CHAPTER 7 - Obstacle restriction and limitation

Section 7.1: General

7.1.1 Introduction

7.1.1.1 The scope of this chapter is to define the standards that control airspace around an aerodrome.

7.1.1.2 An obstacle is defined as a fixed or mobile object that:

(a) stands on, or stands above, the specified surface of an obstacle restriction area which comprises the runway strips, runway end safety areas, clearways and taxiway strips; or

(b) any object that penetrates the obstacle limitation surfaces (OLS), a series of surfaces that set the height limits of objects, around an aerodrome; or

(c) stands outside an OLS and has been assessed as being a hazard to air navigation.

7.1.1.3 Obstacle data requirements for the design of instrument procedures need to be determined in liaison with flight procedure designers.

7.1.1.4 Non compliance with standards may result in DCA issuing hazard notification notices as prescribed in RGA.

7.1.2 Obstacle Restriction

7.1.2.1 Objects, except for approved visual and navigational aids, must not be located within the obstacle restriction area of the aerodrome without the specific approval of DCA.

7.1.2.2 Equipment and installations required for air navigation purposes are to be of minimum practicable mass and height, frangibly designed and mounted, and sited in such a manner as to reduce the hazard to aircraft to a minimum.

7.1.2.3 Obstacles on the obstacle restriction area must be taken into account when determining the obstacle clear approach or take-off surfaces.

7.1.3 Obstacle Limitation

7.1.3.1 An aerodrome operators must establish the OLS applicable to the aerodrome.

Note: A description and illustration of the obstacle limitation surfaces is provided in Section 7.3.

7.1.3.2 The following OLS must be established for a non-instrument runway, a non-precision approach runway and a precision approach runway category I:

(a) conical surface;

(b) inner horizontal surface;

(c) approach surface;

(d) transitional surface; and

(e) take-off climb surface if the runway is meant for take-off.

7.1.3.3 The following OLS must be established for a precision approach runway category II or III:

(a) outer horizontal surface, if so directed by DCA;
(b) conical surface;
(c) inner horizontal surface;
(d) approach surface;
(e) inner approach surface;
(f) transitional surface;
(g) inner transitional surface;
(h) baulked landing surface; and
(i) take-off climb surface if the runway is meant for take-off.

7.1.3.4 The physical dimensions of the OLS surfaces, for approach runways, must be determined using Table 7.1-1.

OLS & Dimensions (in metres and percentages)	Runway Classification									
	Non-instrument				Instrument					
					Non-precision			Precision		
	Code No				Code No			I Code No		II & III Code No
	1*	2	3	4	1, 2	3	4	1, 2	3, 4	3, 4
OUTER HORIZONTAL										
Height (m)									150	150
Radius (m)									15000	15000
CONICAL										
Slope	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Height (m)	35	55	75	100	60	75	100	60	100	100
INNER HORIZONTAL										
Height (m)	45	45	45	45	45	45	45	45	45	45
Radius (m)	2000	2500	4000	4000	3500	4000	4000	3500	4000	4000
APPROACH										
Length of inner edge (m)	60	80	150[a]	150	90	150	300[b]	150	300	300
Distance from threshold (m)	30	60	60	60	60	60	60	60	60	60
Divergence each side	10%	10%	10%	10%	15%	15%	15%	15%	15%	15%
First section length (m)	1600	2500	3000	3000	2500	3000	3000	3000	3000	3000
Slope	5%	4%	3.33%	2.5%	3.33%	3.33%	2%	2.5%	2%	2%
Second section length (m)	-	-	-	-	-	3600[c]	3600	12000	3600	3600
Slope	-	-	-	-	-	2.5%[c]	2.5%	3%	2.5%	2.5%
Horizontal section length (m)	-	-	-	-	-	8400[c]	8400	-	8400	8400
Total length (m)	1600	2500	3000	3000	2500	15000[d]	15000	15000	15000	15000
INNER APPROACH										
Width (m)								90	120	120
Distance from threshold (m)								60	60	60
Length (m)								900	900	900
Slope								2.5%	2%	2%
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%
BAULKED LANDING										
Length of inner edge (m)								90	120	120
Distance from threshold (m)								*	1800[f]	1800
Divergence each side								10%	10%	10%
Slope								4%	3.3%	3.3%

Table 7.1-1: OLS Specification for Approach Runways

(All distances are measured horizontally unless otherwise specified.)
For a precision approach runway the width of the inner approach surface is to be 155m if the code letter is F and the code number is 3 or 4. See ICAO Circular 301 New Larger Aeroplanes – Infringement of the obstacle free zone, operational measures and aeronautical study.

