CHAPTER (3)

PHYSICAL CHARACTERISTICS

3.1 RUNWAYS

Number and orientation of runways

Note: Many factors affect the determination of the orientation, siting and number of runways.

One important factor is the usability factor, as determined by the wind distribution, which is specified hereunder. Another important factor is the alignment of the runway to facilitate the provision of approaches conforming to the approach surface specifications of Chapter 4. In Attachment A, Section 1, information is given concerning these and other factors.

When a new instrument runway is being located, particular attention needs to be given to areas over which airplanes will be required to fly when following instrument approach and missed approach procedures, so as to ensure that obstacles in these areas or other factors will not restrict the operation of the airplanes for which the runway is intended.

3.1.1 The number and orientation of runways at an aerodrome shall be such that the usability factor of the aerodrome is not less than 95 per cent for the airplanes that the aerodrome is intended to serve.

3.1.2 The siting and orientation of runways at an aerodrome shall be such that the arrival and departure tracks minimize interference with areas approved for residential use and other noise sensitive areas close to the aerodrome in order to avoid future noise problems.

Note: Guidance on how to address noise problems is provided in the CARC Guidance Materials, Land Use and Environmental Control 34/LUEC, and Balanced Approach to Aircraft Noise Management 34/BAANM.

3.1.3 Choice of maximum permissible cross-wind components

In the application of Chapter 3 paragraph 3.1.1 it shall be assumed that landing or take-off of airplanes is, in normal circumstances, precluded when the cross-wind component exceeds:

— **37 km/h (20 kt)** in the case of airplanes whose reference field length is 1 500 m or over, except that when poor runway braking action owing to an insufficient longitudinal coefficient of friction is experienced with some frequency, a cross-wind component not exceeding 24 km/h (13 kt) shall be assumed;

— **24 km/h (13 kt)** in the case of airplanes whose reference field length is 1 200 m or up to but not including 1 500 m; and

— **19 km/h (10 kt**) in the case of airplanes whose reference field length less than 1 200 m.

Note: In Attachment A, Section 1, guidance is given on factors affecting the calculation of the estimate of the usability factor and allowances which may have to be made to take account of the effect of unusual circumstances.

3.1.4 Data to be used

The selection of data to be used for the calculation of the usability factor shall be based on reliable wind distribution statistics that extend over as long a period as possible, preferably of not less than ten years. The observations used shall be made at least eight times daily and spaced at equal intervals of time.

Note: These winds are mean winds. Reference to the need for some allowance for gusty conditions is made in Attachment A, Section 1.

Location of threshold

3.1.5 A threshold shall normally be located at the extremity of a runway unless operational considerations justify the choice of another location.

Note: Guidance on the sitting of the threshold is given in Attachment A, Section 11.

3.1.6 When it is necessary to displace a threshold, either permanently or temporarily, from its normal location, account shall be taken of the various factors which may have a bearing on the location of the threshold. Where this displacement is due to an unserviceable runway condition, a cleared and graded area of at least 60 m in length shall be available between the unserviceable area and the displaced threshold. Additional distance shall also be provided to meet the requirements of the runway end safety area as appropriate.

Note: Guidance on factors which may be considered in the determination of the location of a displaced threshold is given in Attachment A, Section 11.

Actual length of runways

3.1.7 Primary runway

Except as provided in Chapter 3 paragraph 3.1.9, the actual runway length to be provided for a primary runway shall be adequate to meet the operational requirements of the airplanes for which the runway is intended and shall be not less than the longest length determined by applying the corrections for local conditions to the operations and performance characteristics of the relevant airplanes.

Note 1: This specification does not necessarily mean providing for operations by the critical airplane at its maximum mass.

Note 2: Both take-off and landing requirements need to be considered when determining the length of runway to be provided and the need for operations to be conducted in both directions of the runway.

Note 3: Local conditions that may need to be considered include elevation, temperature, runway slope, humidity and the runway surface characteristics.

Note 4: When performance data on airplanes for which the runway is intended are not known, guidance on the determination of the actual length of a primary runway by application of general correction factors is given in the CARC Guidance Material Runway Design 34/RWYD.

3.1.8 Secondary runway

The length of a secondary runway shall be determined similarly to primary runways except that it needs only to be adequate for those airplanes which require to use that secondary runway in addition to the other runway or runways in order to obtain a usability factor of at least 95 per cent.

3.1.9 Runways with stopways or clearways

Where a runway is associated with a stopway or clearway, an actual runway length less than that resulting from application of Chapter 3 paragraph 3.1.7 or 3.1.8, as appropriate, may be considered satisfactory, but in such a case any combination of runway, stopway and clearway provided shall permit compliance with the operational requirements for take-off and landing of the airplanes the runway is intended to serve.

Note: Guidance on use of stopways and clearways is given in Attachment A, Section 2.

Width of runways

3.1.10 The width of a runway shall be not less than the appropriate dimension specified in the following tabulation:

Note 1: The combinations of code numbers and OMGWS *for which widths are specified have been developed for typical airplane characteristics.*

Note 2: Factors affecting runway width are given in the CARC Guidance Material Runway Design 34/RWYD.

Note 3: See 2 concerning the provision of runway shoulders, in particular for Code F aeroplanes with four (or more) engines.

Outer Main Gear Wheel Span (OMGWS)

Code number	Up to but not including 4.5 m	4.5 m up to but not including 6 m	6 m up to but not including 9 m	9 m up to but not including 15 m
1[a]	18 m	18 m	23 m	-
2[a]	23 m	23 m	30 m	-
3	30 m	30 m	30 m	45 m
4	-	-	45 m	45 m

a. The width of a precision approach runway shall be not less than 30 m where the code number is 1 or 2.

Minimum distance between parallel runways

3.1.11 Where parallel non-instrument runways are intended for simultaneous use, the minimum distance between their center lines shall be:

— 210 m where the higher code number is 3 or 4;

— 150 m where the higher code number is 2; and

— 120 m where the code number is 1.

3.1.12 Where parallel instrument runways are intended for simultaneous, the minimum distance between their center lines shall be:

— 1 035 m for independent parallel approaches;

— 915 m for dependent parallel approaches;

— 760 m for independent parallel departures;

— 760 m for segregated parallel operations;

except that:

a) for segregated parallel operations the specified minimum distance:

1) may be decreased by 30 m for each 150 m that the arrival runway is staggered toward the arriving aircraft, to a minimum of 300 m; and

2) shall be increased by 30 m for each 150 m that the arrival runway is staggered away from the arriving aircraft;

b) for independent parallel approaches, combinations of minimum distances and associated conditions other than those specified in the PANS-ATM Document

may be applied when it is determined that such combinations would not adversely affect the safety of aircraft operations.

Slopes on runways

3.1.13 Longitudinal slopes

The slope computed by dividing the difference between the maximum and minimum elevation along the runway center line by the runway length shall not exceed:

— 1 per cent where the code number is 3 or 4; and

— 2 per cent where the code number is 1 or 2.

3.1.14 Along no portion of a runway shall the longitudinal slope exceed:

— 1.25 per cent where the code number is 4, except that for the first and last quarter of the length of the runway the longitudinal slope shall not exceed 0.8 per cent;

— 1.5 per cent where the code number is 3, except that for the first and last quarter of the length of a precision approach runway category II or III the longitudinal slope shall not exceed 0.8 per cent; and

— 2 per cent where the code number is 1 or 2.

3.1.15 Longitudinal slope changes

Where slope changes cannot be avoided, a slope change between two consecutive slopes shall not exceed:

— 1.5 per cent where the code number is 3 or 4; and

— 2 per cent where the code number is 1 or 2.

Note: Guidance on slope changes before a runway is given in Attachment A, Section 4.

3.1.16 The transition from one slope to another shall be accomplished by a curved surface with a rate of change not exceeding:

— 0.1 per cent per 30 m (minimum radius of curvature of 30 000 m) where the code number is 4;

— 0.2 per cent per 30 m (minimum radius of curvature of 15 000 m) where the code number is 3; and

— 0.4 per cent per 30 m (minimum radius of curvature of 7 500 m) where the code number is 1 or 2.

