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1 INTRODUCTION

- 1.1 This guidance material has been prepared for use with Statutory Instruments S.I. 423 of 1999 Irish Aviation Authority (En Route Obstacles to Air Navigation) Order 1999 and S.I. 14 of 2002 Irish Aviation Authority (Obstacles to Aircraft in Flight) Order 2002 for the definition of protected surfaces in the vicinity of aerodromes.
- 1.2 Survey information for an aerodrome is essential for its effective utilization. The local airspace must be regarded as an integral part of the aerodrome environment. Knowing the location of obstacles and nature of the terrain in the airport environment is essential for efficient and safe air operations.
- 1.3 The effective use of an aerodrome may be considerably influenced by the natural features and man made construction inside and outside its boundary. These may result in limitations on the distances available for take-off and landing and on the range of meteorological conditions in which the take-off and landing can be undertaken. For these reasons certain areas of the local airspace must be regarded as integral parts of the aerodrome environment. The degree of freedom from obstacles in these areas is as important to the safe and efficient use of the aerodrome as are the more obvious physical requirements of the runways and their associated strips.
- 1.4 The method of assessing the significance of any proposed object within the aerodrome boundary or in the vicinity of an aerodrome is to define obstacle limitation surfaces particular to a runway and its intended use. The purpose of this guidance material is to define these obstacle limitation surfaces and their characteristics and to describe the action to be taken in respect of objects which penetrate them. In ideal circumstances all surfaces will be free from obstacles but when a surface is infringed, any safety measures required by the Authority will have regard to:
 - 1.4.1 The nature of the obstacle and its location relative to the surface origin, to the extended centre line of the runway or normal approach and departure paths and to existing obstructions;
 - 1.4.2 The amount by which the surface is infringed;
 - 1.4.3 The gradient presented by the obstacle to the surface origin;
 - 1.4.4 The volume and type of air traffic at the aerodrome; and

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1.4.5 The instrument approach procedures published for the aerodrome.

1.5 Safety measures could be as follows:

1.5.1 Promulgation in AIP-Ireland of appropriate information;

1.5.2 Marking and/or lighting of the object;

1.5.3 Variation of the runway distances declared as available;

1.5.4 Limitation of the use of the runway to visual approaches only; and

1.5.5 Restrictions on the type or amount of traffic.

1.6 In addition to the requirements prescribed in this guidance material it may be necessary to call for other restrictions to development on and in the vicinity of the aerodrome in order to protect the performance of visual and electronic aids to navigation and to ensure that such development does not affect instrument approach procedures and associated obstacle clearance limits.

1.7 This guidance material describes obstacle limitation surfaces around an aerodrome that are to be maintained free from obstacles.

1.8 The shielding principles to be used for assessing whether an existing obstacle shields another one or a new one is explained in section 3.2.3.

1.9 An aerodrome operator shall establish a systematic means of surveying and monitoring any object that penetrates these surfaces and report any penetration immediately to the Aerodrome and PANS-OPS & Airspace Inspector's. This information will than be promulgated through the Aeronautical Information Services and air traffic services unit so that aeroplane operations can be conducted safely at all time.

1.10 When requested, an aerodrome operator shall also work jointly with the Aerodrome and PANS-OPS & Airspace Inspector's to plan and determine the allowable height limits for new developments in the vicinity of and outside its aerodrome and the type of instrument or visual flight operations that may be permitted taking the obstacle survey plan into account.

1.11 The guidance material does not alleviate the responsibility of airport managers from compliance with ICAO Standards.

