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. Taxiways are designated alphabetically, avoiding the use of I, O, and X. Alphanumerics may be used when necessary; e.g. A1, B3.

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. Taxilanes are further discussed in Chapter 6 for the Army and Air Force, and MIL-HDBK-1021/1 for the Navy and Marine Corps.

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

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

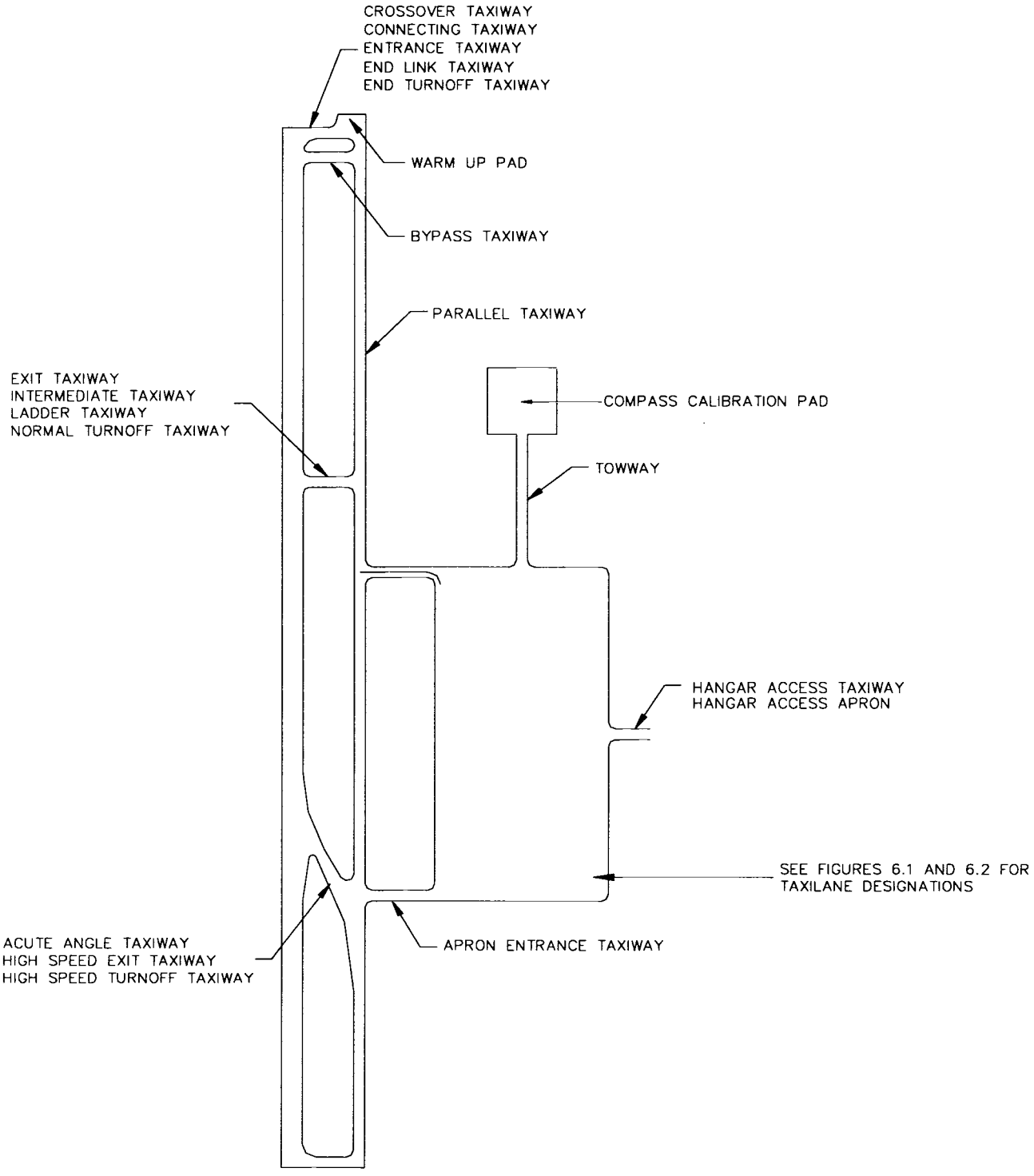
5.4.2. Direct Access. Taxiways should provide as direct an access as possible from the runway to the apron. Connecting taxiways should be provided to join the runway exit points to the apron.