* Runways used for air transport operations at night by aircraft with maximum take-off mass not exceeding 5,700 kg are required to meet code 2 standards.
A 90 m where width of runway is 30 m.
b 150 m if only used by aeroplanes requiring 30 m wide runway.
c No actual ground survey required unless specifically required by procedure designer.
e Distance to end of runway strip.
f Or to the end of the runway strip, whichever is less.

7.1.3.5 The physical dimensions of the take-off climb OLS surfaces for take-off runways must be determined using Table 7.1-2.

Take-off climb surface– dimensions (in meters and percentages)	**Take-off Runways Code number**		
	1*	2	3 or 4
Length of inner edge	60	80	180 [b]
Minimum distance of inner edge from runway end c	30	60	60
Rate of divergence (each side)	10%	10%	12.5%
Final width	380	580	1800 [d]
Overall length	1600	2500	15000
Slope	5%	4%	2% [e]

Table 7.1-2: Take-off runways

* Runways used for air transport operations at night by aircraft with maximum take-off mass not exceeding 5,700 kg are required to meet code 2 standards.
A All dimensions are measured horizontally unless otherwise specified.
B The length of the inner edge may be reduced to 90 m if the runway is intended to be used by aeroplanes having an mass less than 22,700 kg and operating in VMC by day. In this case the final width may be 600 m, unless the flight path may involve a change of heading in excess of 15°.
C The take-off climb surface starts from the end of clearway if a clearway is provided.
D The final width may be reduced to 1200 m if the runway is used only by aircraft with takeoff procedure which does not include changes of heading greater than 15° for operations conducted in IMC or at night.
E The operational characteristics of aircraft for which the runway is intended should be examined to see if it is desirable to reduce the slope to cater for critical operating conditions. If the specified slope is reduced, corresponding adjustment in length for take-off climb is to be made so as to provide protection to a height of 300 m. If no object reachs the 2% take-off climb surface, new objects should be limited to preserve the existing obstacle free surface, or a surface down to a slope of 1.6%

7.1.3.6 Where two OLS surfaces overlap, the lower surface must be used as the controlling OLS.

7.1.4 Procedures for Aerodrome Operators to deal with obstacles

7.1.4.1 The aerodrome operators must monitor the OLS applicable to the aerodrome and report to DCA any infringement or potential infringement of the OLS.

Note: Aerodrome operators need to liaise with appropriate planning authorities and companies that erect tall structures, to determine potential infringements. Every effort should be made to implement the OLS standards and limit the introduction of new obstacles.

7.1.4.2 When a new obstacle is detected, the aerodrome operators must ensure that the information is passed on to pilots, through NOTAM, in accordance with the standards for aerodrome reporting procedures set out in Chapter 10.

7.1.4.3 Information on any new obstacle must include:

(a) the nature of the obstacle (for instance structure or machinery);
(b) distance and bearing of the obstacle from the start of the take-off end of the runway if the obstacle is within the take-off area, or else from the ARP;
(c) height of the obstacle in relation to the aerodrome elevation; and
(d) if it is a temporary obstacle, the time it exists as an obstacle.

7.1.5 Objects outside the OLS

7.1.5.1 Under RGA any object which extends to a height of 150 m or more above l ground level must be notified to DCA.

7.1.5.2 Any object that extends to a height of50 m or more ground level must be regarded as an obstacle unless it is assessed by DCA to be otherwise.

7.1.6 Objects that could become obstacles

7.1.6.1 If a proposed object or structure is determined to be an obstacle, details of the proposal must be referred to DCA to determine whether it will be a hazard to aircraft operations.

