Runway. FAC: 1111

CATCODE: 111111
OPR: AFCEC/COS
OCR: AF/A3O-A

1.1. **Description.** The runway is the paved surface provided for normal aircraft takeoffs and landings. This category includes crosswind, parallel, primary, instrument and instrument type runways. Runway lighting is not included but is captured under Facility Analysis Category 1361. See **CATCodes: 111411** for unpaved runways, **111115** for paved overruns, **112211** for taxiways, **113321** for aprons, **116116** for short field takeoff and landing zones, and **116663** for helicopter pads. **CATCode 116642** provides the requirements for the paved shoulders of runways, aprons, taxiways, and airfield pads.

Runways, Taxiways and Ramps: A runway is differentiated from other surfaces on the airfield by being the only surface an aircraft (other than a helicopter) either lands on or takes off from. Runways may also be used for taxiing aircraft and in some cases for parking aircraft. Runways are always designated (and normally marked) by a rounded and shortened number between 1 and 36), to match the 1 to 360-degree compass bearing in which the runway is oriented. Runway markings are always white. Runways are also bordered by white lights.

Runways are classified as either Class A or Class B based on the intended aircraft use per Table 3-1 of UFC 3-260-01. Relative characteristics of Class A and Class B runways are presented in Table 3-2 of UFC 3-260-01. The following are descriptions for the types of runways:

1.1.1. **Primary Instrument.** The primary runway is equipped with navigational aids (NAVAIDS) for restricted visibility operations. The primary runway is the runway oriented in the direction of maximum wind coverage. Terrain conditions or populated areas on the extended runway centerline may make minor deviations necessary.

1.1.2. **Crosswind.** A runway oriented so that its centerline intersects the primary instrument runway at an angle greater than 15 degrees. Refer to UFC 3-260-01, paragraphs 3-4.3, 3-5, and 3-6 for further discussion.

1.1.3. **Instrument.** A runway which has NAVAIDS, lighting, and markings for restricted visibility operations. The two basic types of instrument runways are precision instrument runways and non-precision instrument runways.

1.1.3.1. **Precision Instrument Runway.** A precision instrument runway has an instrument landing system (ILS), microwave landing system (MLS), or precision approach radar (PAR) as NAVAIDS. These systems provide electronic glide slope information to the pilot.

1.1.3.2. **Non-Precision Instrument Runway.** A non-precision instrument runway has a VOR (VHF Omnidirectional Range), VOR-DME (distance measuring equipment), TACAN (tactical air navigation), NDB (non-directional beacon), LOC (localizer), LOC-DME, LDA (localizer directional aid), or SDF (simplified direction facility) as NAVAIDS providing azimuth and range information only (no glide slope information). Refer to AFI 32-1044*,* AFI 32- 1042*,* and ETL 04-2 for additional information on identifying runway lighting and marking requirements.

1.1.4. **Alternate Combat Runway (ACR).** An ACR is used to launch and recover aircraft while bomb-damaged main runways are under repair. The requirement for an ACR applies only to air bases in high threat areas without a secondary runway. An ACR can be used as a Minimum Operating Strip (MOS) during airfield damage repair operations with the following features:

1.1.4.1. **Lighting.** Lighting may be provided by emergency or expedient lighting sets. See AFH 10-222 V7, *Emergency Airfield Lighting Systems*, for additional guidance.

1.1.4.2. **Arresting System.** Arresting capability may be provided by mobile aircraft arresting system (MAAS). See Aircraft Arresting Systems (**CATCODE 116922)**. Permanent anchoring foundations may be installed.

1.2. **Requirements Determination.** Most Air Force missions can safely operate with only one runway. New crosswind or parallel runways are authorized only under the conditions described below. These restrictions also apply to existing secondary runways; therefore, an existing secondary runway should not be widened, lengthened, or extensively rehabilitated or strengthened unless the retention of a secondary runway is essential to the mission.

1.3. **Scope Determination.** Steps for determining runway requirements are:

1.3.1. **Step 1.** Determine the basic runway requirement. Each Air Force installation assigned an aircraft flying mission is authorized a runway. Length, width, and other design parameters depend on the assigned aircraft; however, it should also support other operations. For rotorcraft runway requirements, reference UFC 3-260- 01.

1.3.2. **Step 2.** Determine the need for a crosswind runway. A crosswind runway may be considered when wind coverage on the primary runway is less than 90 percent or when the beam wind component on the primary runway is greater than 21 kph (11 knots) during periods of restricted visibility. Wind coverage studies to determine runway orientation are addressed in Appendix B, section 4, of UFC 3-260-01. A crosswind runway must not be planned or programmed unless authorized by AF/A3O-A. Reference the methodology included in Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5300-13, *Airport Design,* to determine the percentage of time and the extent of reduced visibility required when the beam wind component exceeds 21 KPH (11 knots) before authorization for a crosswind runway may be requested.