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2 REFERENCES

- 2.1 ICAO Annex 14
- 2.2 ICAO Annex 15
- 2.3 Doc 8168 – ICAO Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS)
- 2.4 Doc 9137 - ICAO Airport Services Manual

3 DETAIL

3.1 Obstacle Limitations

- 3.1.1 The objectives of the specifications in this guidance material are to define the airspace around aerodromes to be maintained free from obstacles so as to permit the intended aeroplane 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.
- 3.1.2 Objects which penetrate the obstacle limitation surfaces contained in this guidance material 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. Criteria for flight procedure design, are contained in Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) (Doc 8168)
- 3.1.3 The establishment of, and requirements for, an obstacle protection surface for visual approach slope indicator systems are specified in paragraphs 3.20 of this guidance material

3.2 Obstacle limitation surfaces *(See ICAO Annex 14 Vol. I)*

3.2.1 Outer horizontal surface

- 3.2.2 In view of the important operational considerations that may arise as the result of the erection of tall structures in the vicinity of aerodromes beyond the areas currently recognised by ICAO Annex 14 the Authority has specified the “Outer Horizontal Surface” as an obstacle limitation surface.
- 3.2.3 An outer horizontal surface is a specified portion of a horizontal plane around an aerodrome beyond the limits of the conical surface. It represents the level above which consideration needs to be given to the control of obstacles in order to facilitate practicable and efficient instrument approach procedures and together with the conical and inner horizontal surface to ensure safe visual manoeuvring in the vicinity of the aerodrome.



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3.2.4 As a broad specification, the outer horizontal surface should extend from the periphery of the conical surface to a minimum radius of 15,000 m from the aerodrome reference point where the runway code number is 3 or 4 and a minimum radius of 10,000 m where the runway code number is 2. It may need to be extended to coincide with the obstacle accountable areas of PANS-OPS for the individual approach procedures at the aerodrome under consideration.

3.2.5 Guidance on the need to provide an outer horizontal surface and its characteristics is contained in the ICAO Airport Services Manual (Doc 9137), Part 6.

3.3 Conical surface

3.3.1 Conical surface is a surface sloping upwards and outwards from the periphery of the inner horizontal surface.

3.3.2 The limits of the conical surface shall comprise:

3.3.3 Lower edge coincident with the periphery of the inner horizontal surface; and

3.3.4 An upper edge located at a specified height above the inner horizontal surface.

Runway Code Number	Non-Instrument	Non-Precision Approach	Precision Approach Category I	Precision Approach Category II or III
1	35m	60m	60m	-
2	55m	60m	60m	-
3	75m	75m	100m	100m
4	100m	100m	100m	100m

Table 1: The conical Surface should extend upwards to the height of the outer horizontal surfaces

3.3.5 The slope of the conical surface shall be measured in a vertical plane perpendicular to the periphery of the inner horizontal surface. The slope is 5% for all combinations of runway code number and types of approach.

3.4 Inner horizontal surface

3.4.1 Inner horizontal surface is a surface located in a horizontal plane above an aerodrome and its environs.

3.4.2 The radius or outer limits of the inner horizontal surface shall be measured from a reference point or points established for such purpose by using circular arcs centred on the runway ends and joined tangentially by straight lines, thus producing a racetrack pattern. To protect two or more widely spaced runways, a more complex pattern could become necessary involving four or more circular arcs. The radii of the circular arcs vary with the runway code number and the type of approach and are specified in Table 2 below.

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 ICAO Airport Services Manual (Doc 9137), Part 6.



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3.4.3 The height of the inner horizontal surface shall be 45m above the elevation datum established for that purpose. The location of the datum shall be agreed with the Authority. The location of the datum shall be agreed with the Authority and may be the calculated midpoint between main runway(s) ends.

3.4.4 Guidance on determining the elevation datum is contained in the ICAO Airport Services Manual (Doc 9137), Part 6.

Runway Code Number	Non-Instrument	Non-Precision Approach	Precision Approach Category I	Precision Approach Category II or III
1	2000m	3500m	3500m	-
2	2500m	3500m	3500m	-
3	4000m	4000m	4000m	4000m
4	4000m	4000m	4000m	4000m

Table 2: Radius of Inner Horizontal surface at runway ends

3.4.5 Where the inner horizontal surface is at any point lower than an approach or take-off climb surface the inner horizontal surface is the obstacle limitation surface.

