ICAO CAIRO UNITING AVIATION

AERODROME SAFEGUARDING WORKSHOP

(Cairo, 4-6 December 2017)

Overview ICAO Standards and Recommended Practices for Aerodrome Safeguarding

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References

- The Convention on International Civil Aviation (Chicago Convention)
- ICAO SARPS – Annex 14 Vol. I, 7th Edition, July 2016
- ICAO SARPS – Annex 15, 15th Edition, July 2016
- ICAO PANS- Aerodromes-Doc 9981, 2nd Edition, 2016
- ICAO PANS-OPS (Aircraft Operations) - Doc 8168
- ICAO Manual on Certification of Aerodromes Doc 9774
- ICAO Airport Services Manual -Doc 9137-Part 6 - Control of Obstacles
- Regional Safety Advisories - MID-RSA/11(Safeguarding Tool Kit)

Introduction

- **Article 15** of the Convention on International Civil Aviation requires that all aerodromes open to public use under the jurisdiction of a Contracting State provide uniform conditions for the aircraft of all other Contracting States.
- **Article 28**: Each State undertakes to provide airports and air navigation services in accordance with the rules and methods established in the Convention
- **Article 37**: Adoption of International Standards and Procedures
- **Article 38**: Deviations from international rules and procedures

Objectives

- The objectives of ICAO specifications on Aerodrome Safeguarding are to:

  - ✓ define the airspace around aerodromes to be maintained free from obstacles so as to permit safety of intended aeroplane operations
  - ✓ prevent the aerodromes from becoming unusable by the growth of obstacles around the aerodromes by establishing a series of obstacle limitation surfaces that define the limits to which objects may project into the airspace.

Aerodrome Safeguarding

Objectives Cont'd

- ✓ Every effort shall be made towards finding appropriate solutions to the conflicts about the use of the national airspace and its preservation for aviation shall be the primary objective in order to promote their efficient use and, above all, the safety of intended aircraft operations.

- ✓ The safety and regularity of air operations at an aerodrome or in a portion of airspace depend on the proper maintenance of their operating conditions, which are directly influenced by land use.

ICAO SARPs

Annex 14 Volume I – 7th Edition, July 2016

Chapter 4: Obstacle Restriction and Removal

4.1 Obstacle limitation surfaces

4.2 Obstacle limitation requirements

4.3 Objects outside the obstacle limitation surfaces

4.4 Other objects

Chapter 6: Visual aids for denoting obstacles

6.1 Objects to be marked and/or lighted

6.2 Marking and/or lighting of objects

Appendix 6: Location of lights on obstacles

Attachment B: Obstacle limitation surfaces

ICAO SARPs (Cont'd)

Chapter 2: Aerodrome Data

Reporting and Managing Aerodrome Data Requirements:

- Aeronautical data
- Aerodrome dimensions and related information including Obstacles
- Accuracy and Integrity requirements

(Separate Presentations)

Obstacle Limitation Surfaces

ICAO definition of Obstacle:

All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that:

a) are located on an area intended for the surface movement of aircraft; or

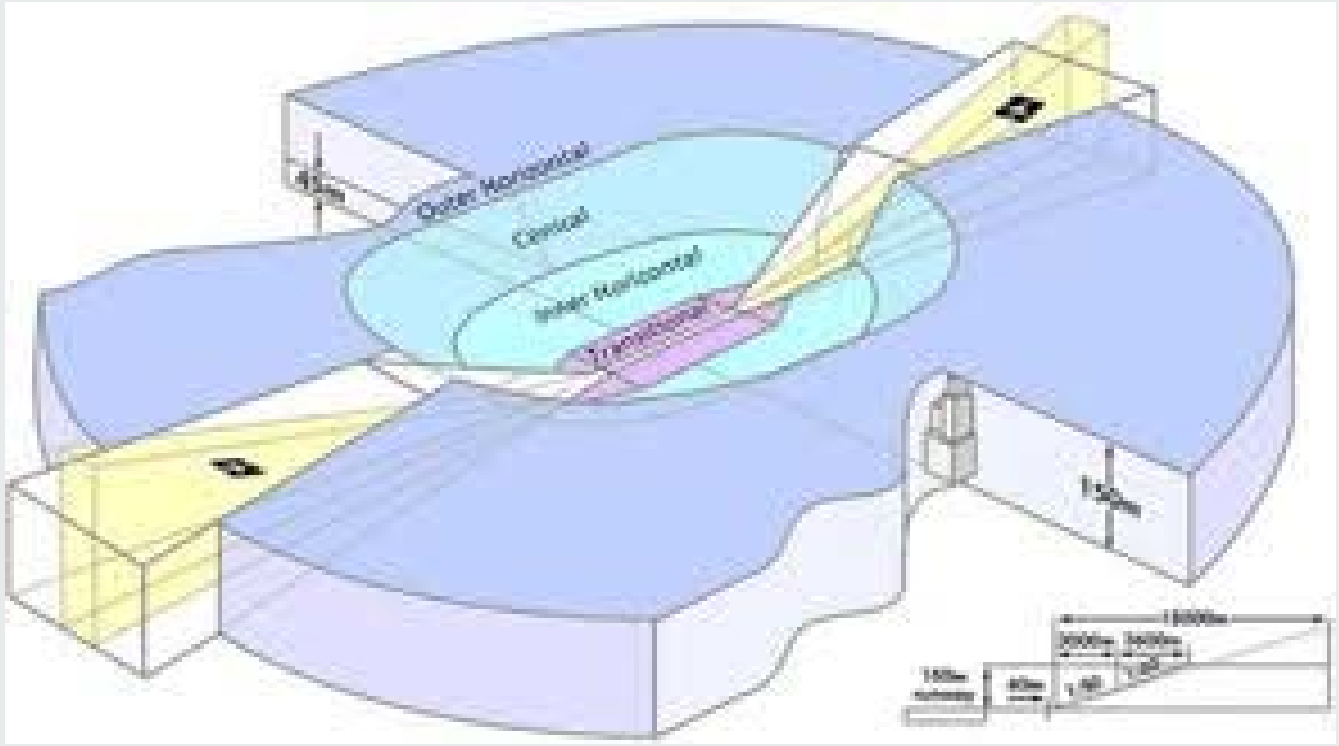
b) extend above a defined surface intended to protect aircraft in flight; or

c) stand outside those defined surfaces and that have been assessed as being a hazard to air navigation.

ICAO SARPs

Definition of Obstacle free zone (OFZ):

The airspace above the inner approach surface, inner transitional surfaces, and balked landing surface and that portion of the strip bounded by these surfaces, which is not penetrated by any fixed obstacle other than a low-mass and frangible mounted-one required for air navigation purposes.