7.1.6.2 Shielded Obstacle. A new obstacle that is shielded by an existing obstacle may be assessed as not imposing additional restrictions to aircraft operations.

Note: Information on the shielding principle is provided in Section 7.4.

7.1.6.3 Marking and lighting of obstacles

(a) DCA may direct that obstacles be marked and or lit and may impose operational restrictions on the aerodrome as a result of an obstacle.
(b) If directed by DCA, lighting and/or marking of obstacles, including terrain, must be carried out in accordance with the standards set out in Chapter 8 and Chapter 9.

7.1.6.4 Temporary and transient obstacles. Temporary obstacles and transient (mobile) obstacles, such as road vehicles, rail carriages or ships, in close proximity to the aerodrome and which penetrate the OLS for a short duration, must be referred to DCA to determine whether they will be a hazard to aircraft operations.

7.1.6.5 Fences or levee banks. A fence or levee bank that penetrates the OLS must be treated as an obstacle.
Note: See Chapter 5 in regard to reporting of fences and levee banks.

7.1.6.6 Hazardous objects below the OLS. Where DCA has identified an object which does not penetrate the OLS to be a hazard to aircraft operations, DCA may require the object to be either:

(a) removed, if appropriate; or
(b) marked and/or lit.

Note: For example inconspicuous overhead wires or isolated objects in the vicinity of the aerodrome.

7.1.7 Monitoring of obstacles associated with instrument runways

7.1.7.3 Aerodrome operators must establish procedures to monitor the OLS and the critical obstacles associated with any additional requirements and have them included in the Aerodrome Manual if provided.

Section 7.2: Aerodrome Obstacle Charts

7.2.1 Type A Charts

7.2.1.1 The Type A chart is an ICAO specified chart that identifies information on all significant obstacles within the take-off area of an aerodrome up to 10 km from the end of the runway.

7.2.1.2 A Type A chart must be prepared for each runway that is used in international operations.

7.2.1.3 The obstacle data to be collected and the manner of presentation of the Type A chart must be in accordance with the standards and procedures set out in ICAO Annex 4.

Note: A Type A chart meeting the accuracy requirements of Annex 4 is adequate.

7.2.1.4 Where no significant obstacle exists within the take-off flight path area, as specified by Annex 4, a Type A chart is not required but a statement must be included in the Aerodrome Manual.

7.2.1.5 At aerodromes with no international operations but used by aircraft above 5,700 kg engaged in air transport operations, the decision to prepare Type A charts, or discrete obstacle information instead of a Type A chart, is a matter for the aerodrome operators to be made in conjunction with the relevant airline.

Note: Refer to AC... 'Guidelines for the provision of obstacle information for take-off flight planning purposes'.

7.2.1.6 Where a Type A chart has been prepared, or updated, a copy of the chart must be given to DCA.

7.2.1.7 Where a Type A chart has been prepared and issued, the take-off area must be monitored and any changes to the Type A chart information must immediately be communicated to all users of the Type A chart.

Notes: 1. Changes to the Type A chart information but not to OLS takeoff climb surface do not require NOTAM action.

2. Where the change to Type A chart information is also the subject of NOTAM action, additional separate advice to Type A chart holders is not necessary.

7.2.1.8 A distribution list of current Type A chart holders must be maintained in the Aerodrome Manual.

7.2.1.9 A Type A chart must be updated when the number of changes to the chart, notified through NOTAM or separate advice, reaches a level which DCA considers excessive.

7.2.2 Type B Charts

7.2.2.1 A Type B chart is an ICAO obstacle chart that provides obstacle data around the aerodrome.

7.2.2.2 A Type B chart, prepared in accordance with the standards and procedures set out in Annex 4, may be provided.

Note: This may be required by operators of aircraft above 5,700 kg to identify obstacles around an aerodrome.

7.2.2.3 The decision to prepare a Type B chart must be made in consultation with DCA.

7.2.2.4 Where required, the obstacle data to be collected and the manner of presentation of the Type B chart must be in accordance with the standards and procedures set out in ICAO Annex 4.

