraft technical order or use the information in FAA AC 150/5300-13 for general purpose CCPs.

6.11.2. **Location.** The CCP 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.** Do not site new CCPs, other aprons, hot cargo spots, or taxiways to these facilities in a way that will allow penetration of the approach or departure clearance surfaces. Provide an access taxiway to and from the primary taxiway to the CCP. The access taxiway must be oriented to facilitate moving the aircraft onto the CCP on a magnetic north heading. If the aircraft should be towed to the CCP, the access taxiway must be designed as a towway. Taxiway and towway design requirements are found in **Chapter 5.**

6.11.3. **Siting Consideration.**

6.11.3.1. Separation Distances. To meet the magnetic quiet zone requirements and prevent outside-magnetic fields from influencing the aircraft compass calibration, efforts must be taken to make sure that minimum separation distances are provided. See UFC 3-260-01, Appendix B, Section 10, *Compass Calibration Pad Magnetic Survey,* for CCP separation distances.

6.11.3.2. Preliminary Survey. During the site selection process, the proposed sites for compass calibration pads must be checked for magnetic influences to ensure that the area is magnetically quiet regardless of adherence to separation distances. Conduct a preliminary survey, as described in UFC 3-260-01, Appendix B, Section 10 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 ensure that the newly constructed item has not created new magnetic influences in the magnetic quiet zone.

6.11.3.3. 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 ensure 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 years for CCPs. This cycle is operationally important as 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 CCP is in a magnetic quiet zone; thus ensuring proper compass calibration. The magnetic survey for CCPs should be performed in accordance with UFC 3-260-01, Appendix B, Section 10.

6.11.4. **CCP Size.**

6.11.4.1. CCP size requirements are shown on **Figure 6.25**. Unless otherwise stated in the datasheets of the primary aircraft using the pad, the CCP shall be sized as follows: length of the largest aircraft plus 10 meters (m) by wingspan of the largest aircraft plus 5 m.

6.11.5. **Grading.** Compass calibration pads will be graded as follows:

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

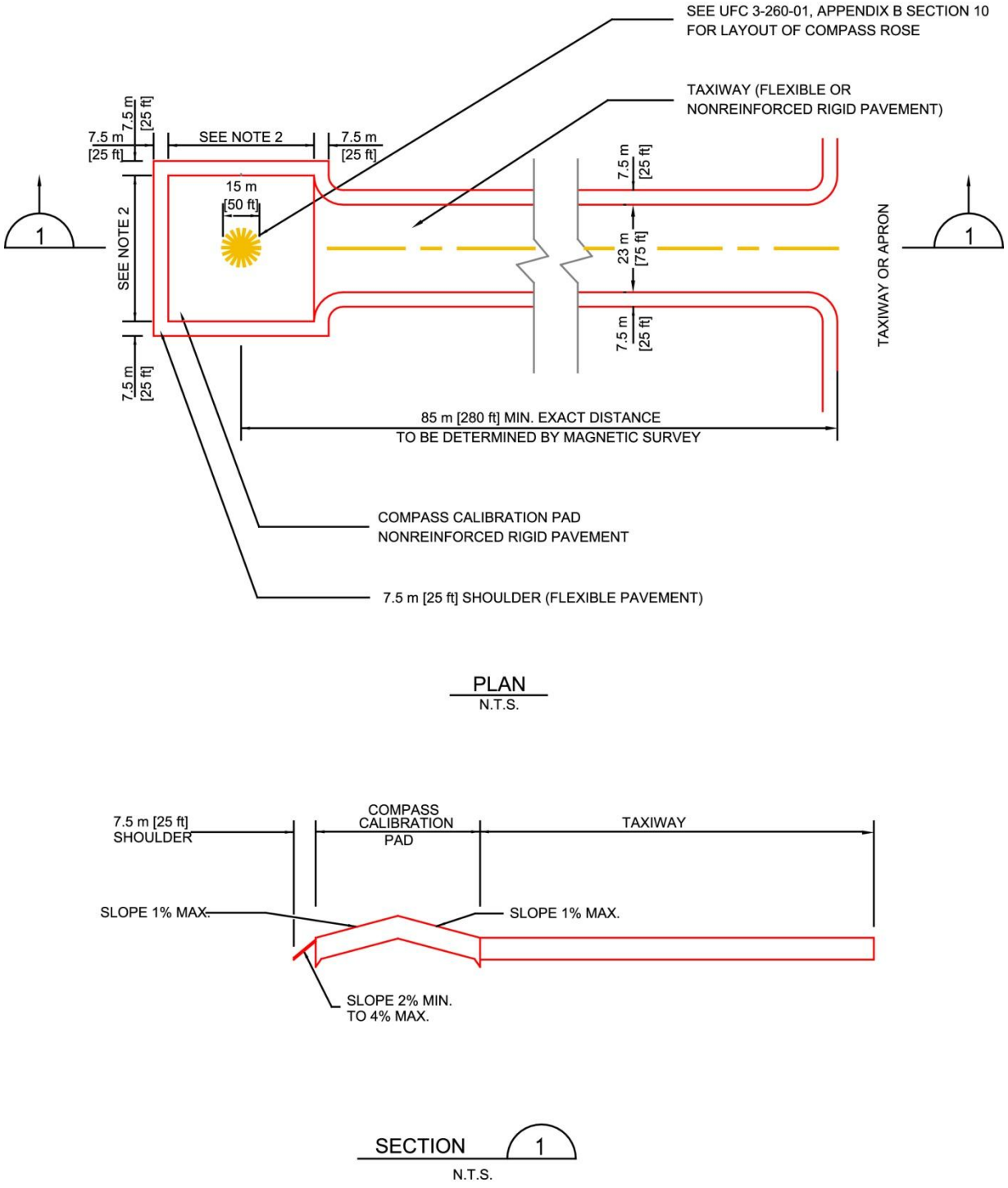
6.11.5.2. Cross-slope. The CCP should be crowned in the center of the pad with a constant cross slope of 1% in all directions to provide surface drainage while facilitating alignment of the aircraft pad.

6.11.6. **Tie Downs/Mooring Points**. Do not place aircraft tie down/mooring points/tie down mooring eyes, or any static grounding points in the CCP pavement.

6.11.7. **Embedded Material.** Due to the influence of ferrous metal on a magnetic field, the Portland Cement Concrete (PCC) pavement for the CCP and access taxiway must not contain any embedded ferrous metal items such as dowels bars, reinforcing steel or steel fibers. In addition, ferrous metal must not be placed in or around the CCP site.

6.11.8. **Control Points.** A control point will be set in the center of the CCP. 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 discussed in UFC 3-260-01, Appendix B, Section 10.

Figure 6.25. Compass Calibration Pad (CCP).



NOTE:
1. Thickness of concrete and base course, base course density, type of shoulder surfacing and California Bearing Radio (CBR) of shoulder base course are governed by existing criteria or are dependent upon site conditions.

2. Size of CCP is length of largest A/C plus 10 m (33 ft) x wingspan of largest A/C + 5 m (16 ft).

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. Do not site new hazardous cargo pads, other aprons, hot cargo spots, or taxiways to these facilities in a way that will allow penetration of the approach or departure clearance surfaces.

6.12.1. **Siting Criteria.** Hazardous cargo pads require explosives site planning as discussed in UFC 3-260-01, Appendix B, Section 9.

6.12.2. **Hazardous Cargo Pad Size.** New Hazardous Cargo Pads shall be designed to meet the C-5 apron design criteria. Coordination with HQ USAFE/SEW is required. 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 onto the hazardous cargo pad.

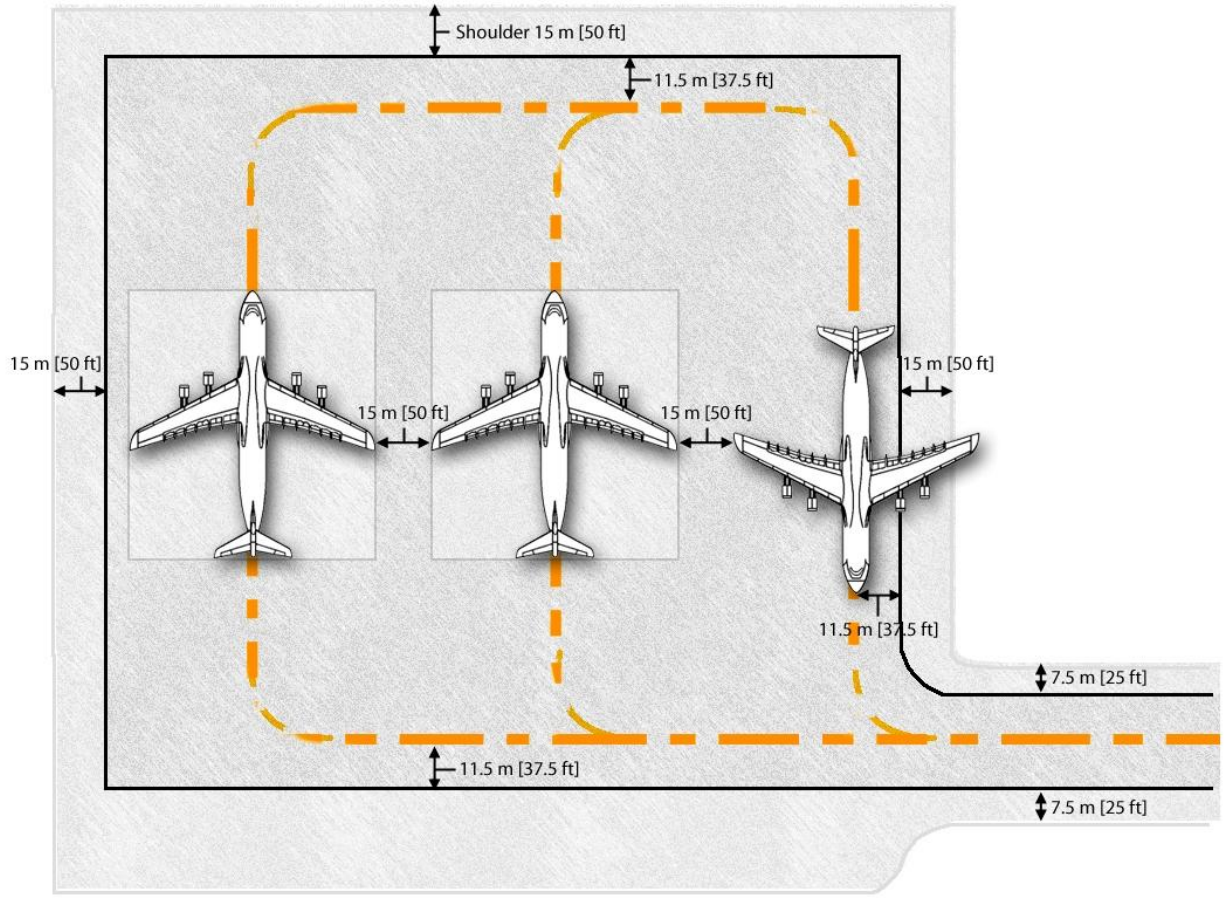
6.12.3. **Tie Down and Grounding Points.** Provide tie downs/mooring capabilities and grounding points on each hazardous cargo pad. See UFC 3-260-01, Appendix B, Section 11 for further information.

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

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

6.12.4.2. Access Road. Provide a paved roadway to improve access to the hazardous cargo pad by trucks and other vehicles.

Figure 6.26. Typical Hazardous Cargo Pad.



NOTES:

1. 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.

2. The distance between parked explosives cargo A/C is driven by explosives safety siting requirements outlined under AFMAN 91-201, Table 12.1 (ILD-Intraline Distance required).

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. An alert apron and an alert pad are shown on **Figure 6.27 and 6.28**, respectively.

6.13.1. **Location.** Locating the alert apron/pad adjacent to a runway end will allow alert aircraft to proceed directly from the apron/pad to the runway threshold without interruptions from other traffic. 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 apron/pad direct, unimpeded access to the runway. Alert aprons/pads must not be located so that the aircraft or shelters are within the clear zone or penetrate the approach or departure clearance surfaces.

6.13.2. **Siting Criteria.** Airspace Imaginary Surfaces. As discussed in **paragraph 6.8.2.2**, aircraft parked on the alert aprons/pads must not project into airspace imaginary surfaces.

6.13.2.1. Explosives Consideration. Explosive-loaded aircraft on alert aprons/pads should be located in accordance with (IAW) approved Explosives Safety Site Plans (ESSP). UFC 3-260-01, Appendix B, Section 9.

6.13.3. **Alert Apron/Pad Size.** Alert aprons/pads dimensions should vary with the length and wingspan of the aircraft to be served and the explosives on the aircraft. Wingtip clearances, presented in **Table 6.2**, are minimum separation distances to be observed at all times.

Table 6.2. 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	45.7	150	38.1	125
KC-135	38.1	125	30.5	100
KC-10	30.5	100	22.9	75

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

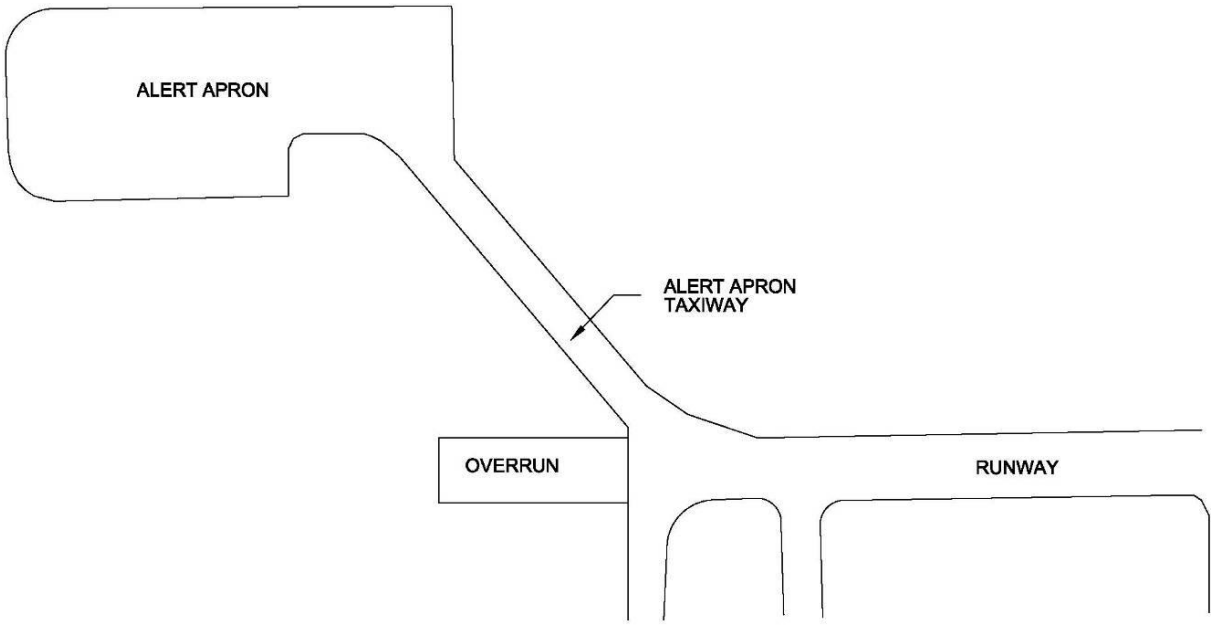
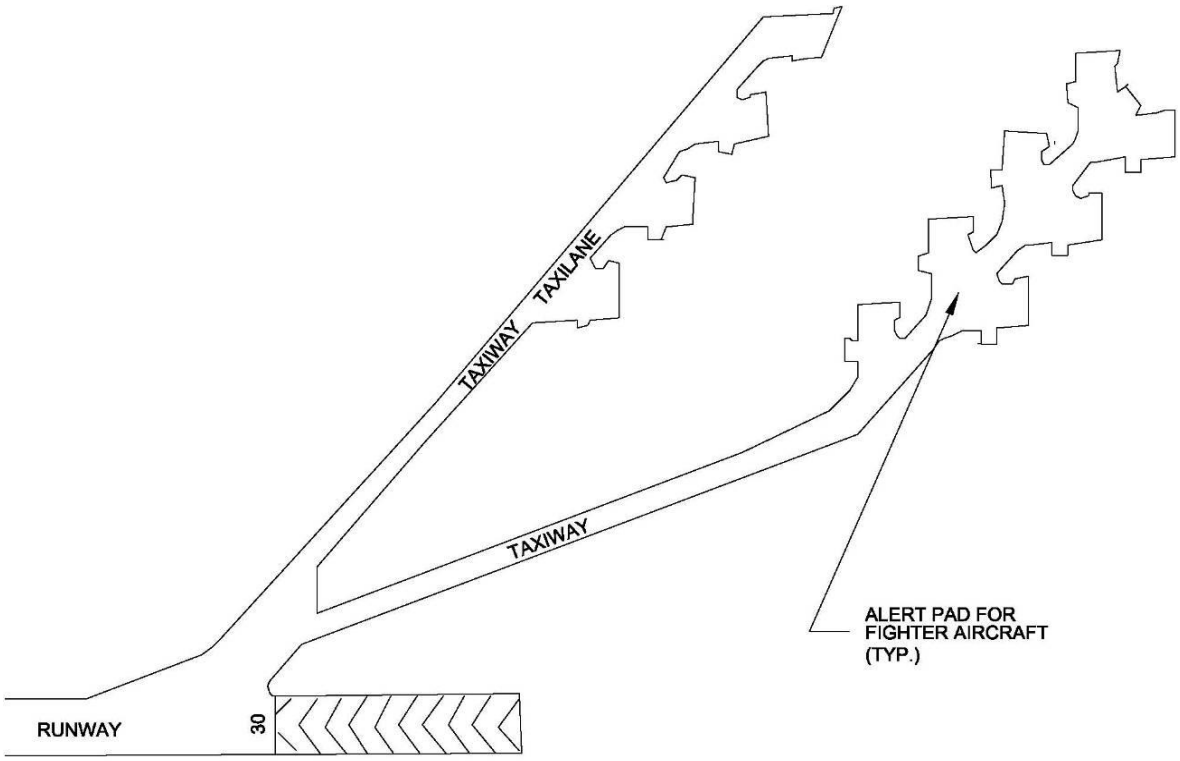
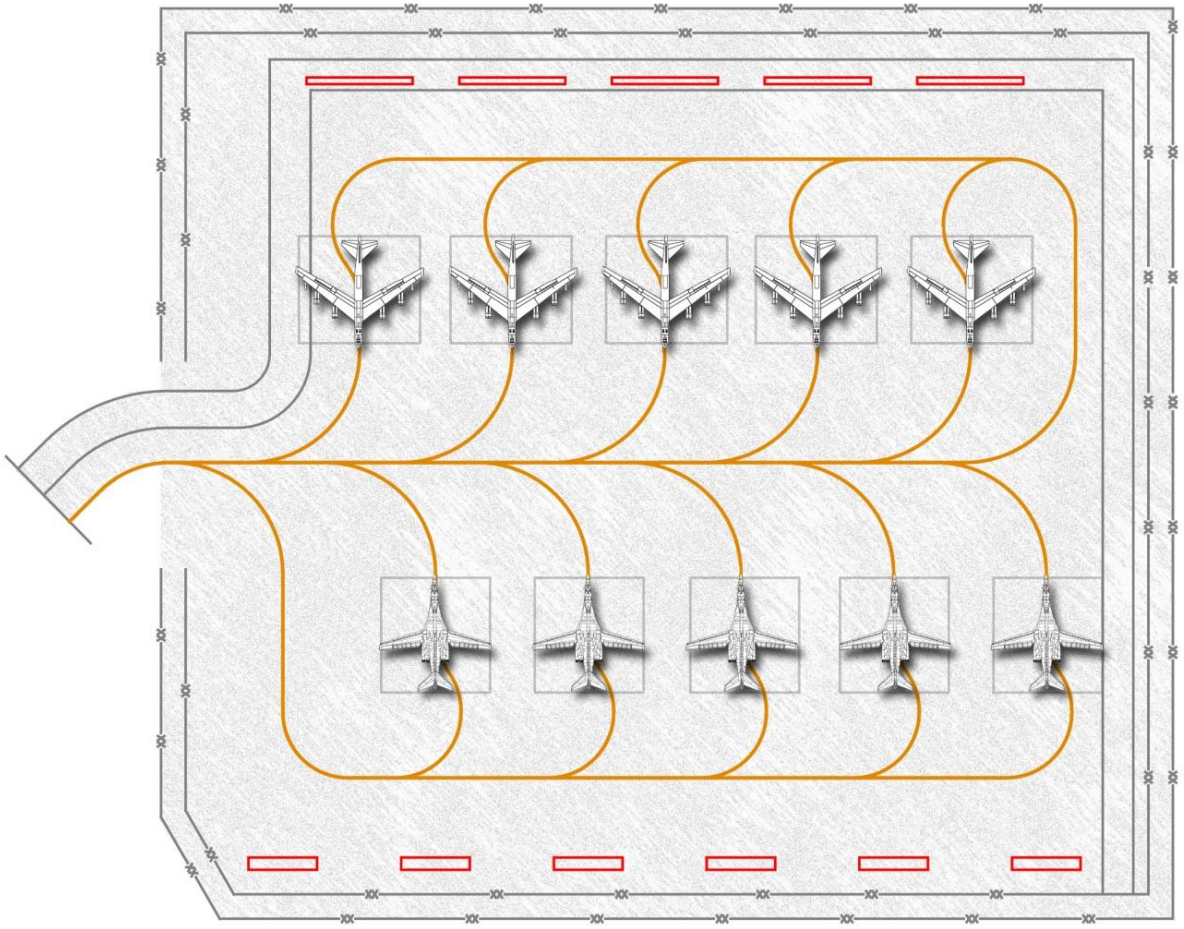


