ICAO Asia/Pacific Workshop – Implementation of New ICAO Annex 14, Volume I SARPs on Obstacle Limitation Surfaces

Introductions

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Introductions: Participants

Please introduce yourselves briefly

1. Your name and location
2. Your experience in the context of OLS
3. Your expectation out of this workshop

Workshop Schedule

Session	Day 1	Day 2	Day 3	Day 4
09:00 -10:00	Introduction	Session II (Why aircraft performance matters)	Session III	Session IV (Aeronautical studies)
Break (10:00-10:30)				
10:30-11:30	Session I (Evolution of OLS)	Session II	Session III	Session IV
Lunch(11:30 – 12:30)				
12:30-14:00	Session I	Session II	Session III	Closing of workshop
Break (14:00-14:30)				
14:30-16:00	Session I	Session III (Tailoring the OLS for Aerodromes)	Session III	

Group Photo

Obstacle Limitation Surfaces

Objectives

At the end of this session, participants will be able to understand

- The existing OLS and its application
- The reason behind the OLS review
- The new concept (OFS/OES)
- What are the changes and benefits

Why do we need OLS?

OLS ensures safety of aircraft during final phase of approach, departure, and circling

- Enable safe aircraft operations
- Prevent obstacles from rendering the airport unusable

In other words, OLS

Ensures the airspace around an airport remains free from obstacles by establishing limits on how far objects can project / extend into the airspace

Types of Surfaces established at aerodromes

Multiple surfaces may be established to safeguard aircraft operations at the aerodrome

- Surfaces that limit obstacles : Obstacle Limitation Surfaces
- Surfaces that restrict the location and limit height of objects to prevent potential disturbance to CNS signal: ILS, Comms and Surveillance templates based on Annex 10, EUR Guidance 015 or OEM specification
- Surfaces that are used for assessment of objects that could potentially affect Instrument Flight Procedures: ICAO PANS-OPS (Doc 8168)

Primary References

- Standards and Recommended Practices (SARPS) on Obstacle Limitation Surfaces (OLS) are contained in ICAO Annex 14, Vol 1, Chapter 4
- Provisions in Doc 9981 PANS-Aerodromes, Part II, Chapter 10 - Obstacle Evaluation and Control
- Additional guidance provided in Doc 9137, Part 6 – Airport Services Manual (Control of Obstacles)

Standard: Essential for the safety or regularity of international air navigation;

Recommended Practice: Desirable in the interest of safety, regularity or efficiency of international air navigation

States are obliged under Article 38 of Chicago Convention to notify ICAO of any differences from Standards.

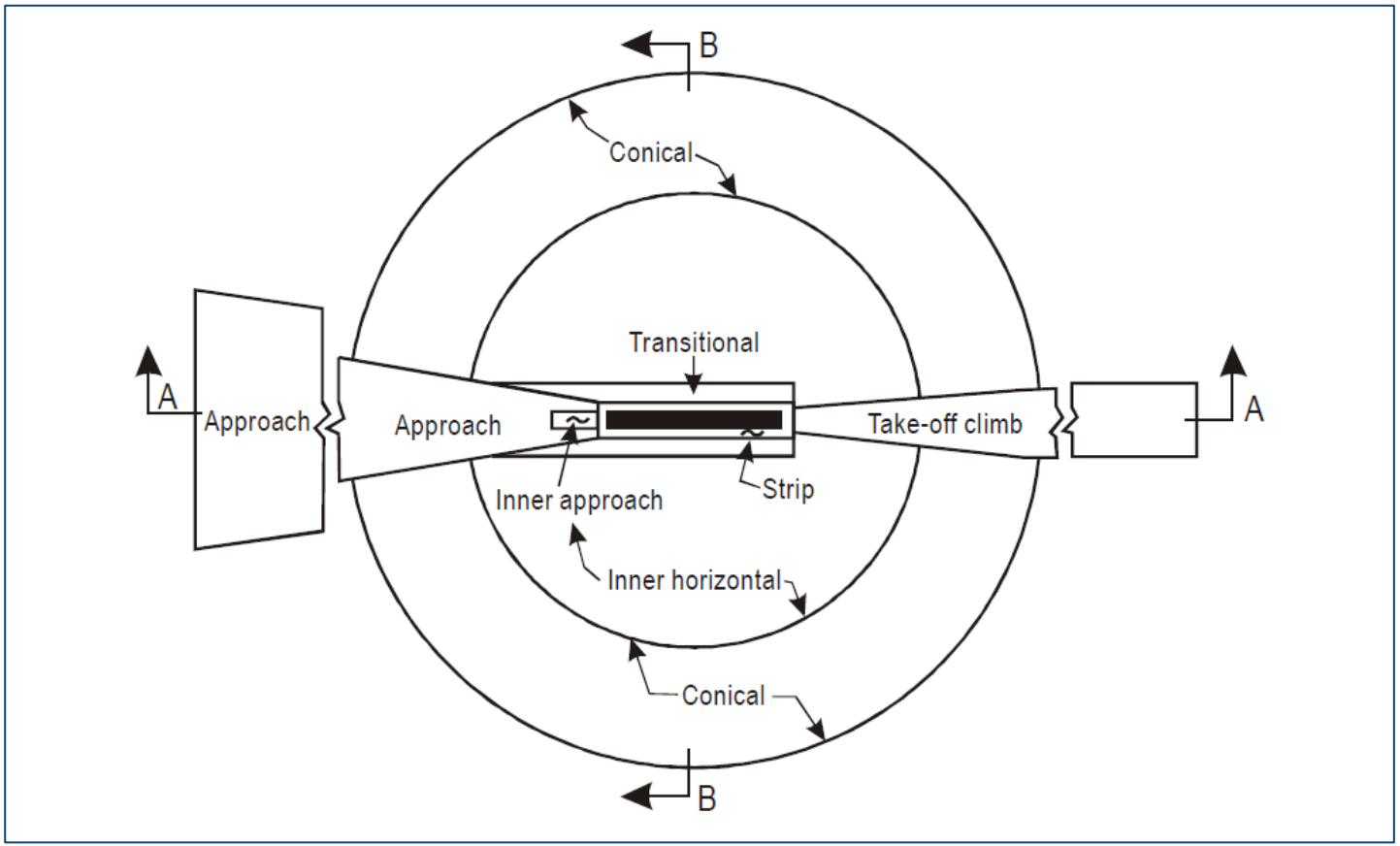
Selecting Surfaces

- Surfaces to be adopted at the aerodrome is dependent on:
  - The kind of operations conducted at the runway i.e. approach only, take-off only or both approach and take-off
  - type of approach conducted at the runway i.e. instrument precision, instrument non-precision or non-instrument
- The dimensions of each surface is tied to the aerodrome reference code number assigned to the runway/aerodrome
- The dimensions will need to be adjusted based on the aerodrome reference code letter assigned to the runway / aerodrome

Types of Approach Runway

Non-instrument (i.e. visual) approach	Non-precision approach	Precision approach, i.e. Category I, II or III
A runway intended for the operation of aircraft using visual approach procedures or an instrument approach procedure to a point beyond which the approach may continue in visual meteorological conditions.	A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type A and a visibility not less than 1 000 m. *Note: Type A refers to approach operation with a decision height at or above 250ft*	A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type B with a specified decision height and runway visual range depending on the category. *Note: Type B refers to approach operation with a decision height below 250ft*

A closer look at existing surfaces



What are the existing surfaces?

1. Approach
2. Transitional
3. Inner Horizontal
4. Conical

For all Types of approach runway

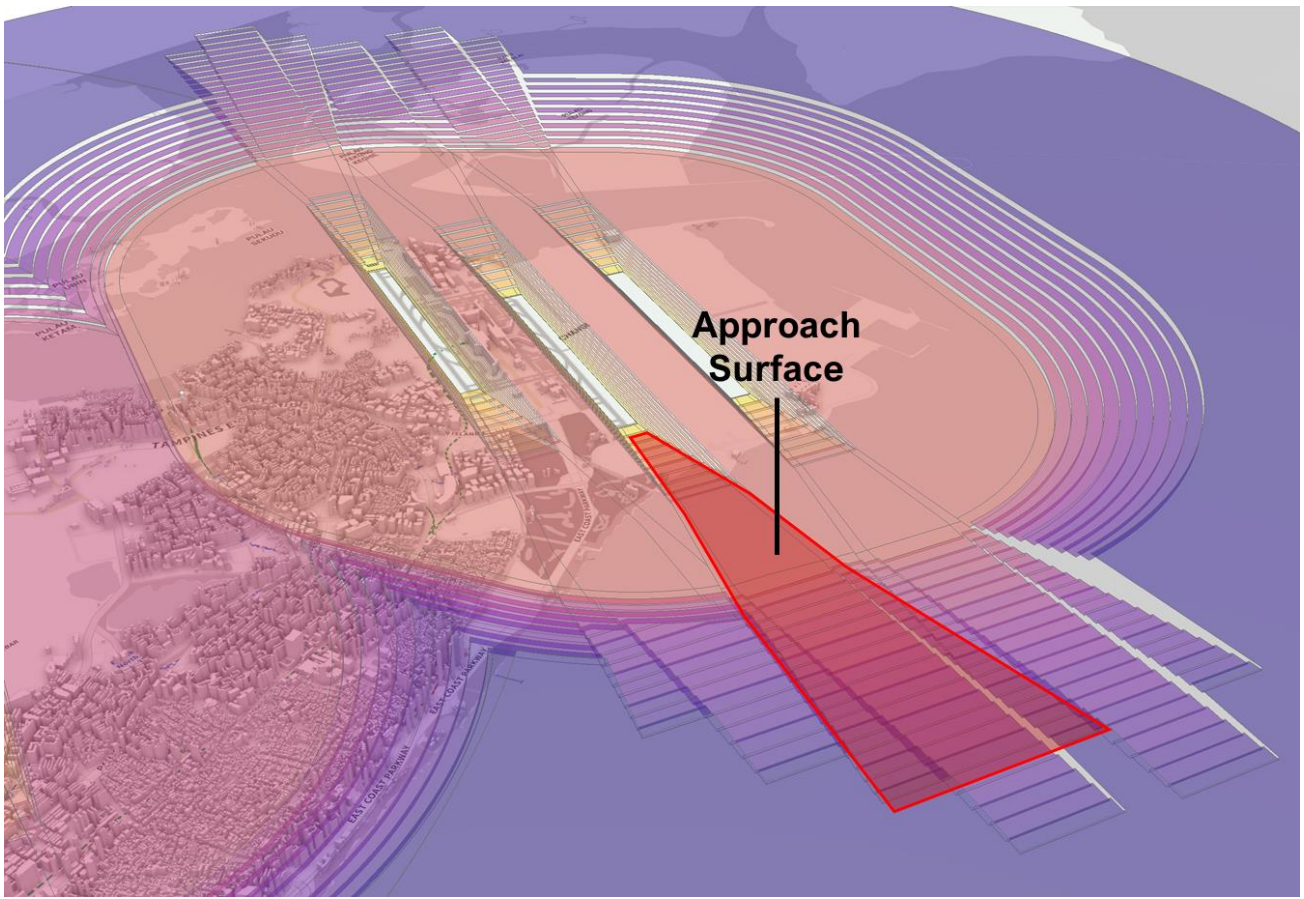
5. Inner Approach + Inner Transitional + Balked Landing *(Recommended for CAT I & Standard for CAT II & III operations)*

For runways with take-off operations:

6. Take off climb

Let us review each individually.