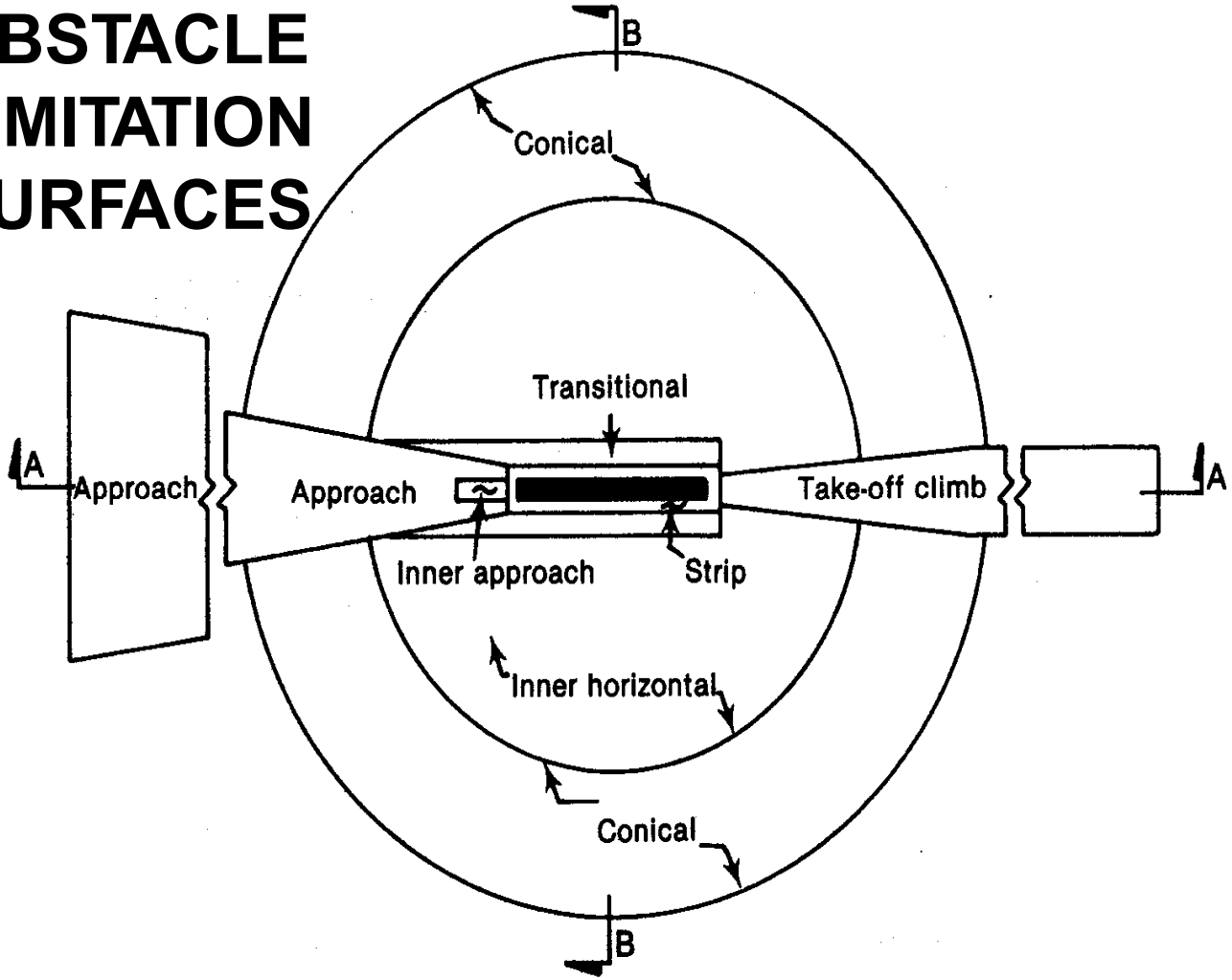

Outer Horizontal
Conical
Inner Horizontal
Transitional

Obstacle Limitation Surfaces

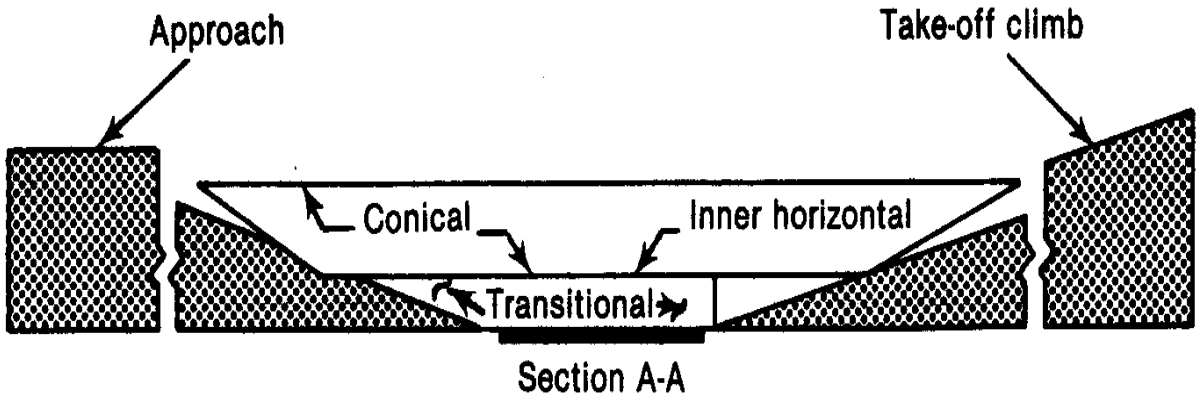
Nine Obstacle Limitation Surfaces:

- Outer horizontal surface
- Conical Surface
- Inner Horizontal Surface
- Approach Surface
- Inner Approach Surface
- Transitional Surface
- Inner Transitional Surface
- Balked Landing Surface
- Take-off Climb

