

CHAPTER (4)

OBSTACLE RESTRICTION AND REMOVAL

The objectives of the specifications in this chapter are to define the airspace around aerodromes to be maintained free from obstacles so as to permit the intended airplane operations at the aerodromes to be conducted safely and to prevent the aerodromes from becoming unusable by the growth of obstacles around the aerodromes. This is achieved by establishing a series of obstacle limitation surfaces that define the limits to which objects may project into the airspace.

Objects which penetrate the obstacle limitation surfaces contained in this chapter may in certain circumstances cause an increase in the obstacle clearance altitude/height for an instrument approach procedure or any associated visual circling procedure or have other operational impact on flight procedure design.

The establishment of, and requirements for, an obstacle protection surface for visual approach slope indicator systems are specified in Chapter 5 paragraph 5.5.41 to 5.5.45.

4.1 OBSTACLE LIMITATION SURFACES

Note: See Figure 4-1.

Outer horizontal surface

Note: Guidance on the need to provide an outer horizontal surface and its characteristics is contained in the CARC Guidance Material Control of Obstacles 34/OBSC.

Conical surface

4.1.1 Description — Conical surface: A surface sloping upwards and outwards from the periphery of the inner horizontal surface.

4.1.2 Characteristics — The limits of the conical surface shall comprise:

- a) a lower edge coincident with the periphery of the inner horizontal surface; and
- b) an upper edge located at a specified height above the inner horizontal surface.

4.1.3 The slope of the conical surface shall be measured in a vertical plane perpendicular to the periphery of the inner horizontal surface.

Inner horizontal surface

4.1.4 **Description** — Inner horizontal surface: A surface located in a horizontal plane above an aerodrome and its environs.

4.1.5 **Characteristics** — The radius or outer limits of the inner horizontal surface shall be measured from a reference point or points established for such purpose.

Note: The shape of the inner horizontal surface need not necessarily be circular. Guidance on determining the extent of the inner horizontal surface is contained in the CARC Guidance Material Control of Obstacles 34/OBSC.

4.1.6 The height of the inner horizontal surface shall be measured above an elevation datum established for such purpose.

Note: Guidance on determining the elevation datum is contained in the CARC Guidance Material Control of Obstacles 34/OBSC.

Approach surface

4.1.7 **Description** — Approach surface: An inclined plane or combination of planes preceding the threshold.

4.1.8 **Characteristics** — The limits of the approach surface shall comprise:

- a) an inner edge of specified length, horizontal and perpendicular to the extended center line of the runway and located at a specified distance before the threshold;
- b) two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended center line of the runway;
- c) an outer edge parallel to the inner edge; and
- d) The above surfaces shall be varied when lateral offset, offset or curved approaches are utilized, specifically, two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended center line of the lateral offset, offset or curved ground track.

4.1.9 The elevation of the inner edge shall be equal to the elevation of the mid-point of the threshold.

4.1.10 The slope(s) of the approach surface shall be measured in the vertical plane containing the center line of the runway and shall continue containing the center line of any lateral offset or curved ground track.

Inner approach surface

4.1.11 **Description** — Inner approach surface: A rectangular portion of the approach surface immediately preceding the threshold.

4.1.12 **Characteristics** — The limits of the inner approach surface shall comprise:

- a) an inner edge coincident with the location of the inner edge of the approach surface but of its own specified length;
- b) two sides originating at the ends of the inner edge and extending parallel to the vertical plane containing the center line of the runway; and
- c) an outer edge parallel to the inner edge.

Transitional surface

4.1.13 **Description** — Transitional surface: A complex surface along the side of the strip and part of the side of the approach surface, that slopes upwards and outwards to the inner horizontal surface.

4.1.14 **Characteristics** — The limits of a transitional surface shall comprise:

- a) a lower edge beginning at the intersection of the side of the approach surface with the inner horizontal surface and extending down the side of the approach surface to the inner edge of the approach surface and from there along the length of the strip parallel to the runway center line; and
- b) an upper edge located in the plane of the inner horizontal surface.

4.1.15 The elevation of a point on the lower edge shall be:

- a) along the side of the approach surface: equal to the elevation of the approach surface at that point; and
- b) along the strip: equal to the elevation of the nearest point on the center line of the runway or its extension.