Figure 6.28. Typical Alert Pad for Fighter Aircraft.



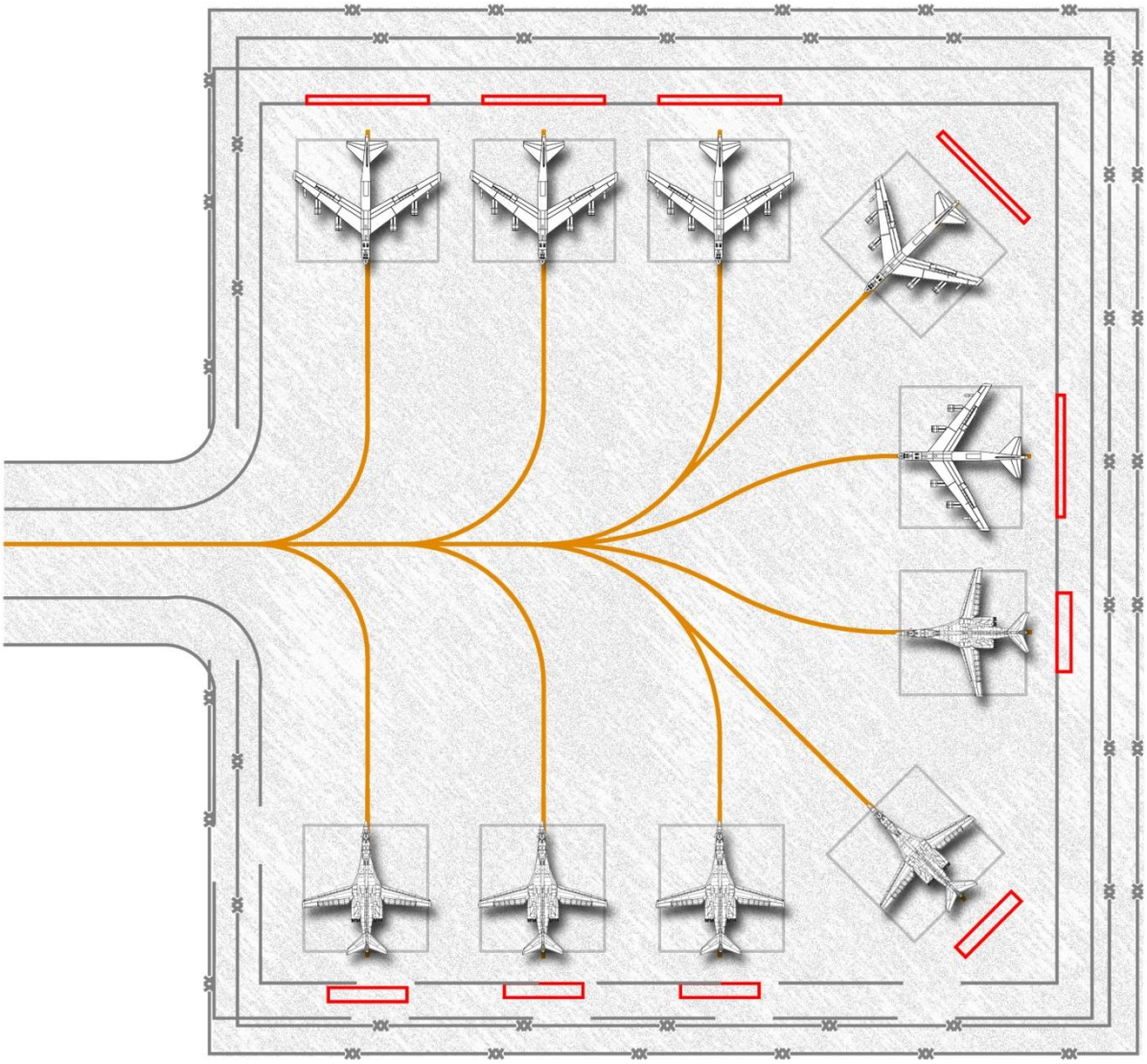
N.T.S.

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



N.T.S.

Figure 6.30. Alert Apron Back-In Parking.



N.T.S.

6.13.4. **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.

6.13.5. **Alert Aircraft Parking Arrangements.**

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

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

6.13.6. **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 UFC 3-260-01, Appendix B, Sections 7 and 8.

6.13.7. **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.

6.13.8. **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 apron/pad. In no case will the initial turnout from the alert apron/pad parking space to the through taxilane exceed 90 degrees. For alert pads 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 (See **Table 6.1**).

6.13.9. **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.

6.13.10. **Tie Downs and Grounding Points.** Provide tie downs/mooring capabilities and grounding points at each aircraft parking location, as discussed in UFC 3-260-01, Appendix B, Section 11.

6.14. Aircraft Wash Racks. Refer to UFC 3-260-01, Chapter 6, *Aprons and Other Pavements*, for aircraft wash rack design criteria. Also refer to the respective host nation's Final Governing Standards (FGS) for environmental requirements. Where an FGS does not exist for a specific host nation, refer to the Overseas Environmental Baseline Guidance Document (OEBGD).

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 facilities. Access aprons should be provided as a supporting item for each hangar and should be sized for the type of 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 6.3**.

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 NFPA Standard 415.

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.

Table 6.3. Hangar Access Apron.

Item No.	Item Description	Class A Runway / Class B Runway Requirement	Remarks
1	Length	Distance to the adjoining operational pavement	Facilities for fixed-wing aircraft. **NOTE:** If the distance from the main operational pavement to the hangar exceeds the apron clearance distance (see **Table 6.1.**, item 15), consider constructing a maneuvering area immediately outside the hangar, large enough to allow turning the aircraft around. The width of the maneuvering area should be equal to the width of the hangar door opening. Connect this maneuvering area to the main apron with a taxiway or towway.
		23 m (75 ft)	Facilities for rotary-wing aircraft, except H-53, as noted below.
		30 m (100 ft)	Facilities regularly servicing H-53 helicopters.
		See **Remarks**	Access aprons are located between the apron and the front of the hangar. Maintenance hangars can be located within the apron clearance distance except, see **Table 6.1.**, Item 15.
2	Width	Equal to or greater than 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% Min 1.0%, Max 1.5% for NATO	Avoid grades that prevent aircraft tail from clearing hangar doors. Minimum grading can be increased to NATO criteria only if NATO project strictly requires such grading. Otherwise, follow standard grading.
		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.

Item No.	Item Description	Class A Runway	Class B Runway	Remarks
		Requirement		
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	N/A		
7	Transverse Grade of Unpaved Shoulder	(a) 40 mm (1-½ in) drop-off at edge of pavement. (b) 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 3.05 m (10 ft).
9	Grade (Area Between Access Apron Shoulder and Wingtip Clearance Line)	Max 10.0% (See **Note 2**)		If the wingtip clearance line falls within the Access Apron Shoulder, no grading is required beyond the Access Apron Shoulder.

NOTES:

1. N/A = 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 instruction 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.

6.16. Taxiing Characteristics on Aprons for Rotary-Wing Aircraft. Taxi routes across parking aprons are marked to provide safe passage. 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. **Hoverlane/Taxilane Width**. 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. Avoid surface drainage patterns with numerous or abrupt grade changes. They can produce excessive pavement flexing and structural damage of aircraft.

6.17.2. **Rotary-Wing Aircraft.** USAFE activities should use the Army grading criteria presented in UFC 3-260-01 for all rotary aircraft except CH-53 and CH-54. For those aircraft, see their respective Mission Design Series Facility Requirements Documents.

6.17.3. **Grades for Aircraft Fueling Ramps.** Grades for ramps on which fueling of aircraft will occur should be in accordance with NFPA Standard 415.

6.18. Shoulders. Paved shoulders are provided around the perimeter of an apron to protect against jet blast and foreign object damage (FOD), to support blast deflectors, for support equipment storage, to provide paved access to fire hydrants, and to facilitate drainage. Criteria for apron shoulders are presented in **Table 6.1** for fixed-wing aprons and AFH 32-1084 for 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. Manholes, hand holes, and drainage structures constructed within these areas should, at a minimum, be designed as stipulated in this section. (NOTE: These requirements do not apply to projects already under design prior to the publication date of this instruction.) Beyond the shoulders, sub-grade structures are not designed to support aircraft wheel loads. The top surface of foundations, manhole covers, hand hole covers, and frames within shoulders should be flush with the grade. Maintenance action is required if the drop-off exceeds 76 mm (3 in).

6.18.1. Paved Shoulder Areas.

6.18.1.1. For structures with their shortest span equal to or less than 0.6 m (2 ft), design based on a wheel load of 34,000 kg (75,000 lb) at a contact pressure of 1,724 kilopascal (kPa) (250 lb per square inch (psi)).

6.18.1.2. For structures with their shortest span greater than 0.6 m (2 ft), design based on the maximum number of wheels that can fit onto the span, considering the most critical assigned aircraft operating at its maximum gross weight. In no case, however, should the design be based on computed stress conditions less than those created by a wheel load of 34,000 kg (75,000 lb) at a contact pressure of 1,724 kPa (250 psi).

6.18.2. **Unpaved Shoulder Areas.**

6.18.2.1. For structures with their shortest span equal to or less than 0.6 m (2 ft), design based on a wheel load of 22,667 kg (50,000 lb) at a contact pressure of 1,724 kPa (250 psi).

6.18.2.2. For structures with their shortest span greater than 0.6 m (2 ft), design based on the maximum number of wheels that can fit onto the span, considering the most critical assigned aircraft operating at its maximum gross weight. In no case, however, should the

design be based on computed stress conditions less than those created by a wheel load of 22,667 kg (50,000 lb) at a contact pressure of 1,724 kPa (250 psi).

6.19. Miscellaneous Apron Design Considerations. In addition to the apron design criteria, consideration should be given to providing room for support structures, equipment (e.g., AGE, hydrant refueling systems), 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 UFC 3-260-01, Appendix B, Sections 7 and 8.

6.19.2. **Line Vehicle Parking and Aerospace Ground Equipment (AGE).** Line vehicle and AGE parking areas are provided for parking of mobile station-assigned and squadron-assigned vehicles and AGE equipment. These areas must remain outside of the apron clearance. Additional information on line vehicle parking is found in UFC 3-260-01, Appendix B, Section 12.

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 (refer to the respective host nation's FGS for environmental requirements. Where an FGS does not exist for a specific host nation, refer to the OEBGD).

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.

Chapter 7

SHORTFIELDS AND TRAINING ASSAULT LANDING ZONES (LZ)

7.1. Criteria for shortfields and training assault LZs in the United States Air Forces in Europe (USAFE) shall follow the criteria of Chapter 7 of the UFC 3-260-01, *Airport and Heliport Planning and Design,* and Engineering Technical Letter (ETL) 09-6, *C-130 and C-17 Landing Zone (LZ) Dimensional, Marking, and Lighting Criteria.*

Chapter 8

AIRCRAFT HANGAR PAVEMENTS

8.1. Criteria for aircraft hangar pavements in the United States Air Forces in Europe (USAFE) shall follow the criteria of Chapter 8 of the UFC 3-260-01, *Airport and Heliport Planning and Design*.

ROBERT E. MORIARTY, Col, USAF
Deputy Director, Installations and Mission Support

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

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Abbreviations and Acronyms Abbreviations and Acronyms

AC—Advisory Circular

AF—Air Force

AFCEE—Air Force Center for Engineering and the Environment

AFCESA—Air Force Civil Engineer Support Agency

AFCESA/CESC—Air Force Civil Engineer Support Directorate

AFFSA—Air Force Flight Standards Agency

AFH—Air Force Handbook

AFI—Air Force Instruction

AFM—Airfield Manager

AFMAN—Air Force Manual

AFPD—Air Force Policy Directive

AFRC—Air Force Reserve Command

AFSBw—Amt für Flugsicherung der Bundeswehr (Bundeswehr Air Traffic Services Office, for German MOBS)

AGE—Aerospace Ground Equipment

AH—Attack Helicopter

AICUZ—Air Installation Compatibility Use Zone

ALRS—Alternate Launch Recovery Surface

AM—Airfield Management

AMC—Air Mobility Command

ANG—Air National Guard

AOB—Airfield Operations Board

AORI—Airfield Obstruction Reduction Initiative

AORP—Airfield Obstruction Reduction Program

APOE—Aerial Ports of Embarkation

APZ—Accident Potential Zone

APZ I—Accident Potential Zone I

APZ II—Accident Potential Zone II

AR—Army Regulation

ARP—Aerodrome Reference Point

ATAP—Air Traffic Act Permit

ATC—Air Traffic Control

ATCALS—Air Traffic Control and Landing Systems

ATCT—Air Traffic Control Tower

ATSEP—Air Traffic System Evaluation

BAK—Barrier, Arresting Kit

BASH—Bird/Wildlife Aircraft Strike Hazard

BCE—Base Civil Engineer

BEMO—Base Equipment Management Office

CAT I ILS—Category I Instrument Landing System

CAT II ILS—category II Instrument Landing System

CBR—California Bearing Ratio

CC—Commander

CCP—Compass Calibration Pad

CE—Civil Engineer

CEG/CC—Civil Engineer Support Group

CH—Cargo Helicopter

CZ—Clear Zone

DA—Department of the Army

DA—decision altitude

dB(a)—Decibel

DH—Decision Height

DoD—Department of Defense

DoDI—DoD Instruction

EMR—Electromagnetic Radiation

ETL—Engineering Technical Letter

FAA—Federal Aviation Administration

FAA AC—Federal Aviation Administration Advisory Circular

FAAH—Federal Aviation Administration Handbook

FAR—Federal Aviation Regulations

FGS—Final Governing Standards

FIM—Facility Investment Matrix

FOD—Foreign Object Damage

FSSZ—Fuel Servicing Safety Zone

ft—foot

FY—Fiscal Year

HQ AFCEE—Headquarters Air Force Center for Engineering and the Environment

HQ AFCESA/CESC—Headquarters Air Force Civil Engineer Support Agency, Operations and Programs Support Directorate, Engineer Support Division

HQ USAFE—Headquarters United States Air Forces in Europe

HQ USAFE/A3—Air and Space Operations Directorate

HQ USAFE/A3Y—Air Operations Command and Control

HQ USAFE/A4/7—Logistics, Installations and Mission Support Directorate

HQ USAFE/A6—Communications Directorate

HQ USAFE/A7P—Programs Division

HQ USAFE/A7PP—Plans and Requirements

HQ USAFE/A7S—Security Forces Division

HQ USAFE/JA—Office of Staff Judge Advocate

HQ USAFE/SE—Safety Directorate

ICAO—International Civil Aviation Organization

IESNA—Illuminating Engineering Society of North America

IFR—Instrument Flight Rules

ILS—Instrument Landing System

In—Inch

Kg—Kilogram

kN—Kilonewton

kPa—Kilopascal

Lb—Pound

LED—Light-Emitting Diode

LZ—Landing Zone

m—Meter

MAAS—Mobile Aircraft Arresting System

MAJCOM—Major Command (USAF)

MAJCOM/CV—Major Command Vice Commander

Max—maximum

MDA—Minimum Descent Altitude

MFZ—Mandatory Frangibility Zone

MILCON—Military Construction

Min—minimum

mm—Millimeter

MOB—Main Operating Base

MSG/CC—Mission Support Group Commander

MSL—Mean Sea Level

N/A—not applicable

NATO—North Atlantic Treaty Organization

NAVAID or NavAIDS—Navigational Aids

NfL—Nachrichten für Luftfahrer

NFPA—National Fire Protection Association

NOTAM—Notice to Airmen

N.T.S—not to scale

OEBGD—Overseas Environmental Baseline Guidance Document

OCR—Office of Collateral Responsibility

OG/CC—Operations Group Commander

O&M—Operation and Maintenance

OH—Observation Helicopter

OPNAVINST—Operations Naval Instruction

OPR—Office of Primary Responsibility

ORM—Operational Risk Management

OSA—Operational Support Airlift

OSS—Operations Support Squadron

PA—Priority Area

PANSOPS—Terminal Instrument Procedures

PCC—Portland Cement Concrete

POV—Privately Owned Vehicle

Psi—pounds per square inch

RAC—Risk Assessment Code

RDS—Records Disposition Schedule

RSZ—Refueling Safety Zone

SABER—Simplified Acquisition Base Engineer Requirements

SI—International System of Units

SII—Special Interest Item

SPR—Single Point Receptacle

MSG/CC—Mission Support Group Commander

STANAG—Standardization Agreement

TERPS—Terminal Instrument Procedures

TM—Technical Manual

T.O.—Technical Order

UFC—Unified Facilities Criteria

UH—Utility Helicopter

US—United States

USACE—U.S. Army Corps of Engineers

USAF—United States Air Force

USAFE—United States Air Forces in Europe

USAFE/CV—USAFE Vice Commander

USAFEI—United States Air Forces in Europe Instruction

VFR—Visual Flight Rules

V-STOL—Vertical/Short Take-Off and Landing

Terms

Aborted Takeoff—An unsuccessful takeoff operation due to power or other mechanical failures.