Section 7.3: Obstacle Limitation Surfaces

7.3.1 General

7.3.1.1 The Obstacle Limitation Surfaces (OLS) are conceptual (imaginary) surfaces associated with a runway, which identify the lower limits of the aerodrome airspace above which objects become obstacles to aircraft operations, and must be reported to DCA.

Note: The term OLS is used to refer to each of the imaginary surfaces that together define the lower boundary of aerodrome airspace, as well as to refer to the complex imaginary surface formed by combining all the individual surfaces.

7.3.1.2 The OLS comprises some or all of the following:

(a) outer horizontal surface;
(b) conical surface;
(c) inner horizontal surface;
(d) approach surface;
(e) inner approach surface;
(f) transitional surface;
(g) inner transitional surface;
(h) baulked landing surface; and
(i) take-off climb surface.

7.3.2 Description of OLS

7.3.2.1 **Reference Elevation Data.** A reference elevation data is to be established as a benchmark for the horizontal and conical surfaces. The reference elevation data is to be:

(a) the same as the elevation of the ARP (rounded off to the next half metre below), provided this elevation is within three meters of the average elevations of all existing and proposed runway ends; otherwise

(b) the average elevation (rounded off to the next half-meter below) of existing and proposed runway ends.

Note: The reference elevation data is not to be confused with the aerodrome elevation published in AIP. Aerodrome elevation is, by definition, the highest point on the landing area.

7.3.2.2 **Outer Horizontal Surface.** The outer horizontal surface is a plane located 150 m above the reference elevation data and extending from the upper edge of the extended conical surface for a distance of 15,000 m (radius) from the aerodrome reference point (ARP).

7.3.2.3 **Conical Surface.** The conical surface comprises both straight and curved elements, which slope upwards and outwards from the edge of the inner horizontal surface to a specified height above the inner horizontal surface. The slope of the conical surface is to be measured in a vertical plane perpendicular to the periphery of the inner horizontal surface.

7.3.2.4 **Inner Horizontal Surface.** The inner horizontal surface is a horizontal plane at a specified height above the reference elevation datum extending to an outer boundary comprising:

(a) in the case of an aerodrome with a single runway, semi-circular curves of a specified radius centered on the middle of each of the runway strip ends and joined tangentially by straight lines on each side of the runway, parallel to the runway centerline;

(b) in the case of an aerodrome with multiple runways, curves of a specified radius centered on the middle of each of the runway strip ends and the curves are joined by a tangential line as two curves intersect.