3.1.17 Sight distance

Where slope changes cannot be avoided, they shall be such that there will be an unobstructed line of sight from:

— any point 3 m above a runway to all other points 3 m above the runway within a distance of at least half the length of the runway where the code letter is C, D, E or F.

— any point 2 m above a runway to all other points 2 m above the runway within a distance of at least half the length of the runway where the code letter is B; and

— any point 1.5 m above a runway to all other points 1.5 m above the runway within a distance of at least half the length of the runway where the code letter is A.

Note: Consideration will have to be given to providing an unobstructed line of sight over the entire length of a single runway where a full-length parallel taxiway is not available. Where an aerodrome has intersecting runways, additional criteria on the line of sight of the intersection area would need to be considered for operational safety. See the CARC Guidance Material Runway Design 34/RWYD.

3.1.18 Distance between slope changes

Undulations or appreciable changes in slopes located close together along a runway shall be avoided. The distance between the points of intersection of two successive curves shall not be less than:

a) the sum of the absolute numerical values of the corresponding slope changes multiplied by the appropriate value as follows:

   — 30 000 m where the code number is 4;

   — 15 000 m where the code number is 3; and

   — 5 000 m where the code number is 1 or 2; or

b) 45 m;

whichever is greater.

Note: Guidance on implementing this specification is given in Attachment A, Section 4.

3.1.19 Transverse slopes

To promote the most rapid drainage of water, the runway surface shall be cambered except where a single crossfall from high to low in the direction of the wind most

frequently associated with rain would ensure rapid drainage. The transverse slope shall be:

— 1.5 per cent where the code letter is C, D, E or F; and

— 2 per cent where the code letter is A or B;

but in any event shall not exceed 1.5 per cent or 2 per cent, as applicable, nor be less than 1 per cent except at runway or taxiway intersections where flatter slopes may be necessary.

For a cambered surface the transverse slope on each side of the center line shall be symmetrical.

Note: On wet runways with cross-wind conditions the problem of aquaplaning from poor drainage is apt to be accentuated. In Attachment A, Section 7, information is given concerning this problem and other relevant factors.

3.1.20 The transverse slope shall be substantially the same throughout the length of a runway except at an intersection with another runway or a taxiway where an even transition shall be provided taking account of the need for adequate drainage.

Note: Guidance on transverse slope is given in the CARC Guidance Material Pavement Design 34/PAVD.

Strength of runways

3.1.21 A runway shall be capable of withstanding the traffic of airplanes the runway is intended to serve.

Surface of runways

3.1.22 The surface of a runway shall be constructed without irregularities that would impair the runway surface friction characteristics or otherwise adversely affect the take-off or landing of an airplane.

Note 1: Surface irregularities may adversely affect the take-off or landing of an airplane by causing excessive bouncing, pitching, vibration, or other difficulties in the control of an airplane.

Note 2: Guidance on design tolerances and other information is given in Attachment A, Section 5. Additional guidance is included in the CARC Guidance Material Pavement Design 34/PAVD.

3.1.23 A paved runway shall be so constructed or resurfaced as to provide surface friction at or above the minimum friction level set by CARC.

3.1.24 The surface of a paved runway shall be evaluated when constructed or resurfaced to determine that the surface friction characteristics achieve the design objectives.

Note: Guidance on surface friction characteristics of a new or resurfaced runway is given in Attachment A, Section 7. Additional guidance is included in the CARC Guidance Material Pavement Surface Condition 34/PSC.

3.1.25 Measurements of the surface friction characteristics of a new or resurfaced paved runway shall be made with a continuous friction measuring device using self-wetting features.

Note: Guidance on surface friction characteristics of new runway surfaces is given in Attachment A, Section 7. Additional guidance is included in the CARC Guidance Material Pavement Surface Condition 34/PSC.

3.1.26 The average surface texture depth of a new surface shall be not less than 1.0 mm.

Macrotexture and microtexture are taken into consideration in order to provide the required surface friction characteristics.

Note 1: Guidance on surface design is given in Attachment A, Section 8.

Note 2: Guidance on methods used to measure surface texture is given in the CARC Guidance Material Pavement Surface Condition 34/PSC.

Note 3: Guidance on design and methods for improving surface texture is given in the CARC Guidance Material Pavement Design 34/PAVD.

3.1.27 When the surface is grooved or scored, the grooves or scorings shall be either perpendicular to the runway center line or parallel to non-perpendicular transverse joints, where applicable.

Note: Guidance on methods for improving the runway surface texture is given in the CARC Guidance Material Pavement Surface Condition 34/PSC.

3.2 RUNWAY SHOULDERS

General

Note: Guidance on characteristics and treatment of runway shoulders is given in Attachment A, Section 9, and in the CARC Guidance Material Runway Design 34/RWYD.

3.2.1 Runway shoulders shall be provided for a runway where the code letter is D or F.

Width of runway shoulders

3.2.2 For aeroplanes with OMGWS from 9 m up to but not including 15 m, the runway shoulders shall extend symmetrically on each side of the runway so that the overall width of the runway and its shoulders is not less than:

— 60 m where the code letter is D or E;
— 60 m where the code letter is F with two- or three-engined aeroplanes; and
— 75 m where the code letter is F *with four (or more)-engined aeroplanes*.

Slopes on runway shoulders

3.2.3 The surface of the shoulder that abuts the runway shall be flush with the surface of the runway and its transverse slope shall not exceed 2.5 per cent.

Strength of runway shoulders

3.2.4 The portion of a runway shoulder between the runway edge and a distance of 30 m from the runway centreline shall be prepared or constructed so as to be capable, in the event of an airplane running off the runway, of supporting the airplane without inducing structural damage to the airplane and of supporting ground vehicles which may operate on the shoulder.

Note: Guidance on strength of runway shoulder is given in the CARC Guidance Material Runway Design 34/RWYD.

Surface of runway shoulders

3.2.5 A runway shoulder shall be prepared or constructed so as to resist erosion and the ingestion of the surface material by aeroplane engines.

3.2.6 Runway shoulders for code letter F aeroplanes shall be paved to a minimum overall width of runway and shoulder of not less than 60 m.

Note: Guidance on surface of runway shoulders is given in CARC Manual 34/RWYD.

3.3 RUNWAY TURN PADS

General

3.3.1 Where the end of a runway is not served by a taxiway or a taxiway turnaround, a runway turn pad shall be provided to facilitate a 180-degree turn of airplanes. (See Figure 3-1).

3.3.2 Reserved.

Note 1: Such areas may also be useful if provided along a runway to reduce taxiing time and distance for airplanes which may not require the full length of the runway.

Note 2: Guidance on the design of the runway turn pads is available in the CARC Guidance Material Runway Design 34/RWYD. Guidance on taxiway turnaround as an alternate facility is available in the CARC Guidance Material Taxiways, Aprons and Holding Bay Design 34/TAHB.

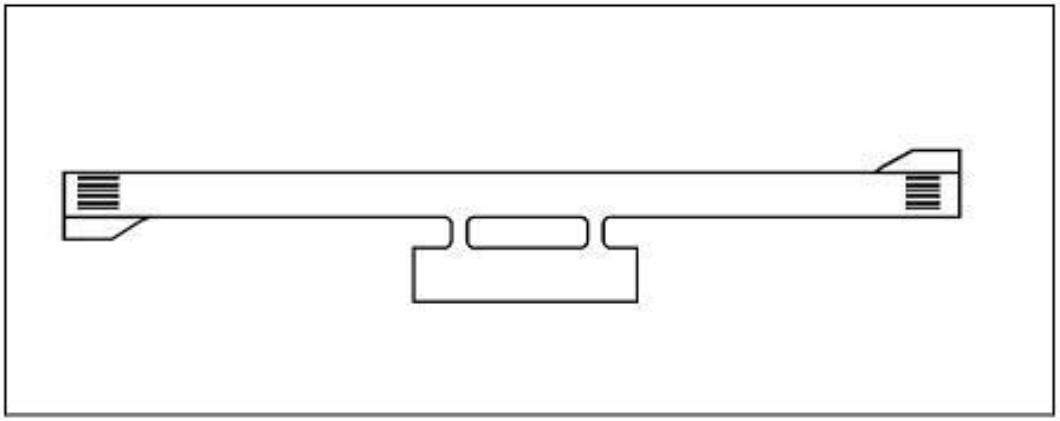

Figure 3-1
Typical turn pad layout

3.3.3 The runway turn pad may be located on either the left or right side of the runway and adjoining the runway pavement at both ends of the runway and at some intermediate locations where deemed necessary.