Note: As a result of b) the transitional surface along the strip will be curved if the runway profile is curved, or a plane if the runway profile is a straight line. The intersection of the transitional surface with the inner horizontal surface will also be a curved or a straight line depending on the runway profile.

4.1.16 The slope of the transitional surface shall be measured in a vertical plane at right angles to the center line of the runway.

Inner transitional surface

Note: It is intended that the inner transitional surface be the controlling obstacle limitation surface for navigation aids, aircraft and other vehicles that must be near the runway and which is not to be penetrated except for frangible objects. The transitional surface described in 1.13 is intended to remain as the controlling obstacle limitation surface for buildings, etc.

4.1.17 Description — Inner transitional surface: A surface similar to the transitional surface but closer to the runway.

4.1.18 Characteristics — The limits of an inner transitional surface shall comprise:

- a) a lower edge beginning at the end of the inner approach surface and extending down the side of the inner approach surface to the inner edge of that surface, from there along the strip parallel to the runway center line to the inner edge of the balked landing surface and from there up the side of the balked landing surface to the point where the side intersects the inner horizontal surface; and
- b) an upper edge located in the plane of the inner horizontal surface.

4.1.19 The elevation of a point on the lower edge shall be:

- a) along the side of the inner approach surface and balked landing surface — equal to the elevation of the particular surface at that point; and
- b) along the strip — equal to the elevation of the nearest point on the center line of the runway or its extension.

Note: As a result of b) the inner transitional surface along the strip will be curved if the runway profile is curved or a plane if the runway profile is a straight line. The intersection of the inner transitional surface with the inner horizontal surface will also be a curved or straight line depending on the runway profile.

4.1.20 The slope of the inner transitional surface shall be measured in a vertical plane at right angles to the center line of the runway.

Balked landing surface

4.1.21 Description — Balked landing surface: An inclined plane located at a specified distance after the threshold, extending between the inner transitional surface.

4.1.22 Characteristics — The limits of the balked landing surface shall comprise:

- a) an inner edge horizontal and perpendicular to the center line of the runway and located at a specified distance after the threshold;
- b) two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the vertical plane containing the center line of the runway; and

- c) an outer edge parallel to the inner edge and located in the plane of the inner horizontal surface.

4.1.23 The elevation of the inner edge shall be equal to the elevation of the runway center line at the location of the inner edge.

4.1.24 The slope of the balked landing surface shall be measured in the vertical plane containing the center line of the runway.

Take-off climb surface

4.1.25 **Description** — Take-off climb surface: An inclined plane or other specified surface beyond the end of a runway or clearway.