3.5 Approach surface

3.5.1 Approach surface is an inclined plane or combination of planes preceding the threshold.

3.5.2 The limits of the approach surface shall comprise:

3.5.3 An inner edge of specified length, horizontal and perpendicular to the extended centre line of the runway and located at a specified distance before the threshold;

3.5.4 Two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended centre line of the runway; and

3.5.5 An outer edge parallel to the inner edge.

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

3.5.7 The slope(s) of the approach surface shall be measured in the vertical plane containing the centre line of the runway.

Table 3: Dimension and Slopes of Approach Surfaces (Non-Instrument)

Approach Surface	Runway Classification			
	Non Instrument Runway			
	Code Number			
	1	2	3	4
Length of Inner Edge	60m	80m	150m	150m
Distance from Threshold	30m	60m	60m	60m
Divergence (Each side)	10%	10%	10%	10%
Length	1600m	2500m	3000m	3000m
Slope	5%	4%	3.33%	2.5%



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All distances are measured horizontally.

Table 4: Dimensions and slopes of approach surfaces (Instrument)

Approach Surface	Runway Classification		
	Non-Precision Approach Runway	Precision Approach Category I	Non-Precision Approach and Precision Approach Category I, II and III
	Code Number	Code Number	Code Number
	1,2	1,2	3,4
Length of Inner Edge	150m	150m	300m
Distance from Threshold	60m	60m	60m
Divergence (Each side)	15%	15%	15%
First Sector			
Length	2500m	3000m	3000m
Slope	3.33%	2.5%	2.0%
Second Sector			
Length	-	12000m	3600m
Slope	-	3%	2.5%
Horizontal Sector			
Length	-		8400m
Total Length	-	15000m	15000m

A – Variable length

All dimensions are measured horizontally

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3.6 Transitional surface

3.6.1 Transitional surface is 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.

3.6.2 The limits of the 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 centre line; and
- b) An upper edge located in the plane in the inner horizontal surface.

3.6.3 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 centre 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.

3.6.4 The slope of the transitional surface shall be measured in a vertical plane at right angles to the centre line of the runway in accordance with;

- a) 20% - non instrument or non-precision approach; Code Number 1 or 2 and
- b) 14.3% - all other runway classifications and code numbers.



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3.7 Take-off climb surface

- 3.7.1 Take-off climb surface is an inclined plane or other specified surface beyond the end of a runway or clearway.
- 3.7.2 The limits of the take-off climb surface shall comprise:
 - a) An inner edge horizontal and perpendicular to the centre 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 take-off climb surface; and
 - c) An outer edge horizontal and perpendicular to the specified takeoff track.
- 3.7.3 The elevation of the inner edge shall be equal to the highest point on the extended runway centre 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 centre line of the clearway.
- 3.7.4 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 centre line of the runway.
- 3.7.5 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 normal to its centre line, and the slope of the centre line shall be the same as that for a straight take-off flight path.

Table 5 - Dimensions and slopes-take-off climb surfaces

Take-Off Climb Surface	Code Number		
	1	2	3 or 4
Length of Inner Edge	60m	80m	180m
Distance from runway end a	30m	60m	60m
Divergence (Each side)	10%	10%	12.5%
Final width	380m	580m	1800mb
Length	1600m	2500m	15000m
Slope	5.0%	4.0%	2.0%

Notes- All dimensions are measured horizontally.

^a The take-off climb surface starts at the end of the clearway if the clearway exceeds the specified distance .(30 m or 60 m as appropriate).

^b 1800 m when the intended track includes changes of heading greater than 15 degrees for operations conducted in IMC or VMC by night.



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3.8 Obstacle free zone (OFZ).

- 3.8.1 An OFZ is intended to protect aeroplanes from fixed and mobile objects during category I, II and III landings when approaches are continued below decision height and during any subsequent missed approach with all engines operating normally (a balked landing). It is not intended to supplant the requirement of other surfaces or areas where these are more demanding.
- 3.8.2 2.7.2 Together the inner approach, inner transitional and balked landing surfaces define a volume of airspace in the immediate vicinity of an aerodrome that is known as the OFZ.