Note: The initiation of the turn would be facilitated by locating the turn pad on the left side of the runway, since the left seat is the normal position of the pilot-in-command.

3.3.4 The intersection angle of the runway turn pad with the runway shall not exceed 30 degrees.

3.3.5 The nose wheel steering angle to be used in the design of the runway turn pad shall not exceed 45 degrees.

3.3.6 The design of a runway turn pad shall be such that, when the cockpit of the airplane for which the turn pad is intended remains over the turn pad marking, the clearance distance between any wheel of the airplane landing gear and the edge of the turn pad shall be not less than that given by the following tabulation:

OMGWS

	Up to but not including 4.5 m	4.5 m up to but not including 6 m	6 m up to but not including 9 m	9 m up to but not including 15 m
Clearance	1.50 m	2.25 m	3 m[a] or 4 m[b]	4 m

a _ If the turn pad is intended to be used by aeroplanes with a wheel base less than 18 m.
b _ If the turn pad is intended to be used by aeroplanes with a wheel base equal to or greater than 18 m.

Note: Wheel base means the distance from the nose gear to the geometric center of the main gear.

Slopes on runway turn pads

3.3.7 The longitudinal and transverse slopes on a runway turn pad shall be sufficient to prevent the accumulation of water on the surface and facilitate rapid

drainage of surface water. The slopes shall be the same as those on the adjacent runway pavement surface.

Strength of runway turn pads

3.3.8 The strength of a runway turn pad shall be at least equal to that of the adjoining runway which it serves, due consideration being given to the fact that the turn pad will be subjected to slow-moving traffic making hard turns and consequent higher stresses on the pavement.

Note: Where a runway turn pad is provided with flexible pavement, the surface would need to be capable of withstanding the horizontal shear forces exerted by the main landing gear tires during turning maneuvers.

Surface of runway turn pads

3.3.9 The surface of a runway turn pad shall not have surface irregularities that may cause damage to an airplane using the turn pad.

3.3.10 The surface of a runway turn pad shall be so constructed or resurfaced as to provide surface friction characteristics at least equal to that of the adjoining runway.

Shoulders for runway turn pads

3.3.11 The runway turn pads shall be provided with shoulders of such width as is necessary to prevent surface erosion by the jet blast of the most demanding airplane for which the turn pad is intended, and any possible foreign object damage to the airplane engines.

Note: As a minimum, the width of the shoulders would need to cover the outer engine of the most demanding airplane and thus may be wider than the associated runway shoulders.

3.3.12 The strength of runway turn pad shoulders shall be capable of withstanding the occasional passage of the airplane it is designed to serve without inducing structural damage to the airplane and to the supporting ground vehicles that may operate on the shoulder.

3.4 RUNWAY STRIPS

General

3.4.1 A runway and any associated stopways shall be included in a strip.

Length of runway strips

3.4.2 A strip shall extend before the threshold and beyond the end of the runway or stopway for a distance of at least:

— 60 m where the code number is 2, 3 or 4;

— 60 m where the code number is 1 and the runway is an instrument one; and

— 30 m where the code number is 1 and the runway is a non-instrument one.

Width of runway strips

3.4.3 A strip including a precision approach runway shall extend laterally to a distance of at least:

— 140 m where the code number is 3 or 4; and

— 70 m where the code number is 1 or 2;

on each side of the center line of the runway and its extended center line throughout the length of the strip.

3.4.4 A strip including a non-precision approach runway shall extend laterally to a distance of at least:

— 140 m where the code number is 3 or 4; and

— 70 m where the code number is 1 or 2;

on each side of the center line of the runway and its extended center line throughout the length of the strip.

3.4.5 A strip including a non-instrument runway shall extend on each side of the center line of the runway and its extended center line throughout the length of the strip, to a distance of at least:

— 75 m where the code number is 3 or 4;

— 40 m where the code number is 2; and

— 30 m where the code number is 1.

Objects on runway strips

Note: Refer to Chapter 9 section 9.9 for information regarding siting of equipment and installations on runway strips.

3.4.6 An object situated on a runway strip which may endanger airplanes shall be regarded as an obstacle and shall be removed.

Note 1: Consideration will have to be given to the location and design of drains on a runway strip to prevent damage to an aeroplane accidentally running off a runway. Suitably designed drain covers may be required. For further guidance, see the CARC Guidance Material Runway Design 34/RWYD.

Note 2: Where open-air or covered storm water conveyances are installed, consideration will have to be given to ensure that their structure does not extend above the surrounding ground so as not to be considered an obstacle. See also Note 1 to 3.4.16.

Note 3: Particular attention needs to be given to the design and maintenance of an open-air storm water conveyance in order to prevent wildlife attraction, notably birds. If needed, it can be covered by a net. Guidance on Wildlife Control and Reduction can be found in the CARC Guidance Material Wildlife Control and Reduction 34/WLCR.

3.4.7 No fixed object, other than visual aids required for air navigation or those required for aircraft safety purposes and which must be sited on the runway strip, and satisfying the relevant frangibility requirement in Chapter 5, shall be permitted on a runway strip:

a) within 77.5 m of the runway center line of a precision approach runway category I, II or III where the code number is 4 and the code letter is F; or

b) within 60 m of the runway center line of a precision approach runway category I, II or III where the code number is 3 or 4; or

c) within 45 m of the runway center line of a precision approach runway category I where the code number is 1 or 2.

No mobile object shall be permitted on this part of the runway strip during the use of the runway for landing or take-off.

Grading of runway strips

3.4.8 That portion of a strip of an instrument runway within a distance of at least:

—75 m where the code number is 3 or 4; and

—40 m where the code number is 1 or 2;

from the center line of the runway and its extended center line shall provide a graded area for airplanes which the runway is intended to serve in the event of an airplane running off the runway.

Note: Guidance on grading of a greater area of a strip including a precision approach runway where the code number is 3 or 4 is given in Attachment A, Section 8.

3.4.9 That portion of a strip of a non-instrument runway within a distance of at least:

—75 m where the code number is 3 or 4;

—40 m where the code number is 2; and

—30 m where the code number is 1;

from the center line of the runway and its extended center line shall provide a graded area for airplanes which the runway is intended to serve in the event of an airplane running off the runway.

3.4.10 The surface of that portion of a strip that abuts a runway, shoulder or stopway shall be flush with the surface of the runway, shoulder or stopway.

3.4.11 That portion of a strip to at least 60 m before the start of a runway shall be prepared against blast erosion in order to protect a landing airplane from the danger of an exposed edge.

Note 1: The area provided to reduce the erosive effects of jet blast and propeller wash may be referred to as a blast pad.

Note 2: Guidance on protection against aeroplane engine blast is available in CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

3.4.12 Where the areas in 4.11 have paved surfaces, they shall be able to withstand the occasional passage of the critical aeroplane for runway pavement design.

Slopes on runway strips

3.4.13 Longitudinal slopes

A longitudinal slope along that portion of a strip to be graded shall not exceed:

—1.5 per cent where the code number is 4;

—1.75 per cent where the code number is 3; and

—2 per cent where the code number is 1 or 2.

3.4.14 Longitudinal slope changes

Slope changes on that portion of a strip to be graded shall be as gradual as practicable and abrupt changes or sudden reversals of slopes avoided.

3.4.15 Transverse Slopes

Transverse slopes on that portion of a strip to be graded shall be adequate to prevent the accumulation of water on the surface but shall not exceed:

—2.5 per cent where the code number is 3 or 4; and

—3 per cent where the code number is 1 or 2;

except that to facilitate drainage the slope for the first 3 m outward from the runway, shoulder or stopway edge shall be negative as measured in the direction away from the runway and may be as great as 5 per cent.