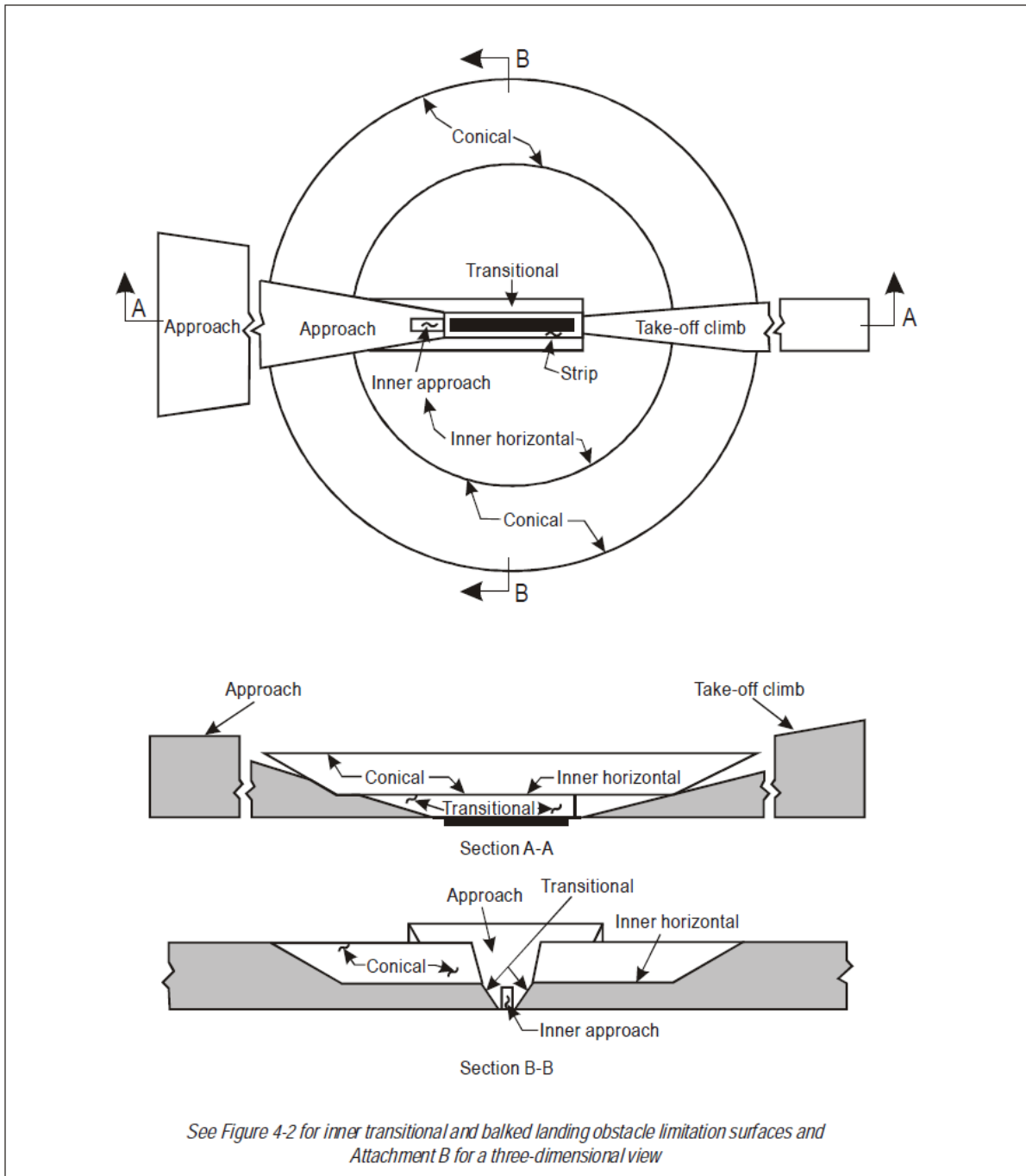
4.1.26 **Characteristics** — The limits of the take-off climb surface shall comprise:

- a) an inner edge horizontal and perpendicular to the center line of the runway and located either at a specified distance beyond the end of the runway or at the end of the clearway when such is provided and its length exceeds the specified distance;
- b) two sides originating at the ends of the inner edge, diverging uniformly at a specified rate from the take-off track to a specified final width and continuing thereafter at that width for the remainder of the length of the takeoff climb surface; and
- d) an outer edge horizontal and perpendicular to the specified take-off track.

4.1.27 The elevation of the inner edge shall be equal to the highest point on the extended runway center line between the end of the runway and the inner edge, except that when a clearway is provided the elevation shall be equal to the highest point on the ground on the center line of the clearway.

4.1.28 In the case of a straight take-off flight path, the slope of the take-off climb surface shall be measured in the vertical plane containing the center line of the runway.

4.1.29 In the case of a take-off flight path involving a turn, the take-off climb surface shall be a complex surface containing the horizontal normals to its center line, and the slope of the center line shall be the same as that for a straight take-off flight path.