5.4.3. 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.

5.4.4. Prevent Delays. A sufficient number of taxiways should be provided to prevent capacity delays which may result when one taxiway must service more than one runway.

5.4.5. Runway Exit Criteria. The number, type, and location of exits is a function of runway length, as shown in Figure 5.2 and as discussed in Chapter 2.

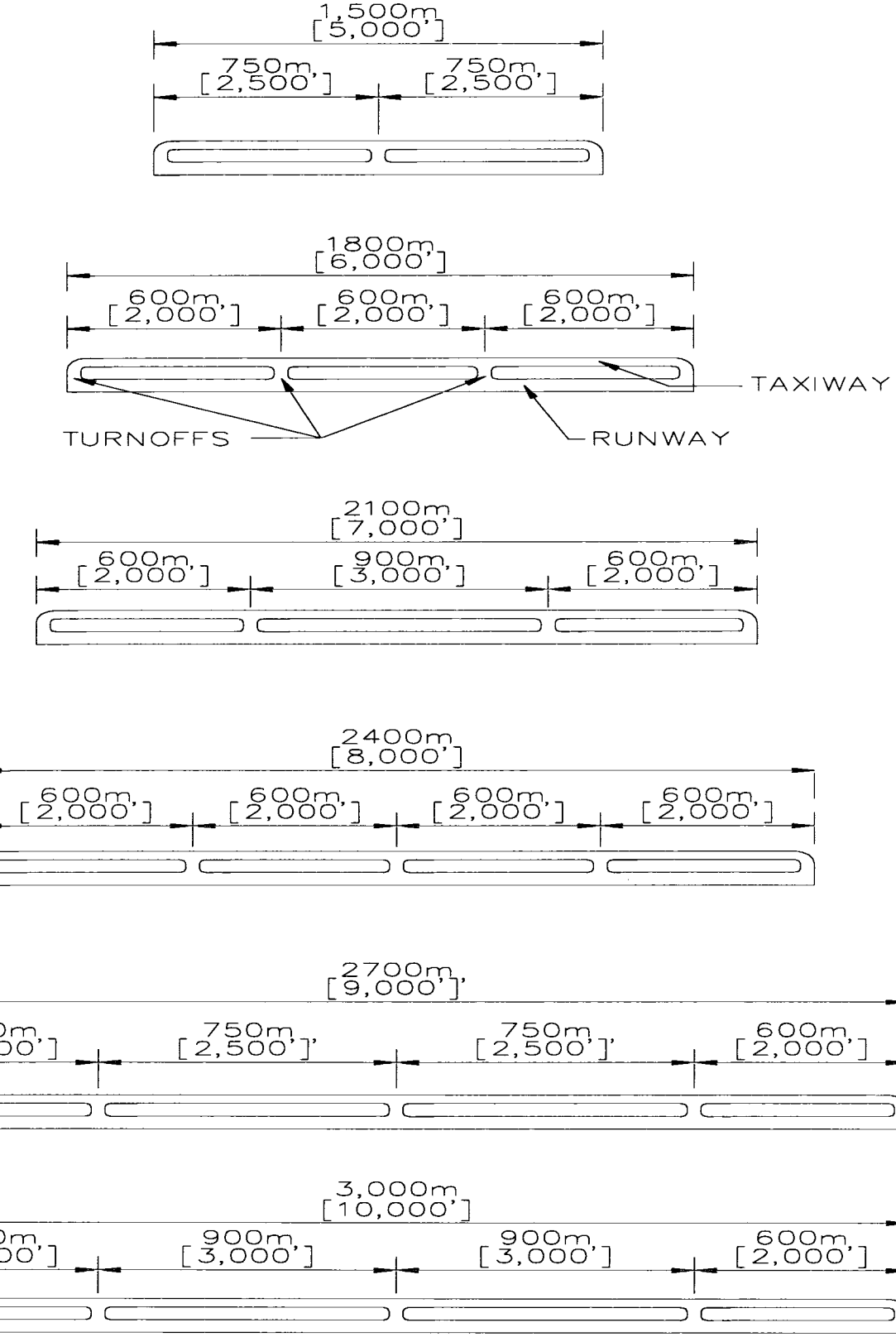
Figure 5.1. Common Taxiway Designations.