3.4.16 The transverse slopes of any portion of a strip beyond that to be graded shall not exceed an upward slope of 5 per cent as measured in the direction away from the runway.

Note 1: Where deemed necessary for proper drainage, an open-air storm water conveyance may be allowed in the non-graded portion of a runway strip and would be placed as far as practicable from the runway.

Note 2: The aerodrome RFF procedure would need to take into account the location of open-air water conveyances within the non-graded portion of a runway strip.

Strength of runway strips

3.4.17 That portion of a strip of an instrument runway within a distance of at least:

— 75 m where the code number is 3 or 4; and

— 40 m where the code number is 1 or 2;

from the center line of the runway and its extended center line shall 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.

Note: Guidance on preparation of runway strips is given in the CARC Guidance Material Runway Design 34/RWYD.

3.4.18 That portion of a strip containing a non-instrument runway within a distance of at least:

— 75 m where the code number is 3 or 4;

— 40 m where the code number is 2; and

— 30 m where the code number is 1;

from the center line of the runway and its extended center line shall 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.

3.5 RUNWAY END SAFETY AREAS

General

3.5.1 A runway end safety area shall be provided at each end of a runway strip where:

a) the code number is 3 or 4; and

b) the code number is 1 or 2 and the runway is an instrument one.

Guidance on runway end safety areas is given in Attachment A, Section 10.

3.5.2 A runway end safety area shall be provided at each end of a runway strip where the code number is 1 or 2 and the runway is a non-instrument one.

Dimensions of runway end safety areas

3.5.3 Reserved.

3.5.4 A runway end safety area shall extend from the end of a runway strip to a distance of at least:

a) 240 m where the code number is 3,or 4; or a reduced length when an arresting system is installed;

b) 120 m where the code number is 1, or 2 and the runway is an instrument one; or a reduced length when an arresting system is installed; and

c) 30 m where the code number is 1 or 2 and the runway is a non-instrument one.

3.5.5 Reserved.

3.5.6 The width of a runway end safety area shall be equal to that of the graded portion of the associated runway strip.

Objects on runway end safety areas

Note: Refer to Chapter 9 section 9.9 for information regarding siting of equipment and installations on runway end safety areas.

3.5.7 An object situated on a runway end safety area which may endanger airplanes shall be regarded as an obstacle and shall be removed.

Clearing and grading of runway end safety areas

3.5.8 A runway end safety area shall provide a cleared and graded area for airplanes which the runway is intended to serve in the event of an airplane undershooting or overrunning the runway.

Slopes on runway end safety areas

3.5.9 General

The slopes of a runway end safety area shall be such that no part of the runway end safety area penetrates the approach or take-off climb surface.

3.5.10 Longitudinal slopes

The longitudinal slopes of a runway end safety area shall not exceed a downward slope of 5 per cent. Longitudinal slope changes shall be gradual and abrupt changes or sudden reversals of slopes avoided.

3.5.11 Transverse slopes

The transverse slopes of a runway end safety area shall not exceed an upward or downward slope of 5 per cent. Transitions between differing slopes shall be gradual.

Strength of runway end safety areas

3.5.12 A runway end safety area shall be so prepared or constructed as to reduce the risk of damage to an airplane undershooting or overrunning the runway, enhance airplane deceleration and facilitate the movement of rescue and fire fighting vehicles as required in Chapter 9 Sections 9.2.34 to 9.2.36.

Note: Guidance on strength of a runway end safety area is given in the CARC Guidance Material Runway Design 34/RWYD.

3.6 CLEARWAYS

Note: Attachment A, Section 2 provides information on the use of clearways.

Location of clearways

3.6.1 The origin of a clearway shall be at the end of the take-off run available.

Length of clearways

3.6.2 The length of a clearway shall not exceed half the length of the take-off run available.

Width of clearways

3.6.3 A clearway shall extend laterally to a distance of at least 75 m on each side of the extended center line of the runway.

Slopes on clearways

3.6.4 The ground in a clearway shall not project above a plane having an upward slope of 1.25 per cent, the lower limit of this plane being a horizontal line which:

a) is perpendicular to the vertical plane containing the runway center line; and

b) passes through a point located on the runway center line at the end of the take-off run available.

Note: Because of transverse or longitudinal slopes on a runway, shoulder or strip, in certain cases the lower limit of the clearway plane specified above may be below the corresponding elevation of the runway, shoulder or strip. It is not intended that these surfaces be graded to conform with the lower limit of the clearway plane nor is it intended that terrain or objects which are above the clearway plane beyond the end of the strip but below the level of the strip be removed unless it is considered they may endanger airplanes.

3.6.5 Abrupt upward changes in slope shall be avoided when the slope on the ground in a clearway is relatively small or when the mean slope is upward. In such situations, in that portion of the clearway within a distance of 22.5 m or half the runway width whichever is greater on each side of the extended center line, the slopes, slope changes and the transition from runway to clearway shall conform with those of the runway with which the clearway is associated.

Objects on clearways

Note: Refer to Chapter section 9.9 for information regarding siting of equipment and installations on clearways.

3.6.6 An object situated on a clearway which may endanger airplanes in the air shall be regarded as an obstacle and shall be removed.

3.7 STOPWAYS

Note: Attachment A, Section 2 provides information on the use of stopways.

Width of stopways

3.7.1 A stopway shall have the same width as the runway with which it is associated.

Slopes on stopways

3.7.2 Slopes and changes in slope on a stopway, and the transition from a runway to a stopway, shall comply with the specifications of Chapter 3 paragraphs 3.1.13 to 3.1.19 for the runway with which the stopway is associated except that:

a) the limitation in Chapter 3 paragraph 3.1.14 of a 0.8 per cent slope for the first and last quarter of the length of a runway need not be applied to the stopway; and

b) at the junction of the stopway and runway and along the stopway the maximum rate of slope change may be 0.3 per cent per 30 m (minimum radius of curvature of 10 000 m) for a runway where the code number is 3 or 4.

Strength of stopways

3.7.3 A stopway shall be prepared or constructed so as to be capable, in the event of an abandoned take-off, of supporting the airplane which the stopway is intended to serve without inducing structural damage to the airplane.

Note: Attachment A, Section 2 presents guidance relative to the support capability of a stopway.

Surface of stopways

3.7.4 The surface of a paved stopway shall be so constructed or resurfaced as to provide surface friction characteristics at or above those of the associated runway.

3.8 RADIO ALTIMETER OPERATING AREA

General

3.8.1 As of 31 December 2008, a radio altimeter operating area shall be established in the pre-threshold area of a precision approach runway.

Length of the area

3.8.2 A radio altimeter operating area shall extend before the threshold for a distance of at least 300 m.

Width of the area

3.8.3 A radio altimeter operating area shall extend laterally, on each side of the extended center line of the runway, to a distance of 60 m, except that, when special circumstances so warrant, the distance may be reduced to no less than 30 m if an aeronautical study indicates that such reduction would not affect the safety of operations of aircraft.

Longitudinal slope changes

3.8.4 On a radio altimeter operating area, slope changes shall be avoided or kept to a minimum. Where slope changes cannot be avoided, the slope changes shall be as gradual as practicable and abrupt changes or sudden reversals of slopes avoided. The rate of change between two consecutive slopes shall not exceed 2 per cent per 30 m.

Note: Guidance on radio altimeter operating area is given in Attachment A, Section 4.3.

3.9 TAXIWAYS

Unless otherwise indicated the requirements in this section are applicable to all types of taxiways.

Note: See Attachment A, Section 22 for specific taxiway design guidance which may assist in the prevention of runway incursions when developing a new taxiway or improving existing ones with a known runway incursion safety risk.

General

3.9.1 Taxiways shall be provided, as dictated by operational requirements, to permit the safe and expeditious surface movement of aircraft.