Accident Potential Zone I (APZ I)—The area beyond the clear zone that possesses a significant potential for accidents.

Accident Potential Zone II (APZ II)—The area beyond APZ I that has a measurable potential for accidents.

AICUZ (Air Installation Compatible Use Zone)—A DoD program designed to promote compatible development around military airfields and to protect the integrity of the installation's flying mission.

Air Traffic—Aircraft in operation anywhere in the airspace and within that area of an airfield or airport normally used for the movement of aircraft.

Aircraft—Fixed-wing (F/W) (Airplane) and rotary-wing (R/W) (helicopter).

Aircraft, Class A—Aircraft listed under Class A Runways in **Table 3.1** of this instruction.

Aircraft, Class B—Aircraft listed under Class B Runways in **Table 3.1** of this instruction.

Aircraft Arresting System—A series of components used to engage and absorb the forward momentum of a routine or emergency landing or an aborted takeoff.

Aircraft Movement Area—For the purpose of this instruction, the Aircraft Movement Area is defined as that area of the airfield encompassed by the Primary Surface and the Clear Zones, as well as all apron areas and taxiways, regardless of their location. See **paragraph 3.14.1** for the specific use of this term.

Aircraft Wash Area—A specially designed paved area for washing and cleaning aircraft.

Aircraft Wash Rack—Paved areas provided at all facilities to clean aircraft in conjunction with periodic maintenance.

Airfield—An area prepared for the accommodation (including any buildings, installations and equipment) of landing and takeoff of aircraft.

Airfield Elevation—The established elevation, in terms of the nearest 300 mm (one foot) above mean sea level (MSL), of the highest point of the usable landing area.

Airfield Reference Point—The designated geographical location of an airfield. It is given in terms of the nearest hundredth of a second of latitude and longitude. The position of the reference point must be as near to the geometric center of the landing area as possible, taking future development of the airfield into account.

Airport—Refers to a civil or municipal airfield.

Airspace—The space above ground or water areas which is or is not controlled, assigned, and/or designated.

Airspace Boundaries—The limits of imaginary surfaces.

Alert Aircraft Parking—An exclusive paved area for armed aircraft to park and have immediate, unimpeded access to a runway.

Alert Pad—Small paved areas provided for single alert aircraft parking.

Approach Control—A service established to control flights, operating under instrument flight rules (IFR), arriving at, departing from and operating in the vicinity of airports by direct communication between approach control personnel and aircraft operating under their control.

Approach Clearance Surface—An inclined plane or combined inclined and horizontal planes arranged symmetrically about the runway centerline extended. The first segment or the beginning of the inclined plane is coincident with the ends and edges of the primary surface, and the elevation of the centerline at the runway end. This surface flares outward and upward from these points.

Apron—A defined area, on an airfield, intended to accommodate aircraft for the purposes of loading or unloading passengers or cargo, refueling, parking or maintenance.

Apron, Aircraft Access—See Apron, Hangar Access.

Apron, Alert—A designated area for multiple alert aircraft parking.

Apron Edge—See Edge of Apron.

Apron, Hangar Access—Hangar access aprons are paved areas connecting hangars with adjacent aircraft aprons when the hangar is located at the outer boundary of the apron clearance distance. Hangars located beyond the apron clearance distance maybe connected to the main apron with a taxiway or a tow way.

Apron, Holding (Engine Run up Area)—A paved area adjacent to the taxiway near the runway ends where final preflight warm-up and engine and instrument checks are performed.

Apron, Parking—A parking apron is a designated paved area on an airfield intended to accommodate fixed-and rotary-wing aircraft for parking.

Arming and Disarming—The loading and unloading of missiles, rockets and ammunition in aircraft.

Aviation Facility—The combination of land, airspace, pavements and buildings which are needed to support an aviation movement or action. An aviation facility can be an airfield, heliport or helipad. The aviation facility includes “airside” and “landside” facilities.

Aviation Movement or Action—An aviation movement or action includes but is not limited to: the landing and take-off of aircraft; readiness of aircraft; flight training of pilots; loading and unloading of aircraft; and the maintenance and fueling of aircraft.

Aviation Easement—A legal right obtained from a property owner to operate aircraft over that property and to restrict the height of any construction or growth on that property.

Balked Landing—An unsuccessful landing.

Balked Landing Surface—An inclined plane starting 1800 meters (m) after the threshold, extending between the inner transitional surface, established to protect aircraft in the event of a balked landing.

Blast Protective Area—An area protected by pavement construction at the ends of runways and taxiways against jet blast erosion.

Clear Zone—A surface on the ground or water beginning at the runway end and symmetrical about the runway centerline extended.

Compass Calibration Pad—An aircraft compass calibration pad is a paved area in an electromagnetically quiet zone where an aircraft's compass is calibrated.

Compass Rose—A graduated circle, usually marked in degrees, indicating directions and printed or inscribed on an appropriate medium.

Conical Surface—An imaginary surface that extends from the periphery of the inner horizontal surface outward and upward at a slope of 20 horizontal to one for a horizontal distance of 2,133.6 m (7,000 ft) to a height, 152.4 m (500 ft) above the established airfield elevation. The conical surface connects the inner horizontal surface with the outer horizontal surface. It applies to fixed-wing installations only.

Controlling Obstacle—The highest obstacle relative to a prescribed plane within a specified area. In precision and non-precision approach procedures where obstacles penetrate the approach surface, the controlling obstacle is the one which results in the requirement for the highest Decision Height (DH) or Minimum Descent Altitude (MDA).

Correctable Obstruction—An obstruction to aircraft operations or air navigation that can be removed, modified, or relocated to comply with airfield safety criteria with areasonable level of effort as determined by the Major Command (MAJCOM).

Crosswind Runway—A secondary runway that is required when the primary runway orientation does not meet crosswind criteria (U.S. Army ETL 1110-3-394, *Aircraft Characteristics for Airfield-Heliport Design and Evaluation*, available at **https://www.my.af.mil/afknprod/ASPs/docman/DOCMain.asp?Tab=0&FolderID=OO-EN-FE-08-8&Filter=OO-EN-FE-08**).

Decision Height—A height above the highest elevation in the touchdown zone, specified for a precision approach, at which a missed approach procedure must be initiated if the required visual reference has not been established.

Decision Height (DH) / Decision Altitude (DA)—Specified for a precision approach, at which a missed approach procedure must be initiated if the required visual reference has not been established. Decision altitude (DA) is referenced to mean sea level (MSL) and decision height (DH) is referenced to the threshold elevation.

Departure Surface—An inclined plane or combined inclined and horizontal planes arranged symmetrically about the runway centerline extended.

Dispersed Platforms—An aircraft parking area spread across an installation consisting of taxitracks and hardened aircraft shelters (for fighters) or single aircraft parking bays (for tankers, cargo and bomber aircraft).

Displaced Threshold—A runway threshold that is not at the beginning of the full-strength runway pavement.

Edge of Apron—The boundary of an apron, marked by painted stripe in accordance with pavement marking manual ETL 94-01.

Emergency Landing Surface—See Emergency Runway.

Emergency Runway—A paved rectangular area of an airfield designed for the recovery and launching of aircraft when the primary-airfield runway is out of commission.

Exemption—A facility or other item constructed under a previous standard. Exemptions must be programmed for replacement away from the airfield environment at the end of their useful life cycle. Exemptions cannot be renovated.

Fixed-Wing Aircraft—A powered aircraft that has wings attached to the fuselage so that they are either rigidly fixed or swing-wing, as distinguished from aircraft with rotating wings, like a helicopter.

Flight Path—The line connecting the successive positions occupied, or to be occupied, by an aircraft, missile or space vehicle as it moves through air or space.

Fuel Servicing Safety Zone (FSSZ)—The FSSZ is the area required for safety around pressurized fuel carrying servicing components; i.e. servicing hose, fuel nozzle, single point receptacle (SPR), hydrant hose car, ramp hydrant connection point, etc. and around aircraft fuel vent outlets. The FSSZ is established and maintained during pressurization and movement of fuel.

Full Stop Landing—The touchdown, rollout and complete stopping of an aircraft to zero speed on runway pavement.

Grade-also Gradient—A slope expressed in percent. For example, a 0.5 percent grade means a 0.5 m (ft) slope in 100 m (ft). All grades may be positive or negative unless otherwise specifically noted.

Hardstand—See Apron.

Helicopter—An aircraft deriving primarily elements of aerodynamic lift, thrust and control from one or more power driven rotors rotating on a substantially vertical axis.

Helicopter (Light)—Helicopters with a gross weight of 2,722 kg (6,000 lbs) or less.

Helicopter (Medium)—Helicopters with a gross weight of 2723 - 5,443 kg (6,001 - 12,000 lbs).

Helicopter (Heavy)—Helicopters with a gross weight over 5,443 kg (1,2,000 lbs).

Helicopter Runway—A prepared surface used for the landing and takeoff of helicopters requiring a ground run.

Helipad—A prepared area designated and used for takeoff and landing of helicopters (includes touchdown and hoverpoint).

Helipad, IFR—A helipad designed for Instrument Flight Rules. IFR design standards are used when an instrument approach capability is essential to the mission and no other instrument landing facilities, either fixed-wing or rotary-wing, are located within an acceptable commuting distance to the site.

Helipad, Limited Use—A visual flight rules (VFR) rotary wing facility for use by AH, OH and UH helicopters. These type helipads support only occasional operations at special locations such as hospitals, headquarters facilities, missile sites and other similar locations. They may also be

located on airfields where one or more helipads are required to separate operations of helicopters such as observation helicopter (OH), utility helicopter (UH) and attack helicopter (AH) from fixed-wing or other helicopter operations.

Heliport—A facility designed for the exclusive operating, basing, servicing and maintaining of rotary-wing aircraft (helicopters). The facility may contain a rotary-wing runway and/or helipads.

Heliport or Helipad Elevation—The established elevation, in terms of the nearest 300 mm (one ft) above mean sea level (MSL), based on the highest point of the usable landing area.

High-Speed Taxiway Turnoff—A taxiway leading from a runway at an angle which allows landing aircraft to leave a runway at a high speed.

Holding Position—A specified location on the airfield, close to the active runway and identified by visual means, at which the position of a taxiing aircraft is maintained in accordance with air traffic control (ATC) instructions (AFI 13-204, *Functional Management of Airfield Operations*,

Horizontal Surfaces, Fixed—Wing:

Inner Horizontal Surface—An imaginary plane 45.72 m (150 ft) above the established airfield elevation. The inner boundary intersects with the approach departure clearance surface and the transitional surface. The outer boundary is formed by scribing arcs with a radius 2,286.0 m (7,500 ft) from the centerline of each runway end, and interconnecting those arcs with tangents.

Outer Horizontal Surface—An imaginary plane 152.4 m (500 ft) above the established airfield elevation extending outward from the outer periphery of the conical surface for a horizontal distance of 9,144.0 m (30,000 ft).

Horizontal Surface, Rotary-Wing—An imaginary plane at 45.72 m (150 ft) above the established heliport or helipad elevation. The inner boundary intersects with the approach or departure clearance surfaces and the transitional surface. The outer boundary is formed by scribing an arc at the end of each runway, and connecting the arcs with tangents or by scribing the arc about the center of the helipad. See **Chapter 4** for dimensions.

Hover—A term applied to helicopter flight when the aircraft: (1) maintains a constant position over a selected point (1 m to 3 m (3 ft to 10 ft) above ground), and (2) is taxiing (airborne) (1 m to 3 m (3 ft to 10 ft) above ground) from one point to another.

Hoverlane—A designated aerial traffic lane for the directed movement of helicopters between a helipad or hoverpoint and the servicing and parking areas of the heliport or airfield.

Hoverpoint—A prepared and marked surface at a heliport or airfield used as a reference or central point for arriving or departing helicopters.

Imaginary Surfaces—Surfaces in space established around airfields in relation to runway(s), helipad(s), or helicopter runway(s) that are designed to define the obstacle free airspace around the airfield. The imaginary surfaces for DoD airfields are the primary surface, the approach or departure clearance surfaces, the transitional surface, the inner horizontal surface and the conical surface (fixed-wing only).

Ingress/Egress, Same Direction—One approach-departure route to and from the helipad exists. The direction from which the rotary-wing aircraft approaches the helipad (ingress) is the only direction which the rotary-wing aircraft departs (egress) from the helipad. Typically, the helipad

is surrounded by obstacles on three sides which make approaches from other directions impossible. For example, if the rotary-wing aircraft approaches from the southwest, it must also depart to the southwest.

Ingress/Egress, Two Direction—Rotary-wing aircraft can approach and depart the helipad from two directions (one direction and the opposite direction). (See also Ingress/Egress, Same Direction.)

Inner Approach Surface—A rectangular portion of the approach surface immediately preceding the threshold.

Inner Transitional Surface—A surface similar to the transitional surface but closer to the runway. The limits of an inner transitional surface shall comprise a lower edge beginning at the end of the inner approach surface and extending down the side of the inner approach surface to the inner edge of that surface, from there along the strip parallel to the runway centre line to the inner edge of the balked landing surface and from there up the side of the balked landing surface to the point where the side intersects the inner horizontal surface; and an upper edge located in the plane of the inner horizontal surface.

Instrument Runway—A runway equipped with electronic navigation aids (NAVAIDS) for which a precision or non-precision approach procedure is approved.

Instrument Flight Rules (IFR)—Rules that govern the procedure for conducting instrument flight. Also see Instrument Meteorological Conditions.

Instrument Landing System (ILS)—A system of ground equipment designed to provide an approach path for exact alignment and descent of an aircraft on final approach to a runway. The ground equipment consists of two highly directional transmitting systems and, along the approach, three (or fewer) marker beacons. The directional transmitters are known as the localizer and glide slope transmitters.

Instrument Meteorological Conditions—Meteorological conditions expressed in terms of visibility, distance from cloud and ceiling; less than minimums specified for visual meteorological conditions.

Intermediate Area—The area between runways and between runways and taxiways that is graded or cleared for operational safety.

Joint and/or Shared Use Airfield—Those airports that are shared by a civilian DoD agency covered under the "Airports and Airway Improvement Act of 1982 (Public LAW 97-248, Sep 3, 1982, 49 USC, APP 2201). Only those facilities (i.e., runways/taxiways) that are used by both civilian and DoD agencies are considered "Shared/Joint Use". All other facilities (parking ramps, hangars, terminals, and so forth) are the sole property of the using agency. A USAF installation where agreements exist among the AF, civil and host nation authorities for joint use of all or a portion of airfield facilities.

Landing Area—See Take-Off and Landing Area.

Landing Field—Any area of land consisting of one or more landing strips, including the intermediate area, that is designed for the safe take-off and landing of aircraft.

Landing Lane—A defined lane on the airfield used for simultaneous take-off and landings of multiple (up to four at one time) helicopters. Landing lanes are used at airfields or heliports

when a high density of helicopters are parked on an apron, or in the process of take-off and landings.

Landing Strip—That portion of an airfield that includes the landing area, the end zones and the shoulder areas. Also known as a flight strip.

Landside Facilities—Landside facilities are facilities not associated with the movement and parking of aircraft but are required for the facilities' mission. These include aircraft maintenance areas, aviation support areas, fuel storage and dispensing, explosives and munitions areas and vehicular needs.

Large Transport Aircraft—A transport aircraft with a wing span of 33.5 m (110 ft) or greater.

Line Vehicle—Any vehicle used on the landing strip, such as a crash fire truck or tow tractor.

Localizer—A directional radio beacon which provides to an aircraft an indication of its lateral position relative to a predetermined final approach course.

Localizer Type Directional Aid (LDA)—A Navigational Aid (NAVAID) used for non-precision instrument approaches with utility and accuracy comparable to a localizer but which is not part of a complete ILS. The LDA is not aligned with the runway. The alignment is greater than 3 degrees (3°) and less than 30 degrees (30°) from the runway centerline.

Magnetic North—The direction indicated by the north-seeking pole of a freely suspended magnetic needle, influenced only by the earth's magnetic field.

Magnetic Variation—At a given place and time, the horizontal angle between the true north and magnetic north measured east or west according to whether magnetic north lies east or west of true north.

Magnetically Quiet Zone—A location where magnetic equipment, such as a compass, is only affected by the earth's magnetic forces.

Navigable Airspace—Airspace above the minimum safe altitudes of flight including airspace needed to insure safety in take-off and landing of aircraft, as prescribed by the Civil Aeronautics Authority.

Non-Precision Approach—An approach flown by reference to electronic navigation aids in which glide slope information is not available.

Non-Instrument Runway—A runway intended for operating aircraft under visual flight rules (VFR).

Obstacle—An existing object, natural growth, or terrain, at a fixed geographical location, or which may be expected at a fixed location within a prescribed area, with reference to which vertical clearance is or must be provided during flight operations.

Obstacle Clearance—The vertical distance between the lowest authorized flight altitude and a prescribed surface within a specified area.