3.9 Inner approach surface

- 3.9.1 Inner approach surface is a rectangular portion of the approach surface immediately preceding the threshold. It is a specified obstacle limitation surface for precision approach runways category I, II or III.
- 3.9.2 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 centre line of the runway; and
 - c) An outer edge parallel to the inner edge.

Table 6 - Dimensions and slopes of inner approach surfaces

Inner Approach Surface	Runway Classification	
	Precision Approach	Precision Approach
	Category I	Category I, II or III
	Code Number	Code Number
	1,2	3,4
Width	90m	120m ^a
Distance from Threshold	60m	60m
Length	900m	900m
Slope	2.5%	2.0%

Notes - all dimensions are measured horizontally

^a - Where the code letter is F the width is increased to 155 m

3.10 Inner transitional surface

- 3.10.1 An inner transitional surface is similar to a transitional surface but closer to the runway.
- 3.10.2 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 be penetrated except for frangible objects. The transitional surface



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described in paragraph 3.6 of this guidance material is intended to remain as the controlling obstacle limitation surface for buildings, etc.

3.10.3 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 centre 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.

3.10.4 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 centre 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 a straight line depending on the runway profile.

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

3.10.6 Inner Transitional Surface Slopes are

- a) 40% - precision approach runway category I; Code number 1 or 2,
- b) 33.3% - precision approach runway category I, II or III; Code number 3 or 4.

3.11 Balked landing surface

3.11.1 Balked landing surface is an inclined plane located at a specified distance after the threshold, extending between the inner transitional surfaces.

3.11.2 The limits of the balked landing surface shall comprise:

- a) An inner edge horizontal and perpendicular to the centre 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 centre line of the runway; and
- c) An outer edge parallel to the inner edge and located in the plane of the inner horizontal surface.

3.11.3 The elevation of the inner edge shall be equal to the elevation of the runway centre line at the location of the inner edge.



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

Table 7 - Dimensions and slopes of balked landing surface

Balked Landing Surface	Runway Classification	
	Precision Approach	Precision Approach
	Category I	Category I, II or III
	Code Number	Code Number
	1,2	3,4
Length of inner edge	90m	120ma
Distance from Threshold	b	1800mc
Divergence (Each Side)	10%	10%
Slope	4.0%	3.33%

All dimensions are horizontal.

^a

- Where the code letter is F the width is increased to 155 m.

^b

- Distance to the end of strip.

^c

- Or to the end of the runway whichever is less.

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3.12 Obstacle limitation requirements

- 3.12.1 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 case 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.
- 3.12.2 Where there are transverse slopes or longitudinal slopes on a strip or clearway the inner edge of the take-off climb surface or an approach surface may lie partly or wholly below the level of the ground in the strip or clearway. It is not necessary that the strip or clearway should, in such cases, be graded to conform with the inner edge of the take-off climb or approach surface.

3.13 Non-instrument runways

- 3.13.1 The following obstacle limitation surfaces shall be established for a non-instrument runway;
- a) Conical surface;
 - b) Inner horizontal surface;
 - c) Approach surface; and
 - d) Transitional surfaces.
- 3.13.2 The heights and slopes of the surfaces shall not be greater than and their other dimensions not less than, those specified in Table 1, 2, 3, 4, 6 and 7 of this guidance material.
- 3.13.3 New objects or extensions of existing objects shall not be permitted above an approach or transitional surface except when, in the opinion of the authority, the new object or extension would be shielded by an existing immovable object.
- 3.13.4 Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Airport Services Manual (Doc 9137), Part 6.
- 3.13.5 New objects or extensions of existing objects shall not be permitted above the conical surface or inner horizontal surface except when 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 aeroplanes or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.
- 3.13.6 Existing objects above any of the surfaces required by paragraph 3.13.1 of this guidance material should as far as practicable be removed except when, in the opinion of the Aerodrome and PANS-OPS & Airspace Inspector, 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 aeroplanes.