Approach surface



Approach Surface

Purpose: Protect aircraft in final phase of approach to land manoeuvre

Description: An inclined plane preceding the runway threshold

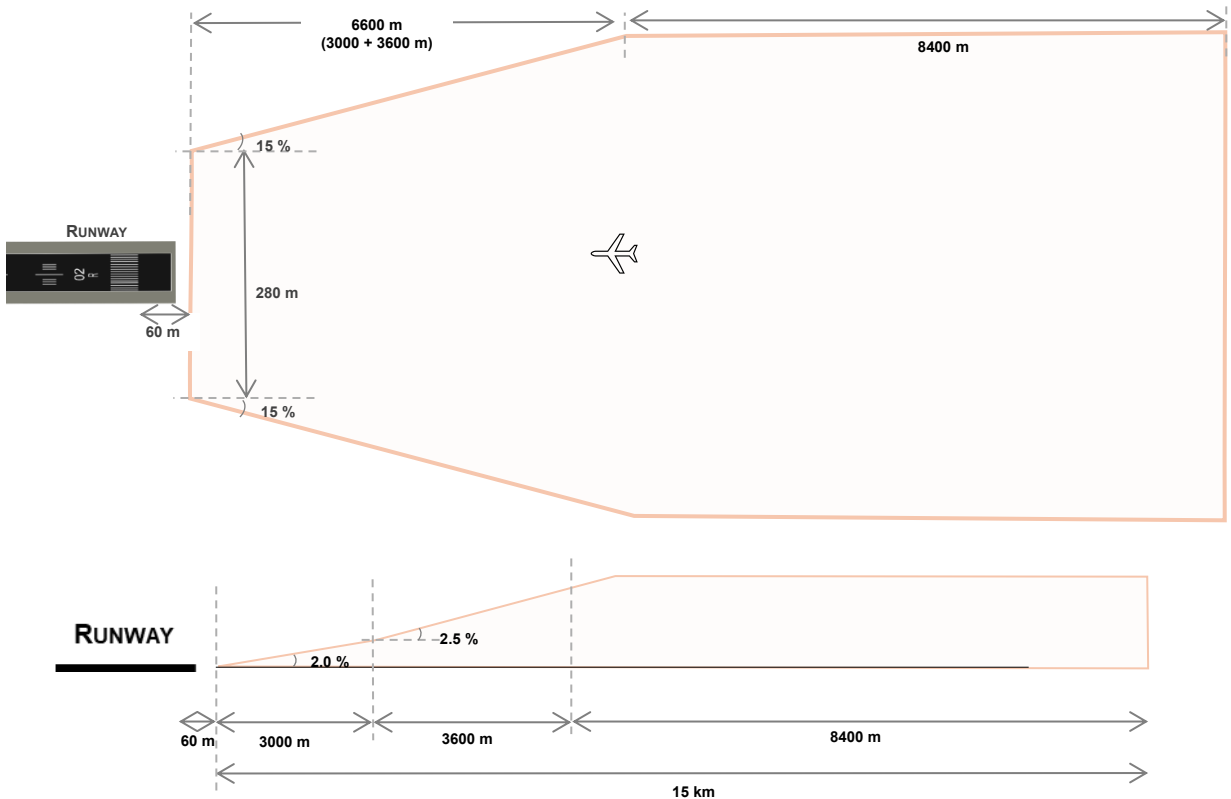
Obstacle Requirement: Shall not be penetrated except when shielded by an immovable object

Dimensions

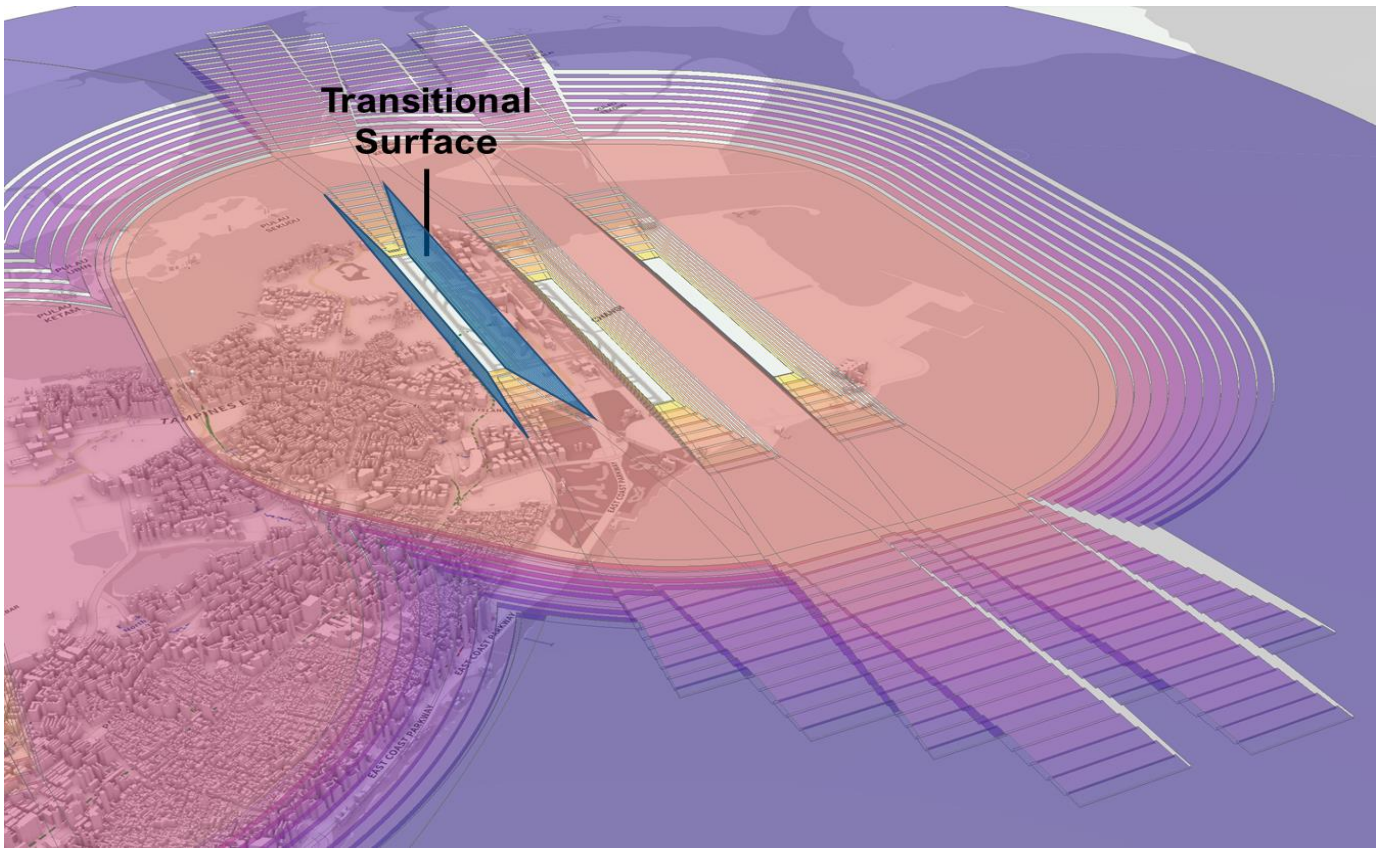
Distance from THR: 60m / Inner edge: 280m / Total Length: 15km / Divergence: 15%

1st segment – 3000m at 2%; 2nd segment – 3600m @ 2.5%; 3rd segment – 8400m @ 0% slope

Approach surface



Transitional surface



Transitional Surface

Purpose: Protect aircraft in final phase of approach to land manoeuvre

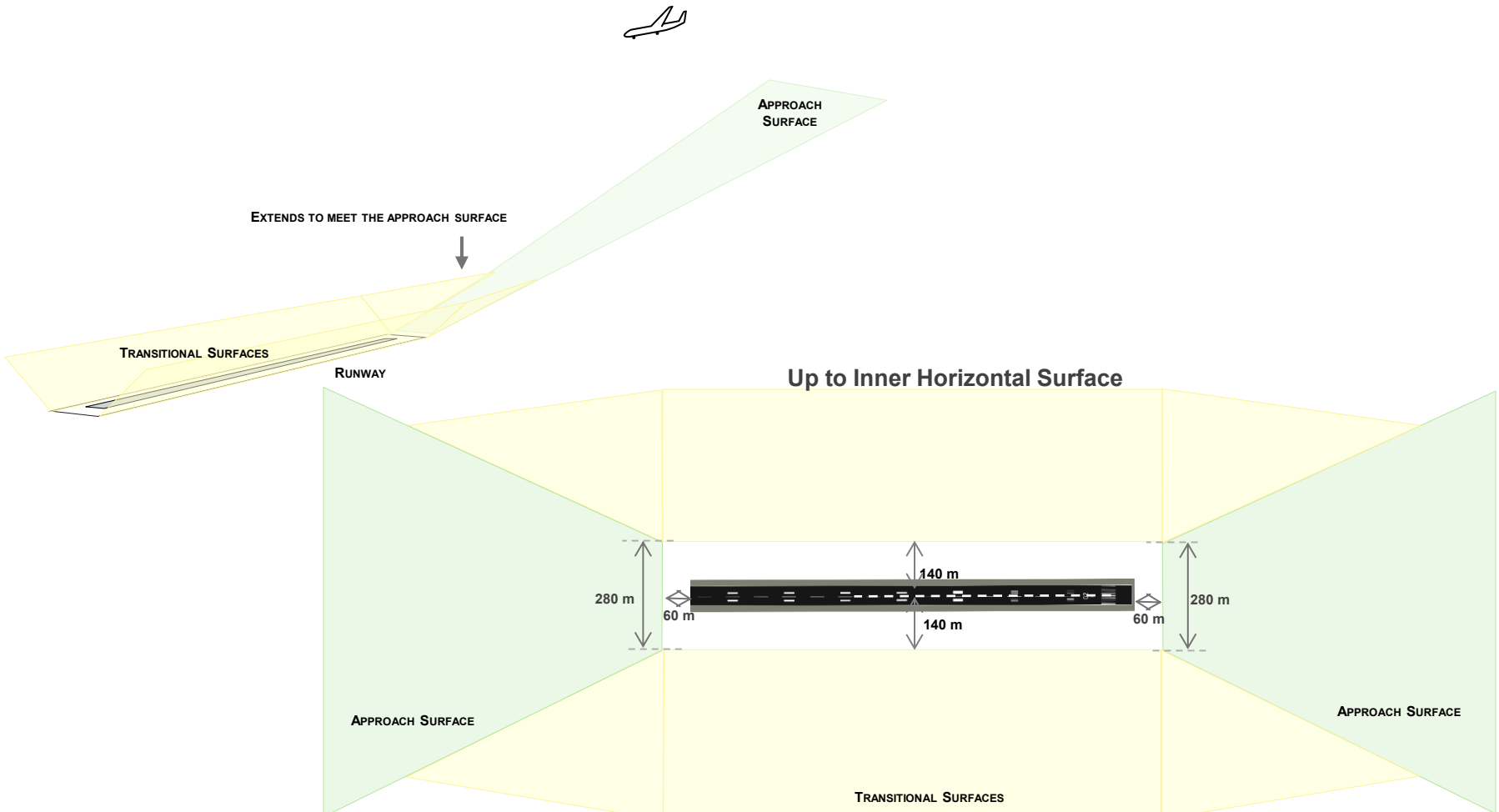
Description: A complex surface along the side of the strip and part of the side of the approach surface, that slopes upwards and outwards to the inner horizontal surface