Obstruction—A natural or man-made object that violates airfield or heliport clearances or projects into imaginary airspace surfaces.

Overrun Area—An area the width of the runway plus paved shoulders extending from the end of the runway to the outer limit of the end zone. This portion is a prolongation of the runway which is the stabilized area.

Parking, Aircraft Undergoing Maintenance—Apron parking space is provided for parking aircraft which must undergo maintenance.

Parking, Alert Aircraft—Parking for aircraft that must be in flight upon short notice.

Parking, Operational Aircraft—Parking for operational aircraft assigned to a particular installation.

Parking, Transient Aircraft—Parking for transient aircraft (non-operational) at the installation, but not assigned there.

Parking, Transport Aircraft—Parking for transport aircraft carrying cargo and personnel which must be loaded and unloaded.

Pavement (Paved Surface)—A durable weather and abrasion resistant surface made from a prepared or manufactured material placed on an established base. General categories of pavements are flexible and rigid.

Permissible Deviation—Airfield support facilities that are not required to meet airfield clearance criteria however, they must meet siting criteria specified in UFC 3-260-01, Appendix B, Section 13, *Deviation from Criteria for Air Force Airfield Support Facilities*, of this supplement.

Power Check—The full power test of an aircraft engine while the aircraft is held stationary.

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.

Precision Approach—An approach in which azimuth and glide slope information are provided to the pilot.

Primary Surface (Fixed—Wing Runways)—An imaginary surface symmetrically centered on the runway, extending 60.96 m (200 ft) beyond each runway end. The width varies depending upon the class of runway and coincides with the lateral clearance distance. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline.

Primary Surface (Rotary—Wing Runways and Landing Lanes)—An imaginary surface symmetrically centered on the runway, extending beyond the runway ends. The width and length depends upon whether the runway/landing lane is to accommodate VFR or IFR operations. The lateral clearance distance coincides with the width of the primary surface. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline.

Runway—A defined rectangular area of an airfield or heliport prepared for the landing and takeoff run of aircraft along its length.

Runway (Class A)—Class A runways are primarily intended for small light aircraft. Ordinarily, these runways have less than 10 % of their operations involving aircraft in the Class B category. These runways are normally less than 2,440 m (8,000 ft).

Runway (Class B)—Class B runways are all fixed-wing runways that accommodate normal operations of Class B Aircraft.

Runway End—As used in this instruction, the runway end is where the normal threshold is located. When the runway has a displaced threshold, the using service will evaluate each individual situation and, based on this evaluation, will determine the point of beginning for runway and airspace imaginary surfaces.

Runway Exit—A taxiway pavement provided for turnoffs from the runway to a taxiway either at normal or high speed.

Runway, Parallel—Two or more runways at the same airport whose centerlines are parallel. In addition to runway number, parallel runways are designated as L (left) and R (right) or, if three parallel runways exist, L (left), C (center), and R (right).

Runway, Rotary-wing—A runway for rolling landings and take-off of rotary-wing aircraft. The rotary-wing runway allows for a helicopter to quickly land and roll to a stop compared to the hovering stop used during a vertical helipad approach.

Runway Threshold—A line perpendicular to the runway centerline designating the beginning of that portion of a runway usable for landing.

Runway Visual Range—The maximum distance in the direction of take-off or landing from which the runway, or the specified lights or markers delineating it, can be seen from a position above a specified point on its centerline at a height corresponding to the average eye-level of pilots at touchdown.

Service Point—A receptacle, embedded in certain airfield pavements, containing outlets for utilities required to service aircraft.

Shoulder—A prepared (paved or unpaved) area adjacent to the edge of an operational pavement.

Slope Ratio—A slope expressed in meters (m) (feet) as a ratio of the horizontal to the vertical distance. For example, 50:1 means 50 m horizontal to 1 m vertical (50 ft horizontal to 1 ft vertical).

Standard VFR Helipad—A helipad designed to Visual Flight Rules (VFR). VFR design standards are used when no requirement exists or will exist in the future for an IFR helipad.

Strategic Transport Aircraft—Larger aircraft, military and commercial, employed for the carriage of personnel and cargo over long distances. Strategic transport aircraft include:

A—400M

An—124

Airbus A—310

B—1B, B-52G/H

B—747, B-767

C—5A/B, C-17

Il—76

KC—10, KC-135R

Tu—154

Suppressed Power Check Pad—A suppressed power check pad is an enclosed power check pad, referred to as a "hush house," where full power checks of jet engines are performed.

Tactical (non-transport) Aircraft—Fixed-wing, manned aircraft used in non-transport military roles. Tactical (non-transport) aircraft include the following:

Alpha Jet
AMX

A—7, A-10

AV—8B (Harrier)

(C)F—18

Eurofighter

F—1, F-3, F-4, F-5, F-15C/D, F-15E, F-16, F-22, F-35

L—159

Mig—29

Mirage 5
Mirage 2000

Su—22

Tactical Transport Aircraft—Fixed-wing military aircraft with relatively short take-off and landing characteristics primarily employed for carriage of personnel and cargo over short/medium distances. Tactical transport aircraft include the following:

An—24 An-26

C—2 C-9, C-12 C-26 C-27J C-130 C-130E, C-130J C-160

Cessna 525, G—222

F—4

Takeoff and Landing Area—A specially prepared or selected surface of land, water, or deck designated or used for takeoff and landing of aircraft.

Taxilane—A designated path marked through parking, maintenance or hangar aprons, or on the perimeter of such aprons to permit the safe ground movement of aircraft operating under their own power.

Taxilane, Interior (secondary taxi routes)—A taxilane which provides a secondary taxi route to individual parking positions or a hangar and is not intended or used as a primary taxi route for through traffic.

Taxilane, Peripheral—A taxilane located along the periphery of an apron that may be considered a primary or a secondary taxi route. Provide wing tip clearance commensurate with the intended use. See Taxilane, Interior, Taxilane, Through, and **Table 6.1**, Items 5 and 6.

Taxilane, Through (primary taxi routes)—A taxilane providing a route through or across an apron which is intended as a primary taxi route for access to other taxilanes, aprons, taxiways or the runway.

Taxiway—A specially prepared or designated path, on an airfield or heliport other than apron areas, on which aircraft move under their own power to and from landing, service and parking areas.

Taxiway, Apron Entrance—A taxiway which connects a parallel taxiway and an apron.

Taxiway, End Turnoff (Entrance Taxiway) (Connecting Taxiway) (Crossover Taxiway)—A taxiway located at the end of the runway that serves as both an access and departure location for aircraft at the runway thresholds.

Taxiway, High—Speed Turnoff (High-Speed Exit) (Acute-angled Exit Taxiway)—A taxiway located intermediate of the ends of the runway and "acute" to the runway centerline to enhance airport capacity by allowing aircraft to exit the runways at a faster speed than normal turnoff taxiways allow. Aircraft turning off runways at high speeds (max. 100 kph (55 knots)) require sufficient length for a high-speed turnoff taxiway to decelerate to a full stop before reaching the parallel taxiway.

Taxiway, Normal Turnoff (Ladder Taxiway) (Intermediate Taxiway) (Exit Taxiway)—A taxiway located intermediate of the end of the runway, typically perpendicular to the runway centerline that allows landing aircraft to exit and clear runways as soon as possible.

Taxiway, Parallel—A taxiway which parallels the runway. The curved connections to the end of the runway permit aircraft ground movement to and from the runway and are considered part of the parallel taxiway when there are no other taxiway exits on the runway. Some parallel taxiways are classified as emergency runways.

Taxitrack—A specially prepared or designated path, on an airfield other than mass parking areas, on which aircraft move under their own power to and from taxiways to dispersed platforms.

Taxiway Turnoff—A taxiway leading from a runway to allow landing aircraft to exit and clear the runway after completing their initial landing roll.

Threshold Crossing Height—The height of the straight line extension of the guide slope above the runway at the threshold.

Tie down Anchor—A device, installed in certain airfield pavements, to which lines tying down an aircraft are secured. Grounding may be provided. This is not to be confused with the aircraft trim pad and thrust anchor shown in UFC 3-260-01, Appendix B, Section 14, *Construction Phasing Plan and Operational Safety on Airfields During Construction*.

Touchdown Point—A designated location on a landing lane, taxiway or runway for permitting more rapid launch or recovery of helicopters in a high-density area.

Towway—A paved surface over which an aircraft is towed.

Transitional Surface—An imaginary surface that extends outward and upward at right angles to the runway centerline and the runway centerline extended at a slope ratio of 7H:1V. The transitional surface connects the primary and the approach departure clearance surfaces to the inner horizontal, the conical and the outer horizontal surfaces.

Transitional Surfaces (Rotary—Wing)—The imaginary plane which connect the primary surface and the approach or departure clearance surfaces to the horizontal surface, or extends to a prescribed horizontal distance beyond the limits of the horizontal surface. Each surface extends outward and upward at a specified slope measured perpendicular to the runway centerline or helipad longitudinal centerline (or centerlines) extended.

True North—The direction from an observer's position to the geographic North Pole. The north direction of any geographic meridian.

Unsuppressed Power Check Pad—A power check pad without an enclosure or other type of noise suppressor. It is generally used as a back up or interim facility to a suppressed power check pad. The unsuppressed power check pad, in its simplest form, is a paved area on which full power engine diagnostic testing can be performed without noise or jet blast limitations.

Visual Flight Rules (VFR)—Rules that govern the procedures for conducting flight under visual conditions. Also see Visual Meteorological Conditions.

Vertical Sight Distance—The longitudinal distance visible from one location to another. Usually, a height above the pavement surface is also defined.

Vertical/Short Take—Off and Landing (V-STOL)—A tilt-rotor Vertical Take-Off and Landing Aircraft, that has the ability to operate as either a fixed- or rotary-wing aircraft.

Waiver, Construction—A temporary airfield waiver used to identify, coordinate and approve construction activity on or near the airfield. The Installation Commander is the approval authority for construction waivers.

Waiver, Contingency—An airfield waiver used to support a contingency operation. Contingency waivers cannot exceed 180 days (6 months) without Headquarters United States Air Forces in Europe (HQ USAFE) approval. The Installation Commander or equivalent, is the contingency waiver approval authority for an installation.

Waiver, Permanent—An airfield waiver established for violations that cannot be reasonably corrected and pose little or no risk to flying operations. Such violations are typically caused by natural topographic features. The Major Command Vice Commander (MAJCOM/CV) is the approval authority for permanent waivers.

Waiver, Temporary—An airfield waiver established to address safety mitigation for correctable obstructions or violations of other airfield criteria such as grades. MAJCOM/CV is the approval authority for temporary waivers. These waivers require CV approval each year (continuous 12 months).

Wind Rose—A diagram showing the relative frequency and strength of the wind in correlation with a runway configuration and in reference to true north. It provides a graphic analysis to obtain the total wind coverage for any runway direction.

Wind Direction—The direction from which the wind is blowing in reference to true north.

Attachment 2

UNITED STATES AIR FORCES IN EUROPE (USAFE) AIRFIELD AND AIRSPACE WAIVER PROGRAM

A2.1. Waivers to Criteria and Standards

A2.1.1. When proposed objects, activities, or facilities will violate airfield imaginary surfaces, safe clearance, or other design criteria established in this instruction, they must be analyzed to determine potential impact to aircraft operations before construction activities begin. Waivers are processed when compliance with criteria cannot be achieved; the proposed object, activity or facility poses little or no risk to flying safety; and there are no other viable alternatives. For work executed through contract, waivers to criteria must be processed and approval obtained before construction or alteration contracts are issued. For work executed by Government personnel, waivers to criteria must be processed and approval obtained before construction or alterations of facilities begin. The Base Civil Engineer (BCE) initiates an airfield waiver request as soon as design indicates airfield criteria cannot be met and all alternatives have been exhausted. Facilities listed as permissible deviations (see UFC 3-260-01, Appendix B, Section 13, Deviation from Criteria for Air Force Airfield Support Facilities beginning at paragraph B13.2.) do not require a waiver if sited and constructed properly. The USAFE Vice Commander (USAFE/CV) may grant permissible deviation status for other airfield related facilities or systems that are unique to the command but must provide acceptable construction standards, siting criteria, and aircraft clearance requirements for such items.

A2.1.2. Responsibilities:

A2.1.2.1. Air Force Civil Engineer Support Agency (HQ AFCESA/CEOA). Recommends policy on waivers and provides technical assistance on the waiver program.

A2.1.2.2. Air Force Flight Standards Agency (HQ AFFSA):

A2.1.2.2.1. Reviews all policy changes to airfield planning and design criteria prior to implementation to determine operational impact on airfield and aircraft operations.

A2.1.2.2.2. Approves all requests for waivers to instrument procedure criteria in AFI 11-230, *Instrument Procedures*, or AFMAN (I) 11-226, United States Standard for Terminal Instrument Procedures (TERPS)

A2.1.2.2.3. Processes requests for waivers according to AFI 11-230.

A2.1.2.3. Programs Division (HQ USAFE/A7P):

A2.1.2.3.1. Coordinates with Directors of Air and Space Operations (HQ USAFE/A3); Logistics, Installations and Mission Support (HQ USAFE/A4/7), Communications and Information (HQ USAFE/A6), Safety (HQ USAFE/SE), Security Forces Division (HQ USAFE/A7S), and Third Air Force (3rd AF) before submitting waiver requests to the USAFE Vice Commander (HQ USAFE/CV) for approval or disapproval.

A2.1.2.3.2. Sets and enforces reasonable safety precautions.

A2.1.2.3.3. Monitors actions to correct temporarily waivered items within specified periods.

A2.1.2.3.4. Establishes procedures to ensure an annual review of all temporarily waivered items.

A2.1.2.3.5. Establishes the administrative procedures for processing waivers.

A2.1.2.3.6. Establishes guidance for the development and implementation of an obstruction reduction program.

A2.1.2.3.7. Maintains (for record) one copy of all pertinent documents relative to each waiver, including a record of staff coordination on actions at base and command levels.

A2.1.2.4. BCE:

A2.1.2.4.1. Coordinates with airfield operations (Airfield Management (AM), TERPS and Air Traffic Control (ATC)), flying and ground safety, flight operations, logistics, security forces and communications to request waivers.

A2.1.2.4.2. Annotates proposed waiver location on appropriate E series map for base and HQ USAFE evaluation.

A2.1.2.4.3. Establishes and updates (at least annually) maps of approved waivered items in accordance with AFI 32-7062, Base Comprehensive Planning, and maintains this information on the appropriate map (see Attachment 7, Item E of AFI 32-7062, Airfield Operations). Also see AFMAN (I) 11-226, United States Standard for Terminal Instrument Procedures (TERPS) and AFMAN 11-230, Instrument Procedures.

NOTE: Effective 1 October 2007, surveys must be accurate to the tolerances established within **FAA Publication 405, *Standards for Aeronautical Surveys and Related Products,* available at https://www.my.af.mil/afknprod/ASPs/docman/DOCMain.asp?Tab=0&FolderID=OO-EN-FE-08-8-1&Filter=OO-EN-FE-08**.

A2.1.2.4.4. Develops a Military Construction (MILCON) Program, or other project program, to systematically correct non-permanent waivers. Project listing shall include, by waiver, Wing Facilities Board Priority based on Consolidated Priority List (CPL); Facility Investment Matrix (FIM) rating; Risk Assessment Code (RAC) rating; fund type (e.g. Operation and Maintenance (O&M), MILCON, 3080, Airfield Obstruction Reduction Initiative (AORI) Program, etc.); project Fiscal Year (FY); and estimated time for execution. Corrective action information will be maintained on USAFE FORM 583, Approved Waivers to Airfield and Airspace Criteria ("Remarks" column). See **paragraph A2.2.1.3.3** for additional information.

A2.1.2.4.5. Presents a summary of waivered items to the Facilities Board each year for information and action. An annual presentation of waivers at the Facilities Board meets the minimum requirements of this instruction. It is recommended that a summary of waivers be presented at least twice a year to the Facilities Board.

A2.1.2.4.6. Presents a summary of waivered items to the Airfield Operations Board (AOB) twice a year for information and action. A waiver presentation twice a year

meets the minimum requirements of this instruction. It is recommended that waivers be presented at each AOB.

A2.1.2.4.7. Establishes a procedure for recording, reviewing and acting on waivers. Maintains records similar to those required at HQ USAFE/A7P. For additional guidance on how to formalize waiver procedures, see **paragraph A2.2.1**.

A2.1.2.4.8. Obtains a waiver from the Installation Commander for any construction projects and activity that violate any airfield clearance criteria during the construction project.

A2.1.2.4.9. Advises HQ USAFE/A7P of any cancelled permanent and temporary waivers.

A2.1.2.4.10. Participate in an annual assessment of the airfield/airspace criteria using the USAF Standardize Airfield Inspection Checklist. See AFI 13-213, Airfield Management. For ATSEP inspection checklist topics, see UFC 3-260-01, Appendix B, Section 4, *Wind Coverage Studies*.

A2.1.3. When requesting a waiver for obstructions, consider grouping adjacent supporting items with a controlling obstruction (i.e. highest building) or grouping related items (i.e. series of cable markers). One obstruction that has different type violations (taxiway, runway, apron criteria) and not meeting height, color, and frangibility criteria cannot be grouped

A2.1.4. Obstruction Classification in the Airfield Waiver Program. Airfield obstructions can be classified in one of six categories: Temporary Waiver, Permanent Waiver, Construction Waiver, Contingency Waiver, Permissible Deviation, or Unapproved Obstruction. Proper classification of airfield obstructions is the first step towards establishing a competent airfield waiver program.

A2.1.5. Obstruction Classification by Category.

A2.1.5.1. Temporary Waivers.

A2.1.5.1.1. Establish temporary waivers for correctable obstructions. Examples of correctable obstructions include manholes, junction boxes, poles.

A2.1.5.1.2. The BCE's representative prepares temporary waiver requests and obtains coordination from airfield operations (AM, TERPS and ATC), flying and ground safety, flight operations, logistics, security forces, and communications before submitting the waiver request to USAFE through the Installation Commander. These requests are then processed for coordination with the same functional offices at command level, and are approved or disapproved by the USAFE/CV.

A2.1.5.1.3. The Installation Commander will ensure an Operational Risk Management (ORM) Assessment is performed according to **Attachment 3**, *Risk Management (RM) for Airfield Obstructions and Waiver Requests*, of this instruction on all proposed waiver requests prior to submission to HQ USAFE for their review and action.

A2.1.5.1.4. Effective Length of Waiver. Temporary waivers are valid for one year only (twelve continuous months) after USAFE/CV approval. Any extension of a

temporary waiver beyond one year requires re-approval from USAFE/CV. BCE must resubmit a temporary waiver request following the procedures in **paragraph A2.3.1**.