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- 3.13.7 In considering proposed construction account should be taken of the possible future development of an instrument runway and consequent requirements for more stringent obstacle limitation surfaces.
- 3.13.8 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 aeroplanes.
- 3.13.9 In considering proposed construction, account should be taken of the possible future development of an instrument runway and consequent requirement for more stringent obstacle limitation surfaces.

3.14 Non-precision approach runways

- 3.14.1 The following obstacle limitation surfaces shall be established for a non-precision approach runway:
- a) Conical surface;
 - b) Inner horizontal surface;
 - c) Approach surface; and
 - d) Transitional surfaces.
- 3.14.2 The heights and slopes of the surfaces shall not be greater than, and their other dimensions not less than, those specified in this Guidance material, except in the case of the horizontal section of the approach surface (See paragraph 3.14.3 of this Guidance material).
- 3.14.3 The approach surface shall be horizontal beyond the point at which the 2.5 % slope intersects:
- a) A horizontal plane 150m 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.

- 3.14.4 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 the new object or extension would be shielded by an existing immovable object.
- 3.14.5 Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Airport Services Manual, Part 6.
- 3.14.6 New objects or extensions of existing objects should not be permitted above the approach surface beyond 3 000 m from the inner edge, the conical surface or inner horizontal surface except when the object would be shielded by an existing immovable



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object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity operations of aeroplanes.

3.14.7 Existing objects above any of the surfaces required by paragraph 3.14 should as far as practicable be removed except when, in the opinion of the Aerodrome and PANS-OPS & Airspace Inspector, 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 aeroplanes.

3.14.8 Because of the 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 aeroplanes.

3.15 Precision approach runways

3.15.1 See paragraph 9.9 of Annex 14 for information regarding siting of equipment and installations on operational areas.

3.15.2 Guidance on obstacle limitation surfaces for precision approach runways is given in the ICAO Airport Services Manual, Part 6.

3.15.3 The following obstacle limitation surfaces shall be established for a precision approach runway category I;

- a) Conical surface;
- b) Inner horizontal surface;
- c) Approach surface: and
- d) Transitional surfaces.

3.15.4 The following obstacle limitation surfaces should be established for a precision approach runway category 1:

- a) Inner approach surface;
- b) Inner transitional surfaces; and
- c) Balked landing surface.

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

- a) Conical surface;
- b) Inner horizontal surface;
- c) Approach surface and inner approach surface;



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- d) Transitional surfaces;
 - e) Inner transitional surfaces; and
 - f) Balked landing surface.
- 3.15.6 The heights and slopes of the surfaces shall not be greater than, and their other dimensions not less than, those specified in table 1, 2, 3, 4, 6 and 7 of this Guidance material, except in the case of the horizontal section of the approach surface (See paragraph 3.15.7 of this Guidance material).
- 3.15.7 The approach surface shall be horizontal beyond the point at which the 2.5 % 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;
 - c) Whichever is the higher.
- 3.15.8 Fixed objects shall not be permitted above the inner approach surface, the inner approach surface, the inner transitional surface or the balked landing surface (the OFZ), 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.
- 3.15.9 Fixed objects shall not be permitted to penetrate the balked landing surface extended at the slope and splay to the lowest height at which protection is afforded by the PANS-OPS missed approach surface. This is the height at which the balked landing surface and Category I ILS missed approach surface intersect. Mobile objects shall not be permitted above this surface during the use of the runway for landing.
- 3.15.10 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 Aerodrome and PANS-OPS & Airspace Inspector, the new object or extension would be shielded by an existing immovable object.
- 3.15.11 Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Airport Services Manual, Part 6.
- 3.15.12 New objects or extensions of existing objects should not be permitted above the conical surface and the inner horizontal surface except when 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 operations of aeroplanes.
- 3.15.13 Existing objects above an approach surface, a transitional surface, the conical surface and inner horizontal surface should as far as practicable be removed except when 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 operations of aeroplanes.