Note: Guidance on layout of taxiways is given in the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

3.9.2 Sufficient entrance and exit taxiways for a runway shall be provided to expedite the movement of airplanes to and from the runway and provision of rapid exit taxiways considered when traffic volumes are high.

3.9.3 The design of a taxiway shall be such that, when the cockpit of the airplane for which the taxiway is intended remains over the taxiway center line markings, the clearance distance between the outer main wheel of the airplane and the edge of the taxiway shall be not less than that given by the following tabulation:

OMGWS

	Up to but not including 4.5 m	4.5 m up to but not including 6 m	6 m up to but not including 9 m	9 m up to but not including 15 m
Clearance	1.50 m	2.25 m	3 ma, b or 4 mc	4 m

a On straight portions.
b On curved portions if the taxiway is intended to be used by aeroplanes with a wheel base of less than 18 m.
c On curved portions if the taxiway is intended to be used by aeroplanes with a wheel base equal to or greater than 18 m.

Note: Wheel base means the distance from the nose gear to the geometric center of the main gear.

Width of taxiways

3.9.4 A straight portion of a taxiway shall have a width of not less than that given by the following tabulation:

Code letter	Taxiway width
A	7.5 m
B	10. 50 m
C	15 m
D	18 m if the taxiway is intended to be used by airplanes with an outer main gear wheel span of less than 9 m; 23 m if the taxiway is intended to be used by airplanes with an outer main gear wheel span equal to or greater than 9 m
E	23 m
F	25 m

Note: Guidance on width of taxiways is given in the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

Taxiway curves

3.9.5 Changes in direction of taxiways shall be as few and small as possible. The radii of the curves shall be compatible with the maneuvering capability and normal taxiing speeds of the airplanes for which the taxiway is intended. The design of the curve shall be such that, when the cockpit of the airplane remains over the taxiway center line markings, the clearance distance between the outer main wheels of the airplane and the edge of the taxiway shall not be less than those specified in 3.9.3.

Note 1: An example of widening taxiways to achieve the wheel clearance specified is illustrated in Figure 3-2. Guidance on the values of suitable dimensions is given in the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

Note 2: The location of taxiway center line markings and lights is specified in Chapter 5 paragraphs 5.2.8.4 and 5.3.16.11.

Note 3: Compound curves may reduce or eliminate the need for extra taxiway width.

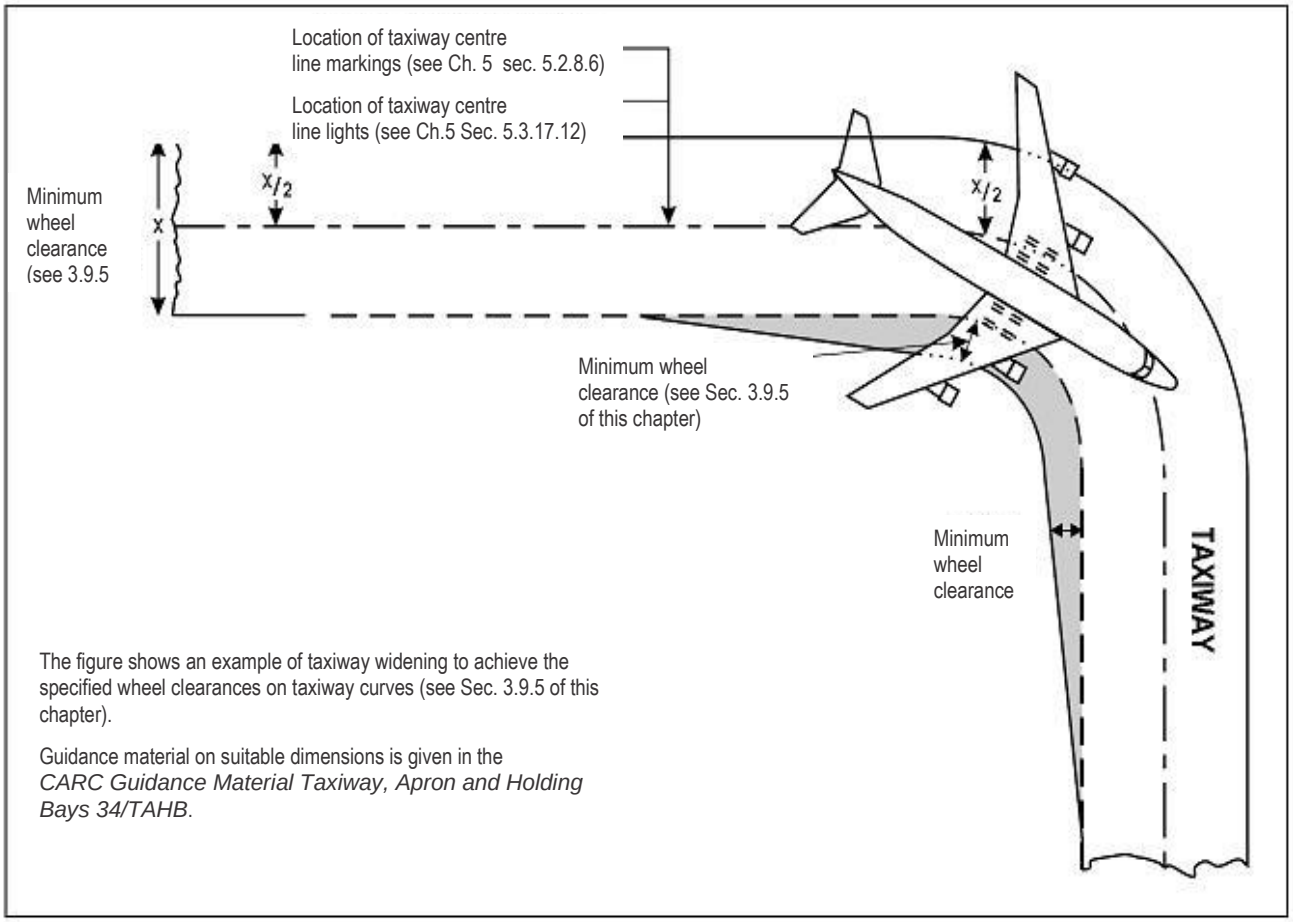

Figure 3-2
Taxiway curve

Junctions and intersections

3.9.6 To facilitate the movement of airplanes, fillets shall be provided at junctions and intersections of taxiways with runways, aprons and other taxiways. The design of the fillets shall ensure that the minimum wheel clearances specified in 3.9.3 are maintained when airplanes are maneuvering through the junctions or intersections.

Note: Consideration will have to be given to the airplane datum length when designing fillets. Guidance on the design of fillets and the definition of the term airplane datum length are given in the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

Taxiway minimum separation distances

3.9.7 The separation distance between the center line of a taxiway and the center line of a runway, the center line of a parallel taxiway or an object shall not be less than the appropriate dimension specified in Table 3-1, except that it may be permissible to operate with lower separation distances at an existing aerodrome if an aeronautical study indicates that such lower separation distances would not adversely affect the safety or significantly affect the regularity of operations of airplanes.

Note 1: Guidance on factors which may be considered in the aeronautical study is given in the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

Note 2: ILS and MLS installations may also influence the location of taxiways due to interferences to ILS and MLS signals by a taxiing or stopped aircraft. Information on critical and sensitive areas surrounding ILS and MLS installations is contained in ICAO Annex 10, Volume I, Attachments C and G (respectively).

Note 3: The separation distances of Table 3-1, column 10, do not necessarily provide the capability of making a normal turn from one taxiway to another parallel taxiway. Guidance for this condition is given in the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

Note 4: The separation distance between the center line of an aircraft stand taxilane and an object shown in Table 3-1, column 12, may need to be increased when jet exhaust wake velocity may cause hazardous conditions for ground servicing.

Slopes on taxiways

3.9.8 Longitudinal slopes

The longitudinal slope of a taxiway shall not exceed:

— 1.5 per cent where the code letter is C, D, E or F; and

— 3 per cent where the code letter is A or B.