A2.1.5.2. Permanent Waivers.

A2.1.5.2.1. Establish permanent waivers for violations that cannot reasonably be corrected or removed and pose little or no threat to flying operations. Examples of cases where permanent waivers are appropriate include violations caused by natural geographic features, development of facilities where the US has no authority to implement USAFE standards, or structures on non-DoD controlled land.

A2.1.5.2.2. The BCE's representative prepares permanent waiver requests and obtains coordination from airfield operations (AM, TERPS and ATC), flying and ground safety, flight operations, logistics, security forces and communications, before submitting the waiver request to HQ USAFE through the Installation Commander. These requests are then processed for coordination with the same functional offices at command level, and are approved or disapproved by the USAFE/CV.

A2.1.5.2.3. The Installation Commander will ensure an ORM Assessment is performed according to **Attachment 3** of this instruction on all proposed waiver requests prior to submission to HQ USAFE for their review and action.

A2.1.5.2.4. Permanent waivers may require approval or coordination from the Air Force Flight Standards Agency (AFFSA) and the Air Force Safety Agency when AFI 32-1042, Standards for Marking Airfields or UFC 3-535-01, Visual Air Navigation Facilities standards apply because deviation from these standards may also affect runway approach minima.

A2.1.5.2.5. Effective Length of Waiver. Permanent waivers do not require an annual submittal, they will be reviewed biennially during the Air Traffic System Evaluation (ATSEP) inspection process. For more information about the ATSEP process and its impact on the airfield waiver program, see **Attachment 5**.

A2.1.5.3. Construction Waivers.

A2.1.5.3.1. Establish construction waivers to identify, coordinate and approve construction activity on or near the airfield. The Installation Commander or equivalent is the construction waiver approval authority for an installation. Construction waivers apply to airfield systems, facilities and on base facilities where construction will require equipment (e.g. trucks, cranes, bull dozers, conduit spools, etc.) that may adversely and temporarily affect flying operations. Construction waivers can be used to correct or remove temporarily waivered obstructions that violate criteria in this instruction by a funded contract or in-house personnel Construction waivers must be obtained prior to start of construction activities.

A2.1.5.3.2. The BCE's representative prepares construction waiver requests and obtains coordination from airfield operations (AM, TERPS and ATC), flying and ground safety, flight operations, logistics and security forces and communications as required, before submitting the waiver request to the Installation Commander for approval or disapproval.

A2.1.5.3.3. The BCE, in cooperation with Wing Safety and AM, will ensure an ORM Assessment is performed according to **Attachment 3** of this instruction on all proposed construction waiver requests prior to submission to the Installation Commander for approval.

A2.1.5.3.4. Effective Length of Waiver. Construction waivers are valid for one year (twelve continuous months) from their effective date or for the duration of the construction project, whichever is less. For projects/efforts greater than one year, a request for extension must be submitted to the Installation Commander.

A2.1.5.3.5. Construction Waiver Review. Construction activities will be monitored at least monthly, by Civil Engineers (CE), Flight Safety and AM to ensure all information contained in the construction waiver remains accurate. Construction activities often change from the original plan and must be reevaluated to ensure there is no change in the level of risk; also mitigation efforts must be reevaluated for their effectiveness during construction. A review process is also required at the start of each project phase.

A2.1.5.4. Contingency Waivers.

A2.1.5.4.1. Establish contingency waivers when real-world contingencies require an installation to operate beyond the criteria in this instruction. Contingency waivers may waive the following criteria: wingtip clearances, apron clearance, taxiway clearance and the 7:1 transitional slope. A contingency waiver cannot waive the following criteria: primary surface, priority area (PA) 1, mandatory frangibility zone (MFZ), clear zone and approach departure clearance surface.

A2.1.5.4.2. The BCE and Airfield Operations representatives prepare contingency waiver requests and obtains coordination from TERPS, ATC, flying and ground safety, flight operations, logistics, security forces, and communications as required, before submitting the waiver request to the Installation Commander for approval or disapproval.

A2.1.5.4.3. The BCE, in cooperation with Wing Safety and AM, will ensure an ORM Assessment is performed on all proposed contingency waiver requests in accordance with **Attachment 3** of this instruction prior to submission to the Installation Commander for approval.

A2.1.5.4.4. Effective Length of Waiver. Locally approved contingency waivers are only valid for six months. For operations greater than six months, a temporary waiver request must be submitted to HQ USAFE through the Installation Commander.

A2.1.5.5. Permissible Deviations.

A2.1.5.5.1. Establish Permissible Deviations for airfield support facilities that are not required to meet airfield clearance criteria. However; they must meet siting criteria specified in UFC 3-260-01, Appendix B, Section 13.

A2.1.5.5.2. The BCE's representative prepares documentation to verify a facility or item was constructed in accordance with the criteria outlined in UFC 3-260-01, Appendix B, Section 13. Before an item can be classified as a permissible deviation, this documentation must be field verified by a representative from Civil Engineering

and AM, approved by the BCE and the Operation Support Squadron Commander, and sent to the Installation Commander for approval.

A2.1.5.5.3. Effective Length of Permissible Deviation. Permissible deviation status is effective for the life of the necessary airfield system. Permissible deviations will be reviewed biennially during the ATSEP inspection process. For more information about the ATSEP process and its impact on the airfield waiver program see UFC 3-260-01, Appendix B, Section 4.

A2.1.5.6. Unapproved Obstructions.

A2.1.5.6.1. Improvements in field surveys and digital mapping will lead to the occasional identification of an existing airfield obstruction. These items must be addressed at the time they are discovered. Ensure each item is properly classified and corrective action developed within 30 days of discovery.

A2.1.6. Waiver Authority.

A2.1.6.1. Temporary and Permanent Waivers. The USAFE/CV may grant permanent and temporary waivers for deviations from criteria in this instruction. The USAFE/CV approves or disapproves these waivers after coordination with all appropriate staff offices and concurrence by Directors of Air and Space Operations (HQ USAFE/A3); Logistics , Installations and Mission Support (HQ USAFE/A4/7), Communications and Information (HQ USAFE/A6), Staff Judge Advocate (HQ USAFE/JA), Safety (HQ USAFE/SE), Security Forces Division (HQ USAFE/A7S), Programs Division (HQ USAFE/A7P), and Third Air Force (3 AF). In the event of a prolonged absence by USAFE/CV, waiver approval authority is delegated to HQ USAFE/A3. Temporary and permanent waiver authority is not delegated below Major Command (MAJCOM) level. The following are waiver classifications subject to local approval:

A2.1.6.2. Permissible Deviations. Authority to classify an obstruction as a permissible deviation to airfield and airspace criteria is delegated to the Installation Commander provided the obstruction meets siting criteria listed in UFC 3-260-01, Appendix B, Section 13, beginning at paragraph B13.1.

A2.1.6.2.1. Waiver approval is required according to AFI 11-230, when deviations from criteria in UFC 3-535-01, Visual Air Navigation Facilities would constitute deviations from the instrument procedure criteria or obstructions to air navigational criteria in AFI 11-230 or AFMAN (I) 11-226, United States Standard for Terminal Instrument Procedures (TERPS).

A2.1.6.3. Construction Waivers. Authority for deviations to the criteria in this instruction is delegated to the Installation Commander when temporary waivers for construction activities or air shows are necessary.

A2.1.6.4. Contingency Waivers. Authority for deviations to the criteria in this instruction is delegated to the Installation Commander when real-world contingencies force installations to operate beyond the limits of the criteria established in this instruction. The Installation Commander is the approval authority for contingency waivers not exceeding six months. If a contingency waiver is needed for up to one year (twelve months), a temporary waiver request must be submitted to HQ USAFE through

the Installation Commander. If the contingency lasts longer than one year, contact HQ USAFE/A7P Community Planning for guidance. Contingency waivers may only be approved when requirements in **paragraph A2.1.5.4** are met.

A2.2. Annual Waiver Review Procedures:

A2.2.1. General annual waiver review procedures. The information in this section provides the minimal requirements for an annual airfield airspace waiver review process. There is an informal and formal annual submittal. The schedule in **Table A2.1** describes the year required (e.g. odd or even) for each submittal listed by installation. Specific informal and formal submittal requirements are detailed in **paragraph A2.2.1.3** It is recommended that each installation develop their own review procedures that meet the specific needs of their installation, provided these minimums are incorporated. The annual review of airfield airspace waivers can be a time consuming event for installations with numerous waivers. It is recommended that the BCE utilize the AFM's quarterly airfield inspection to verify approved waivers. The BCE is a required member of the quarterly airfield inspection and should utilize the inspection to track changes in approved waivers. Noted changes to approved waivers should receive USAFE approval prior to being incorporated on the E-1 map. At a minimum, the E-1 map must be updated annually. The annual airfield airspace waiver package is not the forum for requesting new waivers. New waivers are requested individually at the time of their discovery.

Table A2.1. Annual Airfield Airspace Package Review Submittal Schedule

INSTALLATION	EVEN YEARS	ODD YEARS
Aviano	F	I
Chievres	F	I
RAF Fairford	F	I
Moron	F	I
RAF Lakenheath	F	I
Incirlik	I	F
Lajes	I	F
RAF Mildenhall	I	F
Spangdahlem	I	F
Ramstein	I	F
Note: I = Informal F = Formal		

A2.2.1.1. Annual Waiver Review Participants. At a minimum the annual airfield airspace waiver process must include representation from:

A2.2.1.1.1. Civil Engineering.

A2.2.1.1.2. AFM.

A2.2.1.1.3. TERPS.

A2.2.1.1.4. Flight Safety.

A2.2.1.1.5. ATC.

A2.2.1.2. Waiver Verification. Systematically review each waiver to determine if it must be submitted for recertification. Review must physically verify the waiver's existence and update the status of the corrective action. This must be performed for each waiver. At a minimum, the review and verification must be performed with the AFM, TERPS and a Flight Safety representative. It is highly recommended that a representative from Security Forces and Communications attend the annual review. Many of the items on the airfield influence communications and security operations.

A2.2.1.3. Annual Waiver Submittal, Review and Approval Requirements.

A2.2.1.3.1. Basic Data for USAFE informal review: Installations will review all airfield/airspace waivers annually and present a summary of these waivers (not individual obstruction numbers) to their Facilities Board for information and action. This review shall include:

A2.2.1.3.1.1. Total number of waivers, both temporary and permanent.

A2.2.1.3.1.2. Number of permissible deviations.

A2.2.1.3.1.3. Number of new approved temporary and permanent waivers for the past year.

A2.2.1.3.1.4. Number of eliminated waivers for the past year.

A2.2.1.3.1.5. Prioritized plan/budget for waiver reduction for the next year, which includes a project list from ACES to correct or eliminate temporary waivers to include digital photos of obstructions.

A2.2.1.3.1.6. A letter from the BCE to HQ USAFE/A7P documenting the annual review, along with a copy of the E-1 map showing the USAFE PA 1, 2, and 3, the MFZs, and the Airfield ORM Hazard Areas (**Attachment 3**); and the Facilities Board minutes will be uploaded (in Adobe Acrobat PDF format) on the following USAFE Civil Engineer Plans and Requirements Community of Practice (CoP) site by 1 December each year: https://www.my.af.mil/afknprod/ASPs/docman/DOCMain.asp?Tab=0&FolderID=OO-EN-FE-08-8-1&Filter=OO-EN-FE-08.

A2.2.1.3.2. Additional Data for USAFE formal review and approval: Installations will provide the required supplementary data for airfield/airspace annual review.

A2.2.1.3.2.1. A letter from the Installation Commander to HQ USAFE/A7D documenting the formal review.

A2.2.1.3.2.2. Copy of the AF IMT 1768, Staff Summary Sheet or equivalent electronic form, used for base level coordination with SE, TERPS, CAM and Operations Support Squadron (OSS)/Operational Support Airfield (OSA).

A2.2.1.3.2.3. Digital Photos of each obstruction.

A2.2.1.3.2.4. USAFE FORM 583, Approved Waivers to Airfield and Airspace Criteria

A2.2.1.3.2.5. Updated E-1 Airfield and Airspace Obstructions Map, E-2 Approach and Departure – Zone Obstructions to 10,000 ft, E-3 Approach and Departure Zone Obstruction Beyond 10,000 ft, E-4 Airspace Obstructions – Vicinity and E-9 Aircraft Parking Plan drawn to a scale of 1:5000 m.

A2.2.1.3.3. Instructions for USAFE FORM 583. USAFE FORM 583 summarizes corrective action information for approved airfield airspace waivers. This form is not intended for use to request new waivers. Order obstructions on USAFE FORM 583 so they match Wing priority for removal (i.e., the first waiver on USAFE FORM 583 is the Wing's # 1 priority for removal). Detailed instructions for completing the USAFE FORM 583 are as follows:

A2.2.1.3.3.1. Block 1. Base. Provide the name of your installation.

A2.2.1.3.3.2. Block 2. Submittal Date. Enter the date the biennial waiver package was completed.

A2.2.1.3.3.3. Block 3. Control Surface. Enter the specific surface that the obstruction is violating such as Primary Surface, Clear Zone, etc. Sort out obstructions by control surface violated.

A2.2.1.3.3.4. Block 4. Alpha Prefix. Enter the prefix of the violation taken from the surface codes found in Chapter 3 of this instruction.

A2.2.1.3.3.4.1. Example for Primary surface violation would be coded as A.

A2.2.1.3.3.5. Block 5. Waiver Information

A2.2.1.3.3.5.1. Column a. Waiver Number. Enter the number for approved airfield waivers. Waiver numbers shall be standardized in the command. Waiver number will have a violation prefix designating the surface violated and a three-digit numerical identification number.

A2.2.1.3.3.5.1.1. Example for Primary surface violation at Ramstein AB, Germany = A001. Surface codes for violation prefix are found in Chapter 3 of this instruction.

A2.2.1.3.3.5.2. Column b. Lat/Long Coordinates. Enter the lat/long coordinates of the obstruction location. These coordinates available from your local GIO office.

A2.2.1.3.3.5.3. Column c. Waiver Description. Provide a short description of the obstruction (i.e. light pole, water tower, tree, fence, etc.).

A2.2.1.3.3.5.4. Column d. List the criteria violated. Ensure references are current and refer to criteria in this instruction.

A2.2.1.3.3.5.5. Column e. Frangibility. Note if the obstruction is frangible as described in UFC 3-260-01, Appendix B, Section 13.

A2.2.1.3.3.5.6. Column f. Elevation Runway Centerline. Provide closest runway elevation perpendicular to the obstruction.

A2.2.1.3.3.5.7. Column g. Distance from Runway, Taxiway or Taxitrack Centerline or Edge of Parking Apron. Provide perpendicular distance from

the obstruction to the centerline or edge of the violation such as runway, taxiway, taxitrack, or parking apron.

A2.2.1.3.3.5.8. Column h. Distance from Threshold. Provide distance from the obstruction to a line perpendicular to the nearest threshold.

A2.2.1.3.3.5.9. Column i. Obstruction Marked and, or Lit. Place an L in the column if the object is lit and an M if the object is marked according to Standardization Agreement (STANAG) 3346, Marking and Lightning of Airfield Obstructions.

A2.2.1.3.3.5.10. Column j. Elevation of Control Surface at Most Severe Point of Violation. Provide closest elevation of control surface (e.g. transitional surface, approach or departure surface, etc.) perpendicular to the obstruction.

A2.2.1.3.3.5.11. Column k. Ground Elevation at Most Severe Point of Violation. Provide ground elevation of the obstruction.

A2.2.1.3.3.5.12. Column l. Obstruction Height. Provide the actual height of the obstruction. This measurement is taken from ground level to the highest point of the obstruction.

A2.2.1.3.3.5.13. Column m. Violation. Provide the actual violation of the obstruction. This number may be either a height or distance violation depending the control surface.

A2.2.1.3.3.5.14. Column n. Remarks. Provide any additional information here. If the waiver is temporary enter the project number, and planned removal or correction date. It is understood this is driven by funding and this date is subject to change.

A2.2.1.3.3.5.15. Column o. Date Approved by HQ USAFE. Provide the original date of approval for the waivered item. If original approval documentation is not available to complete this field provide a brief explanation why in the cover letter. After the submittal is approved, submit a new waiver request to obtain official approval for the waivered obstruction.

A2.3. Requirements for Requesting/Processing Temporary or Permanent Waivers to Airfield and Airspace Criteria. The information in this section provides the minimal requirements for a request to airfield airspace criteria. New waivers must be requested individually at the time of their discovery, as indicated in A2.1.1 above. For new construction, a waiver must be obtained prior to construction. If a waiver is approved with conditions, those conditions must be incorporated into the facility's design.

A2.3.1. Temporary and Permanent Airfield Airspace Waiver Request Package Requirements. This information provides the minimal data necessary to request a waiver to the criteria of this instruction. In the future, it is possible that airfield obstructions/waivers could be eliminated. Civil Engineering must remain vigilant to preserve the safe operations of the airfield by providing Wing leadership with new construction alternatives that do not violate airfield criteria. Waiver requests will be highly scrutinized by HQ USAFE

A7P/SE/A3/A7/A4/A6, and 3 AF because final approval authority is the USAFE/CV. Each request shall consist of the following:

A2.3.1.1. Cover Letter. The airfield airspace waiver request package cover letter must be signed out by the Installation Commander and contain the following mandatory attachments which provide the details necessary to staff the request to USAFE/CV for action.

A2.3.1.2. Attachment 1, Completed USAFE FORM 582, Request for Waiver to Airfield and Airspace Criteria.

A2.3.1.3. Attachment 2, Location Plan on map E-1 at 1:5000 m scale. Map must include:

A2.3.1.3.1. Proposed location and its perpendicular distance to runway and taxiway centerlines, to apron, from ends of runways and to existing adjacent structures, as appropriate.

A2.3.1.3.2. Alternate sites considered in the selection process.

A2.3.1.3.3. All existing waivers in the project area, with a minimum distance of 300 m from the project area.

A2.3.1.3.4. Elevations of the proposed facility and project area.

A2.3.1.3.5. Elevations at runway centerline at points perpendicular to the proposed facility (for facilities beyond along the extended runway centerline, use threshold elevation).

A2.3.1.4. Attachment 3, ORM Assessment results. Specific requirements for the ORM are located in Attachment 3 of this instruction.

A2.3.1.5. Attachment 4, Digital photos of obstruction (s).