Obstacle Requirement: Shall not be penetrated except when shielded by an immovable object

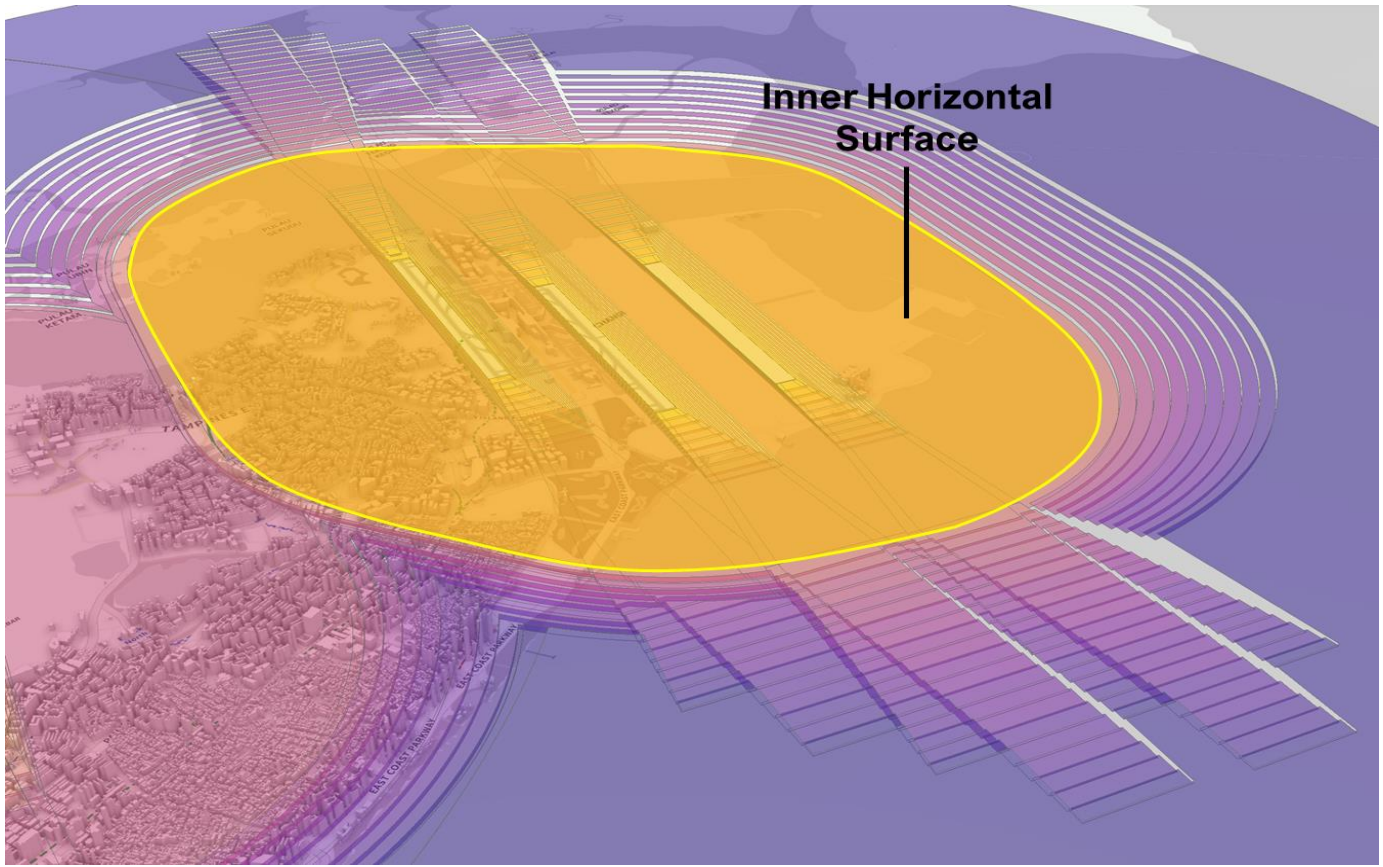
Dimensions

The elevation: a) (1st segment) along the side of the approach surface — equal to the elevation of the approach surface at that point; and b) (2nd segment) along the strip — equal to the elevation of the nearest point on the centre line of the runway or its extension.

Transitional surface



Inner horizontal surface



Inner horizontal Surface

Purpose: Protect airspace for aircraft visual circling prior to landing

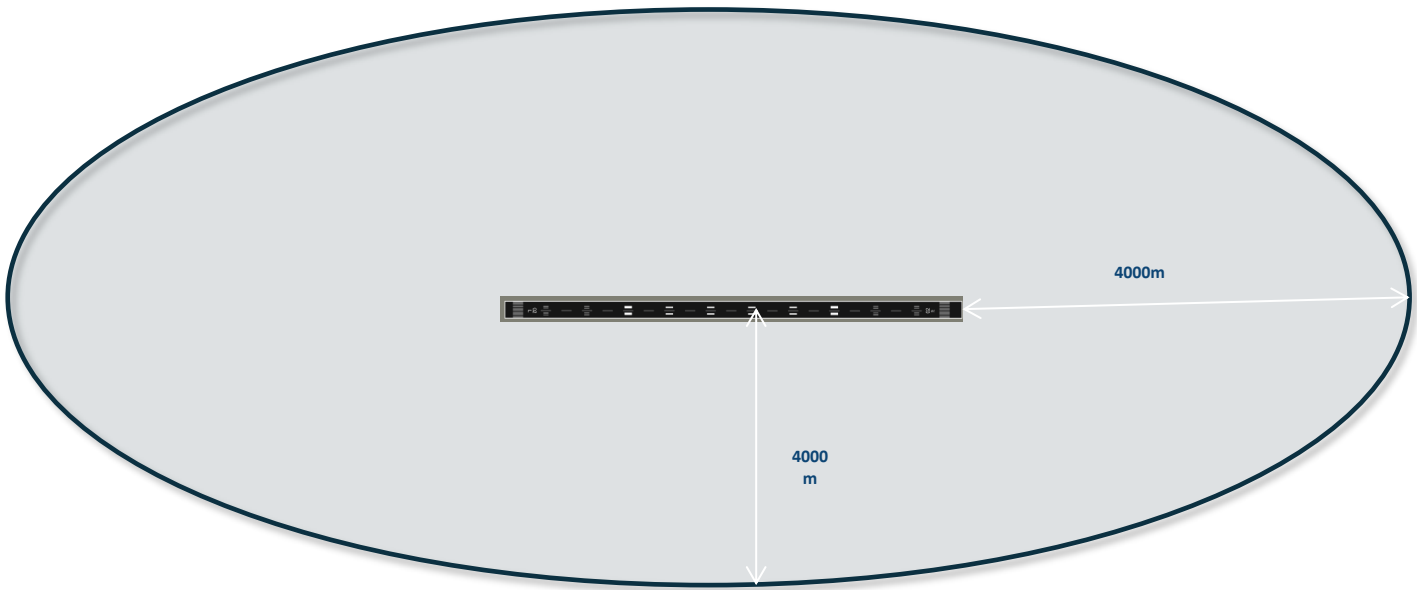
Description: A surface located in a horizontal plane above an aerodrome and its surroundings

Obstacle Requirement: An aeronautical study is required to assess penetration except when shielded by an immovable object

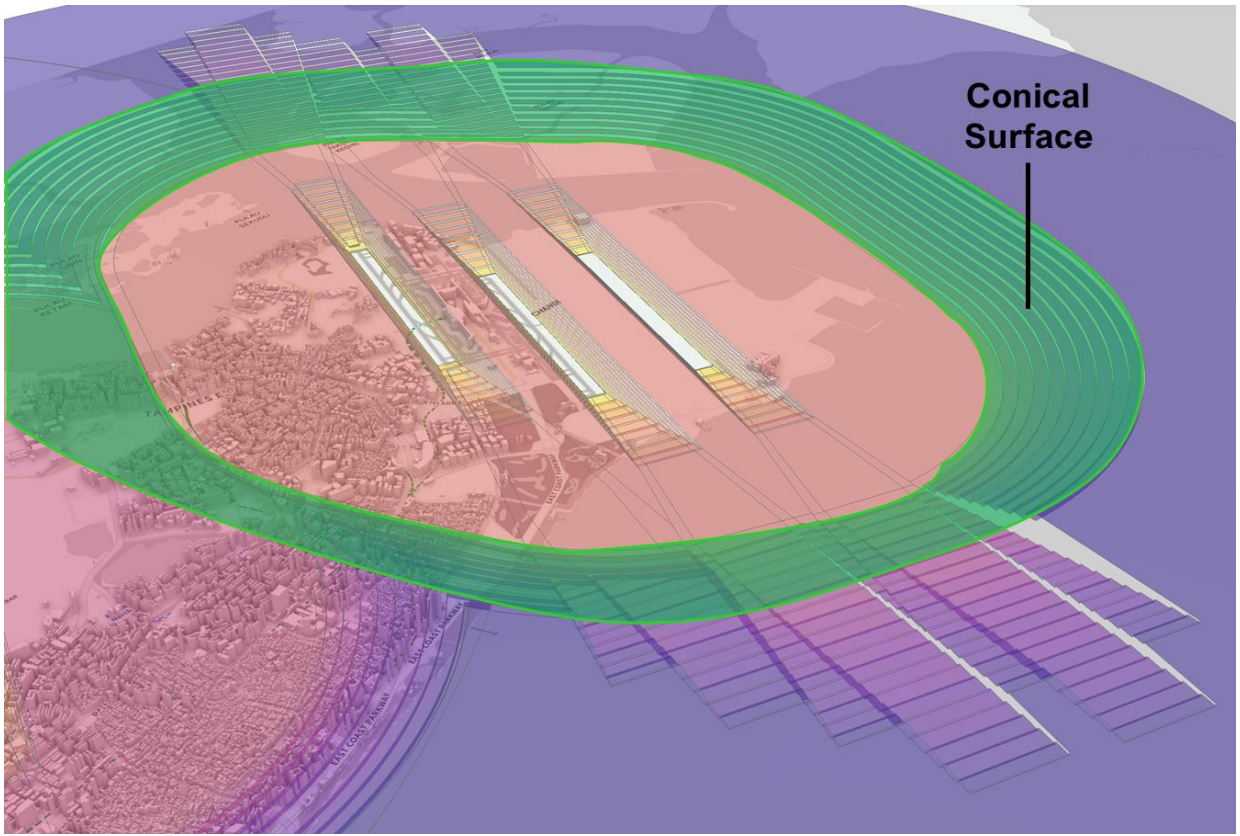
Dimensions

Radius or outer limits: Measured from a reference point/s
Height: 45m above elevation datum
Radius: 4000m

