CIVIL AVIATION PUBLICATION

AGA 08

OBSTACLES, CHARTS & SHIELDING PRINCIPLES

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CHAPTER 1

GENERAL

1.1 INTRODUCTION

The scope of this Chapter is to define the standards that control airspace around an aerodrome. An obstacle is defined as:

(a) any object that 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; and

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

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

Non-compliance with standards may result in the CAA-B issuing a hazard notification notices.

All aerodromes in the Bahamas have to comply with OLS standards and meet PANS-OPS requirements.

1.2 REFERENCES

- CAR AGA 1, 2 and 3
- Annex 4 – Aeronautical Charts (Eleventh Edition July 2009)
- ICAO Doc 8697 – Aeronautical Chart Manual (Third Edition 2016)
- CAR DEF – Definitions

1.3 OBSTACLE RESTRICTION

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 the CAA-B.

Equipment and installations required for air navigation purposes are to be of minimum practicable mass and height, frangible designed and mounted, and sited in such a manner as to reduce the hazard to aircraft to a minimum. Obstacles in the obstacle restriction area must be taken into account when determining the obstacle clear approach or take-off surfaces.

1.4 OBSTACLE LIMITATION

1.4.1 Non-Instrument and Non-Precision Approach Runway

An Aerodrome Operator must establish the OLS applicable to the aerodrome.

The following OLS shall be established for a non-instrument runway and a non-precision instrument runway:

(a) conical surface;

(b) inner horizontal surface;

(c) approach surface;

(d) transitional surface; and

(e) take-off climb surface.

1.4.2 Precision Approach Runway

The following OLS must be established for a precision approach runway:

(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.

The physical dimensions of the OLS surfaces, for approach runways, must be determined using Table 1.1

Table 1-1: Approach Runways

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)								e	1800[f]	1800
Divergence each side								10%	10%	10%
Slope								4%	3.3%	3.3%

Note: All distances are measured horizontally unless otherwise specified.

* *Runways used for commercial air transport operations at night by aircraft with maximum take-off mass not exceeding 5,700 kg are required to meet Code 2 standards.*

▷ *90 m where width of runway is 30 m.*

- ▷ *150 m if only used by aeroplanes requiring 30 m wide runway*
- ▷ *No actual ground survey required unless specifically required by procedure designer.*
- ▷ *Procedure designer will use topographical maps and tall structure databank to determine minimum altitudes.*
- ▷ *Approach area up to this distance needs to be monitored for new obstacles. Refer to procedure designer's advice on significant high ground or tall structure that needs monitoring.*
- ▷ *Distance to end of runway strip.*
- ▷ *Or to the end of the runway strip, whichever is less*

1.4.3 Physical Dimensions of Runway

The physical dimensions of the OLS surfaces, for take-off runways, must be determined using Table 1-2.

Table 1-2: Take-off runways

Take-off climb surface – Dimensions (in metres and percentages)	**Take-off Runways Code number**		
	1*	**2**[a]	**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]

Note: All dimensions are measured horizontally unless otherwise specified.

* Runways used for commercial air transport operations at night by aircraft with maximum take-off mass not exceeding 5,700 kg are required to meet Code 2 standards.

- ▷ For aircraft above 5,700 kg the survey area does not cover full extent of obstacle clearance required.
- ▷ The length of the inner edge may be reduced to 90 m if the runway is intended to be used by aeroplanes having a mass less than 25,000 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°.

- ▷ The take-off climb starts from the end of clearway if a clearway is provided.

- ▷ The final width may be reduced to 1200 m if the runway is used only by aircraft with take-off procedure which does not include changes of heading greater than 15° for operations conducted in IMC or at night.

- ▷ 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 as specified CAR AGA 1 and 3. 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 reaches 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%.

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

1.5 PROCEDURES FOR AERODROME OPERATORS TO DEAL WITH OBSTACLES

1.5.1 General

The Aerodrome Operator must monitor the OLS applicable to the aerodrome and report to the CAA-B 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.

When a new obstacle is detected, the Aerodrome Operator must ensure that the information is passed on to pilots, through NOTAM, in accordance with the standards for aerodrome reporting procedures. 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 the ARP;

(c) height of the obstacle in relation to the aerodrome elevation; and

(d) if it is a temporary obstacle — the time it is an obstacle.

1.5.2 Objects Outside the OLS

Any object which extends to a height of 110 m or more above local ground level must be notified to the CAA-B.

Any object that extends to a height of 150 m or more above local ground level must be regarded as an obstacle unless it is assessed by the CAA-B to be otherwise.

1.5.3 Objects That Could Become Obstacles

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

1.5.4 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 principle of shielding is provided in Chapter 4.

1.5.5 Marking and lighting of obstacles

The CAA-B may direct that obstacles be marked and or lit and may impose operational restrictions on the aerodrome as a result of an obstacle.

If directed by the CAA-B, lighting and/or marking of obstacles, including terrain must be carried out in accordance with the standards set out in CAR AGA 1, 2 and 3.