3.9.9 Longitudinal slope changes

Where slope changes on a taxiway cannot be avoided, the transition from one slope to another slope shall be accomplished by a curved surface with a rate of change not exceeding:

— 1 per cent per 30 m (minimum radius of curvature of 3 000 m) where the code letter is C, D, E or F; and

— 1 per cent per 25 m (minimum radius of curvature of 2 500 m) where the code letter is A or B.

3.9.10 Sight distance

Where a change in slope on a taxiway cannot be avoided, the change shall be such that, from any point:

— 3 m above the taxiway, it will be possible to see the whole surface of the taxiway for a distance of at least 300 m from that point, where the code letter is C, D, E or F;

Table 3-1
Taxiway minimum separation distances

Code letter	Distance between taxiway center line and runway center line (meter)								Taxiway center line to taxiway center line	Taxiway (other than aircraft stand taxilane) center line to object	Aircraft stand taxilane centre line to aircraft stand taxilane centre line	Aircraft stand taxilane center line to object
	Instrument runways Code number				Non-instrument runways Code number							
	1	2	3	4	1	2	3	4	(meter)	(meter)	(meter)	(meter)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A	77.5	77.5	-	-	87.5	47.5	-	-	23	15.5	19.5	12
B	82	82		-	42	52	87	-	23	20	28.5	16.5
C	88	88	158		48	58	93	93	44	26	40.5	22.5
D	-	-	166	166	-	-	101	101	63	37	59.5	33.5
E	-	-	172.5	172.5	-	-	107.5	107.5	76	43.5	72.5	40
F	-	-	180	180	-	-	115	115	91	51	87.5	47.5

The separation distances shown in columns (2) to (9) represent ordinary combinations of runways and taxiways. The basis for development of these distances is given in the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

The distances in columns (2) to (9) do not guarantee sufficient clearance behind a holding airplane to permit the passing of another airplane on a parallel taxiway. Refer to the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

— 2 m above the taxiway, it will be possible to see the whole surface of the taxiway for a distance of at least 200 m from that point, where the code letter is B; and

— 1.5 m above the taxiway, it will be possible to see the whole surface of the taxiway for a distance of at least 150 m from that point, where the code letter is A.

3.9.11 Transverse slopes

The transverse slopes of a taxiway shall be sufficient to prevent the accumulation of water on the surface of the taxiway but shall not exceed:

— 1.5 per cent where the code letter is C, D, E or F; and

— 2 per cent where the code letter is A or B.

Note: Refer to 13.4 regarding transverse slopes on an aircraft stand taxilane.

Strength of taxiways

3.9.12 The strength of a taxiway shall be at least equal to that of the runway it serves, due consideration being given to the fact that a taxiway will be subjected to a greater density of traffic and, as a result of slow moving and stationary airplanes, to higher stresses than the runway it serves.

Note: Guidance on the relation of the strength of taxiways to the strength of runways is given in the CARC Guidance Material Pavement Design 34/PAVD.

Surface of taxiways

3.9.13 The surface of a taxiway shall not have irregularities that cause damage to airplane structures.

3.9.14 The surface of a paved taxiway shall be so constructed or resurfaced as to provide suitable surface friction characteristics.

Note: Suitable surface friction characteristics are those surface properties required on taxiways that assure safe operation of aeroplanes.

Rapid exit taxiways

Note: The following specifications detail requirements particular to rapid exit taxiways. See Figure 3-3. General requirements for taxiways also apply to this type of taxiway. Guidance on the provision, location and design of rapid exit taxiways is included in the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

3.9.15 A rapid exit taxiway shall be designed with a radius of turn-off curve of at least:

— 550 m where the code number is 3 or 4; and

— 275 m where the code number is 1 or 2;

To enable exit speeds under wet conditions of:

— 93 km/h where the code number is 3 or 4; and

— 65 km/h where the code number is 1 or 2.

Note: The locations of rapid exit taxiways along a runway are based on several criteria described in the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB, in addition to different speed criteria.

3.9.16 The radius of the fillet on the inside of the curve at a rapid exit taxiway shall be sufficient to provide a widened taxiway throat in order to facilitate early recognition of the entrance and turn-off onto the taxiway.

3.9.17 A rapid exit taxiway shall include a straight distance after the turn-off curve sufficient for an exiting aircraft to come to a full stop clear of any intersecting taxiway.

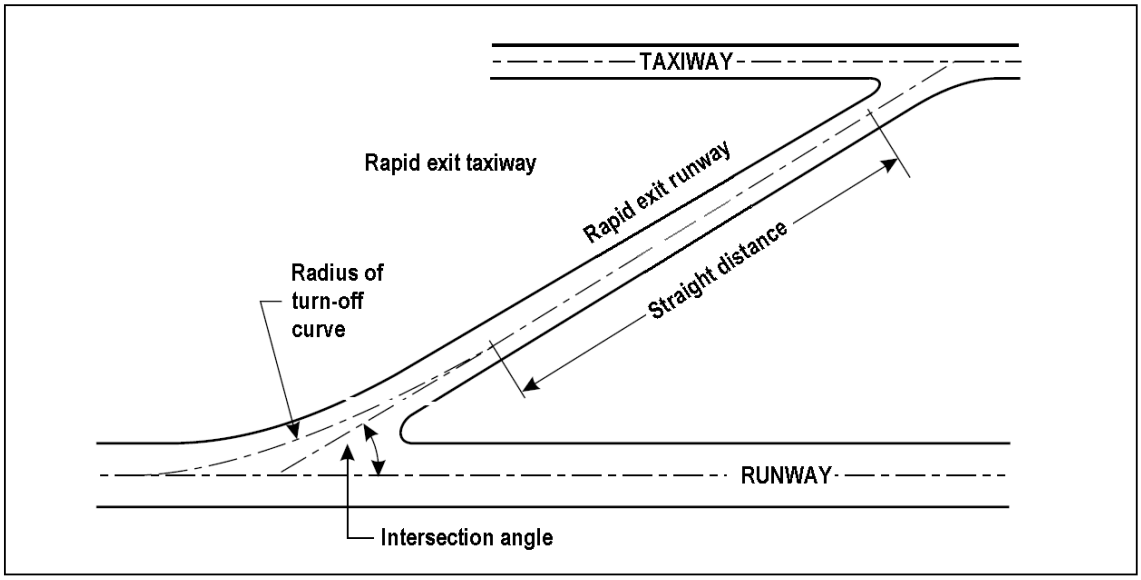

Figure 3-3
Rapid exit taxiway

3.9.18 The intersection angle of a rapid exit taxiway with the runway shall not be greater than 45° nor less than 25° and preferably shall be 30°.

Taxiways on bridges

3.9.19 The width of that portion of a taxiway bridge capable of supporting airplanes, as measured perpendicularly to the taxiway center line, shall not be less than the

width of the graded area of the strip provided for that taxiway, unless a proven method of lateral restraint is provided which shall not be hazardous for airplanes for which the taxiway is intended.

3.9.20 Access shall be provided to allow rescue and fire fighting vehicles to intervene in both directions within the specified response time to the largest airplane for which the taxiway bridge is intended.

Note: If airplane engines overhang the bridge structure, protection of adjacent areas below the bridge from engine blast is required.

3.9.21 A bridge shall be constructed on a straight section of the taxiway with a straight section on both ends of the bridge to facilitate the alignment of airplanes approaching the bridge.

3.10 TAXIWAY SHOULDERS

Note: Guidance on characteristics of taxiway shoulders and on shoulder treatment is given in the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

3.10.1 Straight portions of a taxiway where the code letter is C, D, E or F shall be provided with shoulders which extend symmetrically on each side of the taxiway so that the overall width of the taxiway and its shoulders on straight portions is not less than:

- 44 m where the code letter is F;
- 38 m where the code letter is E;
- 34 m where the code letter is D; and
- 25 m where the code letter is C.

On taxiway curves and on junctions or intersections where increased pavement is provided, the shoulder width shall be not less than that on the adjacent straight portions of the taxiway.

3.10.2 When a taxiway is intended to be used by turbine-engined airplanes, the surface of the taxiway shoulder shall be so prepared as to resist erosion and the ingestion of the surface material by airplane engines.