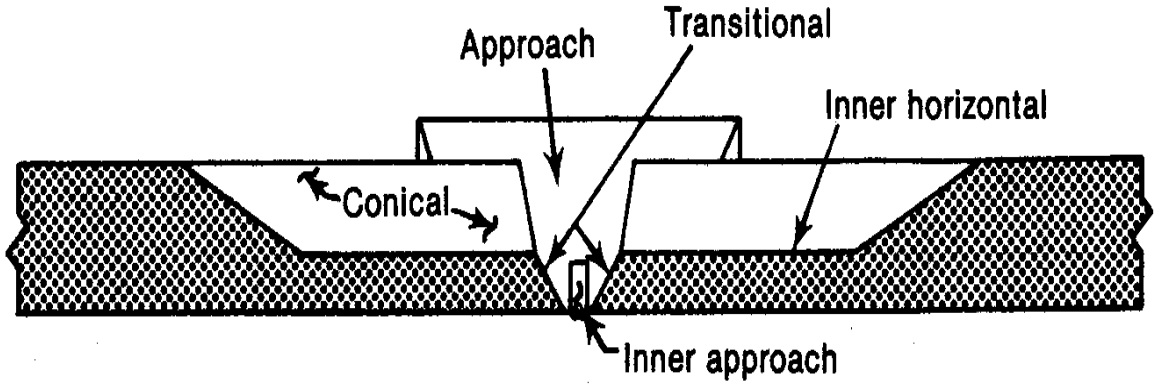
OBSTACLE LIMITATION SURFACES



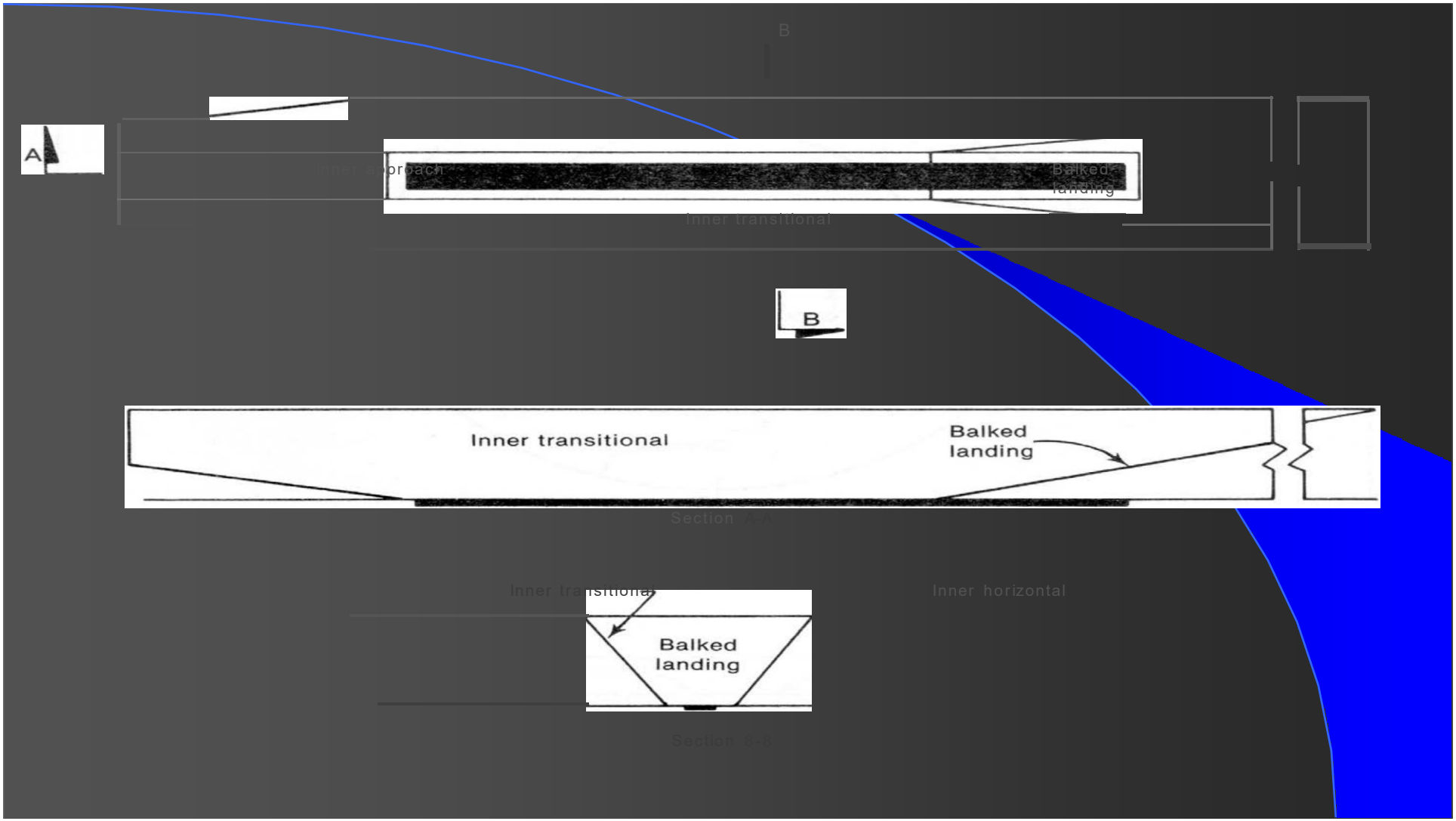
OBSTACLE LIMITATION SURFACES



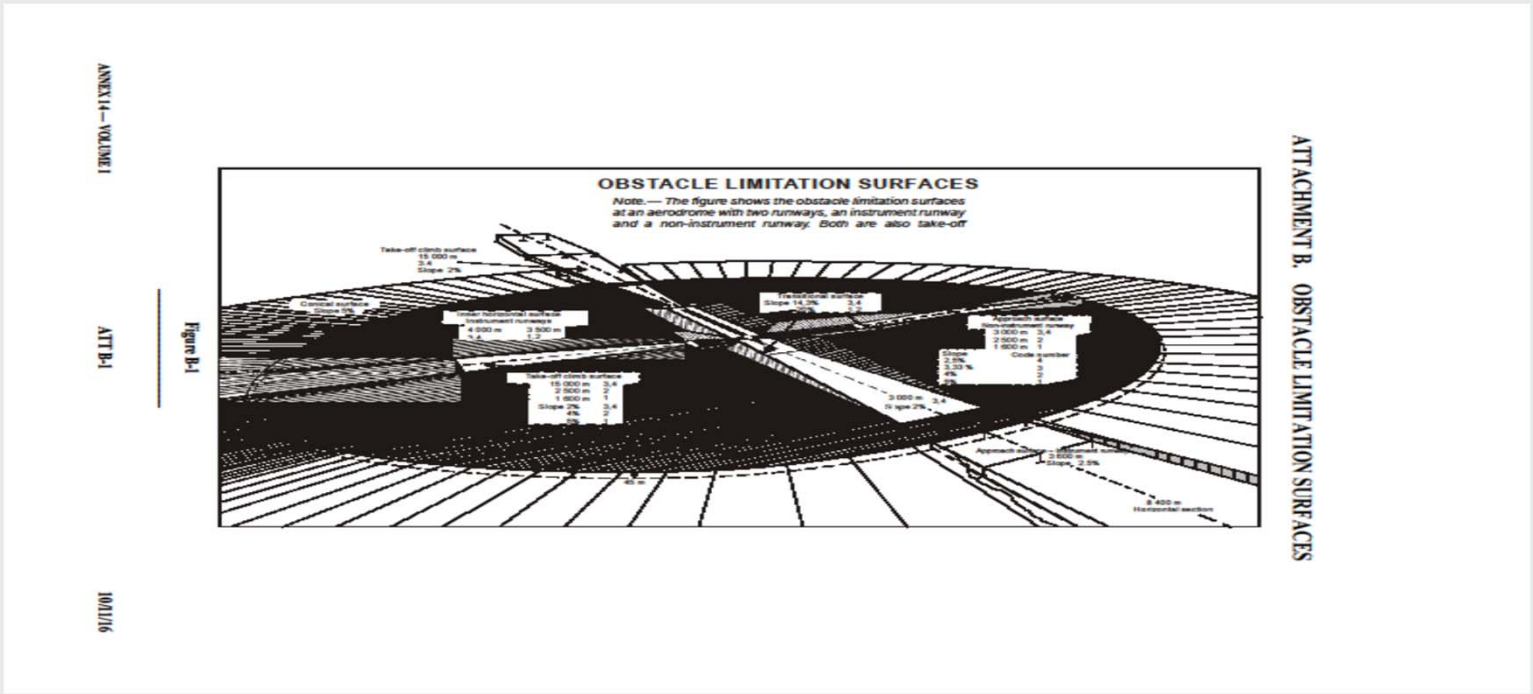
Section A-A



Section B-B


B
A
Inner approach
Balked landing
Inner transitional
B
Inner transitional
Balked landing
Section A-A
Inner transitional
Inner horizontal
Balked landing
Section B-B

ATTACHMENT B: OBSTACLE LIMITATION SURFACES

- 

Obstacle Limitation Requirements