Inner Horizontal Surface



Conical surface



Conical Surface

Purpose: Protect airspace for aircraft visual circling prior to landing

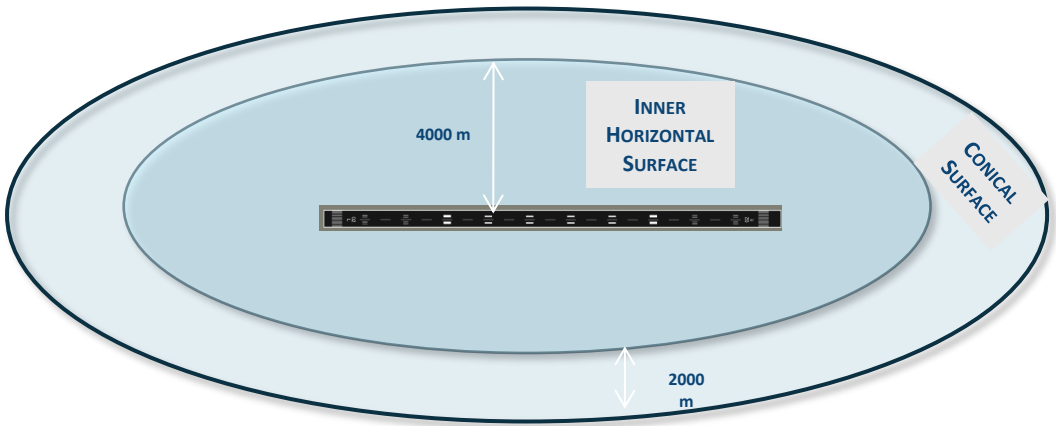
Description: A surface sloping upwards and outwards from the periphery of the inner horizontal surface.

Obstacle Requirement: An aeronautical study is required to assess penetration except when shielded by an immovable object

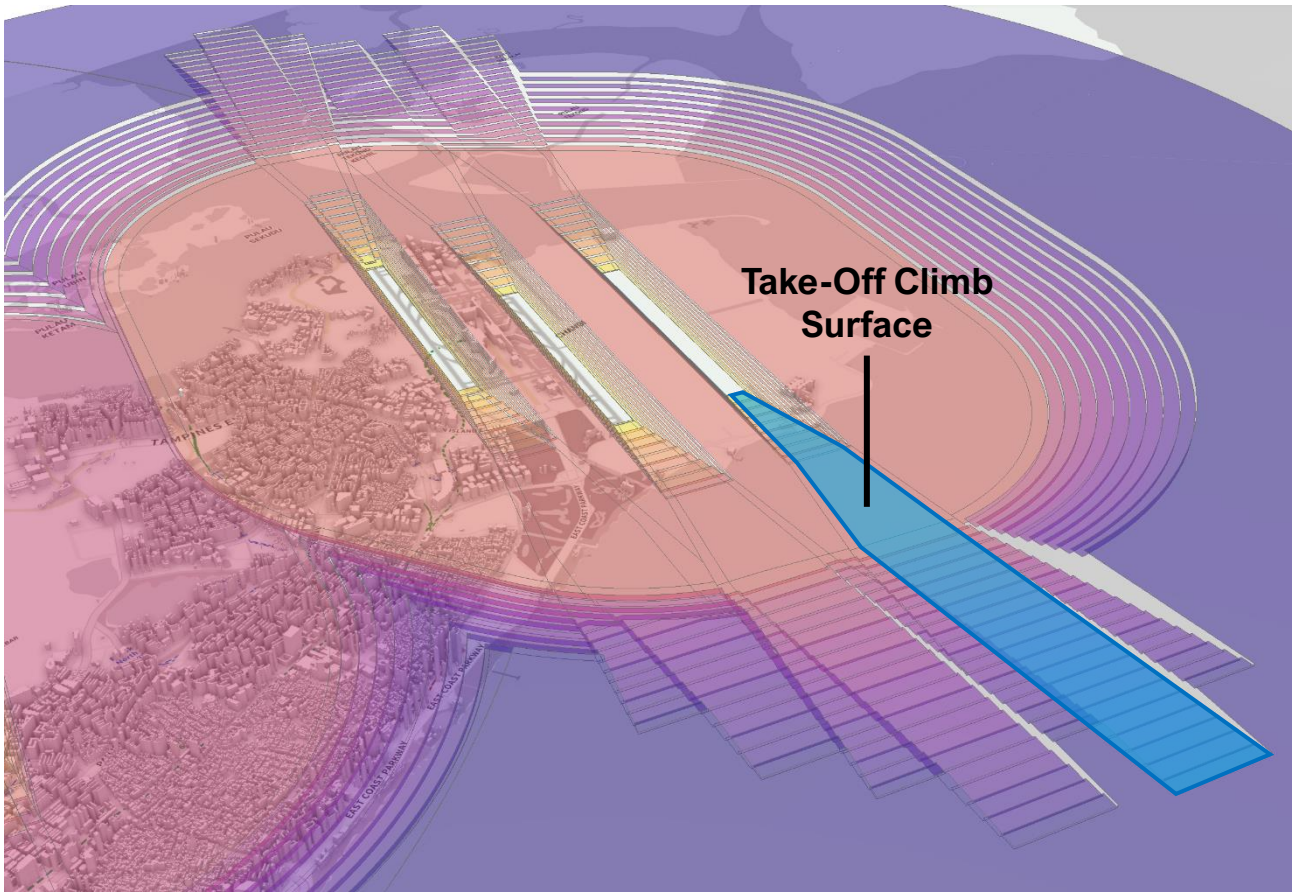
Dimensions

Slope: 5%
Height: 100m above IHS

Conical surface



Take-off Climb Surface



Take-off Climb Surface

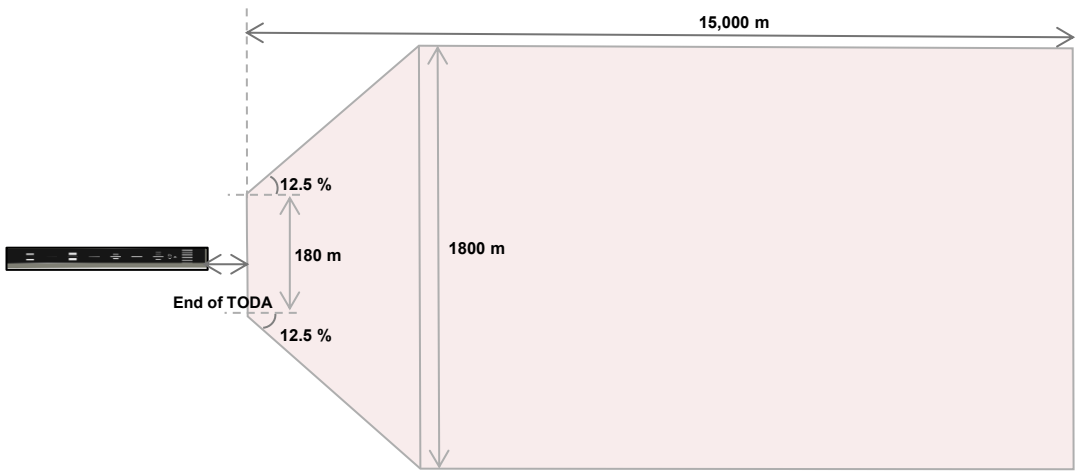
Purpose: Establish the airspace where obstacles may have an impact on aircraft operating limitations during take-off under non-critical operating conditions

Description: An inclined plane or other specified surface beyond the end of a runway or clearway.

Obstacle Requirement: Shall not be penetrated except when shielded by an immovable object

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.

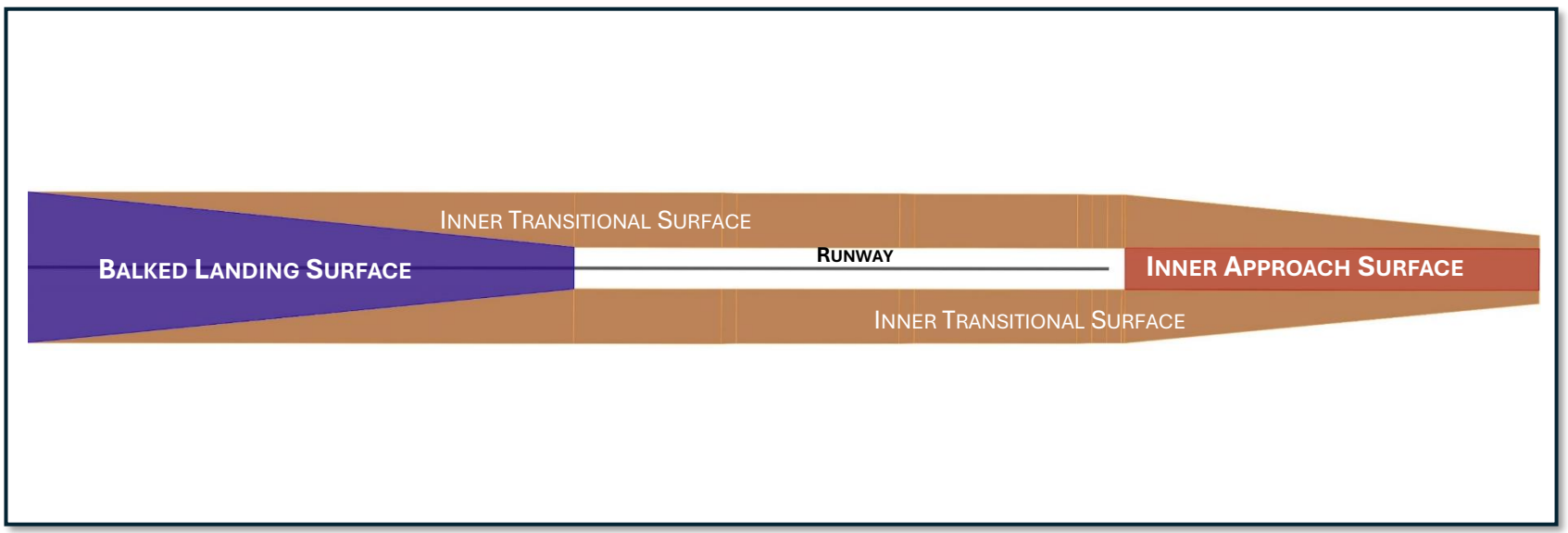
Take-off Climb Surface



Inner transitional, Inner Approach, Balked landing Surfaces

Description: Obstacle Free Zone. Portion of the strip bounded by these surfaces, which is not penetrated by any fixed obstacle other than a low-mass and frangibly mounted one required for air navigation and safety purposes.