**Figure 4-1
Obstacle Limitation Surfaces**

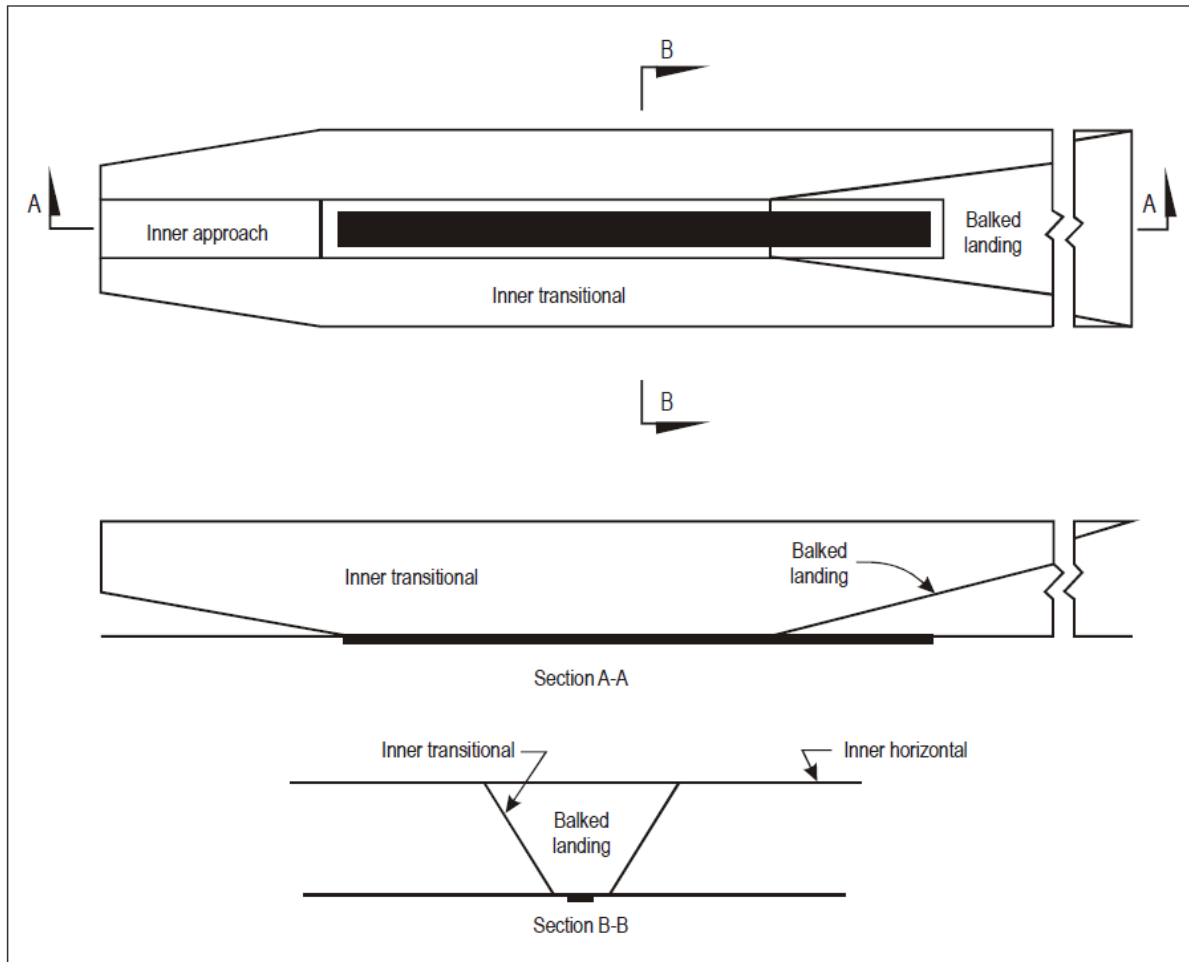


Figure 4-2
Inner approach, inner transitional and balked landing
Obstacle limitation surfaces

4.2 OBSTACLE LIMITATION REQUIREMENTS

Note: The requirements for obstacle limitation surfaces are specified on the basis of the intended use of a runway, i.e. take-off or landing and type of approach, and are intended to be applied when such use is made of the runway. In cases where operations are conducted to or from both directions of a runway, then the function of certain surfaces may be nullified because of more stringent requirements of another lower surface.

Non-instrument runways

4.2.1 The following obstacle limitation surfaces shall be established for a non-instrument runway:

- conical surface;
- inner horizontal surface;

- approach surface; and
- transitional surfaces.

4.2.2 The heights and slopes of the surfaces shall not be greater than, and their other dimensions not less than, those specified in Table 4-1.

4.2.3 New objects or extensions of existing objects shall not be permitted above an approach or transitional surface except when, in the opinion of the JCARC, the new object or extension would be shielded by an existing immovable object.

Note: Circumstances in which the shielding principle may reasonably be applied are described in the CARC Guidance Material Control of Obstacles 34/OBSC.

4.2.4 New objects or extensions of existing objects shall not be permitted above the conical surface or inner horizontal surface except when, in the opinion of the JCARC, the object would be shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of airplanes.

4.2.5 Existing objects above any of the surfaces required by 4.2.1 shall be removed except when, in the opinion of the JCARC, the object is shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of airplanes.