1.5.6 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 the CAA-B to determine whether they will be a hazard to aircraft operations.

1.5.7 Fences or levee banks

A fence or levee bank that penetrates the OLS must be treated as an obstacle.

1.5.8 Hazardous objects below the OLS

Where the CAA-B has identified an object, which does not penetrate the OLS to be a hazard to aircraft operations, CAA-B may require the object to be either:

(a) removed, if appropriate; or

(b) marked and/or lit.

1.6 MONITORING OF OBSTACLES ASSOCIATED WITH INSTRUMENT RUNWAYS

For a precision approach runway, the Aerodrome Operator must monitor any object that may penetrate the applicable OLS.

For a non-precision approach runway, besides monitoring the applicable OLS, obstacle monitoring includes areas outside the OLS, also known as PANS-OPS surfaces, used in the design of the NPA procedures.

To make it easier for Aerodrome Operators to carry out this task, procedure designers will be asked to provide Aerodrome Operators with a drawing or drawings of the area around the aerodrome, showing the designed approach paths, the circling areas and locations of critical obstacles taken into account in the design. In the case of a terrain obstacle, such as a hill, allowance provided for vegetation should also be provided, if appropriate.

Aerodrome Operators must establish procedures to monitor the OLS and the critical obstacles associated with the NPA procedures and have them included in the Aerodrome Manual.

The procedure designer must be advised of any changes of the status of the existing critical obstacles and any proposed development that is likely to be higher than the critical obstacles within the area depicted by the procedure designer.

1.7 ADDITIONAL OBSTACLE ASSESSMENT FOR AN EXISTING NON-INSTRUMENT RUNWAY TO BE UPGRADED TO A NON-PRECISION INSTRUMENT RUNWAY

For code 1 and 2 runways, there is a slight increase in the area of coverage for both the inner horizontal and conical obstacle limitation surfaces, as specified in Table 1-1.

Note: The required survey may be held over until the next OLS survey is due.

For code 1, 2 and 3 runways, an additional survey of the approach obstacle limitation surface may be limited to the first section of the approach OLS (i.e. to a distance of 2500m for code 1 and 2 runways and 3000m for code 3 runways). The purpose of this survey is to identify any obstacle that may affect the location of the threshold or needs to be provided with obstacle marking or lighting.

To allow for possibility of missing obstacle information, an NPA procedure will be checked by flight validation. On-going monitoring of obstacles within the second and horizontal sections of the approach area should be included in the drawing(s) provided by the procedure designer.

Any new object which may penetrate the inner horizontal, conical and the first section of the approach surfaces, as specified in Table 1-1, must be identified and, if its presence cannot be avoided, the details of the obstacles must be forwarded to the CAA-B for assessment of marking and lighting requirements. Any object that may penetrate the PANS-OPS surface, as per advice from the procedural designer, must be forwarded to the PANS-OPS design service provider.

1.8 OBSTACLE PROTECTION FOR CURVED TAKE-OFF

At present, the CAA-B does not promulgate a general standard for obstacle limitation surfaces in respect of curved take-off climb surface. Request for approval for curved take-off procedures may originate from aircraft operators or the Aerodrome Operators, and the CAA-B will deal with such requests on a case-by-case basis.

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CHAPTER 2

AERODROME OBSTACLE CHARTS

2.1 TYPE A CHARTS

The Type A chart is an ICAO chart which identifies information on all significant obstacles within the take-off area of an aerodrome up to 10 km from the end of each runway. A Type A chart must be prepared for each runway that is used for international operations.

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 CAR MAP is adequate

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

At aerodromes with no international operations, used by aircraft above 5,700 kg engaged in air transport operations, under CAR AGA 1, 2 and 3 the decision to prepare Type A charts, or discrete obstacle information instead of a Type A chart, is a matter for the Aerodrome Operator to be made in conjunction with the relevant airline.

Where a Type A chart has been prepared, or updated, a copy of the chart must be submitted to the CAA-B.

Where a Type A chart has been prepared and issued the take-off flight 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.

Note 1: Changes to the Type A chart information but not to OLS take- off climb surface does not require NOTAM action.

Note 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

A distribution list of current Type A chart holders must be maintained.

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 the CAA-B considers excessive.

2.2 TYPE B CHARTS

A Type B chart is an ICAO obstacle chart that provides obstacle data around the aerodrome. A Type B chart, prepared in accordance with the standards and procedures set out in CAR AGA 1, 2 and 3 may be provided.

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

The decision to prepare a Type B chart must be made in consultation with the CAA-B. 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.

2.3 TYPE C CHARTS

A Type C chart is an ICAO obstacle chart that provides data on all significant obstacles up to 45 km from the aerodrome. International aircraft operators may require this chart.

For aerodromes regularly used by aircraft engaged in international aviation, the decision to prepare a Type C chart must be made in consultation with the international aircraft operators and the CAA-B.