3.11 TAXIWAY STRIPS

Note: Guidance on characteristics of taxiway strips is given in the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

General

3.11.1 A taxiway, other than an aircraft stand taxilane, shall be included in a strip.

Width of taxiway strips

3.11.2 A taxiway strip shall extend symmetrically on each side of the center line of the taxiway throughout the length of the taxiway to at least the distance from the center line given in Table 3-1, column 11.

Objects on taxiway strips

Note: Refer to Chapter 9 section 9.9 for information regarding siting of equipment and installations on taxiway strips.

3.11.3 The taxiway strip shall provide an area clear of objects which may endanger taxiing airplanes.

Note 1: Consideration shall be given to the location and design of drains on a taxiway strip to prevent damage to an airplane accidentally running off a taxiway. Suitably designed drain covers are required. For further guidance, see the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

Note 2: Where open-air or covered storm water conveyances are installed, consideration will have to be given to ensure that their structure do not extend above the surrounding ground so as not to be considered an obstacle. See also Note 1 to 3.11.6.

Note 3: Particular attention needs to be given to the design and maintenance of an open-air storm water conveyance in order to prevent wildlife attraction, notably birds. If needed, it can be covered by a net. Guidance on Wildlife Control and Reduction can be found in the CARC Guidance Material Wildlife Reduction and Control 34/WLCR.

Grading of taxiway strips

3.11.4 The center portion of a taxiway strip shall provide a graded area to a distance from the center line of the taxiway of not less than that given by the following tabulation:

- 10.25 m where the OMGWS is up to but not including 4.5 m.
- 11 m where the OMGWS is 4.5 m up to but not including 6 m.
- 12.50 m where the OMGWS is 6 m up to but not including 9 m.
- 18.50 m where the OMGWS is 9 m up to but not including 15 m, where the code letter is D.
- 19 m where the OMGWS is 9 m up to but not including 15 m, where the code letter is E.

— 22 m where the OMGWS is 9 m up to but not including 15 m, where the code letter is F.

Note: Guidance on width of the graded portion of a taxiway is given in CARC Guidance material 34/TAHB.

Slopes on taxiway strips

3.11.5 The surface of the strip shall be flush at the edge of the taxiway or shoulder, if provided, and the graded portion shall not have an upward transverse slope exceeding:

— 2.5 per cent for strips where the code letter is C, D, E or F; and

— 3 per cent for strips of taxiways where the code letter is A or B;

the upward slope being measured with reference to the transverse slope of the adjacent taxiway surface and not the horizontal. The downward transverse slope shall not exceed 5 per cent measured with reference to the horizontal.

3.11.6 The transverse slopes on any portion of a taxiway strip beyond that to be graded shall not exceed an upward or downward slope of 5 per cent as measured in the direction away from the taxiway.

Note 1: Where deemed necessary for proper drainage, an open-air storm water conveyance may be allowed in the non-graded portion of a taxiway strip and would be placed as far as practicable from the taxiway.

Note 2: The aerodrome RFF procedure would need to take into account the location of open-air storm water conveyances within the non-graded portion of a taxiway strip.

3.12 HOLDING BAYS, RUNWAY-HOLDING POSITIONS, INTERMEDIATE HOLDING POSITIONS AND ROAD-HOLDING POSITIONS

General

3.12.1 Holding bay(s) shall be provided when the traffic density is medium or heavy.

3.12.2 A runway-holding position or positions shall be established:

a) on the taxiway, at the intersection of a taxiway and a runway; and

b) at an intersection of a runway with another runway when the former runway is part of a standard taxi-route.

3.12.3 A runway-holding position shall be established on a taxiway if the location or alignment of the taxiway is such that a taxiing aircraft or vehicle can infringe an obstacle limitation surface or interfere with the operation of radio navigation aids.

3.12.4 An intermediate holding position shall be established on a taxiway at any point other than a runway-holding position where it is desirable to define a specific holding limit.

3.12.5 A road-holding position shall be established at an intersection of a road with a runway.

Location

3.12.6 The distance between a holding bay, runway-holding position established at a taxiway/runway intersection or road-holding position and the center line of a runway shall be in accordance with Table 3-2 and, in the case of a precision approach runway, such that a holding aircraft or vehicle will not interfere with the operation of radio navigation aids.

3.12.7 At elevations greater than 700 m (2 300 ft) the distance of 90 m specified in Table 3-2 for a precision approach runway code number 4 shall be increased as follows:

a) up to an elevation of 2 000 m (6 600 ft); 1 m for every 100 m (330 ft) in excess of 700 m (2 300 ft);

b) elevation in excess of 2 000 m (6 600 ft) and up to 4 000 m (13 320 ft); 13 m plus 1.5 m for every 100 m (330 ft) in excess of 2 000 m (6 600 ft); and

c) elevation in excess of 4 000 m (13 320 ft) and up to 5 000 m (16 650 ft); 43 m plus 2 m for every 100 m (330 ft) in excess of 4 000 m (13 320 ft).

3.12.8 If a holding bay, runway-holding position or road-holding position for a precision approach runway code number 4 is at a greater elevation compared to the threshold, the distance of 90 m or 107.5 m, as appropriate, specified in Table 3-2 shall be further increased 5 m for every meter the bay or position is higher than the threshold.

3.12.9 The location of a runway-holding position established in accordance with 3.12.3 shall be such that a holding aircraft or vehicle will not infringe the obstacle free zone, approach surface, take-off climb surface or ILS/MLS critical/sensitive area or interfere with the operation of radio navigation aids.

Table 3-2
Minimum distance from the runway center line
to a holding bay, runway-holding position or road-holding position

Type of runway	Code number 1	2	3	4
Non-instrument	30 m	40 m	75 m	75 m
Non-precision approach	40 m	40 m	75 m	75 m
Precision approach category I	60 m [b]	60 m [b]	90 m [a, b]	90 m [a, b, c]
Precision approach categories II and III	-	-	90 m [a, b]	90 m [a, b, c]
Take-off runway	30 m	40 m	75 m	75 m

a. If a holding bay, runway-holding position or road-holding position is at a lower elevation compared to the threshold, the distance may be decreased °m for every meter the bay or holding position is lower than the threshold, contingent upon not infringing the inner transitional surface.

b. This distance may need to be increased to avoid interference with radio navigation aids, particularly the glide path and localizer facilities. Information on critical and sensitive areas of ILS and MLS is contained in Annex 10, Volume I, Attachments C and G, respectively (see also 3.12.6)

Note 1: The distance of 90 m for code number 3 or 4 is based on an aircraft with a tail height of 20 m, a distance from the nose to the highest part of the tail of 52.7 m and a nose height of 10 m holding at an angle of 45° or more with respect to the runway centerline, being clear of the obstacle free zone and not accountable for the calculation of OCA/H.

Note 2: The distance of 60 m for code number 2 is based on an aircraft with a tail height of 8 m, a distance from the nose to the highest part of the tail of 24.6 m and a nose height of 5.2 m holding at an angle of 45° or more with respect to the runway centerline, being clear of the obstacle free zone.

c. Where the code letter is F, this distance shall be 107.5 m.

Note: The distance of 107.5 m for code number 4 where the code letter is F is based on an aircraft with a tail height of 24 m, a distance from the nose to the highest part of the tail of 62.2 m and a nose height of 10 m holding at an angle of 45° or more with respect to the runway centerline, being clear of the obstacle free zone.

3.13 APRONS

General

3.13.1 Aprons shall be provided where necessary to permit the on- and off-loading of passengers, cargo or mail as well as the servicing of aircraft without interfering with the aerodrome traffic.

Size of aprons

3.13.2 The total apron area shall be adequate to permit expeditious handling of the aerodrome traffic at its maximum anticipated density.

Strength of aprons

3.13.3 Each part of an apron shall be capable of withstanding the traffic of the aircraft it is intended to serve, due consideration being given to the fact that some portions of the apron will be subjected to a higher density of traffic and, as a result of slow moving or stationary aircraft, to higher stresses than a runway.