Note: Because of transverse or longitudinal slopes on a strip, in certain cases the inner edge or portions of the inner edge of the approach surface may be below the corresponding elevation of the strip. It is not intended that the strip be graded to conform with the inner edge of the approach surface, nor is it intended that terrain or objects which are above the approach surface beyond the end of the strip, but below the level of the strip, be removed unless it is considered they may endanger airplanes.

4.2.6 In considering proposed construction, account shall be taken of the possible future development of an instrument runway and consequent requirement for more stringent obstacle limitation surfaces.

Non-precision approach runways

4.2.7 The following obstacle limitation surfaces shall be established for a non-precision approach runway:

- conical surface;
- inner horizontal surface;
- approach surface; and
- transitional surfaces.

4.2.8 The heights and slopes of the surfaces shall not be greater than, and their other dimensions not less than, those specified in Table 4-1, except in the case of the horizontal section of the approach surface (see 4.2.9).

4.2.9 The approach surface shall be horizontal beyond the point at which the 2.5 per cent slope intersects:

- a) a horizontal plane 150 m above the threshold elevation; or
- b) the horizontal plane passing through the top of any object that governs the obstacle clearance altitude/height (OCA/H);

whichever is the higher.

4.2.10 New objects or extensions of existing objects shall not be permitted above an approach surface within 3 000 m of the inner edge or above a transitional surface except when, in the opinion of the JCARC, the new object or extension would be shielded by an existing immovable object.

Note: Circumstances in which the shielding principle may reasonably be applied are described in the CARC Guidance Material Control of Obstacles 34/OBSC.

4.2.11 New objects or extensions of existing objects shall not be permitted above the approach surface beyond 3 000 m from the inner edge, the conical surface or inner horizontal surface except when, in the opinion of the JCARC, the object would be shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of airplanes.

4.2.12 Existing objects above any of the surfaces required by 2.7 shall be removed except when, in the opinion of the JCARC, the object is shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of airplanes.

Note: Because of transverse or longitudinal slopes on a strip, in certain cases the inner edge or portions of the inner edge of the approach surface may be below the corresponding elevation of the strip. It is not intended that the strip be graded to conform with the inner edge of the approach surface, nor is it intended that terrain or objects which are above the approach surface beyond the end of the strip, but below the level of the strip, be removed unless it is considered they may endanger airplanes.

**Table 4-1
Dimensions and Slopes of Obstacle Limitation Surfaces**

APPROACH RUNWAYS

Surface and dimensions ^a (1)	RUNWAY CLASSIFICATION										
	Non-instrument Code number				Non-precision approach Code number			Precision approach category I Code number			II or III Code number
	1 (2)	2 (3)	3 (4)	4 (5)	1,2 (6)	3 (7)	4 (8)	1,2 (9)	3,4 (10)	3,4 (11)	
CONICAL											
Slope	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	
Height	35 m	55 m	75 m	100 m	60 m	75 m	100 m	60 m	100 m	100 m	
INNER HORIZONTAL											
Height	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	
Radius	2 000 m	2 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m	
INNER APPROACH											
Width	—	—	—	—	—	—	—	90 m	120 m ^e	120 m ^e	
Distance from threshold	—	—	—	—	—	—	—	60 m	60 m	60 m	
Length	—	—	—	—	—	—	—	900 m	1 500 m	1 500 m	
Slope	—	—	—	—	—	—	—	2.5%	2%	2%	
APPROACH											
Length of inner edge	60 m	80 m	150 m	150 m	140 m	280 m	280 m	140 m	280 m	280 m	
Distance from threshold	30 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	
Divergence (each side)	10%	10%	10%	10%	15%	15%	15%	15%	15%	15%	
First section											
Length	1 600 m	2 500 m	3 000 m	3 000 m	2 500 m	3 000 m	3 000 m	3 000 m	3 000 m	3 000 m	
Slope	5%	4%	3.33%	2.5%	3.33%	2%	2%	2.5%	2%	2%	
Second section											
Length	—	—	—	—	—	3 600 m ^b	3 600 m ^b	12 000 m	3 600 m ^b	3 600 m ^b	
Slope	—	—	—	—	—	2.5%	2.5%	3%	2.5%	2.5%	
Horizontal section											
Length	—	—	—	—	—	8 400 m _b	8 400 m _b	—	8 400 m _b	8 400 m _b	
Total length	—	—	—	—	—	15 000 m	15 000 m	15 000 m	15 000 m	15 000 m	
TRANSITIONAL											
Slope	20%	20%	14.3%	14.3%	20%	14.3%	14.3%	14.3%	14.3%	14.3%	
INNER TRANSITIONAL											
Slope	—	—	—	—	—	—	—	40%	33.3%	33.3%	
BALKED LANDING SURFACE											
Length of inner edge	—	—	—	—	—	—	—	90 m ^c	120 m ^e	120 m ^e	
Distance from threshold	—	—	—	—	—	—	—	—	1 800 m ^d	1 800 m ^d	
Divergence (each side)	—	—	—	—	—	—	—	10%	10%	10%	
Slope	—	—	—	—	—	—	—	4%	3.33%	3.33%	
OUTER HORIZONTAL											
Radius	—	—	—	—	—	—	—	15 000 m	15 000 m	15 000 m	