1.3.3. **Step 3.** Determine the need for a secondary runway based on air traffic volume. A secondary runway is a runway in addition to the primary instrument runway. A secondary runway may be parallel or crosswind. A second runway parallel to the primary runway may be required if aircraft operations exceed practical capacities. Follow the procedure below to determine whether traffic volume makes a secondary runway necessary:

1.3.3.1. **Traffic Mix.** Determine the traffic mix (the percent of each type of aircraft) using the airfield by comparing flight data over the previous three years. Refer to FAA AC 150/5060-5, *Airport Capacity and Delay*). Table 1 indicates the mix number, based on percentages of aircraft types.

Table 1. Aircraft Mix Percentages.

Mix Number	Percent Type A	Percent Type B	Percent Type C	Percent Types D & E
1	0	0	10 (9-11)	90
2	0	30 (27-33)	30	40
3	20 (18-22)	40	20	20
4	60 (54-66)	20	20	0
NOTES: Type A: Four-engine jet and larger. Type B: Two- and three-engine jet, four-engine piston, and turboprop. Type C: Executive jet and transport type twin-engine piston. Types D and E: Light twin-engine piston and single-engine piston.				

1.3.3.2. **Instrument Meteorological Conditions (IMC).** Determine the percent of time IMCs prevail at that location. IMCs are in effect when the ceiling is lower than 300 m (1,000 ft) or visibility is less than 4.8 km (3 mi).

1.3.3.3. **Instrument Flight Regulations (IFR) Percentages.** Use air traffic data for the past three years to determine the percent of time aircraft operate under IFR conditions. Aircraft may operate under IFR conditions during clear weather to build pilot proficiency.

1.3.3.4. **Calculations.** Use the more restrictive of paragraph 1.3.3.1 and 1.3.3.2 to determine the need for a secondary runway. A secondary runway is necessary when any of following situations exceed the parameters of Table 2:

1.3.3.4.1. The Practical Annual Capacity (PANCAP) is exceeded in any two consecutive years.

1.3.3.4.2. The Practical Hourly Capacity (PHOCAP) is reached or exceeded for at least 20 hours in one year as shown in Table 2.

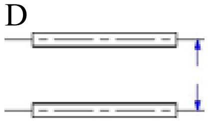
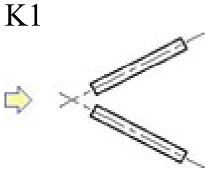
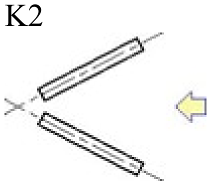
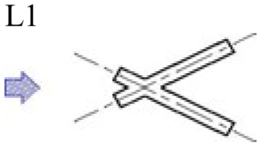
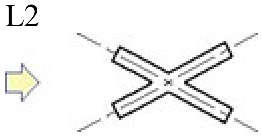
1.3.3.4.3. Aircraft are delayed by five minutes during two adjacent, normal, peak hours each week during a year.

1.3.3.4.4. PHOCAP may reach 54 operations during visual meteorological conditions (VMC) weather conditions and 44 operations during IMC for the following traffic mix: 20 percent four engine jet and larger; 40 percent two and three engine jet, four engine piston and turboprop; 20 percent small jet and twin engine piston; and 20 percent light wing and single engine piston. PANCAP may reach 180,000 operations for a single runway for the same traffic mix. The factors involved in identifying capacities include aircraft mix, frequency of IFR operation, runway occupancy time, and air traffic separation.

1.3.4 **Advance Planning.** Advance planning is necessary due to lead time requirements and the time required to develop supporting documentation. To project traffic loads three to five years in the future, use growth factors of five percent per year or the average air traffic growth of the individual air base over the past three years. Include proposed mission changes in the traffic projection. A detailed engineering analysis may be used to further justify the need for a secondary runway.

1.3.5 **Design Factors.** Secondary runways may not require the same pavement load bearing capacity if there is a reasonable spread in aircraft mix. Landing aids are restricted to visual aids: Runway edge, threshold and end lighting precision approach path indicator (PAPI), and short approach lighting system (SALS). Since instrument landing aids are not authorized, the runway is authorized for visual use only if meteorological conditions and traffic volumes clearly show that a second instrument runway is mission-essential for the based aircraft. See AFI 32-1044 and UFC 3-535- 01, *Visual Air Navigation Systems*, for further information.

Table 2. Runway Capacities for Long-Range Planning Purposes.