NOTE

TAXIWAY LAYOUT IS FOR GUIDANCE ONLY

Figure 5.2. Spacing Requirements - Normal Taxiway Turnoffs.



NORMAL TAXIWAY TURNOFFS

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5.5. Fixed-Wing Taxiway Dimensions. Taxiway dimensions are based on the class of runway which it serves.

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

5.5.2. 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]	23 m [75 ft]	Army and Air Force airfields.
		12 m [40 ft]	23 m [75 ft]	Navy and Marine Corps airfields.
		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 (See note 3.)	7.5 m [25 ft]	7.5 m [25 ft]	Army and Air Force airfields except as noted below.
		NA	3 m [10 ft]	Air Force 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 (90°) or more.
		NA	15 m [50 ft]	Airfields for B-52 Aircraft.
		NA	Not Required	Navy and Marine Corps airfields.
4	Longitudinal Grade of Taxiway and Shoulders	Max 3.0%		Grades may be both positive and negative but must not exceed the limit specified. For Navy and Marine Corps airfields, a maximum of 2.0% is recommended when jet aircraft are required to accelerate from a standing position.

				For Air Force airfields other than multimission, a gradient exception of 5.0 % is 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 Air Force multimission airfield, the gradient is limited to 1.5%.
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	Min 600 m [2,000 ft]between eye level at 2.14 m [7 ft] and an object 3.05 m [10 ft] above taxiway pavement		Army, Navy and Marine Corps airfield taxiways.
		Min 300 m [1,000 ft]. Any two points 3 m [10 ft] above the pavement must be mutually visible for the distance indicated.		Air Force airfield taxiways.
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%		Army, Navy, Marine Corps and Air Force airfields, not otherwise specified.
		NA	Min 1.5% Max 2.0%	Air Force taxiway designed for B-52 aircraft.

9	Transverse Grade of Unpaved Shoulders	(a) 40 mm [1½"] drop off at edge of pavement (b) 5% slope first 3 m [10 ft] from paved shoulder or runway edge where no paved shoulder (c) Beyond 3 m [10 ft] from paved shoulder, 2.0% min, 4.0% max		For additional information, see Figure 3.1.
10	Clearance from Taxiway Centerline to Fixed or Mobile Obstacles (taxiway clearance line)	Min 45.72 m [150 ft]		Army, Navy and Marine Corps airfields.
		Min 45.72 m [150 ft]	Min 60.96 m [200 ft]	Air Force airfields.
		See Remarks		See Table 3.2, Item No. 12 for obstacle definition.
11	Distance Between Taxiway Centerline and Parallel Taxiway/Taxilane Centerline	53 m [175 ft]	57 m [187.5 ft] or wingspan + 15 m [wingspan + 50 ft], whichever is greater	Army airfields.
		53 m [175 ft]	73 m [237.5 ft] or wingspan + 15 m [wingspan + 50 ft], whichever is greater	Air Force and Navy airfields.
12	Grade (area between taxiway shoulder and taxiway clearance line)		Min of 2.0% prior to channelization Max 10.0%[2]	Army, Air Force, Navy, and Marine Corps airfields, except as noted below. For additional information, see Figure 3.1. Slope from shoulder pavement.
		(a) 40 mm [1½"] drop off at edge of paved shoulder (b) 5% slope first 3 m [10 ft] from paved shoulder (c) Beyond 3 m [10 ft] from paved shoulder, 2.0% min, prior to channelization, 10.0% max (See note 2.)		Class A airfields and Air Force taxiways designed for B-52 aircraft. For additional information, see Figure 3.1. Slope away from shoulder pavement.