Shall not be penetrated



Controlling Objects
near the runway

Inner Approach Surface, Inner Transitional Surface and the Balked Landing Surface

- **Fixed Objects** not permitted to penetrate these surfaces
- **Mobile objects** not permitted above these surfaces during the use of the runway for landing

Controlling Obstacles
in the vicinity of the aerodrome

Approach / Transitional

New objects / extensions of existing objects **not permitted** to penetrate these surfaces

Unless new object / extension is shielded by existing immovable object (e.g. terrain)

Existing objects above the surfaces **should be removed** if possible

Unless object is shielded by existing immovable object (e.g. terrain)

Controlling Obstacles
in the vicinity of the aerodrome

Inner Horizontal / Conical Surfaces

- **New objects** / extensions of existing objects **not permitted** to penetrate these surfaces
  - Unless new object / extension is shielded by existing immovable object (e.g. terrain)
  - Or, after aeronautical study, no adverse impact to safety / regularity of aircraft operations

- **Existing objects** above the surfaces **should be removed** if possible
  - Unless object is shielded by existing immovable object (e.g. terrain)
  - Or, after aeronautical study, no adverse impact to safety / regularity of aircraft operations

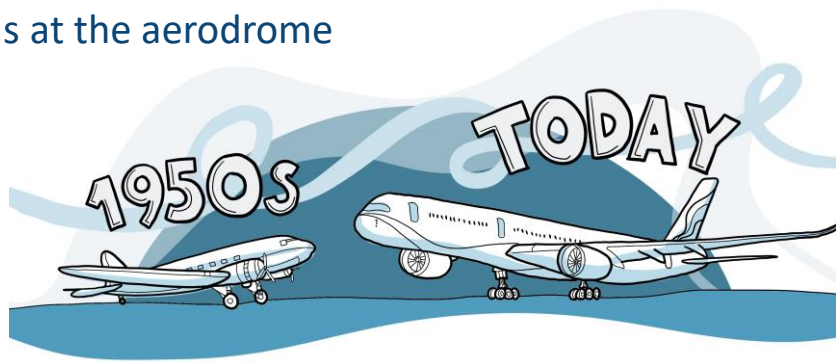
The evolution of OLS

1950s:

- OLS originated with ICAO Annex 14 to standardize obstacle control.
- Designed based on early jet aircraft performance and operational needs.

Today:

- Defined surfaces may be conservative; and /or
- May not protect the intended operations at the aerodrome



Why change?

- Feedback was received at the Air Navigation Conference and ICAO Assembly resulting in a review of OLS SARPs

- ICAO (OLSTF) reviewed surfaces established in 1950s to ascertain its effectiveness in safeguarding airspace against obstacles

- The data driven review indicated the need for developing provisions related to new OLS concept.

Key dates


2025
2030
MARCH
28
AUGUST
4
NOVEMBER
21
SARPs adopted by ICAO Council
Effective Date
Applicability Date
States may transition once the SARPs are effective

New OLS concept

- The introduction of Aeroplane Design Group to categorize OLS instead of ARC
- OLS now includes Obstacle Free Surfaces (OFS) and Obstacle Evaluation Surfaces (OES) with
  - clarity on the purpose of each surface
  - Distinction between surfaces that must not be penetrated and surfaces where penetration may be considered and evaluated through an aeronautical study
- Introduction of inner approach and inner transitional for non-precision instrument and non-instrument runway
- Moving away from the one-size-fits-all surfaces / dimensions. Surfaces adopted at aerodrome are aligned with the type of operations conducted at the aerodrome
- Surfaces are designed to be adaptable and tailored to different operational environments

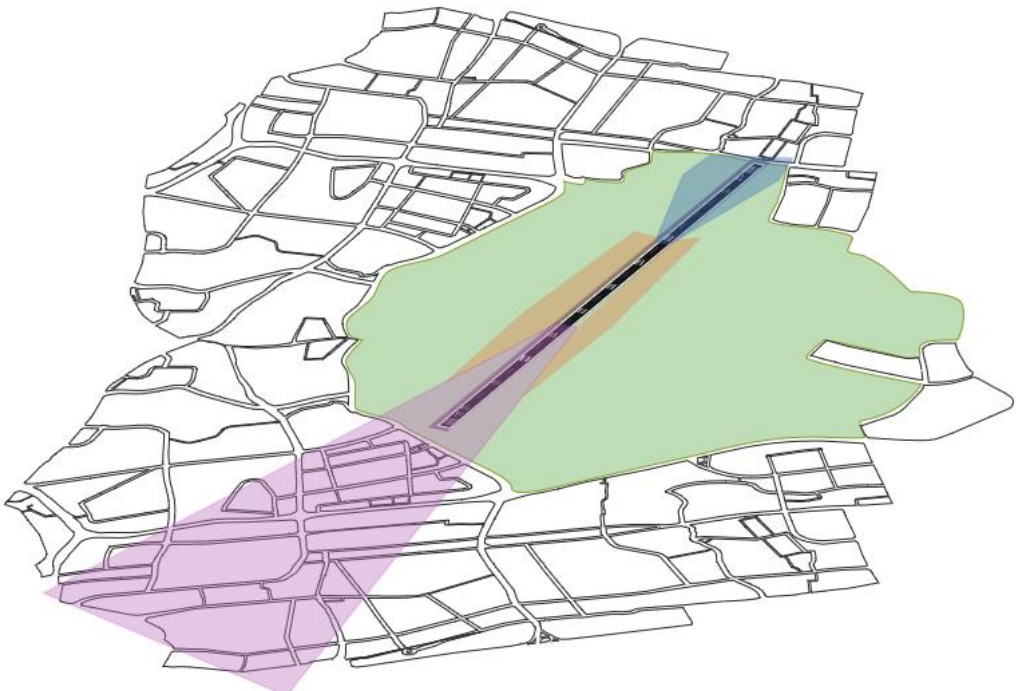
New Categorisation - Aeroplane Design Group (ADG)

Code Element 1		Code Element 2	
Code Number	Aeroplane reference field length	Code Letter	Wingspan
1	Less than 800m	A	Up to but not including 15 m
2	800m up to but not including 1200m	B	15 m up to but not including 24 m
3	1200m up to but not including 1800m	C	24 m up to but not including 36 m
4	1800m and over	D	36 m up to but not including 52 m
		E	52 m up to but not including 65 m
		F	65 m up to but not including 80 m

Aeroplane design group	Indicated airspeed at threshold		Wingspan
I	Less than 169 km/h (91 kt)	and	Up to but not including 24 m
IIA	Less than 169 km/h (91 kt)	and	24 m up to but not including 36 m
IIB	169 km/h (91 kt) up to but not including 224 km/h (121 kt)	and	Up to but not including 36 m
IIC	224 km/h (121 kt) up to but not including 307 km/h (166 kt)	and	Up to but not including 36 m
III	Less than 307 km/h (166 kt)	and	36 m up to but not including 52 m
IV	Less than 307 km/h (166 kt)	and	52 m up to but not including 65 m
V	Less than 307 km/h (166 kt)	and	65 m up to but not including 80 m