Where prepared, the Type C charts may be produced using one of the following methods:

(a) a complete Type C chart in accordance with the standards and procedures set out in ICAO Annex 4; or

(b) based on an actual survey meeting the order of accuracy requirements of ICAO Annex 4, produce a list containing all significant obstacles above a nominal obstacle height; or based on topographical maps, where available, meeting the order of accuracy requirements of Annex 14, produce a list containing all significant obstacles above a nominal obstacle height

CHAPTER 3

OBSTACLE LIMITATION SURFACES

3.1 GENERAL

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 the CAA-B.

Note: The term OLS is used to refer to each of the imaginary surfaces which 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

The OLS comprises the following:

- ▷ outer horizontal surface;
- ▷ conical surface;
- ▷ inner horizontal surface;
- ▷ approach surface;
- ▷ inner approach surface;
- ▷ transitional surface;
- ▷ inner transitional surface;
- ▷ baulked landing surface; and
- ▷ take-off climb surface.

3.2 DESCRIPTION OF OLS

3.2.1 Reference Elevation Datum

A reference elevation datum is to be established as a benchmark for the horizontal and conical surfaces. The reference elevation datum is to be:

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

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

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

3.2.2 Outer Horizontal Surface

The outer horizontal surface is a plane located 150 m above the reference elevation datum 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).

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.

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 centred 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 centreline;

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

Figure 3-1: Relationship of outer horizontal, conical, inner horizontal and transitional surfaces

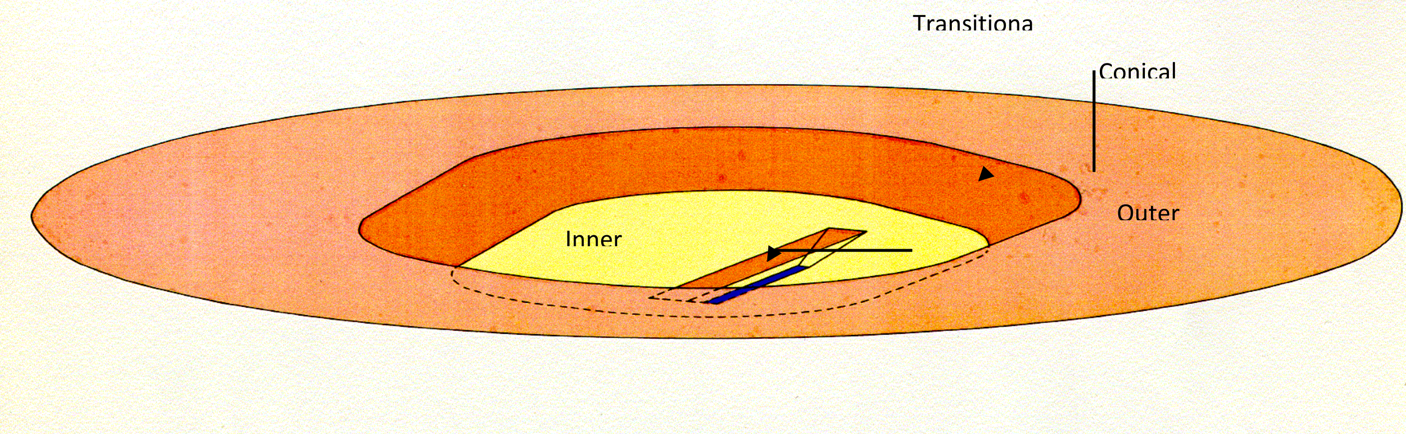
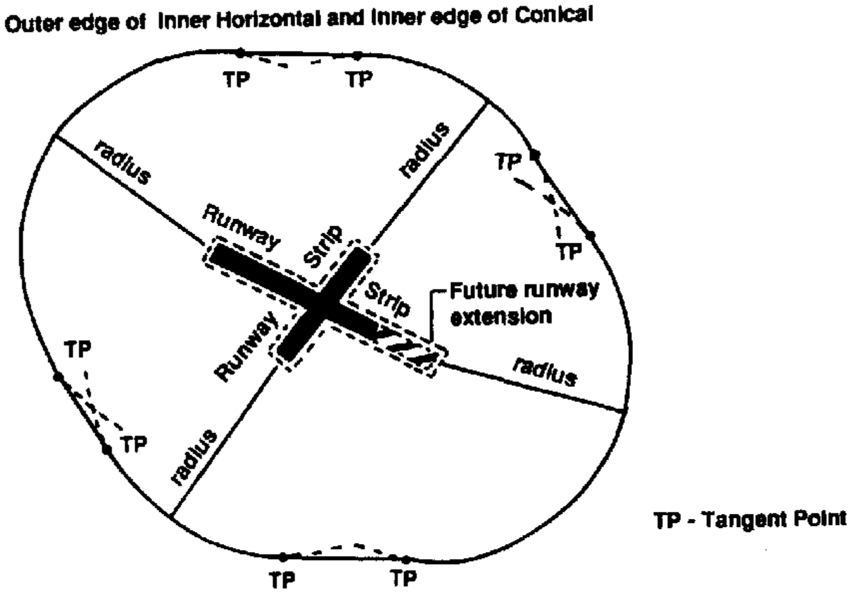


Figure 3-2: Boundary of inner horizontal surface



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.