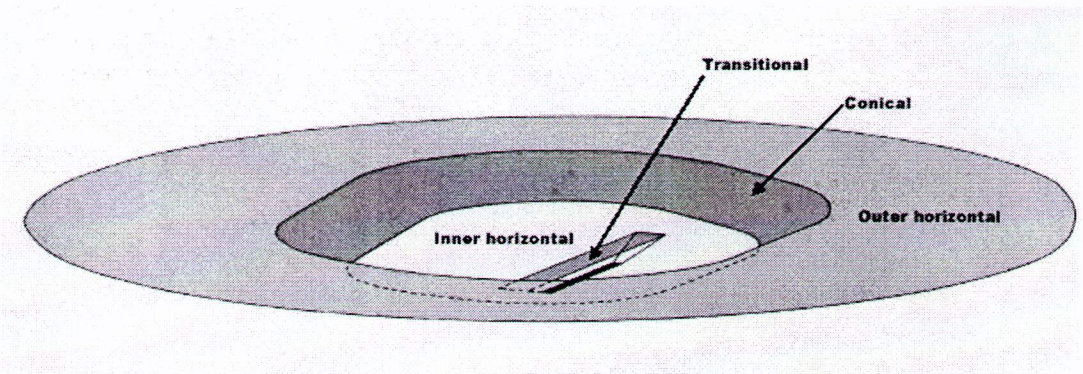

***Figure 7.3-1: Relationship of outer horizontal, conical, inner horizontal* and transitional surfaces**

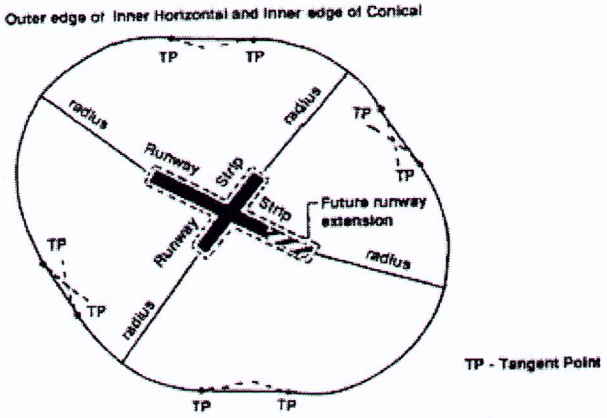

Figure 7.3-2: Boundary of inner horizontal surface

7.3.2.5 **Approach Surface.** The approach surface is an inclined plane or combination of planes which originate from the inner edge associated with each runway threshold, with two sides originating at the ends of the inner edge.

(a) The inner edge associated with each runway threshold has a specified length, and is located horizontally and perpendicularly to the runway centerline, at a specified distance before the threshold.

(b) The two sides diverge uniformly at a specified rate from the extended centerline of the runway.

(c) The approach surface may be divided into three sections and ends at an outer edge that is located at a specified overall distance from the inner edge and parallel to the inner edge.

(c) The elevation of the midpoint of the threshold is to be the elevation of the inner edge.

(e) The slope of each section of the approach surface is at a specified rate and is to be measured in the vertical plane containing the centerline of the runway.

(f) The above surfaces are to 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 centerline of the lateral offset, offset or curved ground track.