Runway Configuration	Description	Mix	PANCAP1	PHOCAP	
				IFR	VFR2
A	Single runway (arrivals = departures)	1	215,000	53	99
		2	195,000	52	76
		3	180,000	44	45
		4	170,000	42	45
B 	Close parallels (IFR dependent)	1	385,000	64	198
		2	330,000	63	152
		3	295,000	55	108
		4	280,000	54	90
C 	Independent IFR approach-departure parallels	1	425,000	79	198
		2	390,000	79	152
		3	355,000	79	108
		4	330,000	74	90
D 	Independent IFR arrivals and departures	1	430,000	106	198
		2	390,000	104	152
		3	360,000	88	108
		4	340,000	84	90
K1 	Open V, dependent operations away from intersection	1	420,000	71	198
		2	335,000	70	136
		3	300,000	63	94
		4	294,000	60	84
K2 	Open V, dependent operations toward intersection	1	235,000	57	108
		2	220,000	56	86
		3	215,000	50	66
		4	200,000	50	53
L1 	Two intersecting at threshold	1	375,000	71	175
		2	310,000	70	125
		3	275,000	63	83
		4	255,000	60	69
L2 	Two intersecting in middle	1	220,000		
		2	195,000		
		3	195,000		
		4	190,000		

NOTES:
1. PANCAP: The maximum number of aircraft operations at an Air Force base in a year. This figure considers traffic reductions due to weather below minimums, noise abatement curfews, air shows, and other air traffic closures that normally occur during the year.
2. PHOCAP: The maximum number of aircraft operations in an hour. PHOCAP is determined primarily by air traffic separation.

1.4. **Runway Dimensions.** Geometric criteria for runway pavements are specified in Table 32 of UFC 3-260-01.

1.4.1. **Runway Width.** The authorized width of a runway depends on the aircraft programmed for the base. See Table 3 for authorized widths.

1.4.2. **Runway Length.** Ensure runway length is sufficient to accommodate all aircraft programmed for the base. Performance curves for each aircraft are in the performance data section of the "Dash One" series of the aircraft technical orders. Length is based on the take off or landing phase, whichever gives the greater length. The designer of the airfield runway coordinates with the respective MAJCOM/A3 to determine the most accurate and economical methods of determining the requirements for individual runway lengths based on the aircraft each base supports. See Table 4 for authorized runway lengths.

1.4.3. **Shoulders.** Shoulders can be both paved and unpaved and are located on each side of the runway. See Table 5 for authorized shoulder widths.

Table 3. Runway Widths.

Aircraft Type	Runway Width
B-52	91.5 m (300 ft)
Fighter Aircraft Including Trainers	45.7 m (150 ft)
Landing Zones (LZ)1	The minimum C-130 short field runway width is 18.3 m (60 ft) but only if there are turnarounds of at least 22.6 m (74 ft) in diameter or existing taxiways are provided. Otherwise, the minimum width is 22.9 m (75 ft). The C-17 requires a minimum runway width of 27.4 m (90 ft).
Helicopter	22.9 m (75 ft) or a pad with a width 1.0 to 2.0 times the length of the largest helicopter using the facility.
Other Aircraft	45.7 m (150 ft)
ACR	27.4 m (90 ft)
NOTE: 1. Engineering Technical Letter (ETL) 09-6, C-130 and C-17 Landing Zone (LZ) Dimensional, Marking, and Lighting Criteria, and Chapter 7 and Table 7-2 in UFC 3-260-01 for more LZ criteria	

Table 4. Runway Lengths.

Category	Runway Length
Landing Zone	The minimum length for a C-17 and C-130 landing zone runway is 1,067 m (3,500 ft), not including overruns. See UFC 3-260-01 and ETL 09-6 for length based on pressure altitude, Runway Condition Reading (RCR), and operating aircraft weights.
Alternate Combat Runway (ACR)	The length of an ACR is 2,300 m (7,500 ft). The ACR facility is a paved strip, 2,300 m (7,500 ft) long, with 91 m (300 ft) paved overruns on each end, and 11 m (36 ft) wide access taxiways. It may be superimposed on a secondary runway, taxiway, or parking apron that meets the desired criteria. There is no specific CATCODE assigned to ACR facilities. Use the code which most closely relates to adjacent pavement. For example, if the ACR is a separate runway, use CATCODE 111111; or if it is superimposed on a taxiway, use CATCODE 112211. Refer to UFC 3-260-01 for additional design criteria.
Helicopter Pad	Generally, a square pad is provided for normal helicopter take off/landing operations. However, for specific types of operations or extensive operations, a runway 490 m (1,600 ft) long may be authorized.

Table 5. Shoulder Widths.

Category	Shoulder Widths (Paved and Unpaved)
Class B	60 m (200 ft)
Landing Zone (LZ)1	3 m (10 ft)
ACR	1.2 m (4 ft)
Class A	15.2 m (50 ft)
Helicopter Strips	7.5 m (25 ft)
NOTE: 1. See ETL 09-6.	