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

The two sides diverge uniformly at a specified rate from the extended centreline of the runway.

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.

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

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 centreline of the runway.

The above surfaces are to be varied when lateral offset, offset or curved approaches are utilised, specifically, two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended centreline of the lateral offset, offset or curved ground track.

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

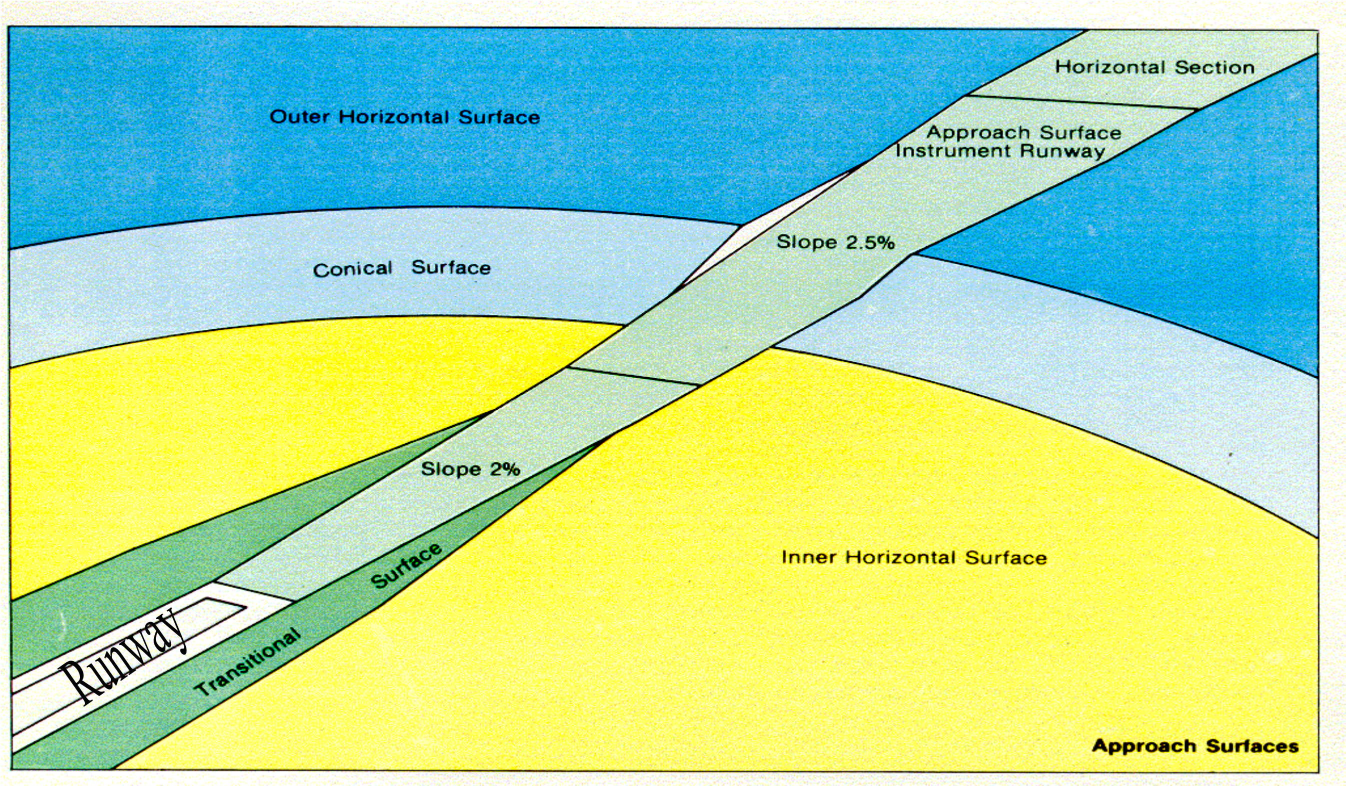
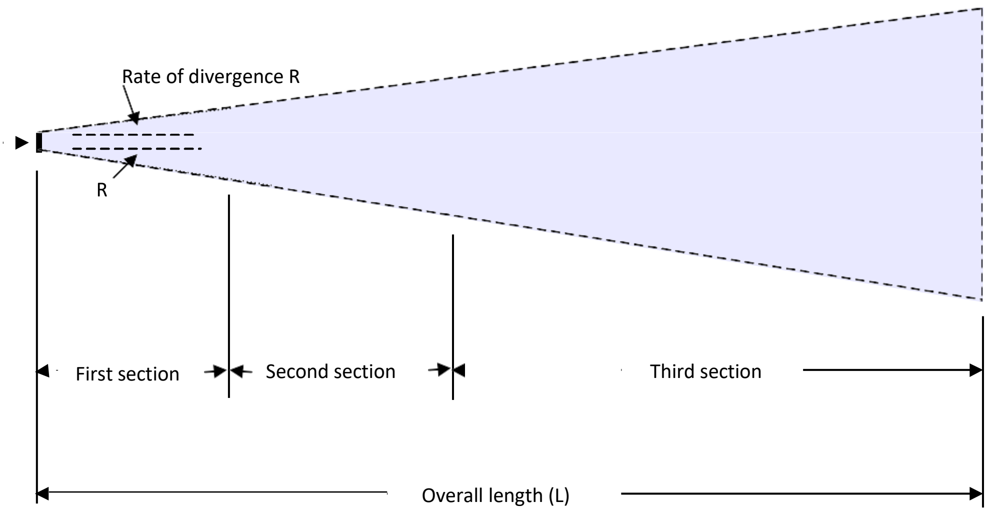