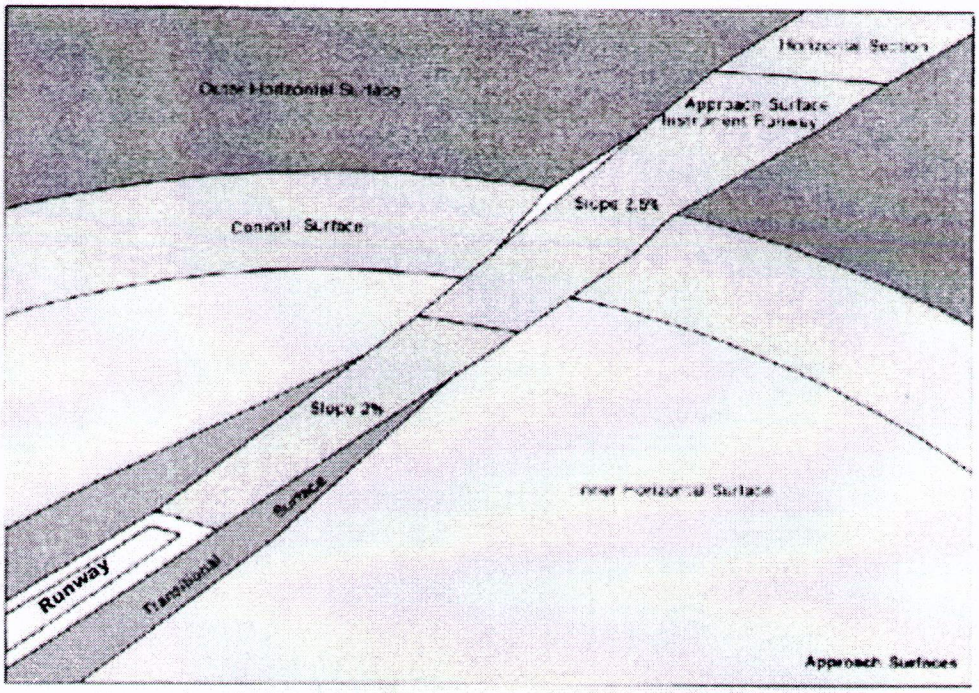

Figure 7.3-3: Approach surface for an instrument approach runway

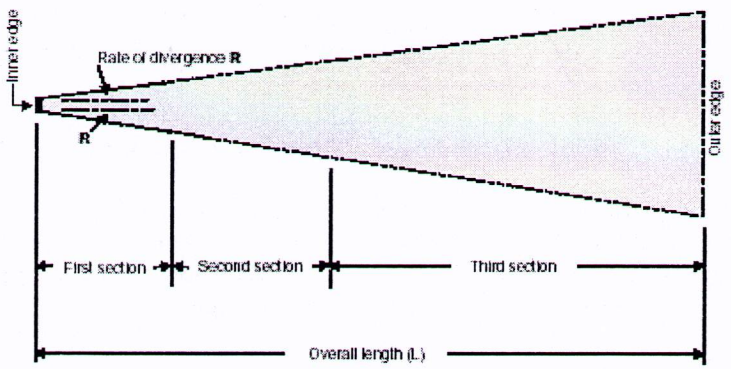

Figure 7.3-4: Plan view of approach surface

7.3.2.6 **Transitional Surface.** The transitional surface comprises inclined planes that originate at the lower edge from the side of the runway strip (the overall strip), and the side of the approach surface that is below the inner horizontal surface, and finishes where the upper edge is located in the plane of the inner horizontal surface. The transitional surface slopes upwards and outward at a specified rate and is to be measured in a vertical plane at right angles to the centerline of the runway.

(a) The elevation of a point on the lower edge of the transition surface is to be:

(i) along the side of the approach surface, equal to the elevation of the approach surface at that point; and

(ii) along the side of the runway strip, equal to the nearest point on the centerline of the runway or stopway.

Note: For the purpose of drawing the transitional surface, the lower edge of the transitional surface along the runway strip may be drawn as a straight line joining the corresponding ends of the approach surfaces at each end of the runway strip. However when assessing whether an object may penetrate the transitional surface, the standard of the transitional surface applies.

7.3.2.7 **Obstacle-Free Zone.** The inner approach, inner transitional and baulked landing surfaces together define a volume of airspace in the immediate vicinity of a precision approach runway, which is known as the obstacle-free zone. This zone must be kept free from fixed objects, other than lightweight frangibly mounted aids to air navigation that must be near the runway to perform their function, and from transient objects such as aircraft and vehicles when the runway is being used for precision approaches.

7.3.2.8 **Inner Approach Surface** The inner approach surface is a rectangular portion of the approach surface immediately preceding the threshold.

(a) The inner approach surface originates from an inner edge of a specified length, at the same location as the inner edge for the approach surface, and extends on two sides parallel to the vertical plane containing the runway centerline, to an outer edge which is located at a specified distance to the inner edge and parallel to the inner edge.

7.3.2.9 **Inner Transitional Surface.** The inner transitional surface is similar to the transitional surface but closer to the runway. The lower edge of this surface originates from the end of the inner approach surface, extending down the side of the inner approach surface to the inner edge of that surface, thence along the runway strip to the inner edge of the baulked landing surface and from there up the side of the baulked landing surface to the point where the side intersects the inner horizontal surface.

(a) The elevation of a point on the lower edge is to be:
  (i) along the side of the inner approach and baulked landing surface, equal to the elevation of the particular surface at that point;
  (ii) along the runway strip, equal to the elevation of the nearest point on the centerline of the runway or stopway.

(b) The inner transitional surface slopes upwards and outwards at a specified rate and is to be measured in a vertical plane at right angles to the centerline of the runway.

(d) The upper edge of the inner transitional surface is located in the plane of the inner horizontal surface.

(e) The inner transitional surface should be used as the controlling surface for navigational aids, aircraft and vehicle holding positions which have to be located near the runway.

(f) The transitional surface should be used for building height control.

7.3.2.10 **Baulked Landing Surface.** The baulked landing surface is an inclined plane originating at a specified distance after the threshold and extending between the inner transitional surfaces.

(a) The baulked landing surface originates from an inner edge of a specified length, located horizontally and perpendicularly to the centerline of the runway, with two sides from the ends of the inner edge diverging uniformly at a specified rate from

the vertical plane containing the centerline of the runway, ending at an outer edge located in the plane of the inner horizontal surface.