NOTES:

1. NA = Not Applicable

2. Bed of channel may be flat.
3. A 15 m (50 ft) paved shoulder is allowed for C-5, C-4, and 747 aircraft where vegetation cannot be established.
4. Metric units apply to new airfield construction and where practical modification to existing airfields and heliports, as discussed in paragraph 1.4.4.
5. The criteria in this manual are based on aircraft specific requirements and are not direct conversions from inch-pound (English) dimensions. Inch-pound units are included only as a reference to the previous standard.
6. Airfield and heliport imaginary surfaces and safe wingtip clearance dimensions are shown as a direct conversion from inch-pound to SI units.

5.6. 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.

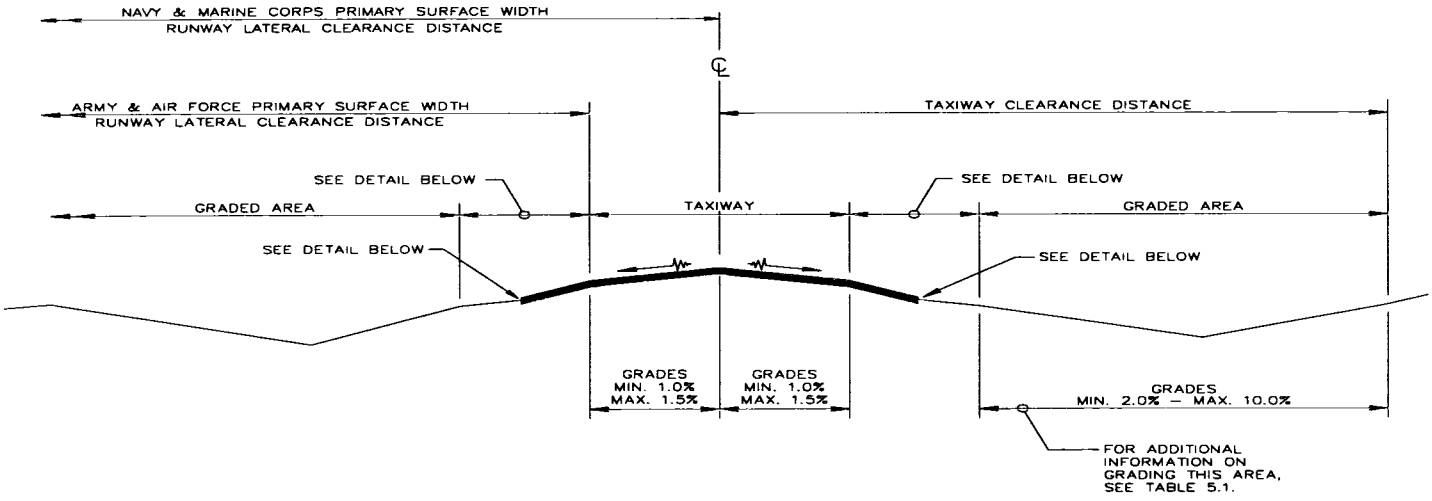
5.7. Taxiways at Dual Use (Fixed- and Rotary-Wing) Airfields:

5.7.1. 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.

5.7.2. 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.

5.8. Taxiway Intersection Criteria. 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 gears, 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 gears pivot on a shorter radius than the nose gear during a turn.

Figure 5.3. Taxiway and Primary Surface Transverse Sections.