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3.15.14 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 that may endanger aeroplanes.

3.16 Runways used for take-off

3.16.1 The following obstacle limitation surface shall be established for a runway used for take-off:

a) Take-off climb surface shall be established for a runway meant for take-off.

3.16.2 The dimension of the surface shall be not less than the dimensions specified in Table 5 of this Guidance material, except that a lesser length may be adopted or the take-off climb surface where such lesser length would be consistent with procedural measures adopted to govern the outward flight of aeroplanes.

3.16.3 The operational characteristics of aeroplanes for which the runway is intended should be examined to see if it is desirable to reduce the slope specified in Table 5 of this Guidance material 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 should be made so as to provide protection to a height of 300m.

3.16.4 New objects or extensions of existing objects shall not be permitted above a take-off climb surface except when, in the opinion of the Aerodrome and PANS-OPS & Airspace Inspector, the new object or extension would be shielded by an existing immovable object.

3.16.5 Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Airport Services Manual, Part 6.

3.16.6 If no object reaches the 2 % (1:50) 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 % (1:62.5).

3.16.7 Existing objects that extend above a take-off climb surface should as far as practicable be removed except when 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 aeroplanes.

3.16.8 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 it is 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 that may endanger aeroplanes. Similar considerations apply at the junction of a clearway and strip where differences in transverse slopes exist.

3.17 Outer horizontal surface.

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- 3.17.1 An outer horizontal surface should be established for an aerodrome where the code number is 2, 3, or 4.
- 3.17.2 It is particularly desirable to review carefully any proposal to erect high masts or other skeletal structures in areas which would otherwise be suitable for use by aircraft on wide visual circuits, or arrival routes towards the aerodrome or circuit, or on departure or missed approach climb paths. Avoidance by marking or lighting cannot always be relied upon in view of the relatively inconspicuous character of these structures.
- 3.17.3 Existing objects, within the area of the outer horizontal surface should as far as practicable be removed if they are both higher than 30 m above the local ground level and higher than the outer horizontal surface, except when in the opinion of the Authority the object is shielded by an existing immovable object, or after an aeronautical study it is determined that the objects would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.
- 3.17.4 Extensions of existing objects, or new objects within the area of the outer horizontal surface should not be permitted if they are both higher than 30 m above the local ground level and higher than the outer horizontal surface, except when in the opinion of the Authority the object is shielded by an existing immovable object, or after an aeronautical study it is determined that the objects would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