(b) The elevation of the inner edge is to be equal to the elevation of the runway centerline at the location of the inner edge.

(c) The specified slope of the baulked landing surface is to be measured in the vertical plane containing the centerline of the runway.

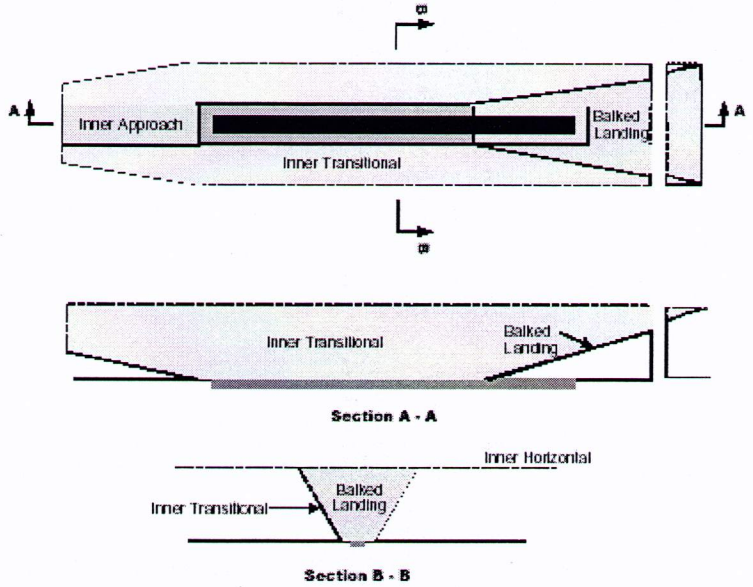

Figure 7.3-5: Inner approach, inner transitional and baulked landing obstacle limitation surfaces

7.3.2.11 **Take-Off Climb Surface.** The take-off climb surface is an inclined plane (or other shape in the case of curved take-off) located beyond the end of the runway or clearway.

(a) The origin of the take-off climb surface is the inner edge of a specified length, located at a specified distance from the end of the runway or the clearway. The plane from the inner edge slopes upward at a specified rate, with the two sides of the plane originating from the ends of the inner edge concurrently diverging uniformly outwards at a specified rate, to a specified final width, and continuing thereafter at that width for the remainder of the specified overall length of the take-off climb surface until it reaches the outer edge which is horizontal and perpendicular to the take-off track.

(b) The elevation of the inner edge is to be equal to the highest point on the extended runway centerline between the end of the runway and the inner edge, except that when a clearway is provided the elevation is to be equal to the highest point on the ground on the centerline on the clearway.

(c) The slope of the take-off climb surface is to be measured in the vertical plane containing the centerline of the runway.

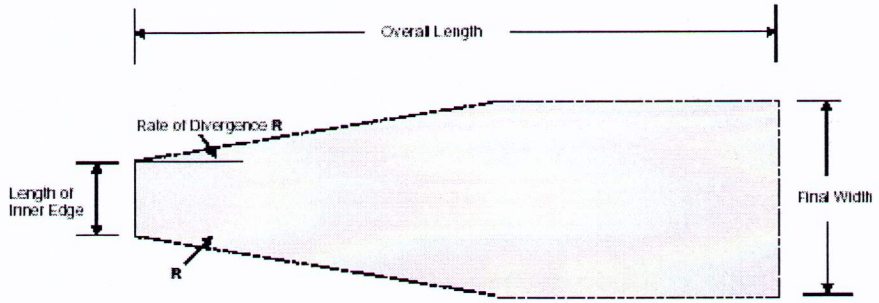

Figure 7.3-6: Plan view of take-off climb surface

Section 7.4: Principles of Shielding

7.4.1 General

7.4.1.1 A new obstacle located in the vicinity of an existing obstacle which has been assessed and deemed to be shielded may be considered as not being a hazard to aircraft.

7.4.1.2 Unless specifically directed by DCA, a shielded obstacle does not require removal, lowering, marking or lighting and should not impose any additional restrictions to aircraft operations.