TAXIWAY TRANSVERSE SECTION
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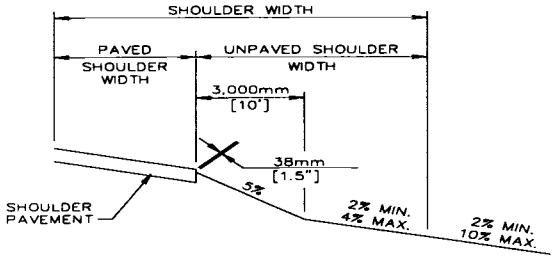
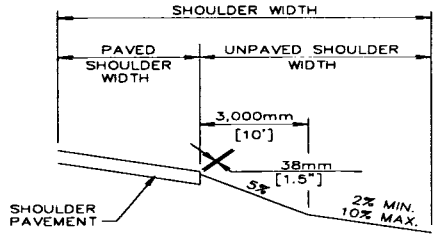


SEE TABLE 5.1 FOR
PAVED AND UNPAVED SHOULDER WIDTHS

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 TAXIWAY FOR CLASS A RUNWAYS
AND CLASS B RUNWAYS FOR B–52 AIRCRAFT
N.T.S.

Table 5.2. Rotary-Wing Taxiways.

Item No.	Item Description	Requirement	Remarks
1	Width	15 m [50 ft]	Army and Air Force facilities.
		12 m [40 ft]	Navy and Marine Corps facilities.
		See Remarks	Basic width applicable to taxiways that support helicopter operations only. When dual use taxiways support fixed-wing aircraft operations, use the appropriate fixed-wing criteria.
2	Longitudinal Grade	Max 2.0%	
3	Transverse Grade	Min 1.0% Max 1.5%	
4	Paved Shoulders		See Table 4.4.
5	Clearance from Centerline to Fixed and Mobile Obstacles (taxiway clearance line)	Min 30.48 m [100 ft]	Basic helicopters clearance. Increase as appropriate for dual use taxiways. See Table 3.2, Item No. 12 for definitions of fixed and mobile obstacles.
6	Grades Within the Clear Area	Max 5.0%	Clear area is the area between the taxiway shoulder and the taxiway clearance line.

NOTES:

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

Table 5.3. Rotary-Wing Taxiway Shoulders.

Item No.	Item Description	Requirement	Remarks
1	Total Width of Shoulder (Paved and Unpaved)	7.5 m [25 ft]	May be increased when necessary to accommodate dual operations with 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"] dropoff at edge of paved shoulder. (b) 5% slope first 3 m [10 ft] from paved shoulder.	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 for rotary-wing facilities.

NOTES:

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

5.8.1. Fillet Only Dimensions. At Army and Air Force aviation facilities, and at Navy and Marine Corps facilities not serving large transport aircraft, only fillets (not lead-in to fillets) are required at intersections. Fillets at taxiway intersections are arcs installed in accordance with Figure 5.4.

5.8.2. Fillet and Lead-in to Fillet Dimensions. At Navy and Marine Corps aviation facilities with Class B runways serving large transport aircraft, fillets and lead-in to fillets are required at intersections. Lead-in to fillets widen the taxiway immediately to an intersection. Fillets and lead-in to fillets are installed in accordance with Figure 5.5.

5.9. High-Speed Runway Exits. 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. Air Force designers should contact their MAJCOM pavements engineer or HQ AFCESA/CESC for assistance. Army designers shold contact CEMRO-ED-TX. Navy and Marine Corps designers may use the criteria for transport aircraft provided within Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5300-13, *Airport Design.*

5.10. 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.

5.10.1. Parking Aprons. The minimum number of apron access taxiways for any parking apron will be two.

5.10.2. 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.

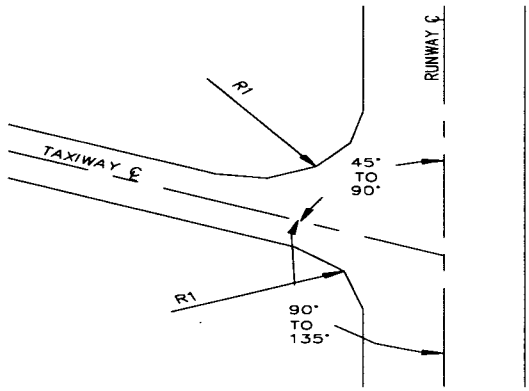
5.11. Shoulders. Shoulders are provided along a taxiway to allow aircraft to recover if they leave the paved taxiway. Paved shoulders prevent erosion caused by jet blast, support an occasional aircraft which may wander off the taxiway, support vehicular traffic, and reduce maintenance of unpaved shoulder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

5.11.1. For Fixed-Wing Taxiways. The shoulder for fixed-wing taxiways may be either paved or unpaved, depending on the agency, 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.