The requirements for obstacle limitation surfaces are specified on the basis of the intended use of a runway, i.e.

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

Obstacle Limitation Requirements

Non-instrument runways

Non-precision approach runways

Precision approach runways

Runways meant for take-off

Note:

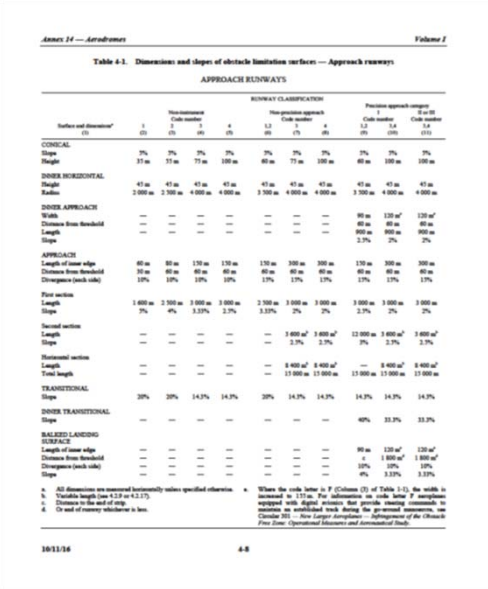
Circumstances in which shielding principle may reasonably be applied are described in the Airport Services Manual (Doc 9137), Part 6.