7.4.1.3 The DCA shall assess and determine whether an obstacle is shielded. The aerodrome operators is to notify DCA of the presence of all obstacles.

7.4.1.4 Only existing permanent obstacles may be considered when assessing shielding of new obstacles.

7.4.2 Shielding Principles

7.4.2.1 In assessing whether an existing obstacle shields an obstacle, DCA will be guided by the principles of shielding detailed below.

7.4.2.2 Obstacles penetrating the approach and take-off climb surfaces

7.4.2.3 An existing obstacle within the approach and take-off climb area is called the critical obstacle. Where a number of obstacles exist closely together, the critical obstacle is the one which subtends the greatest vertical angle measured from the appropriate inner edge.

7.4.2.4 As illustrated below, a new obstacle may be assessed as not imposing additional restrictions if:

(a) when located between the inner edge end and the critical obstacle, the new obstacle is below a plane sloping downwards at 10% from the top of the critical obstacle toward the inner edge; or

(b) when located beyond the critical obstacle from the inner edge end, the new obstacle is not higher than the height of the permanent obstacle; and

(c) where there is more than one critical obstacle within the approach and take-off climb area, and the new obstacle is located between two critical obstacles, the height of the new obstacle is not above a plane sloping downwards at 10% from the top of the next critical obstacle.

7.4.2.5 Obstacles penetrating the inner and outer horizontal and conical surfaces.

7.4.2.6 The new obstacle may be accepted if it is in the vicinity of an existing obstacle, and does not penetrate a 10% downward sloping conical shaped surface from the top of the existing obstacle, i.e. the new obstacle is shielded radially by the existing obstacle.

7.4.2.7 Obstacles Penetrating the Transitional Surfaces.

7.4.2.8 A new obstacle may be assessed as not imposing additional restrictions if it does not exceed the height of an existing obstacle that is closer to the runway strip and the new obstacle is located perpendicularly behind the existing obstacle relative to the runway centre line.

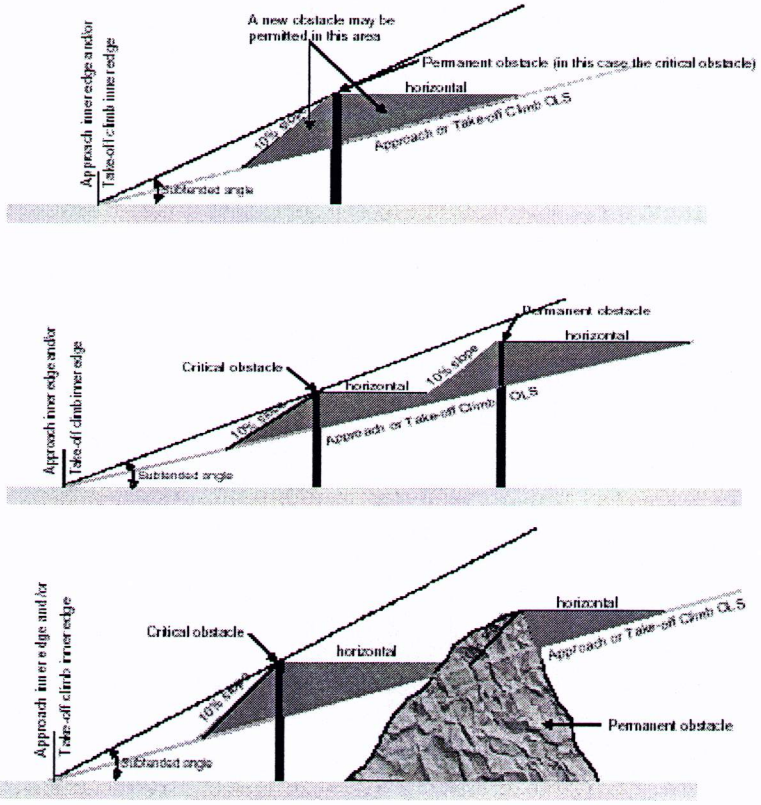

Figure 7.4-1: Shielding of obstacles penetrating the approach and takeoff climb surfaces.