Figure 3-4: Plan view of approach surface



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 centreline of the runway.

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

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

(b) along the side of the runway strip, equal to the nearest point on the centreline 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.

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 which 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.

3.2.8 Inner Approach Surface

The inner approach surface is a rectangular portion of the approach surface immediately preceding the threshold.

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 centreline, to an outer edge which is located at a specified distance to the inner edge and parallel to the inner edge.

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.

The elevation of a point on the lower edge is to be:

(a) along the side of the inner approach and baulked landing surface, equal to the elevation of the particular surface at that point;

(b) along the runway strip, equal to the elevation of the nearest point on the centreline of the runway or stopway.

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 centreline of the runway.

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

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. The transitional surface should be used for building height control.

3.2.10 Baulked Landing Surface

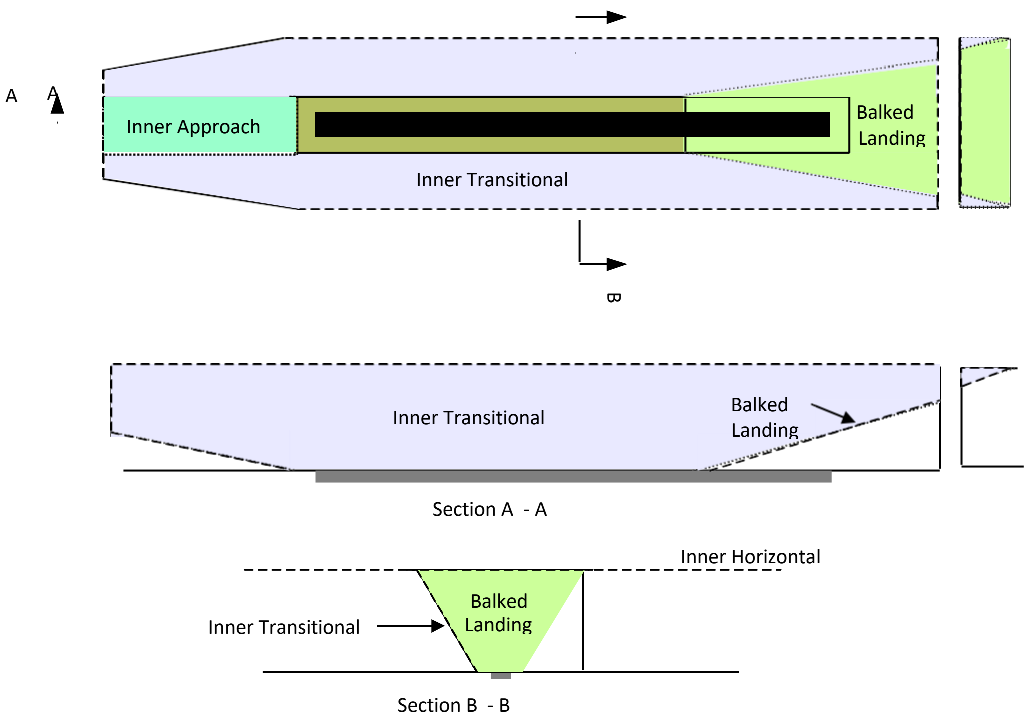
The baulked landing surface is an inclined plane originating at a specified distance after the threshold and extending between the inner transitional surfaces.

The baulked landing surface originates from an inner edge of a specified length, located horizontally and perpendicularly to the centreline 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 centreline of the runway, ending at an outer edge located in the plane of the inner horizontal surface.

The elevation of the inner edge is to be equal to the elevation of the runway centreline at the location of the inner edge.

The specified slope of the baulked landing surface is to be measured in the vertical plane containing the centreline of the runway.