3.18 Objects outside the obstacle limitation surfaces

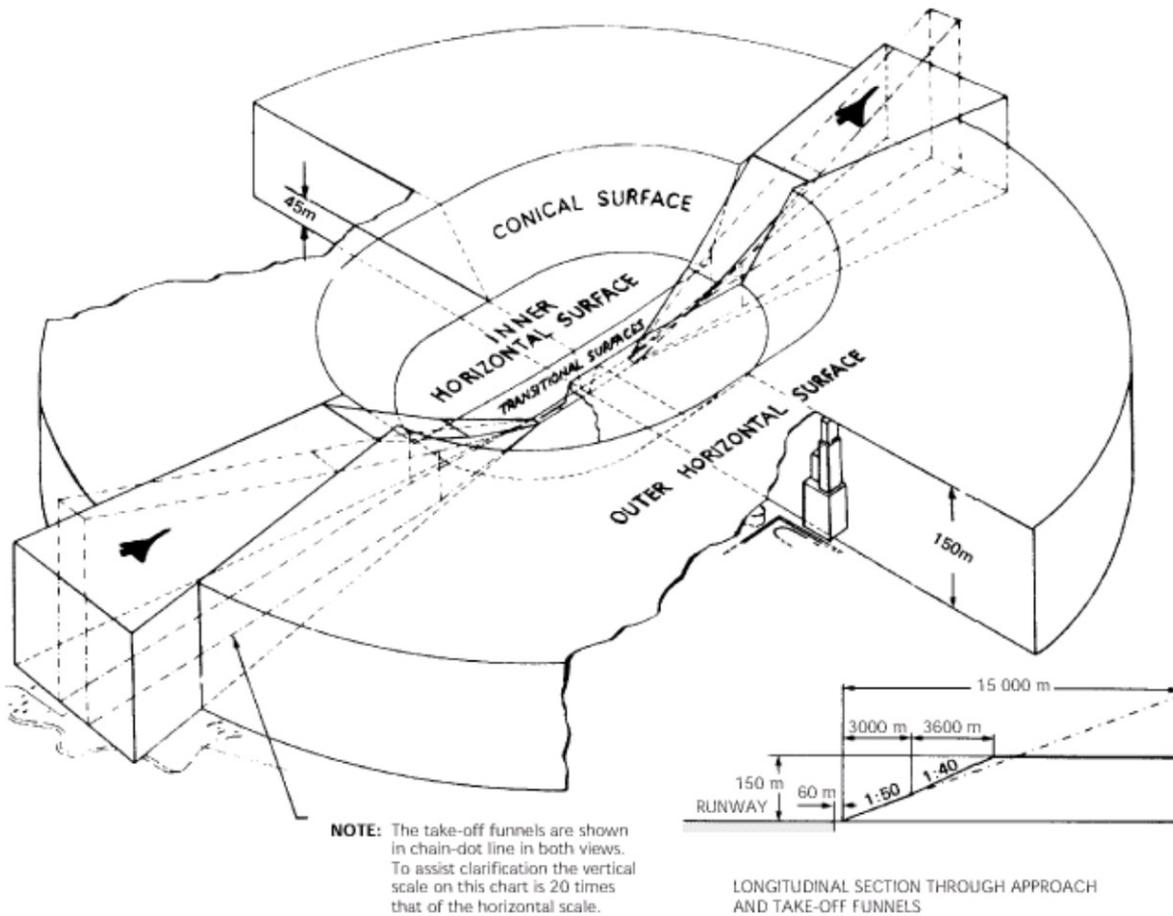
- 3.18.1 Arrangements should be made to enable the Authority to be consulted concerning proposed construction beyond the limits of the obstacle limitation surfaces that extend above a height established by the Authority, in order to permit an aeronautical study of the effect of such construction on the operation of aeroplanes.
- 3.18.2 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 should be regarded as obstacles, unless a special aeronautical study indicates that they do not constitute a hazard to aeroplanes.
- 3.18.3 This study may have regard to the nature of operations concerned and may distinguish between day and night operations.

3.19 Other objects

- 3.19.1 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 should, as far as practicable, be removed.
- 3.19.2 Anything which may, in the opinion of the Aerodrome and PANS-OPS & Airspace Inspector after aeronautical study, endanger aeroplanes on the movement area or in the air within the limits of the inner horizontal and conical surfaces should be regarded as an obstacle and should be removed in so far as practicable.
- 3.19.3 In certain circumstances, objects that do not project above any of the surfaces enumerated in paragraph 3.2 may constitute a hazard to aeroplanes as, for example, where there are one or more isolated objects in the vicinity of an aerodrome.

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3.19.4 Because of the difficulty of recognition special restrictions are placed on elevated wires and their supports. Where no other object penetrates a given obstacle limitation surface, overhead wires and their supports should not penetrate a surface passing through the top of the highest existing object and parallel to the established surface for a distance of 1500 m from the runway threshold.



Obstacle limitation surfaces for runways over 1800 metres.



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3.20 Obstacle protection surface

3.20.1 The following specifications apply to PAPI and APAPI.

3.20.2 An obstacle protection surface shall be established when it is intended to provide a visual approach slope indicator system.