Slopes on aprons

3.13.4 Slopes on an apron, including those on an aircraft stand taxilane, shall be sufficient to prevent accumulation of water on the surface of the apron but shall be kept as level as drainage requirements permit.

3.13.5 On an aircraft stand the maximum slope shall not exceed 1 per cent.

Clearance distances on aircraft stands

3.13.6 An aircraft stand shall provide the following minimum clearances between an aircraft entering or exiting the stand and any adjacent building, aircraft on another stand and other objects:

Code letter	Clearance
A	3 m
B	3 m
C	4.5 m
D	7.5 m
E	7.5 m
F	7.5 m

When special circumstances so warrant, these clearances may be reduced at a nose-in aircraft stand, where the code letter is D, E or F:

a) between the terminal, including any fixed passenger bridge, and the nose of an aircraft; and

b) over any portion of the stand provided with azimuth guidance by a visual docking guidance system.

Note: On aprons, consideration also has to be given to the provision of service roads and to maneuvering and storage area for ground equipment (Refer to the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB for guidance on storage of ground equipment).

3.14 ISOLATED AIRCRAFT PARKING POSITION

3.14.1 An isolated aircraft parking position shall be designated or the aerodrome control tower shall be advised of an area or areas suitable for the parking of an aircraft which is known or believed to be the subject of unlawful interference, or which for other reasons needs isolation from normal aerodrome activities.

3.14.2 The isolated aircraft parking position shall be located at the maximum distance practicable and in any case never less than 100 m from other parking positions, buildings or public areas, etc. Care shall be taken to ensure that the position is not located over underground utilities such as gas and aviation fuel and, to the extent feasible, electrical or communication cables.

3.15 DE-ICING/ANTI-ICING FACILITIES

Note: Safe and efficient airplane operations are of primary importance in the development of an airplane deicing/anti-icing facility. For further guidance, refer to the CARC Guidance Material Aircraft De-icing/Anti-icing Operations 34/ADAO.

General

3.15.1 Airplane de-icing/anti-icing facilities shall be provided at an aerodrome where icing conditions are expected to occur.

Location

3.15.2 De-icing/anti-icing facilities shall be provided either at aircraft stands or at specified remote areas along the taxiway leading to the runway meant for take-off, provided that adequate drainage arrangements for the collection and safe disposal of excess de-icing/anti-icing fluids are available to prevent ground water contamination. The effect of volume of traffic and departure flow rates shall also be considered.

Note 1: One of the primary factors influencing the location of a de-icing/anti-icing facility is to ensure that the holdover time of the anti-icing treatment is still in effect at the end of taxiing and when take-off clearance of the treated airplane is given.

Note 2: Remote facilities compensate for changing weather conditions when icing conditions or blowing snow are expected to occur along the taxi route taken by the airplane to the runway meant for take-off.

3.15.3 The remote de-icing/anti-icing facility shall be located to be clear of the obstacle limitation surfaces specified in Chapter 4 of this Part, not cause interference to the radio navigation aids and be clearly visible from the air traffic control tower for clearing the treated airplane.

3.15.4 The remote de-icing/anti-icing facility shall be so located as to provide for an expeditious traffic flow, perhaps with a bypass configuration, and not require unusual taxiing maneuver into and out of the pads.

Note: The jet blast effects caused by a moving airplane on other airplanes receiving the anti-icing treatment or taxiing behind will have to be taken into account to prevent degradation of the treatment.

Size and number of de-icing/anti-icing pads

Note: An airplane de-icing/anti-icing pad consists of:

a) *an inner area for parking of an airplane to be treated, and*

b) *an outer area for movement of two or more mobile de-icing/ anti-icing equipment.*

3.15.5 The size of a de-icing/anti-icing pad shall be equal to the parking area required by the most demanding airplane in a given category with at least 3.8 m clear paved area all round the airplane for the movement of the de-icing/anti-icing vehicles.

Note: Where more than one de-icing/anti-icing pad is provided, consideration will have to be given to providing deicing/anti-icing vehicle movement areas of adjacent pads that do not overlap, but are exclusive for each pad. Consideration will also need to be given to bypassing of the area by other airplanes with the clearances specified in 3.15.9 and 3.15.10.

3.15.6 The number of de-icing/anti-icing pads required shall be determined based on the meteorological conditions, the type of airplanes to be treated, the method of application of de-icing/anti-icing fluid, the type and capacity of the dispensing equipment used, and the departure flow rates.

Note: Refer to the CARC Guidance Material Taxiway, Apron and Holding Bays 34/TAHB.

Slopes on de-icing/anti-icing pads

3.15.7 The de-icing/anti-icing pads shall be provided with suitable slopes to ensure satisfactory drainage of the area and to permit collection of all excess de-icing/anti-icing fluid running off an airplane. The maximum longitudinal slope shall be as little as practicable and the transverse slope shall not exceed 1 per cent.

Strength of de-icing/anti-icing pads

3.15.8 The de-icing/anti-icing pad shall be capable of withstanding the traffic of the aircraft it is intended to serve, due consideration being given to the fact that the de-icing/anti-icing pad (like an apron) will be subjected to a higher density of traffic and, as a result of slow-moving or stationary aircraft, to higher stresses than a runway.

Clearance distances on a de-icing/anti-icing pad

3.15.9 A de-icing/anti-icing pad shall provide the minimum clearances specified in 13.6 for aircraft stands. If the pad layout is such as to include bypass configuration, the minimum separation distances specified in Table 3-1, column 11, shall be provided.

3.15.10 Where the de-icing/anti-icing facility is located adjoining a regular taxiway, the taxiway minimum separation distance specified in Table 3-1, column 11, shall be provided. (See Figure 3-4.)

Environmental considerations

Note: The excess de-icing/anti-icing fluid running off an airplane poses the risk of contamination of ground water in addition to affecting the pavement surface friction characteristics.

3.15.11 Where de-icing/anti-icing activities are carried out, the surface drainage shall be planned to collect the run-off separately, preventing its mixing with the normal surface run-off so that it does not pollute the ground water.

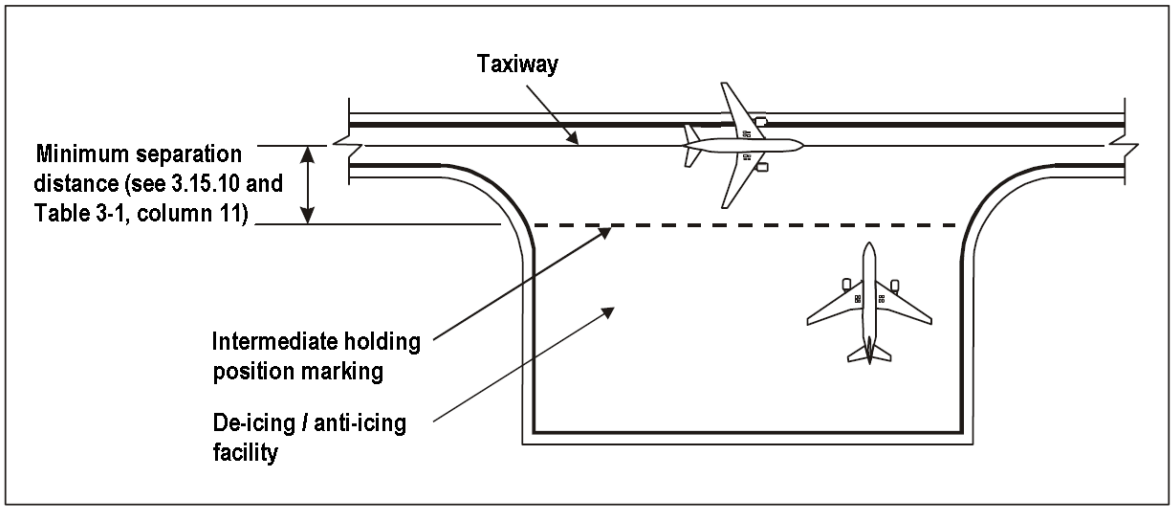

Figure 3-4
Minimum separation distance on a de-icing/anti-icing facility