Figure 3-5: Inner approach, inner transitional and baulked landing obstacle limitation surfaces



3.2.11 Take-Off Climb Surface

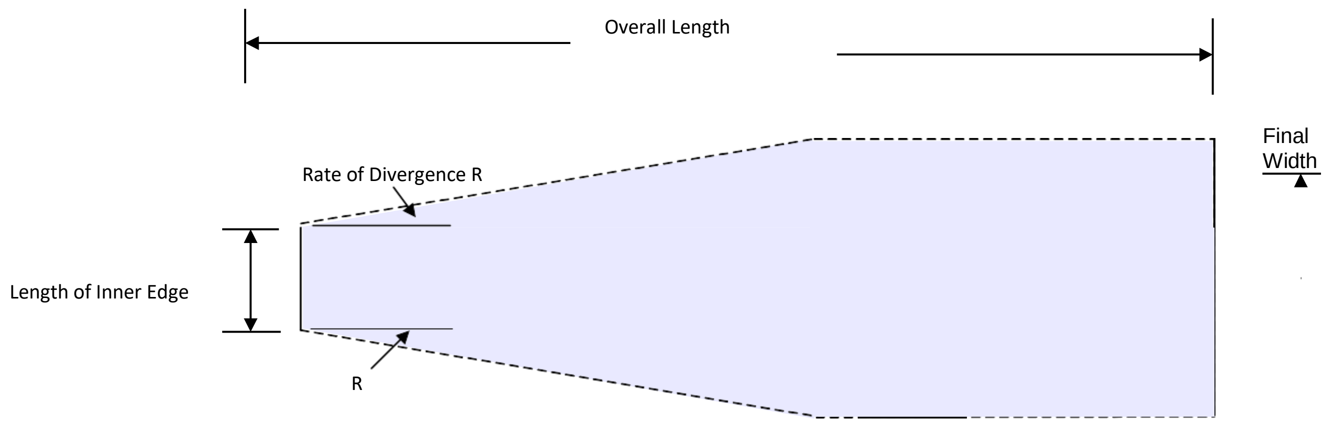
The take-off climb surface is an inclined plane (or other shape in the case of curved take-off) located beyond the end of the runway or clearway.

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.

The elevation of the inner edge is to be equal to the highest point on the extended runway centreline 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 centreline on the clearway.

The slope of the take-off climb surface is to be measured in the vertical plane containing the centreline of the runway.

Figure 3-6: Plan view of take-off climb surface



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CHAPTER 4

PRINCIPLES OF SHIELDING

4.1 GENERAL

The purpose of this Chapter is to provide detailed information on the shielding principle to allow a more logical criterion to be applied to the approval of new constructions and to prescribe marking and illumination of obstacles.

Based CAR AGA 1, Chapter 4, Obstacle Restriction and Removal, a clear operative protection is determined to the Aerodromes, by means of the OLS, in which it is established that the presence of new objects or enlarge existing ones will not be allowed above a certain surface, except when, after a technical assessment by the CAA-B, the new object or the enlarged object is shielded by an existing permanent object (fixed obstacle).

A new obstacle located in the vicinity of an existing obstacle and assessed as not being a hazard to aircraft is deemed to be shielded.

Shielding principles are employed when some object, an existing building or natural terrain (hills or mountains), already penetrates above one of the obstacle limitation surfaces described in CAR AGA 1, and they are shielding another object. If it is considered that the nature of an object is such that its presence may be described as permanent, then additional objects within a specified area around it may be permitted to penetrate the surface without being considered as obstacles. The original obstacle is considered as dominating or shielding the surrounding area.

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

The CAA-B shall assess and determine whether an obstacle is shielded. The aerodrome operator is to notify the CAA-B of the presence of all obstacles.

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

The permanency of the immovable obstacle which is to be considered as shielding an area should be given very careful review. An object should be classed as immovable only if, when taking the longest view possible, there is no prospect of removal being practicable, possible or justifiable, regardless of how the pattern, type or density of air operations might change.

ICAO Doc 9137, Part 6 establishes that It is generally agreed that the formula for shielding should be based on a horizontal plane projected from the top of each obstacle away from the runway and a plane with a negative slope of I0% towards the runway. Any object which is below either of the two planes would be considered shielded. The permission to allow objects to penetrate an obstacle limitation surface under the shielding principle should, however, be qualified by reference to the need for an aeronautical study in all cases.

Any object within a radius of 150 meters and below any of the indicated planes, could considered shielded by the dominant object. More specific principles are indicated in Section 4.2.

The shielding effect of immovable obstacles laterally in approach and take-off climb areas is different. In certain circumstances, it may be advantageous to preserve existing unobstructed cross- section areas, particularly when the obstacle is close to the runway. This would guard against future changes in either approach or take-off climb area specifications or the adoption of a turned take-off procedure.

4.2 SHIELDING PRINCIPLES

In assessing whether an existing obstacle shields an obstacle, CAA-B will be guided by the principles of shielding detailed below.

4.2.1 Obstacles penetrating the approach and take-off climb surfaces

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.