a. All dimensions are measured horizontally unless specified otherwise.

b. Variable length (see 4.2.9 or 4.2.17).

c. Distance to the end of the strip.

d. Or end of runway whichever is less.

e. Where the code letter is F (Column (3) of Table 1-1), the width is increased to 140 m, except for those aerodromes that accommodate a code letter F airplanes equipped with digital avionics that provide steering commands to maintain an established track during the go-around maneuver, see ICAO Circular 301 – New Larger Aeroplanes - Infringement of the Obstacle Free Zone: Operational Measures and Aeronautical Study.

Precision approach runways

Note 1: Guidance on obstacle limitation surfaces for precision approach runways is given in the CARC Guidance Material Control of Obstacles 34/OBSC.

Note 2: Refer to Chapter 9 section 9.9 for information regarding siting of equipment and installations on operational areas.

4.2.13 The following obstacle limitation surfaces shall be established for a precision approach runway:

- conical surface;
- inner horizontal surface;
- approach surface;
- transitional surfaces;
- inner approach surface;
- inner transitional surfaces;
- balked landing surface.

4.2.14 Reserved.

4.2.15 The following obstacle limitation surfaces shall be established for a precision approach runway category II or III:

- conical surface;
- inner horizontal surface;
- approach surface and inner approach surface;
- transitional surfaces;
- inner transitional surfaces; and
- balked landing surface.

4.2.16 The heights and slopes of the surfaces shall not be greater than, and their other dimensions not less than, those specified in Table 4-1, except in the case of the horizontal section of the approach surface (see 4.2.17).

4.2.17 The approach surface shall be horizontal beyond the point at which the 2.5 per cent slope intersects:

- a) a horizontal plane 150 m above the threshold elevation; or
- b) the horizontal plane passing through the top of any object that governs the obstacle clearance limit; whichever is the higher.

4.2.18 Fixed objects shall not be permitted above the inner approach surface, the inner transitional surface or the balked landing surface, except for frangible objects which because of their function must be located on the strip. Mobile objects shall not be permitted above these surfaces during the use of the runway for landing.

4.2.19 New objects or extensions of existing objects shall not be permitted above an approach surface or a transitional surface except when, in the opinion of the JCARC, the new object or extension would be shielded by an existing immovable object.

Note: Circumstances in which the shielding principle may reasonably be applied are described in the CARC Guidance Material Control of Obstacles 34/OBSC.

4.2.20 New objects or extensions of existing objects shall not be permitted above the conical surface and the inner horizontal surface except when, in the opinion of the JCARC, an object would be shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of airplanes.

4.2.21 Existing objects above an approach surface, a transitional surface, the conical surface and inner horizontal surface shall be removed except when, in the opinion of the JCARC, an object is shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of airplanes.

Note: Because of transverse or longitudinal slopes on a strip, in certain cases the inner edge or portions of the inner edge of the approach surface may be below the corresponding elevation of the strip. It is not intended that the strip be graded to conform with the inner edge of the approach surface, nor is it intended that terrain or objects which are above the approach surface beyond the end of the strip, but below the level of the strip, be removed unless it is considered they may endanger airplanes.

Runways meant for take-off

4.2.22 The following obstacle limitation surface shall be established for a runway meant for take-off:

- take-off climb surface.