Obstacle Free Surfaces

Overview



Obstacle Free Surfaces

Characteristics

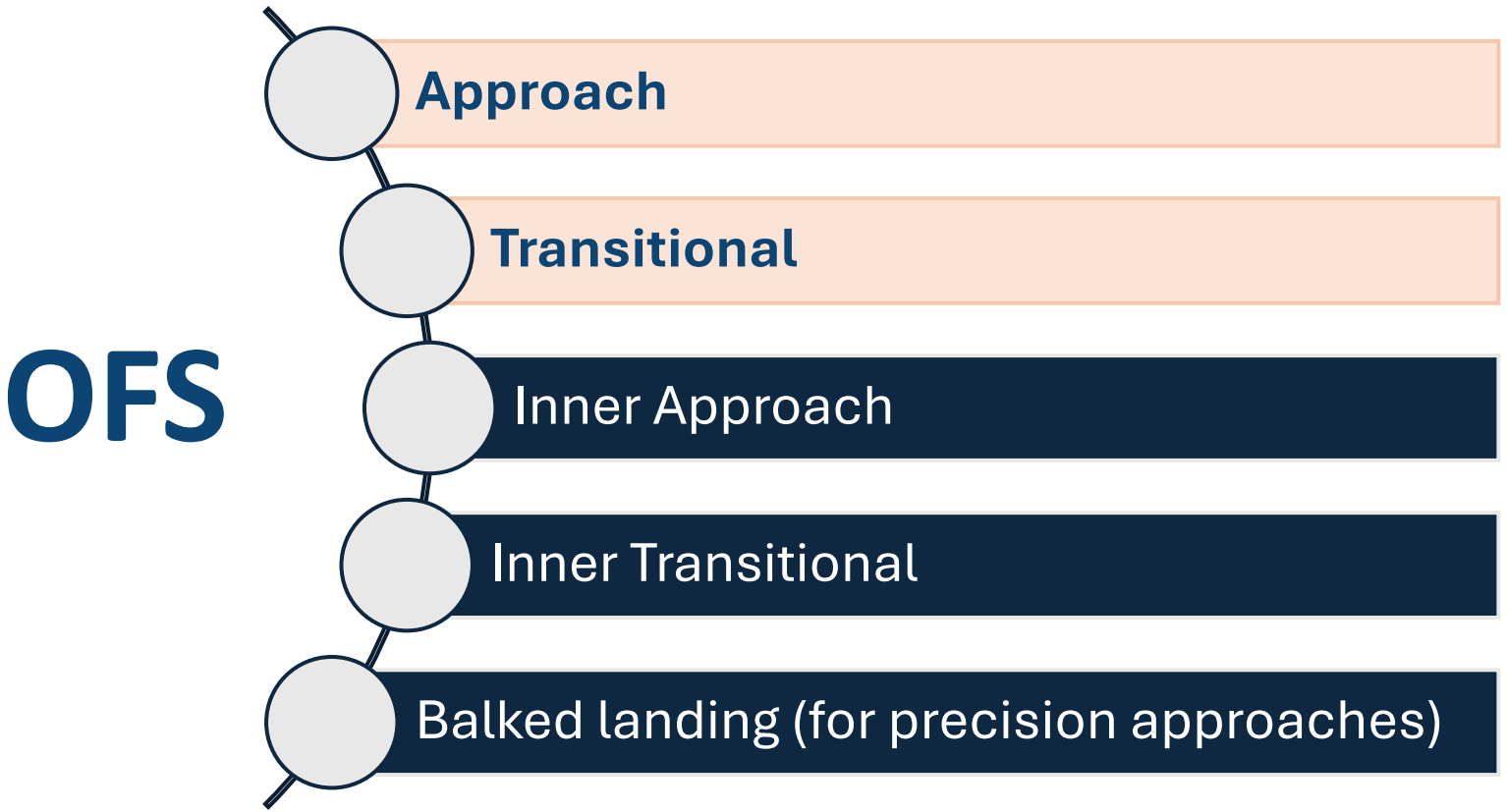
Critical for safe runway operations

Narrower and shorter than existing OLS

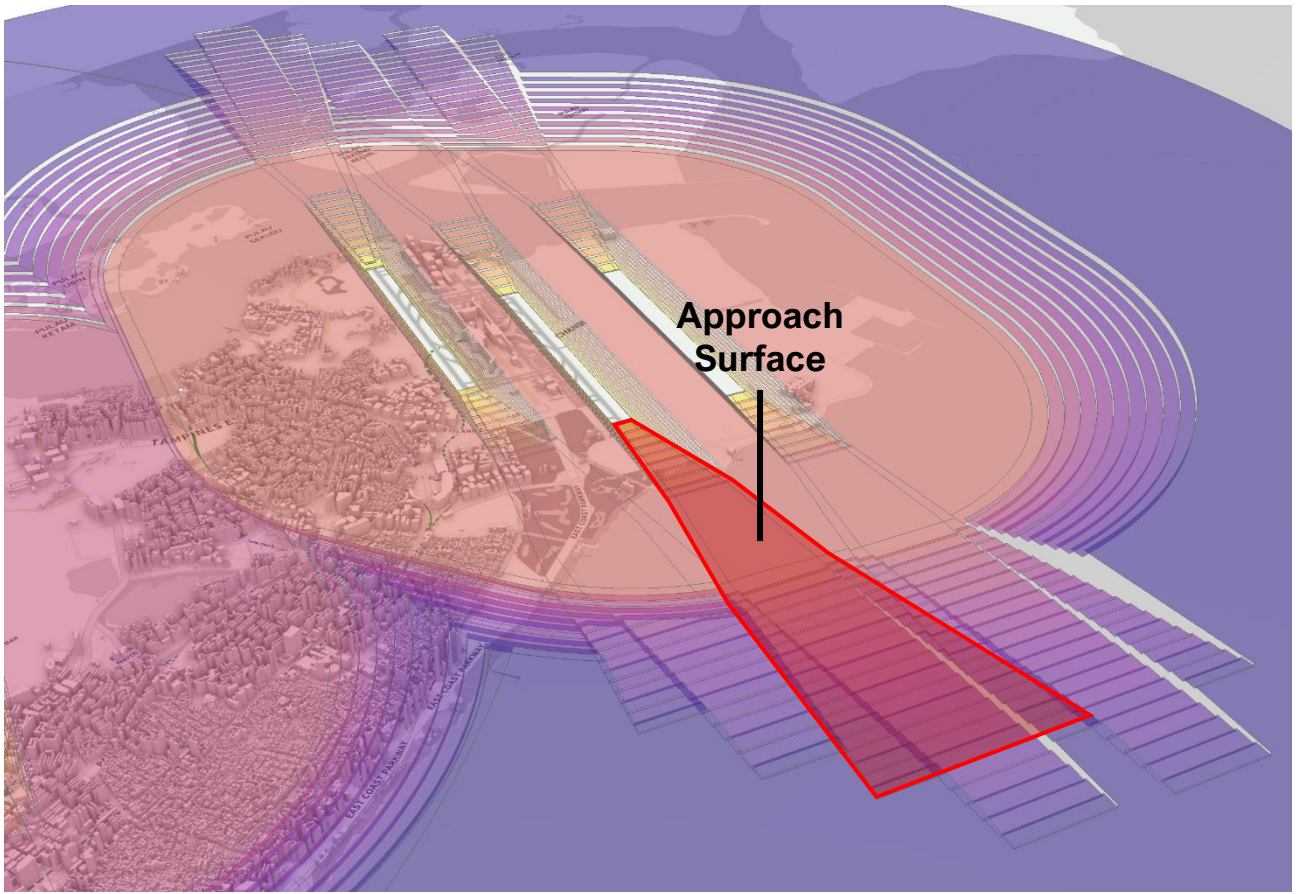
Shall not be penetrated

Closer and aligned to runway

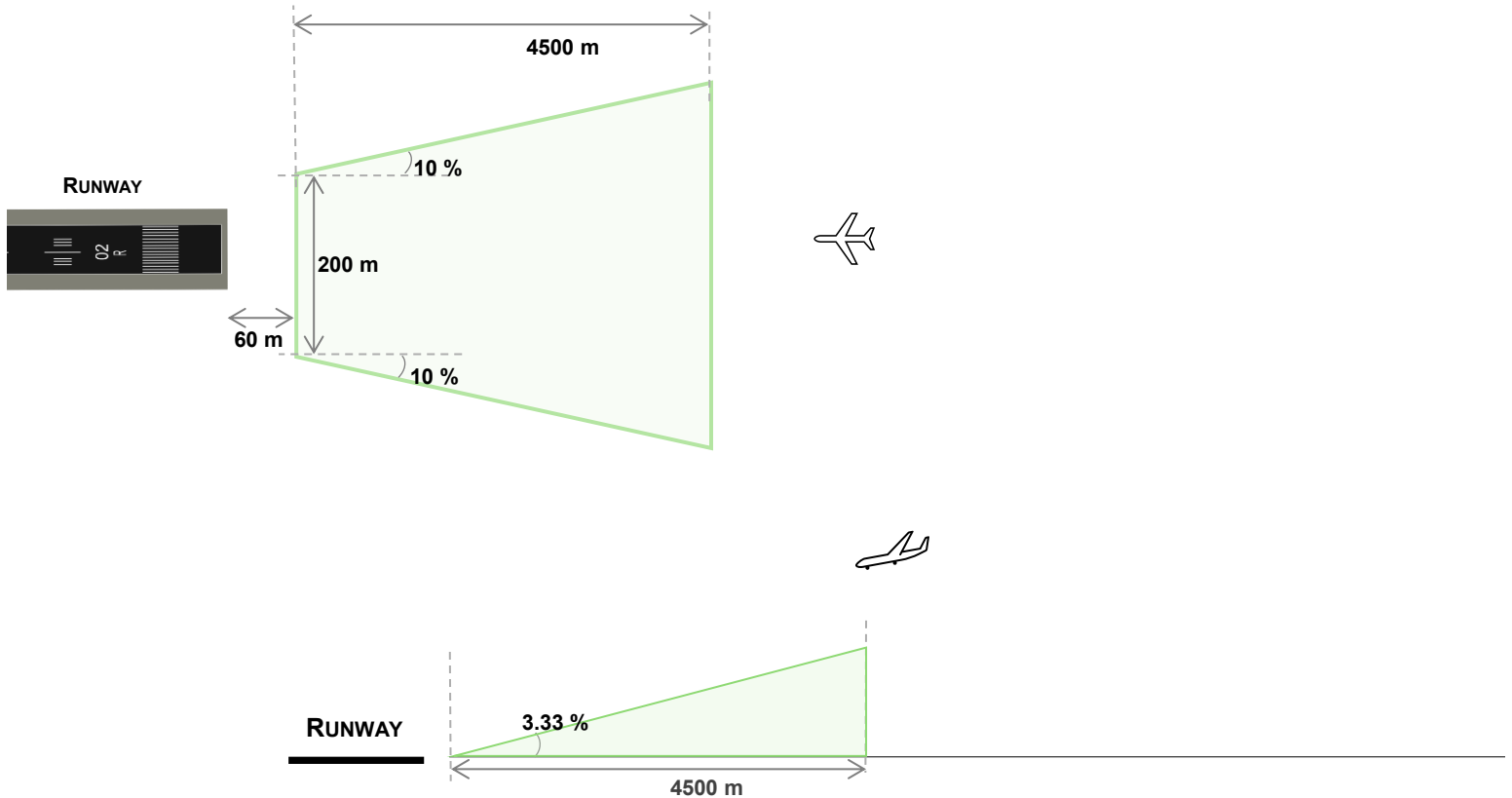
Which are the Obstacle Free Surfaces?