A2.3.1.6. Attachment 5, Proposed Corrective Action for temporary waivers. Corrective action to include:

A2.3.1.6.1. Project number or Civil Engineer Work Request (AF IMT 332, BCE Work Request) number.

A2.3.1.6.2. Project Description.

A2.3.1.6.3. Programmed Cost.

A2.3.1.6.4. FIM Rating.

A2.3.1.6.5. Risk Assessment Code (RAC).

A2.3.1.6.6. Estimated Execution Date (FY).

A2.3.1.6.7. Wing Facilities Board Priority based on Consolidated Priority List (CPL)

A2.3.1.7. Attachment 6, Safety Precautions. Provide details of the safety precautions that will mitigate the hazard of the waivered item (i.e., local Notice to Airmen (NOTAM), obstruction lighting and marking, publication in the Flight Information Publication, locally developed procedures for movement around the item, etc.).

A2.3.1.8. Proof of Coordination. Provide proof of base level coordination with the following offices (a copy of the AF IMT 1768, Staff Summary Sheet or equivalent electronic form will suffice):

A2.3.1.8.1. Mission Support Group.

A2.3.1.8.2. Civil Engineering.

A2.3.1.8.3. Communications.

A2.3.1.8.4. Security Forces.

A2.3.1.8.5. Operations Group.

A2.3.1.8.6. Operational Support Squadron.

A2.3.1.8.6.1. OSS/OSA.

A2.3.1.8.6.2. OSS/OSAA.

A2.3.1.8.6.3. OSS/OSAT.

A2.3.1.8.7. USAFE TERPS Representative.

A2.3.1.8.8. Wing Safety.

A2.3.1.8.8.1. Ground Safety.

A2.3.1.8.8.2. Flight Safety.

A2.3.2. Construction Waiver Request Package Requirements. The BCE must request a waiver from the Installation Commander for any construction projects and activity that violate any airfield clearance criteria during the construction project. Construction waiver requests must be submitted at least 45 days before the scheduled construction start date, or an emergency construction waiver when 45 days are not possible. Construction waivers must be approved prior to start of construction. ***NOTE:*** Emergency maintenance and repair requirements and routine maintenance activities such as mowing and maintenance of airfield systems, are exempt from this requirement; however, the BCE will coordinate with AM, flight safety, and flight operations offices to ensure implementation of appropriate safety measures including NOTAMs or Local NOTAMs. Construction waivers require information similar to waiver requests sent to HQ USAFE. Construction waivers must contain:

A2.3.2.1. Description of Proposed Waivered Object to include: dimensions, type of construction on the airfield including equipment; number of construction personnel; if the activity will produce emissions of any kind; and the duration of the construction activity.

A2.3.2.2. Location Plan at 1:5000 m scale to include: proposed location and its perpendicular distance to runway and taxiway centerlines, to apron, from ends of runways, and to existing adjacent structures, as appropriate; elevations of the proposed facility and project area; elevations at runway centerline at points perpendicular to the proposed facility (for facilities beyond along the extended runway centerline, use threshold elevation); and size of largest piece of construction equipment used in the construction area(s).

A2.3.2.3. ORM Assessment results. Specific requirements for the ORM are located in **Attachment 3**.

A2.3.2.4. A construction phasing plan (see UFC 3-260-01, Appendix B, Section 14, Construction Phasing Plan and Operational Safety on Airfields During Construction). Provide details of the safety precautions that will mitigate the hazard of the waivered item (i.e., local NOTAM, obstruction lighting and marking, publication in the Flight Information Publication, locally developed procedures for movement around the item, equip all construction personnel with orange vests, mark or flag equipment, etc.).

A2.3.2.5. Construction waivers will be reviewed by Civil Engineering (CE), Flight Safety and AM to ensure all information contained in the temporary construction waiver remains accurate (office reviews are acceptable).

A2.3.3. Contingency Waiver Request Package Requirements. The Installation Commander is the approval authority for contingency waivers not exceeding six months. If a contingency waiver is needed for up to one year (twelve months), a temporary waiver request must be submitted to HQ USAFE through the Installation Commander. If the contingency lasts longer than one year, contact HQ USAFE/A7P Community Planning for guidance. Contingency waivers must contain:

A2.3.3.1. Description of proposed activity to include: criteria violated, how the current contingency is forcing the base to not comply with criteria, and expected length of operation.

A2.3.3.2. Location Plan at 1:5000 m scale to include: proposed location of activity and its relationship to the runway.

A2.3.3.3. ORM Assessment results. Specific requirements for the ORM are located in **Attachment 3** of this instruction.

A2.3.3.4. Provide details of the safety precautions that will mitigate the hazard of the waivered item (i.e., local NOTAM, obstruction lighting and marking, publication in the Flight Information Publication, locally developed procedures for movement around the item, implementation of wing walkers or other personnel in accordance with AFI 11-218, etc.).

Attachment 3

RISK MANAGEMENT (RM) FOR AIRFIELD OBSTRUCTIONS AND WAIVER REQUESTS

A3.1. Risk Management (RM).

A3.1.1. RM provides a systematic way to identify and select control measures that do not rely simply on intuition and experience. It consists of three primary steps, namely: (1) hazard identification, (2) risk assessment, and (3) risk control. A Civil Engineering (CE) representative will be the Office of Primary Responsibility (OPR) for the RM process for airfield obstructions, with Safety and Airfield Management (AM) acting as Offices of Collateral Responsibility (OCRs). However, the OPR and the OCRs must collaborate to complete the RM.

A3.1.1.1. RM is defined as a logic-based, common-sense approach to making calculated decisions on human, material and environmental factors before, during and after potentially dangerous activity, both on and off duty. RM has played an ever-increasing role in the airfield waiver process. Currently, all airfield waiver requests require an RM assessment be completed prior to submittal to USAFE. The material in this attachment is designed to: (1) assist base personnel with RM guidelines as they pertain to the airfield environment, and (2) provide examples of RM assessments for different types of waiver packages.

A3.1.1.2. When discussing RM, it is important to understand the difference between hazard and risk. The hazard is the condition; it only becomes a risk when the hazard has been assessed for how likely it is to cause an accident (probability), and how severe that accident would be if the hazard did cause an accident (severity).

A3.1.1.3. Airfield waivers require a full risk management assessment (Steps 1, 2, and 3) before submittal to HQ USAFE/A7P. Locally approved airfield waivers require only a risk assessment (Step 2) prior to Installation Commander approval.

A3.1.1.4. To be a systematic process, there must be tools to use that will provide a reasonable assurance that all hazards have been identified. The amount of time available will be 1suited to a particular operation than others.

A3.1.1.4.1. Operations Analysis. An operational analysis is a list of the major steps of an operation, usually listed in chronological order. The idea is to use this as a checklist to make sure you identify the hazards in each phase of an operation. This tool is used in virtually all risk management operations to include the most time critical.

A3.1.1.4.2. Scenario Building. Scenario building involves mentally visualizing what will occur during each phase of an operation. Then, visualize the operation again including the things that can go wrong and noting the outcomes. This will help to identify hazards that must be addressed. Because of its simplicity, this tool should be included in most hazard identification applications to include some time-critical situations.

A3.1.1.4.3. Change Analysis. The change analysis tool is used to detect the hazard implications of both planned and unplanned changes to a process. This allows the risk management process to focus only on aspects that have changed, eliminating the need to reanalyze a total operation just because a change has occurred in one area. This tool can save a great deal of effort in those situations where a process has already been risk managed; thus there is focus on the changes rather than the whole operation.

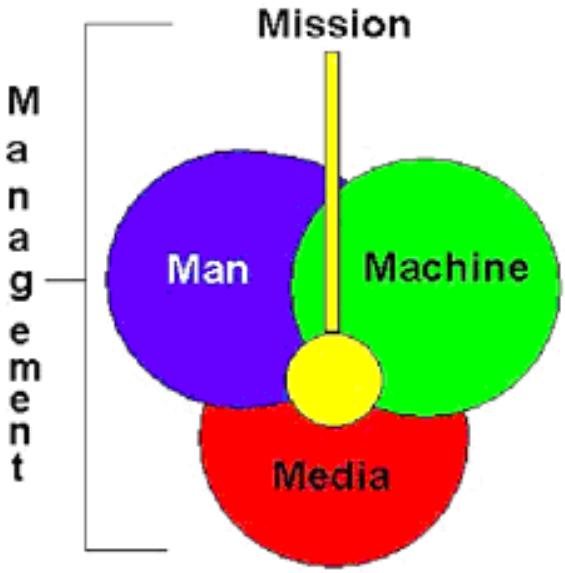
A3.1.1.4.4. What If. What if asks what could go wrong and what hazards would show up as a result. It is designed to add structure to the intuitive and experimental expertise of personnel. One of the most powerful and effective of the hazard identification tools.

A3.1.1.4.5. Logic Diagram. The logic diagram tool is used to add detail and rigor to the hazard identification process. Its graphic structure is an excellent means of capturing and correlating the hazard data produced by other tools. Because it is more structured than some of the other tools, the logic diagram requires more time and effort to complete, limiting its use to higher risk issues.

A3.1.1.5. The Three Step USAFE RM Process.

A3.1.1.5.1. Step One, Identify the Hazard. **Figure A3.1** breaks down the origins of risk. When looking for the hazards of an operation, each of these areas should be broken down to its component parts and used as a tool to help identify conditions that could cause a hazard. Start with the given mission. The five-M model is composed of man, machine, media, mission and management. A man uses a machine, which is operated in some media to accomplish the mission. All of the components are affected by management who sets the rules, goals and expectations for mission accomplishment.

Figure A3.1. The 5-M Model.



A3.1.1.5.2. Step Two, Risk Assessment. A key part of the RM process is conducting a two-part risk assessment. This step assigns each hazard a risk code (value) so that a list can be developed that has the highest risk at the top. **Figure A3.2** is the standard 4x5 risk assessment matrix used by the USAF. The risk assessment matrix is used to quantify hazards and make them risks.

Figure A3.2. Risk Assessment Matrix.

HAZARD: Aircraft Impact with Facility			HAZARD PROBABILITY				
			Frequent	Likely	Occasional	Seldom	Unlikely
			A	B	C	D	E
SEVERITY	Catastrophic	I	Extremely High		High		
	Critical	II					
	Moderate	III			Medium		
	Negligible	IV				Low	

A3.1.1.5.2.1. Severity and Probability are used to determine the risk level (extremely high, high, medium and low). Each hazard will have a Roman numeral and a letter associated with it, which defines its risk level.

A3.1.1.5.2.2. Severity. Severity describes how much damage could occur if a hazard results in a mishap. Standard RM terms associated with severity are:

A3.1.1.5.2.2.1. Catastrophic - Mission impossible, system loss or death/permanent disability.

A3.1.1.5.2.2.2. Critical - Mission impaired, major system damage, or permanent or partial disability.

A3.1.1.5.2.2.3. Moderate - Mission possible using alternate options, minor system damage or minor injury.

A3.1.1.5.2.2.4. Negligible - Minor mission disruptions, minor system impairment or first aid required.

A3.1.1.5.2.3. Probability. Probability describes the frequency of a mishap caused by a hazard. Standard RM terms associated with probability are:

A3.1.1.5.2.3.1. Frequent - Occurs often-in career or equipment service life. Everyone exposed.

A3.1.1.5.2.3.2. Likely - Occurs several times in a career or equipment life. Most members exposed, occurrence predictable.

A3.1.1.5.2.3.3. Occasional - Occurs sometime in career or in life of equipment. Sporadically.

A3.1.1.5.2.3.4. Seldom - Possible to occur in career or equipment life. Remote chance.

A3.1.1.5.2.3.5. Unlikely - Assume it will never occur. Possible but improbable.

A3.1.1.5.3. Step Three, Risk Controls. The third and final step of the USAFE RM process is the identification and implementation of controls for each hazard identified, starting with the greatest risk. Each risk control must be evaluated for its ability to reduce or eliminate the risk and the cost to implement the control measure and for its impact to the severity and probability of the risk.

A3.1.1.5.3.1. General risk controls are accepted when the benefits outweigh the cost. There are multiple ways to control risk. The list below provides some common examples of risk controls.

A3.1.1.5.3.1.1. Reduce - An operation is made up of many tasks. The operation can be made less risky by reducing some of the tasks.

A3.1.1.5.3.1.2. Avoid - Go around the threat, wait for a more opportune time to attack the risk.

A3.1.1.5.3.1.3. Spread - Risk can be spread by dispersing assets. An example is the spacing of munitions storage facilities or dispersing tactical aircraft across an airfield to reduce the threat of loss from an enemy attack.

A3.1.1.5.3.1.4. Transfer - Risk can be transferred by using a machine to move the risk away from man. Risk may also be transferred by utilizing a different operation to accomplish a specific mission.

A3.1.1.5.3.2. Hierarchy of Controls. Below are the specific control measures in priority order. If a hazard is engineered out of a system, it is gone. Compare that to giving up on controlling the hazard and simply wearing protective equipment to minimize the damage.

A3.1.1.5.3.2.1. Engineer - Design a better method/machine.

A3.1.1.5.3.2.2. Guard or Control - Yellow line/red line guard switch.

A3.1.1.5.3.2.3. Limit Exposure - Provide adequate safe distance.

A3.1.1.5.3.2.4. Selection of Personnel.

A3.1.1.5.3.2.5. Procedures - Rules, restrictions, limitations.

A3.1.1.5.3.2.6. Training and Education.

A3.1.1.5.3.2.7. Warn.

A3.1.1.5.3.2.8. Reduce Effects - Provide safety equipment.

A3.1.1.5.3.3. Risk Control Implementation. It is important that the control measures be implemented in a way that is appropriate and understood. To make the implementation directive clear, consider using examples, providing pictures or charts and including job aids. Also, be clear on who should be responsible at the unit level for implementation. These should include the level of responsibility for

making decisions relative to the control measure to establish accountability.

A3.1.1.5.3.4. Risk Control Accountability. Accountability is an important area of RM. The accountable person is the one who makes the decision (approves the controls) and hence, the right person (appropriate level) must make the decision. But most important, having the appropriately documented RM analysis will help the decision maker explain their actions and decisions. Some probability of a mishap always exists unless the control measure selected is to not conduct the operation. **Table A3.1** illustrates the success rate for implementation of a control from best to worst.

Table A3.1. The Involvement Continuum

User Ownership	Best
Co-Ownership	^
Team Member	^
Input	^
Coordination	^
Comment and Feedback	^
Robot (inspect and enforce)	**Worst**

A3.1.1.5.3.5. Participation. **Table A3.1** shows the importance of workers developing their own controls using RM and deciding to implement it. If people are simply ordered to comply and inspections put in place to ensure compliance, it is likely that the long-term success of the implementation will be low. Risk control implementation must:

A3.1.1.5.3.5.1. Obtain Command Support - To be successful, command must be behind the control put in place. Prior to implementing a control, get higher-level approval. Then, explore the appropriate ways to demonstrate command commitment.

A3.1.1.5.3.5.2. Communicate - The control must be deployed in a method that insures it will be received by the intended audience. Also, the control must be communicated in a way that is understandable by the user. In the initial phase of the process, careful thought should be given to the design of the controls to ensure it will last the length of the project.

A3.1.1.5.3.5.3. Measure the Effect - Deploy the controls along with a feedback mechanism that provides information back on whether the controls are achieving the intended purpose. This can best be achieved by designing the controls to include user ownership. Measure the effect of the implementation where possible.

A3.2. RM Process for Airfield Airspace Waiver Packages (Example)

A3.2.1. The purpose of integrating RM into the airfield waiver process is to identify the hazard (obstruction), analyze the risk (risk assessment), implement controls (safety precautions) and reevaluate the controls (corrective action). The RM process applies to

temporary, permanent and temporary-construction waiver requests. The following example is of an RM analysis representing a temporary airfield waiver request for a perimeter road project.

A3.2.2. Temporary Waiver Request (Example). For this example a project is constructing a perimeter road that will violate clear zone and apron criteria. A RM assessment is performed as part of the temporary waiver request as required in **Attachment 2**. Using the three-step process this example outlines the minimal requirements for a risk assessment submitted as part of a waiver request to HQ USAFE/A7P.

A3.2.2.1. RM Assessment for Perimeter Road Project. Background. The Perimeter Road Project is a Fiscal Year (FY) 50 Military Construction (MILCON) project that will construct a perimeter road around the airfield. The current base boundary lies within the runway and apron clearance zones, therefore the perimeter road will violate these two airfield clearances. Utilizing RM will facilitate assessing the risk involved in constructing the road at its proposed location. The long-range plan to correct this hazard is to acquire land and relocate the base boundary and perimeter road outside of the airfield clearances.

A3.2.2.1.1. Step 1. Identify hazards associated with constructing the perimeter road in the runway and apron clear zones:

A3.2.2.1.1.1. Aircraft mishap (lands short and hits vehicle or pedestrian).

A3.2.2.1.1.2. Aircraft mishap (exits runway on departure and hits vehicle or pedestrian).

A3.2.2.1.1.3. Aircraft mishap (aircraft ingests foreign object damage (FOD) resulting from vehicular traffic near apron).

A3.2.2.1.1.4. Equipment mishap (vehicle departs road and damages Navigational Aid).

A3.2.2.1.2. Step 2. Assess the risk of each identified hazard then develop an overall risk level for the project.

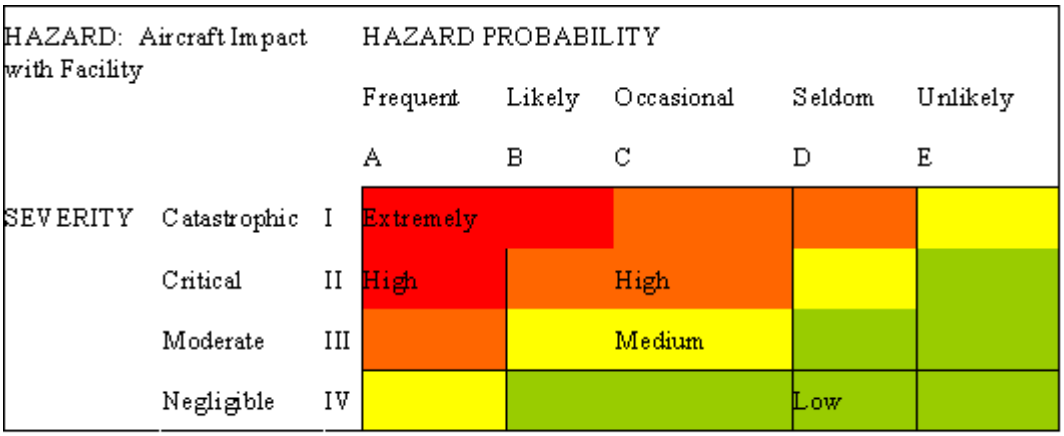
A3.2.2.1.2.1. Assessment for Aircraft Mishap (landing short striking vehicle or pedestrian).