5.11.2. 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.

Figure 5.4. Intersection Geometry for Army and Air Force Facilities, and Navy and Marine Corps Facilities Serving Aircraft with Wingspan Less Than 33.5 meters (110 feet).

RUNWAY WIDTH	FILLET RADIUS	FILLET RADIUS	FILLET RADIUS	FILLET RADIUS
W	R1	R2	R3	R4
LESS THAN 46m [150']	30m [100']	30m [100']	23m [75']	60m [200']
46m [150']	38m [125']	30m [100']	29m [95']	76m [250']
60m [200']	105m [350']	30m [100']	79m [260']	198m [650']
90m [300']	105m [350']	30m [100']	79m [260']	198m [650']



45° AND 135° INTERSECTION
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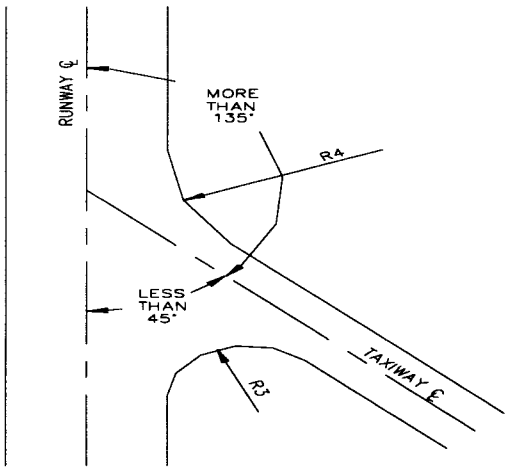
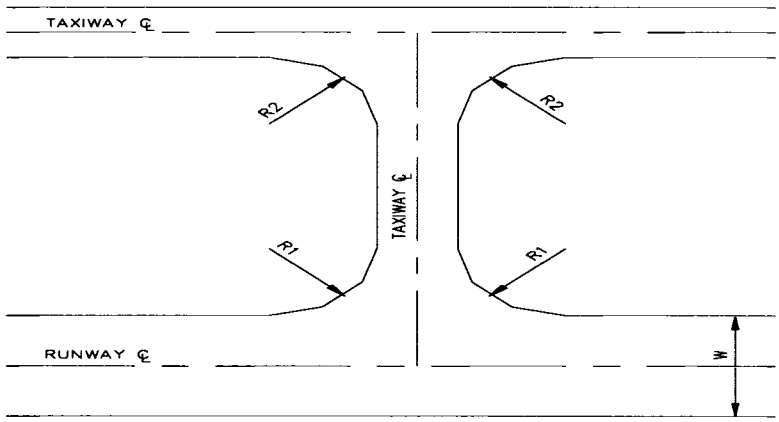


MORE THAN 135° AND LESS THAN 45° INTERSECTION
N.T.S.