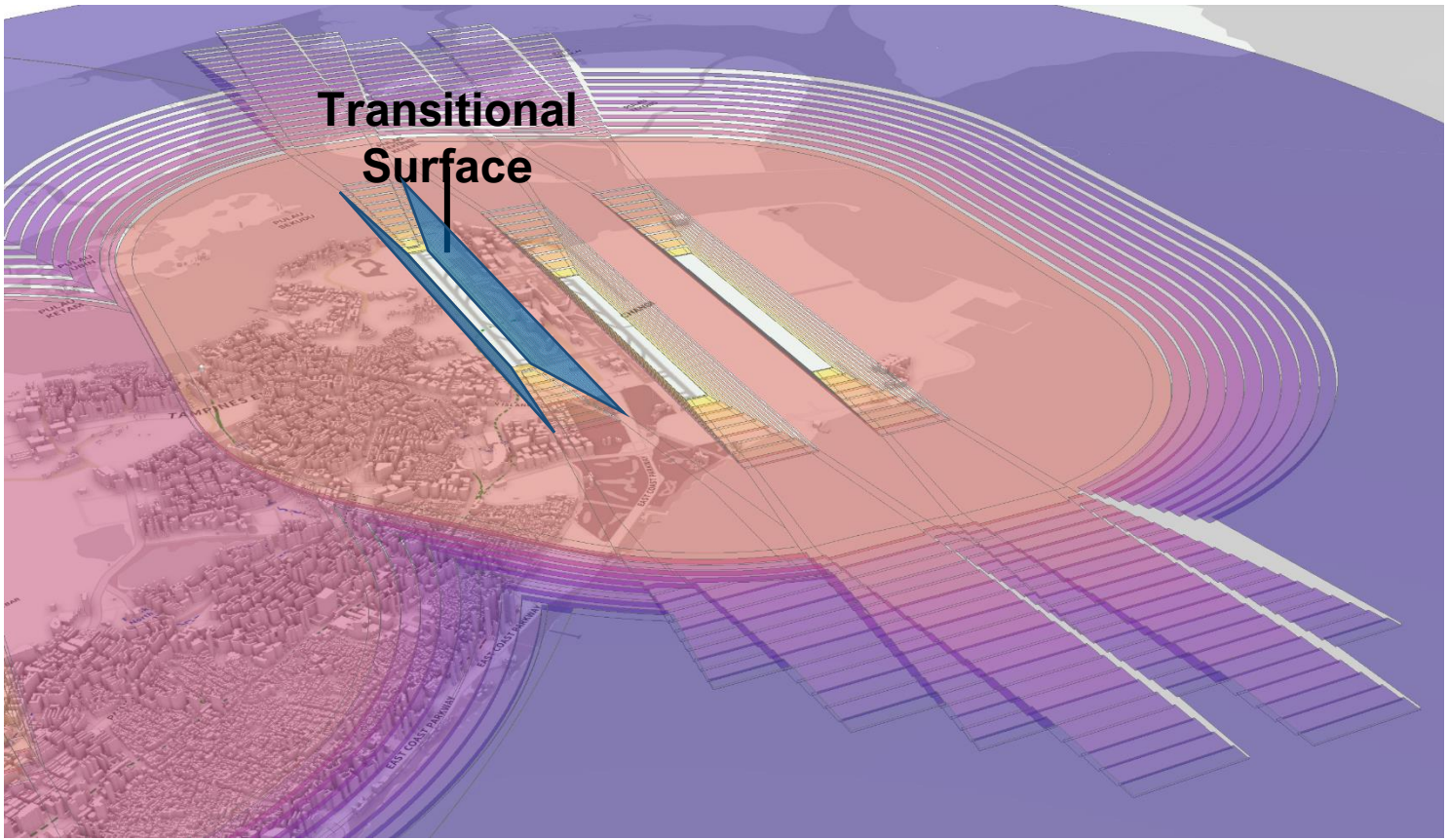
Approach OFS



Approach OFS



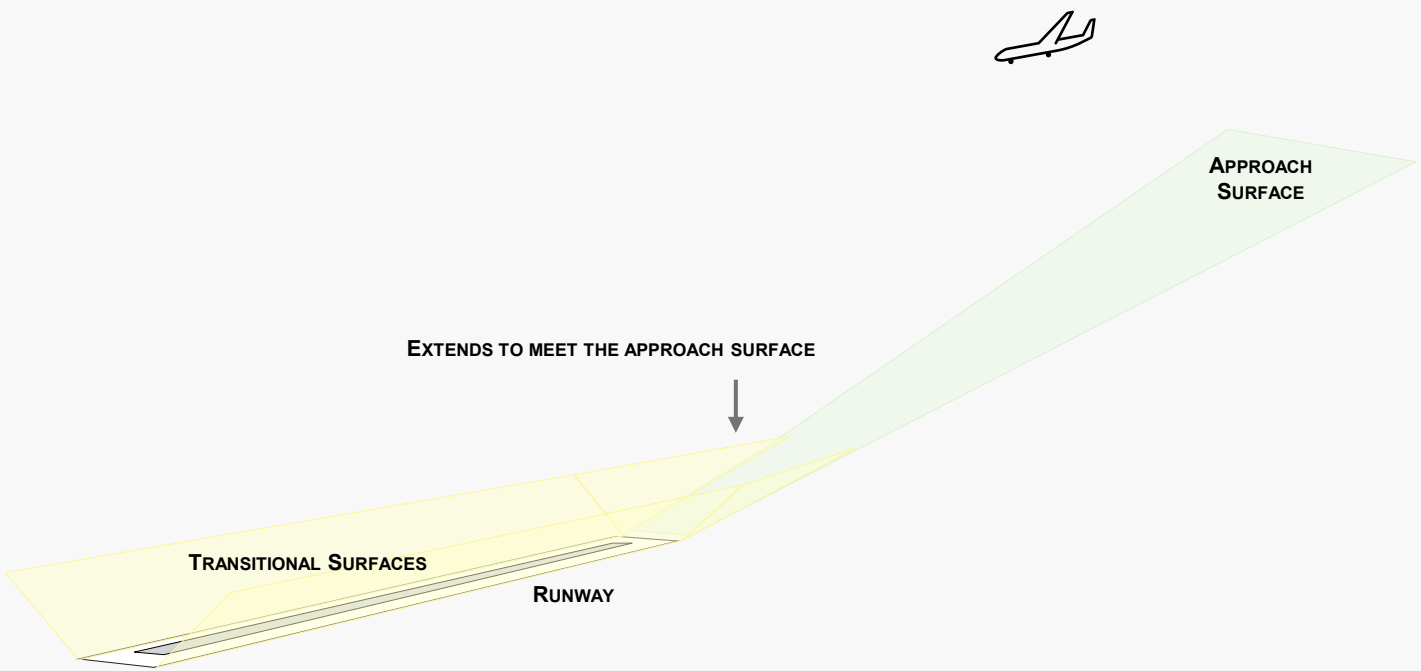
OFS: Transitional



OFS: Transitional

For ADG V

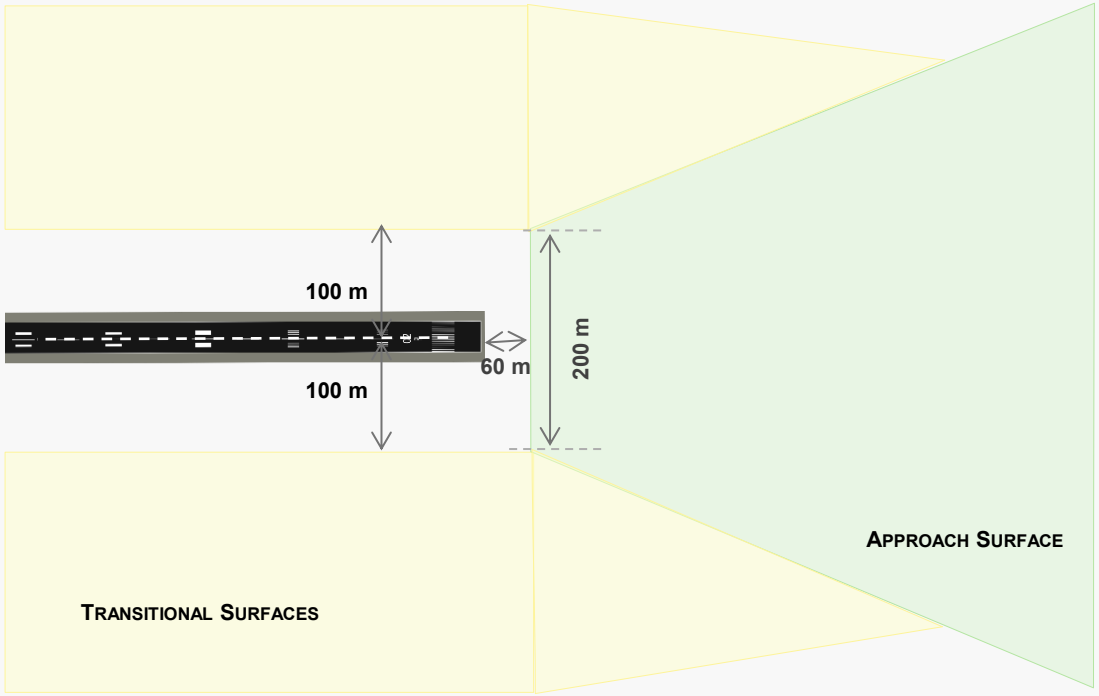
New: Axonometric view | New: Plan view | New: Plan view extended | New: Cross section view



OFS: Transitional

For ADG V

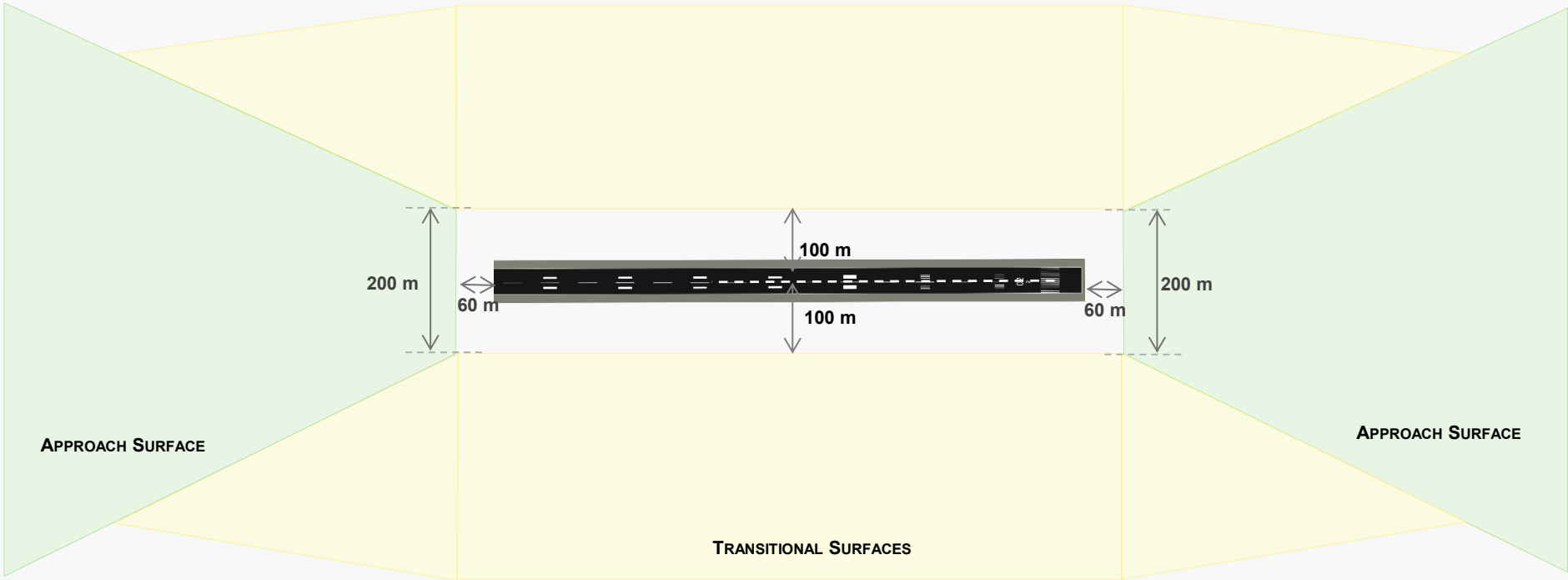
New: Axonometric view | New: Plan view | New: Plan view extended | New: Cross section view