3.20.3 The characteristics of the obstacle protection surface i.e. origin, divergence, length and slope shall correspond to those specified in the relevant column of Table 8

	Runway Type/Code Number							
	Non-Instrument Code Number				Instrument Code Number			
Surface Dimensions	1	2	3	4	1	2	3	4
Length of inner Edge	60m	80m	150m	150m	150m	150m	300m	300m
Distance from Threshold	30m	60m	60m	60m	60m	60m	60m	60m
Divergence (Each Side)	10%	10%	10%	10%	15%	15%	15%	15%
Total Length	7500m	7500m	15000m	15000m	7500m	7500m	15000m	15000m
Slope-PAPAA	-	A-0.57°	A-0.57°	A-0.57°	A-0.57°	A-0.57°	A-0.57°	A-0.57°
Slope - APAPIa	A-0.9°	A-0.9°	-	-	A-0.9°	A-0.9°	-	-

Table 8

a. Angles as indicated in Appendix D, Figure 6D.2

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3.21 Dimensions and slopes of the obstacle protection surface

- 3.21.1 New objects or extensions of existing objects shall not be permitted above an obstacle protection surface except when in the opinion of the Authority the new object or extension would be shielded by an existing immovable object.
- 3.21.2 Existing objects above an obstacle protection surface shall be removed except when in the opinion of the Authority 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 of operations of aeroplanes.
- 3.21.3 Where an aeronautical study indicates that an existing object extending above an obstacle protection surface could adversely affect the safety of operations of aeroplanes one or more of the following measures shall be taken:
- a) Suitably raise the approach slope of the system;
 - b) Reduce the azimuth spread of the system so that the object is outside the confines of the beam;
 - c) Displace the axis of the system and its associated obstacle protection surface by no more than 5 degrees;
 - d) Suitably displace the threshold; and
 - e) Where d) is found to be impracticable, suitably displace the system upwind of the threshold to provide an increase in threshold crossing height equal to the height of the object penetration.

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3.22 Objects outside aerodrome obstacle limitation surfaces (En-route obstacles).

- 3.22.1 For obstacles located beyond the limits of the obstacle limitation surfaces of an aerodrome, reference should be made to the Irish Aviation Authority Order S.I. 423 of 1999 (En Route Obstacles to Air Navigation) Order 1999.

3.23 Principles of shielding

3.23.1 General

- a) The principle of shielding is employed to permit a more logical approach to restricting new construction and prescribing obstacle marking and lighting. Shielding principles are applied when some object, an existing building or natural terrain, already penetrates above one of the obstacle limitation surfaces described. If it is considered by the Authority that the nature of the 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. No obstacle can be considered as shielded if it is closer to the runway than the shielding obstacle. At other locations, in the application of the shielding principle the Authority will follow the guidance presented in the ICAO Airport Services Manual, Part 6 supported by an aeronautical study.
- b) 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.
- c) Unless specifically directed by the Aerodrome and PANS-OPS & Airspace Inspector, a shielded obstacle does not require removal, lowering, marking or lighting and should not impose any additional restrictions to aircraft operations.
- d) The Aerodrome and PANS-OPS & Airspace Inspector will assess and determine whether an obstacle is shielded. An aerodrome operator shall notify the Aerodrome and PANS-OPS & Airspace Inspector of the presence of all obstacles and their detailed characteristics through the submission of its Aerodrome Guidance material.
- e) Only existing permanent obstacles may be considered in assessing shielding of new obstacles.

3.23.2 Shielding principles

- a) In assessing whether an existing obstacle shields an obstacle, the Aerodrome and PANS-OPS & Airspace Inspector will be guided by the principles of shielding detailed below.
 - (a) Obstacle penetrating the approach and take-off climb surfaces
- b) 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.
- c) As illustrated in Figure 1, a new obstacle may be assessed as not imposing additional restrictions if:



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- d) 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;
- e) 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

3.23.3 (iii) 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.

3.24 Obstacle penetrating the inner and outer horizontal and conical surfaces

3.24.1 A 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.

3.25 Obstacle penetrating the transitional surfaces

3.25.1 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 centre line.

3.26 Obstacle penetrating the inner and outer horizontal and conical surfaces

3.26.1 A 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.

3.27 Obstacle penetrating the transitional surfaces

3.27.1 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 centre line.

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Figure 1.