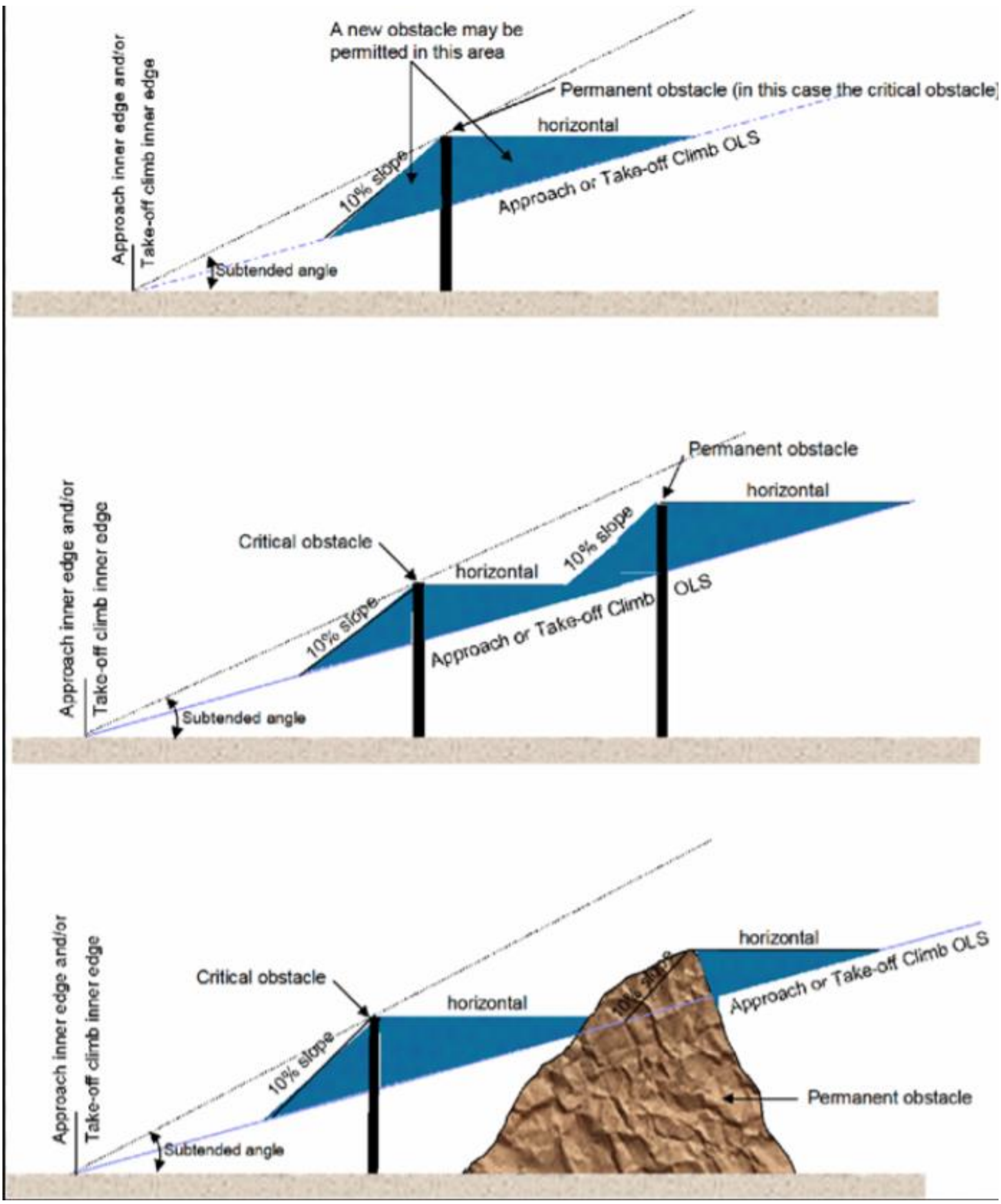
As illustrated in figure 4-1, a new obstacle may be assessed as not imposing additional restrictions if:

(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;

(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;

(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.

Figure 4-1: Shielding of obstacles penetrating the approach and take-off climb surface



4.2.2 Obstacles penetrating the inner and outer horizontal and conical surfaces

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.

4.2.3 Obstacles Penetrating the Transitional Surfaces

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

4.2.4 Limitations

The shielding principle which is used to permit the erection of new permanent obstacles should not be considered when:

(a) is within runway strips

(b) the permanent objects are destined to be erected within the inner 3,000 m from the threshold, above an approach surface, take-off climb surface or baulked landing surface.

(c) the object penalises the instrument approach areas although they do not exceed the limits defined by the obstacle limitation surfaces;

(d) Though the conditions in (c) are satisfied, the available free spaces or areas immediately adjacent to the runway extremities are regarded as extensions or the runway length available or, where applicable, as future stopways;

(e) parallel runways are planned and areas common to instrument approach procedures have to be unified;

(f) there is a request of installation a high-voltage power lines, fuel storage facilities, etc.

(g) in the case of a frangible object, its height has been designed so as to ensure vertical clearance by aircraft;

(h) in case of planned instrument approaches, the type of implementation and probable operating procedure have not been defined.

(i) a shielded obstacle cannot be used to shield another obstacle when it is located on the approach surface, take-off climb.

(j) Is located within the transition surface and does not comply with 4.2.3.