90° TAXIWAY INTERSECTION
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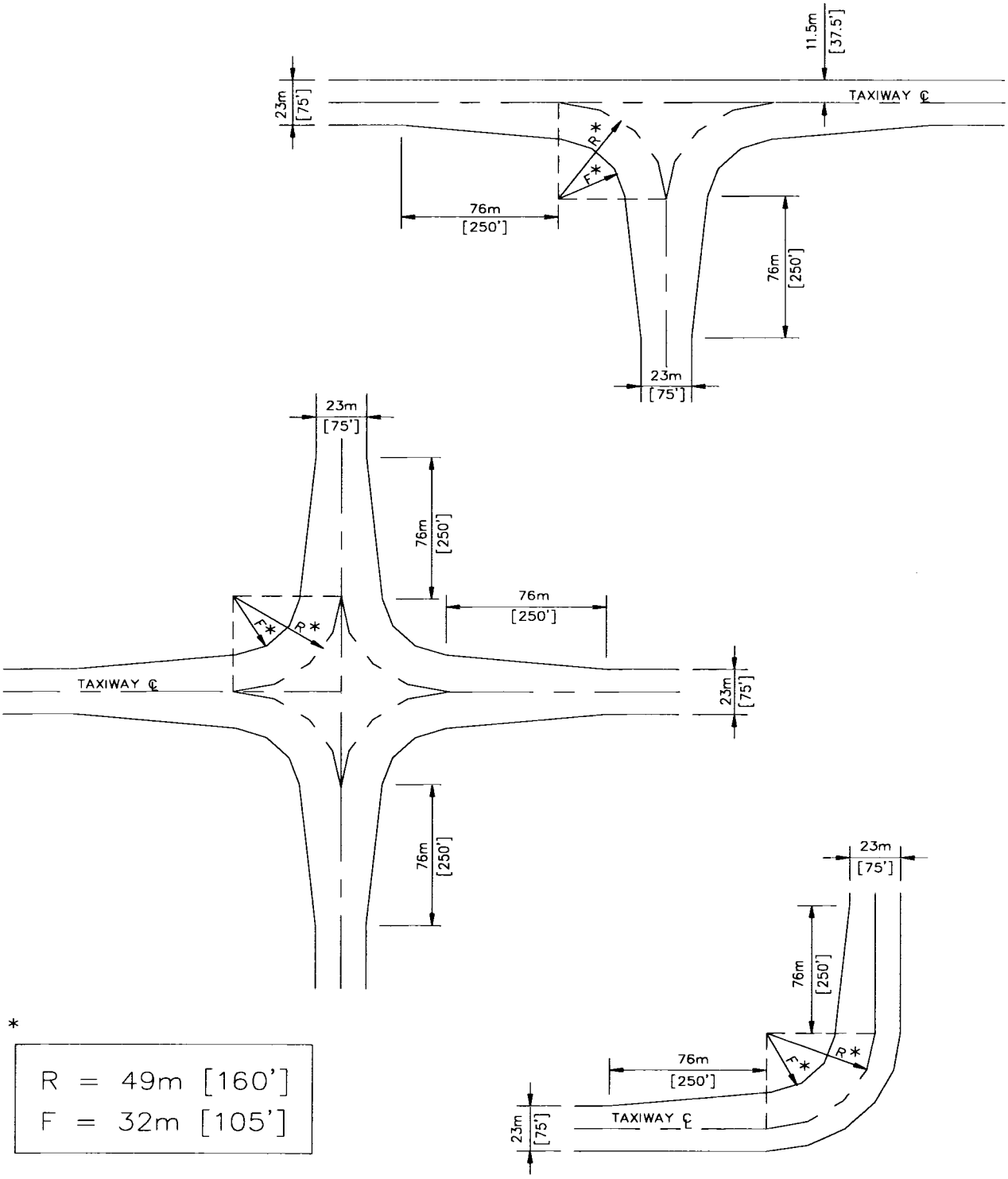
Figure 5.5. Intersection Geometry for Navy and Marine Corps Facilities Serving Aircraft with Wingspan Greater than 33.5 meters (110 feet).



5.12. Towways. A towway is used to tow aircraft from one location to another.

5.12.1. Dimensions. Table 5.4 presents the criteria for towway layout and design including clearances, slopes, and grading dimensions.

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

5.12.3. 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 5.4 and Figure 5.6.

5.13. 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.

Table 5.4. Towways.

Item No.	Item Description	Class A Runway / Class B Runway Requirement	Remarks
1	Width	(outside gear width of towed mission aircraft) +3 m [10 ft]	Army and Air Force facilities. 1.5 m [5 ft] on each side of gear.
		11 m [36 ft]	Navy and Marine Corps facilities for carrier aircraft.
		12 m [40 ft]	Navy and Marine Corps facilities for patrol and transport aircraft.
		10.7 m [35 ft]	Navy and Marine Corps facilities for rotary-wing aircraft.
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.
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	NA (See note 1.)	
7	Transverse Grade	Min 2.0% Max 3.0%	Pavement crowned at towway centerline. Slope pavement downward from centerline of towway.