Obstacle Limitation Requirements

- Table 4-1. Details; Dimensions and slopes of obstacle limitation surfaces — Approach runways
- Table 4-2. Dimensions and slopes of obstacle limitation surfaces - Runways meant for take-off

Obstacle Limitation Requirements

- Table 4.1: Dimensions and slopes of obstacle limitation surfaces — Approach runways



Annex 14 — Aerodromes *Volume I*

Table 4-1. Dimensions and slopes of obstacle limitation surfaces — Approach runways

APPROACH RUNWAYS

Surface and dimension[a] (1)	RUNWAY CLASSIFICATION: Non-instrument, Code number 1 (1)	Non-instrument, Code number 2 (2)	Non-instrument, Code number 3 (3)	Non-instrument, Code number 4 (4)	Non-precision approach, Code number 1,2 (5)	Non-precision approach, Code number 3 (6)	Non-precision approach, Code number 4 (7)	Non-precision approach, Code number 4 (8)	Precision approach category I, Code number 1,2 (9)	Precision approach category I, Code number 3,4 (10)	Precision approach category II or III, Code number 3,4 (11)
CONICAL											
Slope	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Height	35 m	55 m	75 m	100 m	60 m	75 m	100 m		60 m	100 m	100 m
INNER HORIZONTAL											
Height	45 m	45 m	45 m	45 m	45 m	45 m	45 m		45 m	45 m	45 m
Radius	2 000 m	2 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m		3 500 m	4 000 m	4 000 m
INNER APPROACH											
Width	—	—	—	—	—	—	—		90 m	120 m[d]	120 m[d]
Distance from threshold	—	—	—	—	—	—	—		60 m	60 m	60 m
Length	—	—	—	—	—	—	—		900 m	900 m	900 m
Slope									2.5%	2%	2%
APPROACH											
Length of inner edge	60 m	80 m	150 m	150 m	150 m	300 m	300 m		150 m	300 m	300 m
Distance from threshold	30 m	60 m	60 m	60 m	60 m	60 m	60 m		60 m	60 m	60 m
Divergence (each side)	10%	10%	10%	10%	15%	15%	15%		15%	15%	15%
First section											
Length	1 600 m	2 500 m	3 000 m	3 000 m	2 500 m	3 000 m	3 000 m		3 000 m	3 000 m	3 000 m
Slope	5%	4%	3.33%	2.5%	3.33%	2%	2%		2.5%	2%	2%
Second section											
Length	—	—	—	—	—	3 600 m[d]	3 600 m[d]		12 000 m	3 600 m[d]	3 600 m[d]
Slope	—	—	—	—	—	2.5%	2.5%		3%	2.5%	2.5%
Horizontal section											
Length	—	—	—	—	—	8 400 m[d]	8 400 m[d]		—	8 400 m[d]	8 400 m[d]
Total length	—	—	—	—	—	15 000 m	15 000 m		15 000 m	15 000 m	15 000 m
TRANSITIONAL											
Slope	20%	20%	14.3%	14.3%	20%	14.3%	14.3%		14.3%	14.3%	14.3%
INNER TRANSITIONAL											
Slope	—	—	—	—	—	—	—		40%	33.3%	33.3%
BALKED LANDING SURFACE											
Length of inner edge	—	—	—	—	—	—	—		90 m	120 m[d]	120 m[d]
Distance from threshold	—	—	—	—	—	—	—		c	1 800 m[d]	1 800 m[d]
Divergence (each side)	—	—	—	—	—	—	—		10%	10%	10%
Slope	—	—	—	—	—	—	—		4%	3.33%	3.33%

a. All dimensions are measured horizontally unless specified otherwise.
b. Variable length (see 4.2.9 to 4.2.17).
c. Distance to the end of strip.
d. Or end of runway whichever is less.
e. Where the code letter is F (Column (3) of Table 1-1), the width is increased to 155 m. For information on code letter F aeroplanes equipped with digital avionics that provide steering commands to maintain an established track during the go-around manoeuvre, see Circular 351 — *New Larger Aeroplanes — Infringement of the Obstacle Free Zone: Operational Measures and Aeronautical Study*.