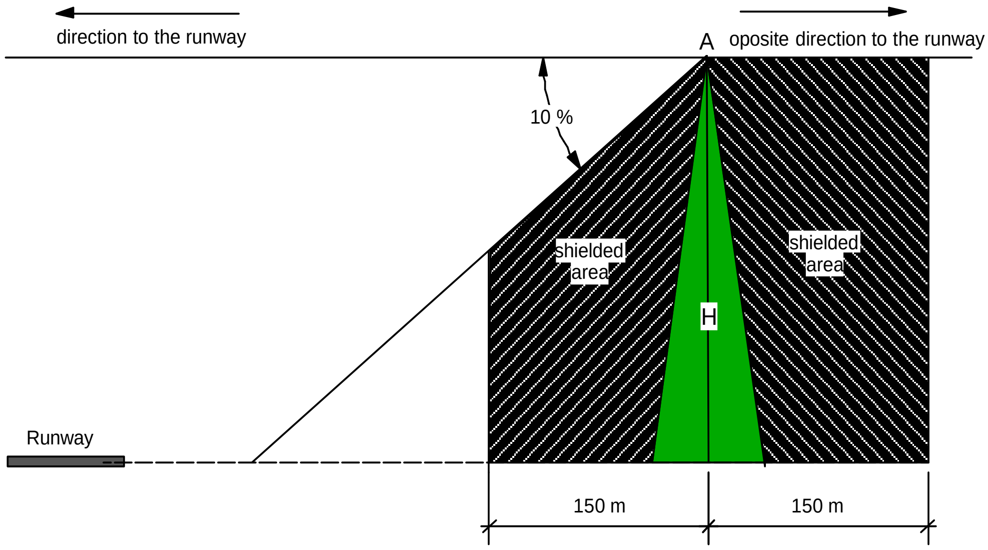
4.3 Competent Authority

The applicability of the shielding criterion is solely the authority of the CAA-B and can only be applied with its approval and any object granted with the principle of shielding must be subject to compliance with the criteria of marking and lighting as the case, determined by the CAA-B.

The application for the shielding criterion must be accompanied by calculations, coordinates, location charts, drawings of the object to be installed and generals of the shielding object (coordinates height, dimensions, elevation of the terrain, use).

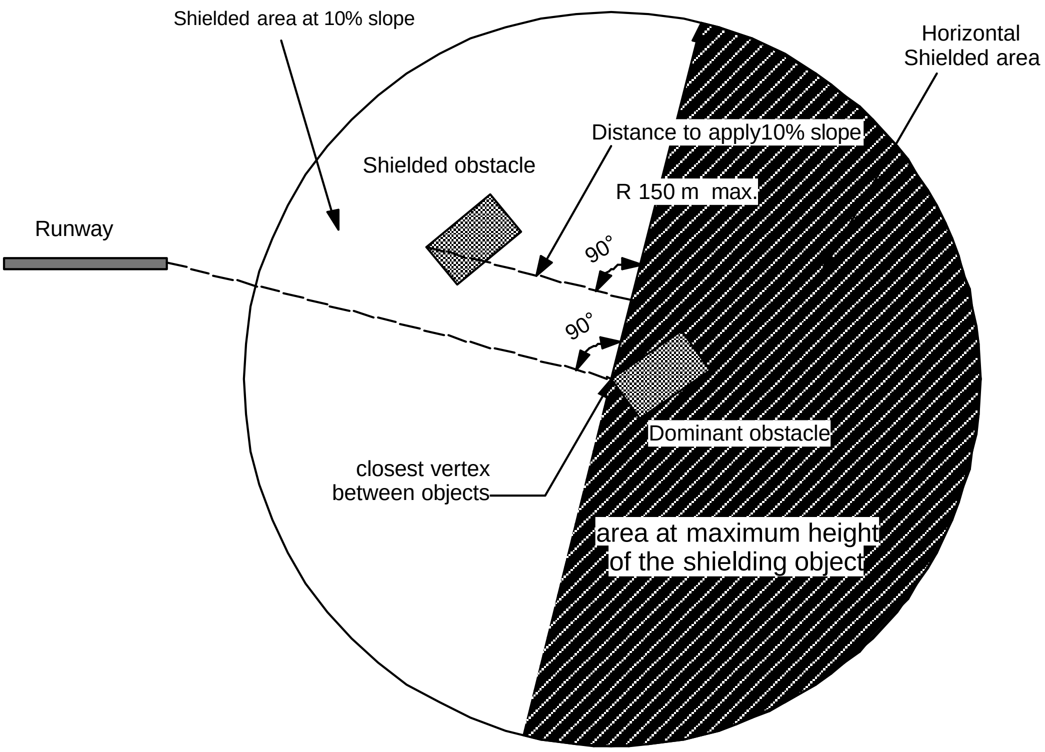
APPENDIX 1 TO CHAPTER 4

Fig. 4-2 Cross section of shielding principle



A is the maximun height of the H dominant obstacle

Fig. 4-3 Shielding Area and graphic description of shielding principle



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