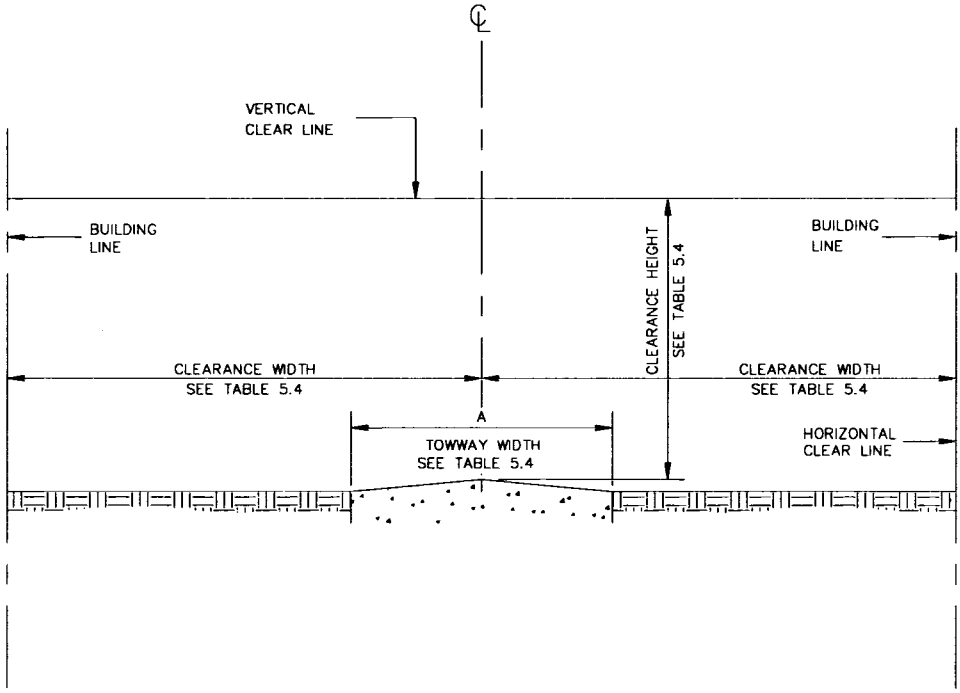
8	Towway Turning Radius	46 m [150 ft] radius	Criteria presented here are for straight sections of towway. Pavement width and horizontal clearance lines may need to be increased at horizontal curve locations, based on aircraft alignment on the horizontal curve.
9	Fillet Radius at Intersections	30 m [100 ft] radius	
10	Transverse Grade of Unpaved Shoulder	(a) 40 mm [1½"] drop off at edge of pavement. (b) 5% slope first 3 m [10 ft] from edge of pavement. (c) Beyond 3 m [10 ft] from edge of pavement, 2.0% min, 4.0% max.	
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]	Army and Air Force facilities.
		15 m [50 ft]	Navy and Marine Corps facilities for Carrier Aircraft.
		23 m [75 ft]	Navy and Marine Corps facilities for patrol and transport aircraft.
		14 m [45 ft]	Navy and Marine Corps facilities for rotary-wing aircraft.
12	Vertical Clearance From Towway Pavement Surface to Fixed or Mobile Obstacles	(Height of towed mission aircraft) + 3 m [10 ft]	Army and Air Force facilities.
		7.5 m [25 ft]	Navy and Marine Corps facilities for carrier aircraft.
		14 m [45 ft]	Navy and Marine Corps facilities for patrol and transport aircraft.
		9 m [30 ft]	Navy and Marine Corps facilities for rotary-wing aircraft
13	Grade (area between taxiway shoulder and taxiway clearance line)	Min of 2.0% prior to channelization Max 10%. (See note 2.)	

NOTES:

1. NA = Not Applicable
2. Bed of channel may be flat.

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

Figure 5.6. Towway Criteria.



TYPICAL CROSS SECTION (SHOWING SAFETY CLEARANCES)

N.T.S.