A3.2.2.1.2.2. Severity. If an aircraft did land short, for whatever reason, and did strike a vehicle or pedestrian, the resulting accident would be catastrophic. There would certainly be system loss (aircraft damage) and possible loss of life or permanent disability.

A3.2.2.1.2.3. Probability. USAF pilots are professionals and receive training to handle emergency situations, therefore it is unlikely that a pilot would cause the aircraft to land short and cause a mishap.

A3.2.2.1.2.3.1. Landing short striking vehicle score = I-E.

Figure A3.3. Sample Risk Assessment Matrix – Landing Short.



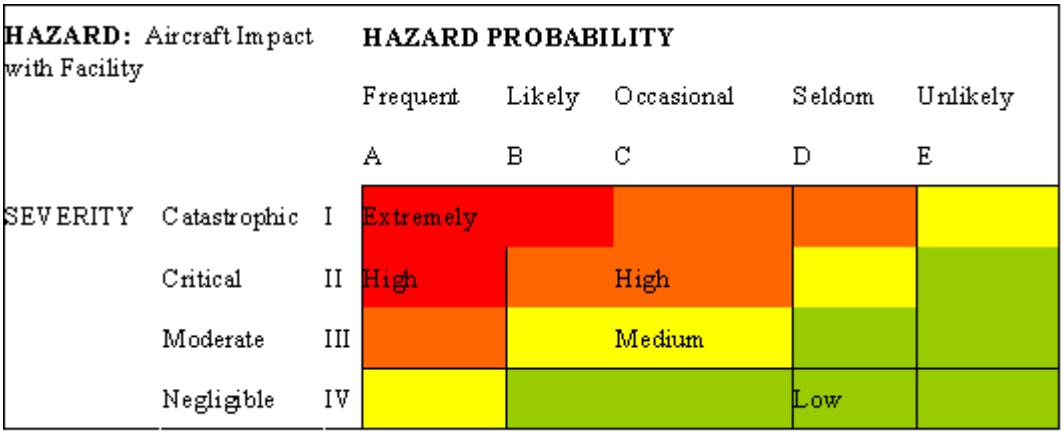
A3.2.2.1.2.4. Assessment for Aircraft Mishap (exiting runway at departure end and striking vehicle or pedestrian).

A3.2.2.1.2.5. Severity. If an aircraft did exit the runway, for whatever reason, and did strike a vehicle or pedestrian, the resulting accident would be catastrophic. There would certainly be system loss (aircraft damage) and possible loss of life or permanent disability.

A3.2.2.1.2.6. Probability. USAF pilots are professionals and receive training to handle emergency situations. Runway 18/36 is equipped with 305 m (1000 ft) overruns and redundant BAK-12 aircraft arresting systems. On average, the overrun barrier is engaged once every 5 years. Pilot skill and the in-place safety features of Runway 18/36 provides for an unlikely exiting of the runway at the departure end resulting in an aircraft mishap.

A3.2.2.1.2.6.1. Exiting runway at departure end and striking vehicle or pedestrian = I-E.

Figure A3.4. Sample Risk Assessment Matrix – Vehicle or Pedestrian Strike.



A3.2.2.1.2.7. Assessment for Aircraft Mishap (ingests FOD resulting from

vehicular traffic near apron).

A3.2.2.1.2.8. Severity. When an aircraft ingests FOD it is possible for the engine to sustain damage. If the damage is immediate the engine could be destroyed and prevent the aircraft from accomplishing its mission. Engine damage is major system damage. The resultant mishap would be critical.

A3.2.2.1.2.9. Probability. Our maintenance crews, safety personnel and airfield managers (AFMs) are professionals and follow an installation approved FOD control plan that has all but eliminated FOD incidents at this installation. It is recognized that the FOD plan must be modified to incorporate the new perimeter road and therefore is not applicable to this assessment. Given the distance of the perimeter road from the apron and dedication of installation leadership and the airfield crew, it is unlikely that an aircraft would experience FOD damage and cause a mishap.

A3.2.2.1.2.9.1. Ingesting FOD and damaging aircraft = II-E.

Figure A3.5. Sample Risk Assessment Matrix – FOD Ingestion.

HAZARD: Aircraft Impact with Facility			**HAZARD PROBABILITY**				
			Frequent	Likely	Occasional	Seldom	Unlikely
			A	B	C	D	E
SEVERITY	Catastrophic	I	Extremely				
	Critical	II	High		High		
	Moderate	III			Medium		
	Negligible	IV				Low	

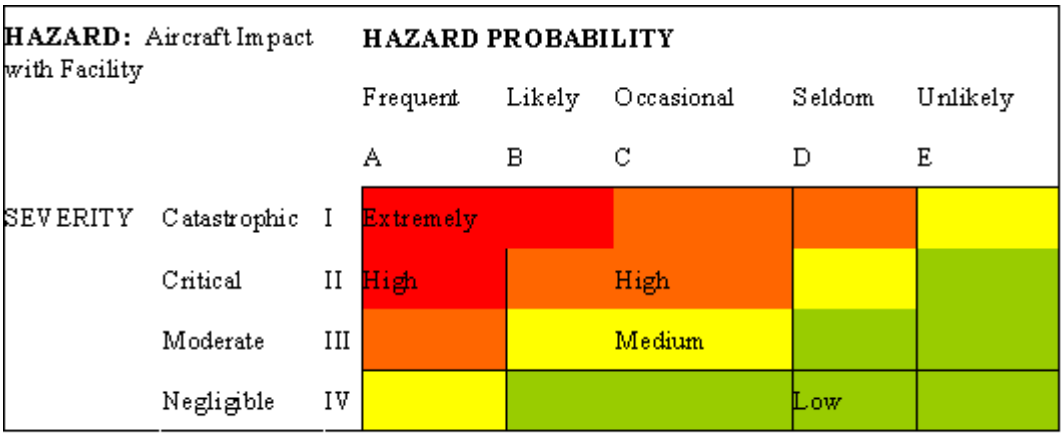
A3.2.2.1.2.10. Assessment for Vehicular Mishap (vehicle departs perimeter road and strikes navigational aid).

A3.2.2.1.2.11. Severity. Speed limits on perimeter road are set at 50 KPH and navigational aids (NAVAIDS) on our airfield are frangible and obstruction lit. If a vehicle departed the perimeter road and struck a nearby navigational aid there would be minor systems damage to the NAVAIDS and possibly minor injury to the vehicle operator resulting in moderate overall damage.

A3.2.2.1.2.12. Probability. The probability of a vehicle departing the perimeter road is occasional. Poor visibility from less than desirable weather conditions has caused two Privately Owned Vehicles (POVs) to depart other portions of the perimeter road in the last 5 years.

A3.2.2.1.2.12.1. Vehicle striking navigational aid = III-C.

Figure A3.6. Sample Risk Assessment Matrix –NAVAIDS Strike.



A3.2.2.1.2.13. Overall risk rating for project = Medium.

A3.2.2.1.3. Step 3. Risk Controls. The requirements for a perimeter road and the unavailability of land, dictate the perimeter road be sited in the proposed location, therefore we cannot avoid, spread or transfer the risk. The only appropriate controls are to reduce the risk by implementing the following:

A3.2.2.1.3.1. Engineer - The proposed perimeter road site is located as far from the runway end and apron edge as possible. NAVAIDS near the perimeter road are frangible and obstruction lit.

A3.2.2.1.3.2. Guard or Control - Traffic control lights have been integrated into the perimeter road design. These "stop lights" are controlled by the tower and will halt vehicular traffic when aircraft are taking off or landing on the runway.

A3.2.2.1.3.3. Limit Exposure - Traffic control lights are located outside of the runway clear zones and are frangible. NAVAIDS are set back from the perimeter road as far as possible and are frangible.

A3.2.2.1.3.4. Selection of Personnel - N/A. We investigated limiting GOVs with flightline certified drivers to the perimeter road, however some community functions are only accessible only via the perimeter road therefore we cannot limit access to flightline certified drivers in GOVs.

A3.2.2.1.3.5. Procedures - Traffic control lights contain an information sign requiring drivers to stop when lights are red. Traffic light information has been posted on the installation website and been passed to squadron orderly rooms for dissemination. A local Notice to Airmen (NOTAM) has been published to inform operators of the control lights.

A3.2.2.1.3.6. Training and Education - Traffic control lights are briefed to all new arrivals at the base new comers briefing.

A3.2.2.1.3.7. Warn. Information signs warning of the hazards of low flying aircraft are posted adjacent to the traffic control lights.

A3.2.2.1.3.8. Reduce Effect - The only equipment provided with the perimeter

road project is the traffic control lights.

A3.2.2.1.3.9. Installation Commander has approved use traffic control lights on the perimeter road project. The traffic lights added $5,000 to the cost of the project and require $100/year for maintenance for the life of the waiver. Land acquisition is expected to take 10 years so the maintenance cost for the life of the control lights is expected to be $1,000 and is deemed an acceptable resource cost.

A3.2.2.1.3.10. Risk Control Implementation. With Installation Commander approval, the BCE has incorporated the traffic control lights into the perimeter road project. Since the project is still in design and awaiting waiver approval, the traffic lights are on hold pending approval of the waiver and awarding of the construction project.

A3.3. Assessment. A RM assessment must be prepared, in cooperation, by CE, SE and OSS and approved by the Installation Commander. Chief of Safety can approve RM assessments for temporary construction waivers. If an Installation Commander approves a temporary construction waiver, it is assumed that by doing that the Commander also endorses the risk assessment.

A3.4. Review. The waiver OPR/OCR will review the on-going effectiveness of the approved risk controls and make changes as deemed necessary and brief the Installation Commander of any updates.

Attachment 4

LAND USE COMPATIBILITY GUIDELINES FOR CLEAR ZONE AND USAFE PRIORITY AREAS (PAS)

Table A4.1. Land Use Guidelines for Critical Airfield Safety Areas.

Land Use Category	Compatibility [1]		
	USAFE Priority Zone 1	USAFE Priority Zone 2	USAFE Priority Zone 3
Residential			
Single family: detached	NO	NO	YES [2]
Single family: semidetached	NO	NO	YES [2]
Single family: attached row	NO	NO	YES [2]
Two units: side-by-side	NO	NO	YES [2]
Two units: one above the other	NO	NO	YES [2]
Apartments: walk-up	NO	NO	YES [2]
Apartments: elevator	NO	NO	YES [2]
Group quarters	NO	NO	YES [2]
Residential hotels	NO	NO	YES [2]
Mobile home parks or courts	NO	NO	YES [2]
Transient lodging	NO	NO	YES [2]
Other residential	NO	NO	YES [2]
Manufacturing [3]			
Food and kindred products	NO	NO	YES [2]
Textile mill products	NO	NO	YES [2]
Apparel and other furnished products, products made from fabrics, leather and similar materials	NO	NO	YES [2]
Lumber and wood products	NO	YES [2]	YES [2]
Furniture and fixtures	NO	NO	YES [2]
Paper and allied products	NO	NO	YES [2]
Printing, publishing, and allied products	NO	NO	YES [2]
Chemicals and allied products	NO	NO	YES [2]
Petroleum refining and related industries	NO	NO	YES [2]
Rubber and miscellaneous plastic goods	NO	NO	YES [2]
Stone, clay and glass products	NO	NO	YES [2]

Land Use Category	Compatibility [1]		
	USAFE Priority Zone 1	USAFE Priority Zone 2	USAFE Priority Zone 3
Primary metal products	NO	NO	YES [2]
Fabricated metal products	NO	NO	YES [2]
Professional, scientific and controlling instruments, photographic and optical goods, watches and clocks	NO	NO	YES [2]
Miscellaneous manufacturing	NO	NO	YES [2]
Transportation, Communications, and Utilities [3, 4, 5]			
Railroad, rapid rail transit, and street railway transportation	NO	YES [2]	YES[2]
Motor vehicle transportation	NO	YES [2]	YES [2]
Aircraft transportation	NO	YES [2]	YES [2]
Marine craft transportation	NO	YES [2]	YES [2]
Highway and street rights-of-way	NO	YES [2]	YES [2]
Auto parking	NO	YES [2]	YES [2]
Communication	NO	YES [2]	YES [2]
Utilities	NO	YES [2]	YES [2]
Solid waste disposal (landfills, incinerators, etc)	NO	NO	YES [2]
Other transportation, communications, and utilities	NO	YES [2]	YES [2]
Perimeter, security, maintenance, fire/crash rescue roads	YES[2]	YES [2]	YES [2]
Trade			
Wholesale trade	NO	NO	YES [2]
Building materials (retail), hardware and farm equipment	NO	NO	YES [2]
General merchandise (retail)	NO	NO	YES [2]
Food - retail	NO	NO	YES [2]
Automotive, marine craft, aviation (retail)	NO	NO	YES [2]
Apparel and accessories (retail)	NO	NO	YES [2]
Furniture, home furnishings, and equipment (retail)	NO	NO	YES [2]
Eating and drinking places	NO	NO	YES [2]

Land Use Category	Compatibility [1]		
	USAFE Priority Zone 1	**USAFE Priority Zone 2**	**USAFE Priority Zone 3**
Other retail trade	NO	NO	YES [2]
Services [6]			
Finance, insurance and real estate	NO	YES [2]	YES [2]
Personal services	NO	YES [2]	YES [2]
Cemeteries	NO	YES [2, 7]	YES [2]
Business services	NO	YES [2]	YES [2]
Warehousing and storage services	NO	YES [2]	YES [2]
Repair services	NO	YES [2]	YES [2]
Professional services	NO	YES [2]	YES [2]
Hospitals, nursing homes	NO	NO	YES [2]
Other medical facilities	NO	NO	YES [2]
Contract construction services	NO	YES [2]	YES [2]
Government services	NO	YES [2]	YES [2]
Educational services	NO	NO	YES [2]
Indoor recreation services	NO	NO	YES [2]
Miscellaneous	NO	YES [2]	YES [2]
Public and Quasi-Public Services			
Non-profit organizations including churches	NO	NO	YES [2]
Other public and quasi-public services	NO	NO	YES [2]
Cultural, Entertainment, and Recreation			
Cultural activities	NO	NO	YES [2]
Public assembly	NO	NO	YES [2]
Auditoriums, concert halls	NO	NO	YES [2]
Outdoor music shells, amphitheaters	NO	NO	YES [2]
Amusements	NO	NO	YES [2]
Playground’s neighboring parks	NO	NO	YES [2]
Community and regional parks	NO	NO	YES [2]
Nature exhibits	NO	YES [2, 8]	YES [2]
Spectator sports including arenas	NO	NO	YES [2]
Golf course, riding stables	NO	YES [2, 8]	YES [2]

Land Use Category	Compatibility [1]		
	USAFE Priority Zone 1	**USAFE Priority Zone 2**	**USAFE Priority Zone 3**
Water-based recreational areas	NO	YES [2, 8]	YES [2]
Resort and group camps	NO	NO	YES [2]
Entertainment assembly	NO	NO	YES [2]
Other outdoor recreation	NO	YES [2, 8]	YES [2]
Resource Production & Extraction			
Agriculture [9]	YES[2, 4]	YES [2]	YES [2]
Livestock farming, animal breeding	NO	YES [2, 10]	YES[2, 10]
Agriculture related activities (processing and husbandry services)	NO	YES [2]	YES [2]
Forestry activities [11]	NO	YES [2]	YES [2]
Fishing activities and related services [12]	NO [12]	YES [2]	YES [2]
Mining activities [13]	NO	YES [2]	YES [2]
Other resource production or extraction	NO	YES [2]	YES [2]
Other			
Permanent open space	YES [2]	YES [2]	YES [2]
Water areas [14]	NO	YES[2]	YES [2]
Trees	NO	YES [2]	YES [2]

NOTES:

1. Applies to USAFE controlled (including easements) property only. A "YES" or "NO" designation for compatible land use is to be used only for gross comparison. Within each, uses exist where further definition may be needed as to whether it is clear or usually acceptable/unacceptable owing to variations in densities of people and structures.

2. Although allowed, these operations/activities/structures shall not be allowed to penetrate imaginary surfaces defined in **Chapter 3**.

3. Other factors to be considered: labor intensity, structural coverage, explosive characteristics, air pollution, electronic interference with aircraft, height of structures, and potential glare to pilots.

4. No structures (except airfield lighting and navigational aids necessary for the safe operation of the airfield when there are no other siting options), buildings, or above-ground utilities/communications should normally be installed in the Clear Zone. The Clear Zone is subject to severe restriction.

5. No passenger terminals and no major aboveground transmission lines in the APZ.

6. Low-intensity office uses only. Ancillary uses such as meeting places, auditoriums, etc, are not recommended in the APZ.

7. Excludes chapels located within the APZ.

8. Facilities must be low-intensity; club houses, meeting places, auditoriums, large classes, etc., are not

Land Use Category	Compatibility [1]		
	USAFE Priority Zone 1	USAFE Priority Zone 2	USAFE Priority Zone 3
recommended in the APZ. 9. Excludes feedlots and intensive animal husbandry within the APZ. Activities that attract concentrations of birds, creating a hazard to aircraft operations, should be excluded. 10. Includes feedlots and intensive animal husbandry. 11. Lumber and timber products removed due to establishment, expansion, or maintenance of the primary surface and imaginary surfaces will be disposed of in accordance with appropriate DOD Natural Resource Instructions. 12. Controlled hunting and fishing may be permitted for the purpose of wildlife control. 13. Surface mining operations that could create retention ponds that may attract waterfowl and present bird aircraft strike hazards (BASH) or operations that produce dust and/or light emissions that could impact pilot vision are not compatible. 14. Naturally occurring water features (e.g., rivers, lakes, streams, wetlands) are pre-existing, non-conforming land uses. Naturally occurring water features that attract waterfowl present a potential BASH.			

Attachment 5

CIVIL ENGINEER'S (CE) ROLE IN THE AIR TRAFFIC SYSTEM EVALUATION PROGRAM (ATSEP)

A5.1. Air Traffic System Evaluation Program (ATSEP). The ATSEP evaluates the ability of the air traffic system to meet standards and operational requirements of civil and military users. All USAFE and host nation locations (where USAF has functional responsibility) are subject to this program. This attachment will briefly describe the ATSEP program and further define CE's role in the program. The ATSEP fulfills the portion of CE requirements under the Unit Compliance Inspection (UCI) and shall not be duplicated.