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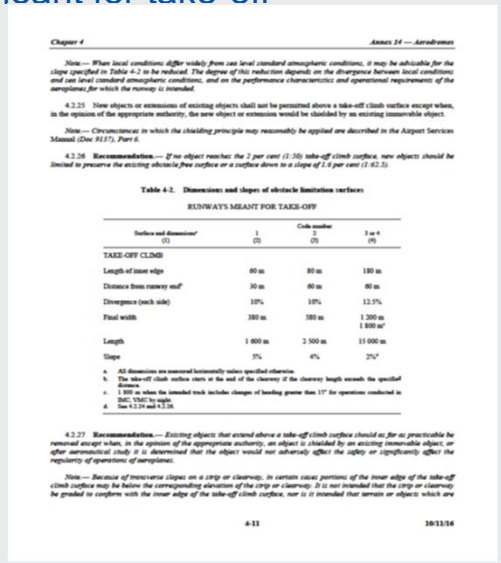
- Table 4-2: Dimensions and slopes of obstacle limitation surfaces - Runways meant for take-off



Chapter 4 *Annex 14 — Aerodromes*

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

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

Note.— Circumstances in which the shielding principle may reasonably be applied are described in the Airport Services Manual (Doc 9137), Part 6.

4.2.26 **Recommendation.**— *If no object reaches the 2 per cent (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 per cent (1:62.5).*

Table 4-2. Dimensions and slopes of obstacle limitation surfaces

RUNWAYS MEANT FOR TAKE-OFF

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

a. All dimensions are measured horizontally unless specified otherwise.
b. The take-off climb surface starts at the end of the clearway if the clearway length exceeds the specified distance.
c. 1 800 m when the intended track includes changes of heading greater than 15° for operations conducted in IMC, VMC by night.
d. See 4.2.24 and 4.2.28.

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

Note.— Because of transverse slopes on a strip or clearway, in certain cases portions of the inner edge of the take-off climb surface may be below the corresponding elevation of the strip or clearway. It is not intended that the strip or clearway be graded to conform with the inner edge of the take-off climb surface, nor is it intended that terrain or objects which are

4-11 10/11/16

Objects outside the obstacle limitation surfaces

- Arrangements should be made to enable the appropriate authority to be consulted concerning proposed construction beyond the limits of the obstacle limitation surfaces that extend above a height established by that authority, in order to permit an aeronautical study of the effect of such construction on the operation of aeroplanes.

- 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.


SAFETY
FIRST

Other objects

- 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.

- Anything which may, in the opinion of the appropriate authority 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.

Visual aids for denoting obstacles

- Objects to be marked and/or lighted
  - Objects within the lateral boundaries of the obstacle limitation surfaces
  - Objects outside the lateral boundaries of the obstacle limitation surfaces

Visual aids for denoting obstacles

- Marking and/or lighting of objects
  - Mobile objects
  - Fixed objects
  - Wind turbines
  - Overhead wires, cables, etc., and supporting towers

Siting of equipment and installations on operational areas

- **Chapter 9.9 of Annex 14 Volume I**
- Any equipment or installation required for air navigation or for aircraft safety purposes which must be located:
- a) on that portion of a runway strip or
- b) on a runway end safety area, a taxiway strip or within the distances specified in Table 3-1; or
- c) on a clearway and which would endanger an aircraft in the air;

  is regarded as an obstacle and shall be frangible and mounted as low as possible.
- Guidance on the siting of navigation aids is contained in the **Aerodrome Design Manual (Doc 9157), Part 6 - Frangibility.**

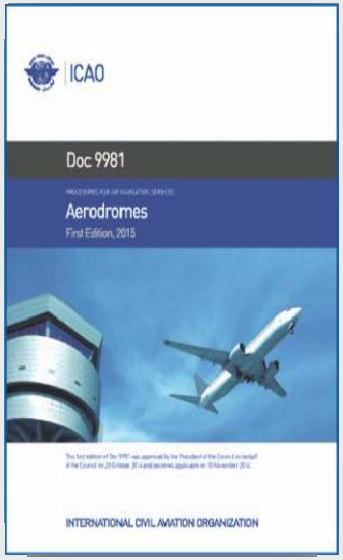
ICAO PANS-Aerodromes- Doc 9981

- The PANS - Aerodromes contains two parts:

  Part I — ADR certification, safety assessments and compatibility

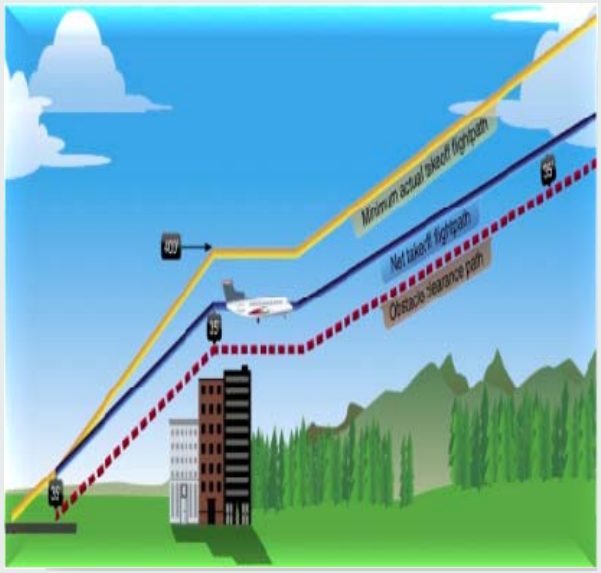
  Part II — Aerodrome operational Management

- PANS-Aerodrome - future work program for its revision will include Obstacle control and management



ICAO PANS-OPS (Aircraft Operations) - Doc 8168

- Surfaces established by Procedure designers of Air Navigation Services and Aircraft Operations (PANS-OPS) are intended to safeguard an aeroplane from collision with obstacles when flying on instruments



ICAO PANS-OPS (Aircraft Operations) - Doc 8168

- PANS-OPS specify the size and dimensions of the obstacle-free airspace needed for the approach, for the missed approach initiated at or above the OCA/H and for the visual maneuvering (circling) procedure.

- Visual maneuvering (circling procedures) described in PANS-OPS, is a visual extension of an instrument approach procedure. The size of the area for a visual maneuvering (circling) varies with the flight speed

ICAO PANS-OPS (Aircraft Operations) - Doc 8168

- In many cases, the size of the area will be considerably larger than that covered by the Annex 14 inner horizontal surface. Therefore circling altitudes/height calculated according to PANS-OPS for actual operations may be higher than those based only on obstacles penetrating the inner horizontal surface area.
- more information is contained at Annex 6 – Aircraft Operations

ICAO PANS-OPS (Aircraft Operations) - Doc 8168

Obstacle Assessment Surfaces (OAS):

Obstacle Assessment Surfaces (OAS) establish a volume of airspace, inside which it is assumed the flight paths of aeroplanes making ILS approaches and subsequent missed approaches will be contained with sufficiently high probability.

ICAO PANS-OPS (Aircraft Operations) - Doc 8168

ILS, Radar and other Electronic Aide to Air Navigation

- Basic ILS, surfaces Radar
- Other Electronic Aide to Air Navigation (VOR / Microwave line…..)
- Visual Aids:
- Control Tower

ICAO PANS-OPS (Aircraft Operations) - Doc 8168

ILS, Radar and other Electronic Aide to Air Navigation (Cont'd)

- Visual Aids: to be protected by:

  - preventing them from being obscured;
  - preventing the installation and display of other lights, particularly street lighting, in a pattern or color which could be mistaken for visual aids;
  - preventing a high level of background lighting which could diminish their effectiveness; and
  - preventing other lights which could dazzle pilots.

- Control Tower:

  Aerodrome operator should do all effort needed to provide protection needed to keep control tower line of sight clear form any obstacles

ICAO Guidance Material
Airport Service Manual – Part 6
Control of Obstacles

- This part of the Airport Services Manual includes guidance on the control of obstacles in the vicinity of airports. Much of the material included is closely associated with the specifications contained in Annex 14- Vol. I

- The main purpose of this manual is to encourage the uniform application of those specifications and to provide information and guidance to States.

Regional Safety Advisories
MID RSA/11- Safeguarding of Aerodromes

RSA/11 is intended to:

- provide guidance for Civil Aviation Regulators, Aerodrome Operators and other stakeholders involved in aerodromes safeguarding;
- provide guidance on the Safeguarding of aerodromes by controlling proposed developments in areas surrounding aerodromes; and it
- explains the process, duties and responsibilities that will be adopted by the civil aviation regulators, service providers and concerned stakeholders.

New Amendment to Annex 14 Volume I and PANS Aerodromes Doc 9981

- SL AN 4/1.1.57-17/44 dated 19 April 2017
- . SL17-044e-Proposed Amen to Ann14 Vol I &PANS Aerodromes.pdf
- The proposed amendment to Annex 14, Volume I and PANS-Aerodromes is envisaged for applicability on 8 November 2018
- Will include beside others; minimum separation distances, dimensions and slopes of obstacle limitation surfaces — approach runways (Table 4-1)
- **Aerodrome Regulators and Aerodrome Operators: Be ready for the amendments**

ICAO

THANK YOU