4.2.23 The dimensions of the surface shall be not less than the dimensions specified in Table 4-2, except that a lesser length may be adopted for the take-off climb surface where such lesser length would be consistent with procedural measures adopted to govern the outward flight of airplanes.

4.2.24 The operational characteristics of airplanes for which the runway is intended shall be examined to see if it is desirable to reduce the slope specified in Table 4-2 when critical operating conditions are to be catered to. If the specified slope is reduced, corresponding adjustment in the length of take-off climb surface shall be made so as to provide protection to a height of 300 m.

Note: When local conditions differ widely from sea level standard atmospheric conditions, it may be advisable for the slope specified in Table 4-2 to be reduced. The degree of this reduction depends on the divergence between local conditions and sea level standard atmospheric conditions, and on the performance characteristics and operational requirements of the airplanes for which the runway is intended.

4.2.25 New objects or extensions of existing objects shall not be permitted above a take-off climb surface except when, in the opinion of the JCARC, the new object or extension would be shielded by an existing immovable object.

Note: Circumstances in which the shielding principle may reasonably be applied are described in the CARC Guidance Material Control of Obstacles 34/OBSC..

4.2.26 If no object reaches the 2 per cent (1:50) take-off climb surface, new objects shall be limited to preserve the existing obstacle free surface or a surface down to a slope of 1.6 per cent (1:62.5).

4.2.27 Existing objects that extend above a take-off climb surface shall be removed except when, in the opinion of the appropriate authority, an object is shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of airplanes.

Note: Because of transverse slopes on a strip or clearway, in certain cases portions of the inner edge of the take-off climb surface may be below the corresponding elevation of the strip or clearway. It is not intended that the strip or clearway be graded to conform with the inner edge of the take-off climb surface, nor is it intended that terrain or objects which are above the take-off climb surface beyond the end of the strip or clearway, but below the level of the strip or clearway, be removed unless it is considered they may endanger airplanes. Similar considerations apply at the junction of a clearway and strip where differences in transverse slopes exist.

**Table 4-2
Dimensions and Slopes of Obstacle Limitation Surface**

RUNWAYS MEANT FOR TAKE-OFF

Surface and dimensions ^a	Code number		
	1	2	3
(1)	(2)	(3)	(4)
TAKE-OFF CLIMB			
Length of inner edge	60 m	80 m	180 m
Distance from runway end ^b	30 m	60 m	60 m
Divergence (each side)	10%	10%	12.5%
Final width	380 m	580 m	1 200 m 1 800 m ^c
Length	1 600 m	2 500 m	15 000 m
Slope	5%	4%	2% ^d

- a. All dimensions are measured horizontally unless specified otherwise.
- b. The take-off climb surface starts at the end of the clearway if the clearway length exceeds the specified distance.
- c. 1 800 m when the intended track includes changes of heading greater than 15° for operations conducted in IMC, VMC by night
- d. See 4.2.24 and 4.2.26.

4.3 OBJECTS OUTSIDE THE OBSTACLE LIMITATION SURFACES

4.3.1 Arrangements shall be made with municipalities to enable the JCARC to be consulted concerning proposed construction beyond the limits of the obstacle limitation surfaces that extend above a height established by the JCARC, in order to permit an aeronautical study of the effect of such construction on the operation of airplanes.

4.3.2 In areas beyond the limits of the obstacle limitation surfaces, at least those objects which extend to a height of 150 m or more above ground elevation shall be regarded as obstacles, unless a special aeronautical study indicates that they do not constitute a hazard to airplanes.

Note: This study may have regard to the nature of operations concerned and may distinguish between day and night operations.

4.4 OTHER OBJECTS

4.4.1 Objects which do not project through the approach surface but which would nevertheless adversely affect the optimum siting or performance of visual or non-visual aids shall be removed.

4.4.2 Anything which may, in the opinion of the JCARC after aeronautical study, endanger airplanes on the movement area or in the air within the limits of the inner horizontal and conical surfaces shall be regarded as an obstacle and shall be removed.

Note 1: In certain circumstances, objects that do not project above any of the surfaces enumerated in D.1 may constitute to airplanes as, for example, where there are one or more isolated objects in the vicinity of an aerodrome.

Note 2: Figure 4-3 the following page illustrates a three dimensional view of the obstacle limitation surfaces at an aerodrome.

Figure 4-3
Obstacle Limitation Surfaces
3-Dimensional View