A5.2. HQ USAFE/A3Y is responsible for scheduling, implementing, and reporting ATSEP visits within USAFE.

A5.3. Objective. Analyze, from an operational viewpoint, the total air traffic system for safety, compatibility and adequacy. Analyze and evaluate all pertinent areas that are a part of, or affect, the air traffic system for compliance with regulatory guidance.

A5.4. Scope. Evaluate the quality of service and support (e.g., Weather, CE, Safety, Airspace Management) provided to air traffic system users and compliance with standards by Air Traffic Control (ATC), Airfield Management (AM) and Air Traffic Control and Landing Systems (ATCALS) maintenance. Provide trend information and recommend system improvements.

A5.5. Scheduling Evaluations.

A5.5.1. HQ USAFE will conduct ATSEPs where they have functional responsibility (to include host nation locations) for ATC, AM, CE or ATCALS. USAFE will forward a copy of their annual ATSEP schedule to Air Force Flight Standards Agency (HQ AFFSA/XAS) by 1 August each year for planning and budgeting. USAFE will forward schedule changes to HQ AFFSA/XAS as they occur.

A5.5.2. HQ USAFE/A3 will notify the Installation Commander, Operations Group Commander (OG/CC) or equivalent operational commander, and the Mission Support Group Commander (MSG/CC) of the scheduled evaluation not later than 60 days prior to the event. HQ USAFE/A3YA will notify base-level Operations Support, CE, and Communications squadron commanders by including them on the 60-day notification. This notification will include evaluation dates, a list of ATSEP team requirements (i.e., office space, computer support, and phones), a request for any locally identified items requiring special attention and ATSEP questionnaires, along with instructions for their distribution, completion and collection. The Installation Commander (or OG/CC or equivalent operational commander) and MSG/CC will acknowledge receipt and advise HQ USAFE/A3, not later than 30 days prior to scheduled evaluation date, of any requirements that cannot be met.

A5.6. Conducting the ATSEP Evaluation.

A5.6.1. An evaluation will be conducted at each location at least once every 24 months. Follow the guidelines established in AFI 13-218_USAFESUP1, *Air Traffic System Evaluation Program*, using all applicable regulatory guidance and compliance checklists. Evaluators will: observe airfield operations, interview key personnel from wing organizations and adjacent airports, review local airfield procedures and documentation, conduct testing

and evaluate ATCALS maintenance, Weather, CE and Safety support. HQ USAFE/A3 ATCALS maintenance, CE, safety and weather personnel should participate as ATSEP team members to ensure an in-depth evaluation of system support functions.

A5.6.2. There may be times when other functional evaluations, which also address ATSEP evaluated areas, are conducted simultaneously with an ATSEP (e.g., AF Weather Technical Standardization and Evaluation Program or Inspector General inspections). ATSEP evaluation frequency may be adjusted to support reducing the inspection "footprint" if the ATSEP is combined with other inspection/evaluation programs (adjustment should be limited to plus 6 months or minus 12 months).

A5.6.3. For any particular evaluation, the ATSEP team composition and scope of the evaluation will depend primarily on levels of USAF functional responsibility within that air traffic system. The ATSEP team will conduct an in-depth evaluation ranging from a comprehensive analysis of all air traffic system components and user satisfaction to completion of the compliance checklists. Contact Programs Division, Plans and Requirements Branch (HQ USAFE/A7PP) Community of Practice (CoP) web site for the latest CE ATSEP checklist information at the following link:

https://www.my.af.mil/afknprod/ASPs/docman/DOCMain.asp?Tab=0&FolderID=OO-EN-FE-08-8-1&Filter=OO-EN-FE-08.

A5.7. Evaluation Areas. Applicable USAF, (North Atlantic Treaty Organization) NATO, International Civil Aviation Organization (ICAO), Host Nation and HQ USAFE requirements will be thoroughly evaluated from an operational viewpoint. The following areas, as a minimum, will be observed:

A5.7.1. ATC operations.

A5.7.2. Airspace management and configuration.

A5.7.3. Terminal Instrument Procedures (TERPS, or PANSOPS in Germany).

A5.7.4. Interface with adjoining air traffic facilities.

A5.7.5. AM operations.

A5.7.6. ATCALS support.

A5.7.7. CE support of ATC, AM, ATCALS and TERPS requirements (i.e., CE Maps, airfield obstruction/waiver program, airfield signs/markings, auxiliary power, facility grounding/ lightning protection).

A5.7.8. Safety awareness programs: public relations, Midair Collision Avoidance (MACA), and Bird/Wildlife Aircraft Strike Hazard (BASH) programs.

A5.7.9. Weather Support (i.e., Cooperative Weather Watch and Tower Visibility Reporting).

A5.7.10. Specialized requirements (local directives).

A5.8. Observations. Annotate deficiencies identified during this comprehensive analysis in the ATSEP report as Observations. Observations are system deficiencies that clearly indicate actual or potential flying mission impact or adversely affect flight safety. Each Observation must contain the following elements:

A5.8.1. Observation Statement. The Observation Statement must clearly state the deficiency and define the mission impact or safety of flight indicators.

A5.8.2. Discussion. The Discussion should contain information that supports the Observation. The Discussion is also the appropriate place to include unit or wing input.

A5.8.3. Recommendation. The Recommendation should indicate any possible means to correct the deficiency and specifically address the agency/office best able to correct the deficiency. Recommendations will be based on previous successful actions to close Observations or best practices learned through experience.

A5.9. Special Interest Items (SII). Air Force Flight Standards Agency (HQ AFFSA/XA) identifies annual ATSEP SIIs using the previous years' ATSEP reports. Once SIIs have been determined by HQ AFFSA/XA, the SIIs are coordinated with HQ USAFE to ensure validity. AF-level SIIs will be evaluated using a checklist developed by HQ AFFSA/XAS. SII checklists contain questions that should be used by units to conduct self-inspections. SIIs will be rated either satisfactory or unsatisfactory based on the overall checklist. Because some of the checklists must be evaluated subjectively, a single unsatisfactory question in the body of the SII does not automatically render the entire SII unsatisfactory. However, if the answer to the most fundamental question (e.g., "Does a BASH program exist?") is no, the SII would be unsatisfactory. Unsatisfactory SIIs will be reported, tracked and closed in the same manner as Observations. HQ USAFE may develop and manage USAFE-specific SIIs as deemed necessary.

A5.10. Key CE Support Areas. CE's support of the airfield and its operations can make or break an ATSEP inspection. Improvements in safety of airfield operations are the goal of the ATSEP inspections. The ATSEP inspection of key CE programs will include:

A5.10.1. Airfield Waiver Program. The identification, tracking and removal of airfield obstructions are the responsibility of CE. The airfield waiver program is the main device for improving the airfield environment. Key components (Airfield Obstruction Reduction Initiative, Airfield Waivers, Project Siting, Frangibility, etc) of the waiver program reviewed by ATSEP inspectors are found in the CE ATSEP checklist.

A5.10.2. Airfield Lighting and Marking Program. Airfield lighting, markings and signs providing clear guidance for the movement of aircraft, vehicles, equipment and personnel on the airfield are paramount to safe operations. Areas reviewed by ATSEP inspectors are found in the AM (Airfield Portion) ATSEP checklist. Consult the HQ USAFE/A7PP CoP site at the following link: https://www.my.af.mil/afknprod/ASPs/docman/DOCMain.asp?Tab=0&FolderID=OO-EN-FE-08-8-1&Filter=OO-EN-FE-08.

A5.10.3. Mapping Support. Several of the OSS offices under inspection require current CE maps to perform their jobs. The following is a list of maps that should be made available to the AFM, Operational Support Squadron (OSS), TERPS and Safety on an annual basis:

A5.10.3.1. Current C, E, and M series maps.

A5.10.3.1.1. C-1 Installation Layout.

A5.10.3.1.2. C-2 Off-Installation.

A5.10.3.1.3. C-3 Regional Location.

A5.10.3.1.4. C-4 Vicinity Location.

A5.10.3.1.5. E-1 On-Base Obstructions to Airfield Criteria.

A5.10.3.1.6. E-2 Approach/Departure Zone Obstructions to 3048 m (10,000 ft).

A5.10.3.1.7. E-3 Approach/Departure Zone Obstructions 3048 m (10,000 ft) to 16 km 10 miles).

A5.10.3.1.8. E-4 Airspace Obstructions – Vicinity.

A5.10.3.1.9. E-7 Airfield Pavement Plan.

A5.10.3.1.10. E-9 Aircraft Parking Plan.

A5.10.3.1.11. E-10 Airfield Lighting System.

A5.10.3.1.12. M-2 Short Range Development Plan.

A5.10.3.1.13. M-3 Long Range Development Plan.

A5.10.4. Snow and Ice Removal Plan. ATSEP inspectors will review the snow and ice removal plan to validate the plan's currency and effectiveness. It is important that CE show participation in the development of this plan.

A5.10.5. Participation in the BASH Program. CE is responsible for participating in the BASH program, as BASH control measures involve CE support. ATSEP inspectors will review the BASH plan for effectiveness and CE involvement.

A5.10.6. Airfield Systems Support. CE Operations provides most of CE's daily support to OSS by ensuring the airfield critical systems are operational. Key areas reviewed during the ATSEP process are:

A5.10.6.1. Generator / Emergency Power Support. Ensure emergency power generators are fully functional and are sized for the correct load. Aircraft Arresting System Support / Certification. Ensures aircraft arresting systems are in compliance and required maintenance is being conducted.

A5.10.6.2. Airfield Pavement Inspections. Ensures airfield pavement inspections are made with Air Force Civil Engineer Support Agency's (AFCESA's) pavement evaluation plan.

A5.10.6.3. Airfield Sweeper Support. Ensures there is appropriate sweeper support.

A5.10.6.4. Lightning Protection Systems and Grounding of ATCALS facilities. Ensures ATCALS facilities have adequate lightning protection and grounding.

Attachment 6

AIRFIELD CRITERIA AND WAIVER PROCESSING PROCEDURES FOR GERMAN MAIN OPERATING BASES (MOBS)

A6.1. Air Traffic Act Permit (ATAP). Ramstein AB and Spangdahlem AB operate under approved ATAP agreements between the Federal Republic of Germany (FRG) and the USAF. These agreements implement a modified set of the International Civil Aviation Organization (ICAO) and the North Atlantic Treaty Organization (NATO) criteria for Ramstein AB and Spangdahlem AB. This attachment is intended to provide Ramstein and Spangdahlem personnel with guidance on applicable airfield criteria, waiver processing procedures, and new construction siting information.

A6.2. Applicable Airfield Criteria. The ATAP for each installation implements a modified ICAO criteria for the runway surfaces and NATO criteria for aprons, parallel taxiway/emergency runways, and taxitracks. Many of the ICAO clearance surfaces evolve from the Aerodrome Reference Point (ARP). The ARP for each installation is defined in the ATAP and must be used for surface calculation and obstruction evaluation. The following information is intended as guidance. A copy of the approved ATAP is available from USAFE Programs Division Office (HQ USAFE/A7P).

A6.2.1. Ramstein AB. Obstacles violating the criteria in **Table A6.1** must be reported to HQ USAFE/A7PP and AFSBw. Airfield obstructions must be marked and lighted according to ICAO Annex 14 and NATO standards.

A6.2.1.1. **ARP:**

A6.2.1.1.1. Location. 49 26’ 12.872” N 007 36’ 01.119” S (WGS-84 grid coordinate system).

A6.2.1.1.2. Elevation. 235.90 m above Mean Sea Level (MSL).

A6.2.2. Spangdahlem Air Base. Obstacles violating the criteria in **Table A6.1** must be reported to HQ USAFE/A7PP and AFSBw. Airfield obstructions must be marked and lighted IAW ICAO Annex 14 and NATO standards.

A6.2.2.1. **ARP:**

A6.2.2.1.1. Location. 49 58’ 35.544” N 006 41’ 54.609” S (WGS-84 grid coordinate system).

A6.2.2.1.2. Elevation. 357.49 m above MSL.

Table A6.1. Applicable Airfield Criteria, Germany.

Item No.	Surface	Dimension	Remarks
1	Runway Strip (a.k.a. Primary Surface) Width	300 m (984 ft)	Centered on the runway centerline.
2	Runway Strip (a.k.a. Primary Surface) Length	60 m (196.9 ft)	Extending beyond threshold.

Item No.	Surface	Dimension	Remarks
3	Total Length of Approach Surface	15,000 m (49,213 ft)	
4	Conical Surface Slope	20:1	Slope ratio is horizontal: vertical. EXAMPLE: 20:1 is 20 m (ft) horizontal to 1 m (ft) starting at the outer edge of the inner horizontal surface terminating at a height of 100 m (328 ft)
5	Conical Surface Height	100 m (328 ft)	Above the established airfield elevation.
6	Inner Horizontal Surface Height	45 m (150 ft)	Above the established airfield elevation.
7	Inner Horizontal Surface Radius	4,000 m (13,123.4 ft)	An imaginary surface constructed by scribing an arc with a radius of 4,000 m (13,123.4 ft) about the centerline at the midpoint of the runway.
8	Approach Surface (Approach Clearance Surface) Slope	50:1	Slope ratio is horizontal, 50H:1V, to vertical.
9	Start of Approach Surface (Approach Departure Clearance Surface)	60 m (196.9 ft)	Beginning in front of threshold.
10	Approach Surface (approach Departure Clearance Surface) Width	300 m (984 ft)	Centered on the runway extended centerline.
11	Approach Surface (approach Departure Clearance Surface) Divergence	15% 10 % for Non Instrument	Flares outward from the runway extended centerline.
12	Transition Surface (Transitional Surface) Slope	7:1	Slope ratio is horizontal, 7H:1V, to vertical.
13	Inner Approach Surface Slope	50:1	Slope ratio is horizontal, 50H:1V, to vertical.
14	Beginning of Inner Approach Surface	60 m (196.9 ft)	Corresponds with beginning of the Approach Surface.
15	Inner Approach Surface Width	155 m (508.5 ft)	Centered on the runway extended centerline.
16	Inner Approach Surface Length	900 m (2,952.8 ft)	

Item No.	Surface	Dimension	Remarks
17	Inner Transitional Surface Slope	3:1	Slope ratio is horizontal, 3H:1V, to vertical.
18	Go-around Surface (Missed Approach) Slope	30:1	Slope ratio is horizontal, 30H:1V, to vertical.
19	Start of Go-around Surface (Missed Approach)	1,800 m (5,905.5 ft)	Beyond threshold.
20	Go-around Surface (Missed Approach) Width	155 m (508.5 ft)	Centered on runway extended centerline.
21	Go-around Surface (Missed Approach) Divergence	10%	Flares outward from runway centerline.
22	Start of Departure Surface	60 m (197 ft)	Measured from the threshold of the runway
23	Departing Surface Beginning Width	180 m (590 ft)	
24	Departure Surface Divergence	12,5 %	
25	Length of Departure Surface	15,000 m (49,213 ft)	
26	Departure Surface Final Width	1,800 m (5,906 ft)	
27	Slope of Departure Surface	50:1	

A6.2.3. Taxiways. Criteria in **Chapters 5** apply for taxiways, with the exception of clearances from taxiway centerlines to fixed or mobile obstacles (Item 10 in **Table 5.1**). Taxiway clearances shall conform to the following standards at German installations:

Table A6.2. Taxiway Clearances to Fixed or Mobile Obstacles in Germany

Aircraft Code of Primary Aircraft Using the Taxiway (see Table A6.2)	Distance from Centerline to Obstacles
A - E	50 m (164 ft)
F	57.5 m (188.7 ft)

A6.2.3.1. Applicable aircraft codes are determined by wingspan. Code letters, their associated wingspans, and common USAFE aircraft within each category are presented in **Table A6.3**. These aircraft codes are necessary for determining appropriate clearances for both taxiway and taxilanes within this Attachment.

Table A6.3. Aircraft Codes for Taxiway and Taxilane Clearances

Code Letter	Wingspan Range	Common USAFE Aircraft
A	Less than but not including 15 m (49 ft)	C-21, F-15, F-16

B	15 m (49 ft) up to but not including 24 m (79 ft)	A-10, C-20
C	24 m (79 ft) up to but not including 36 m (118 ft)	C-40 (B737/700)
D	36 m (118 ft) up to but not including 52 m (171 ft)	C-17, C-130, KC-10, KC-135
E	52 m (171 ft) up to but not including 65 m (213 ft)	B-747/400
F	65 m (213 ft) and greater	C-5

A6.2.4. Aprons and Taxilanes. Criteria in **Chapter 6** apply for aprons, with the exception of taxilane clearances (Item 6 in **Table 6.1**). Taxilane clearances are presented in **Table A6.4**. At German installations will be the minimum distance from the centerline of the taxiway to obstacles (Item (a) in **Table A6.4**) or the wingtip clearances (Item (b) in **Table A6.4**), whichever is greater.

Table A6.4. Taxilane Clearances to Fixed or Mobile Obstacles in Germany

Aircraft Code of Primary Aircraft Using the Taxilane (see Table A6.2)	Minimum Distance from Centerline of Taxilane to Obstacles	Required Wingtip Clearance of Aircraft Using Taxilane
	Item (a)	Item (b)
A	12 m (39.4 ft)	9.2 m (30 ft)
B	16.5 m (54.1 ft)	9.2 m (30 ft)
C	24.5 m (80.4)	9.2 m (30 ft)
D	36 m (118.1 ft)	9.2 m (30 ft) (aircraft with wingspan less than 33.5 m)
D	36 m (118.1 ft)	15.3 m (50 ft) (aircraft with wingspan greater than 33.5 m)
E	42.5 m (139.4 ft)	15.3 m (50 ft)
F	50.5 m (165.7 ft)	15.3 m (50 ft)
Note: Taxilane clearances will be determined by taking the greater of either item (a) or (b).		

A6.2.5. Runway Strip Strength. The strength along the graded parts of the runway strip from the center line of the runway and its extended center line should be so prepared or constructed as to minimize hazards arising from differences in load-bearing capacity to airplanes which the runway is intended to serve in the event of an airplane running off the runway. Additionally, the strip shall be prepared to prevent the landing gear of aircraft using the runway from sinking more than 15 cm (5.9 inches (in)). The graded portion of the strip that is required to meet these strength criteria is presented in **Figure A6.1** on the next page.

A6.2.6. Exceptions (waivers) to these criteria require AFSBw and HQ USAFE approval. Process waivers according to **Attachment 2**. USAFE bases will coordinate waiver requests with AFSBw before submitting them to HQ USAFE/A7P.

Figure A6.1. Runway Strip Grading