OFS: Transitional

For ADG V

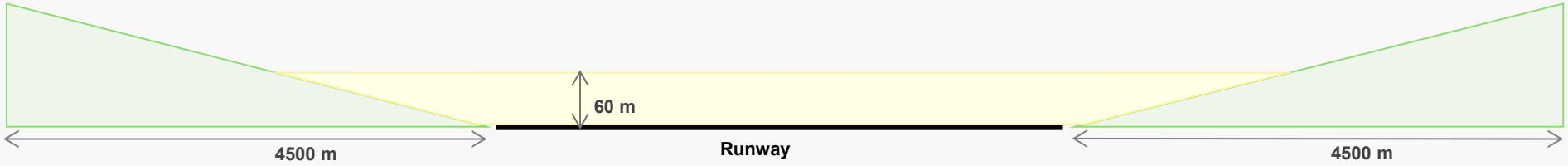
New: Axonometric view | New: Plan view | New: Plan view extended | New: Cross section view



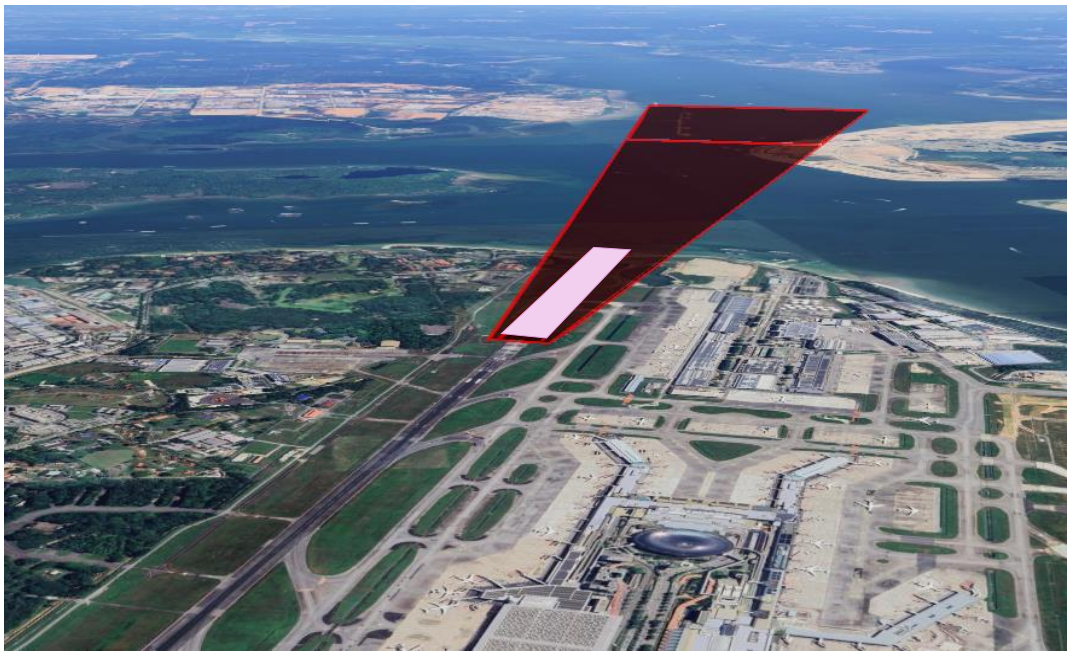
OFS: Transitional

For ADG V

New: Axonometric view | New: Plan view | New: Plan view extended | New: Cross section view



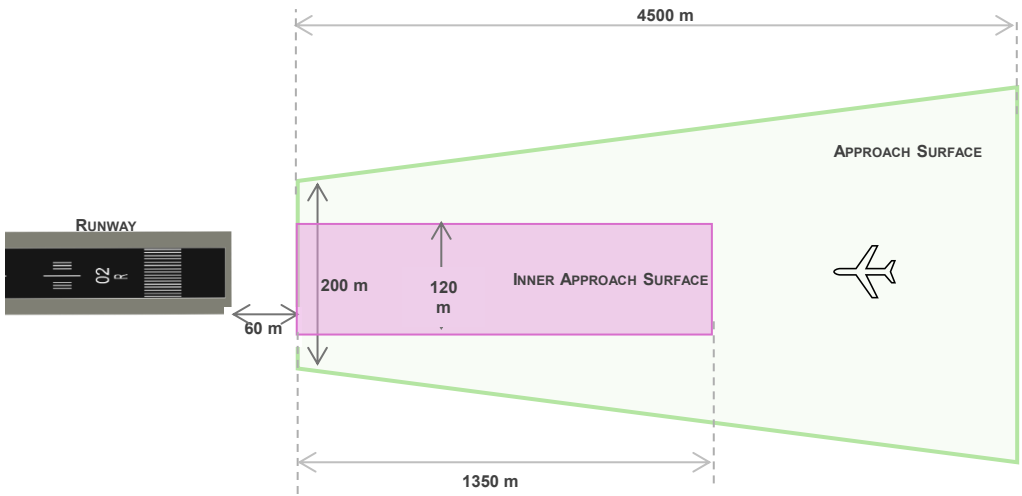
Inner Approach OFS



Purpose: Protects an aeroplane against fixed and mobile obstacles before the threshold, in the descent phase of the balked landing or late go-around manoeuvres following a standard 3.0° approach

Description: A rectangular portion of the approach surface immediately preceding the threshold.

Inner Approach OFS



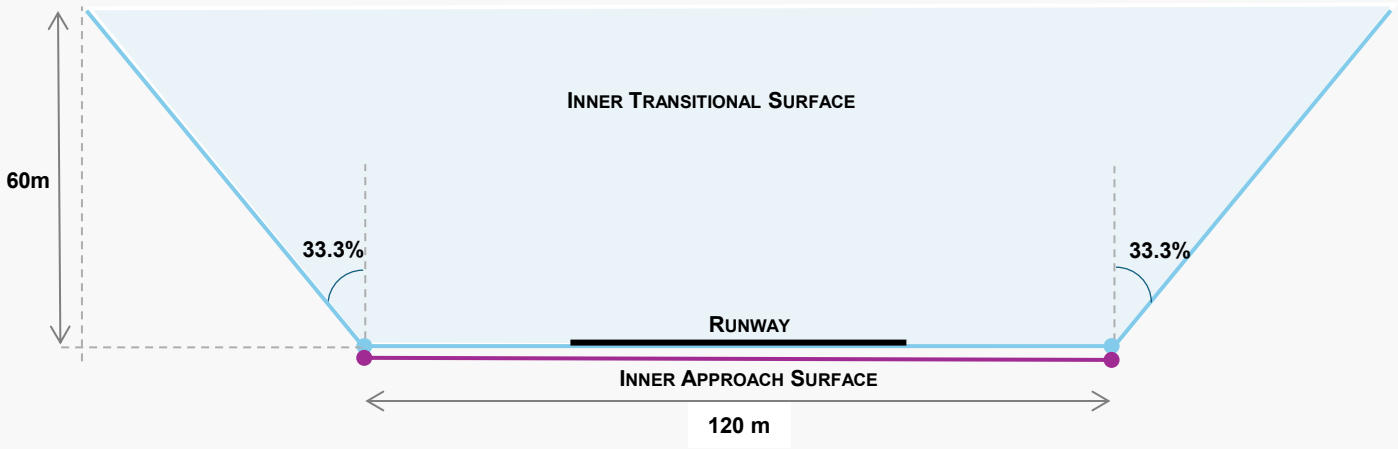
Inner approach surface lies exactly over the approach surface

Inner Transitional OFS

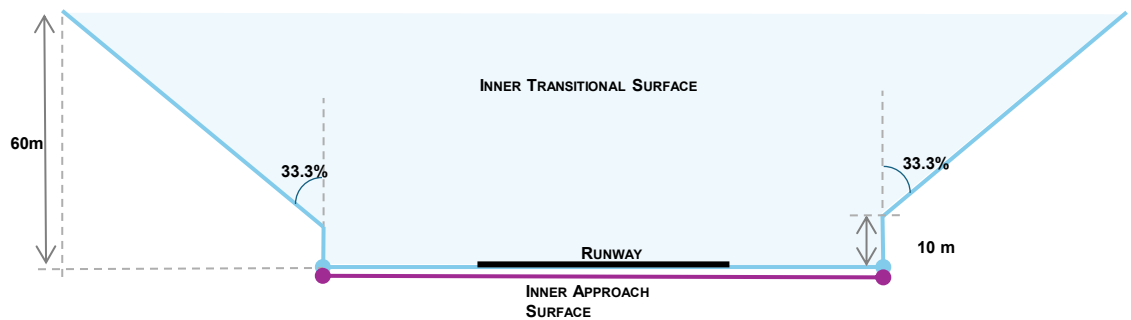
Purpose: Establish the airspace to be maintained free from fixed and mobile obstacles to protect an aeroplane in the climb phase of the balked landing or late go-around manoeuvres following a standard 3.0°approach, beyond the inner approach surface.

OFS: Inner Transitional Surface: Instrument Precision

New: Axonometric view | New: Plan view | New: Cross section (short end)

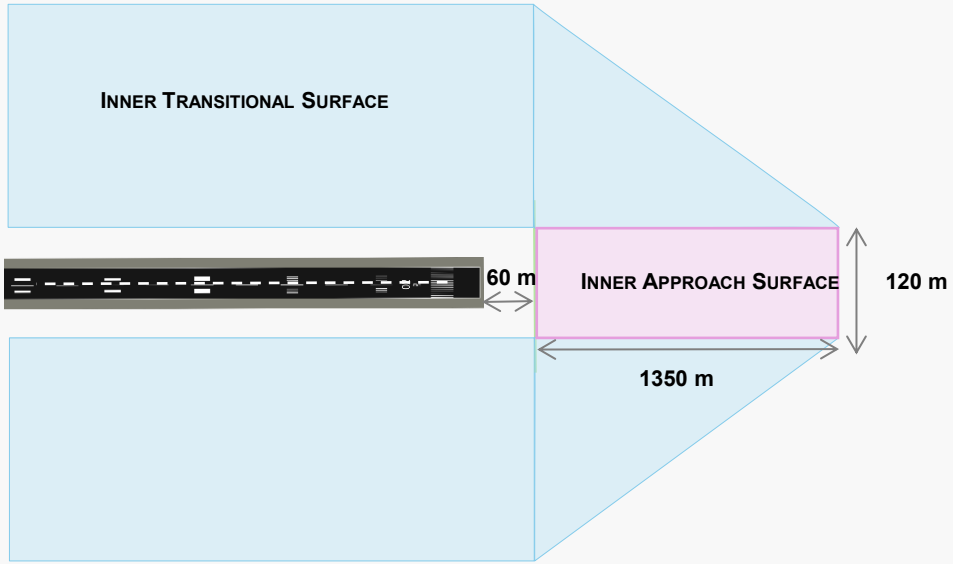


Inner Transitional OFS – Non-Instrument & Non-Precision



OFS: Inner Transitional Surface: Instrument Precision

New: Axonometric view | New: Plan view | New: Cross section (short end)



OFS: Balked Landing

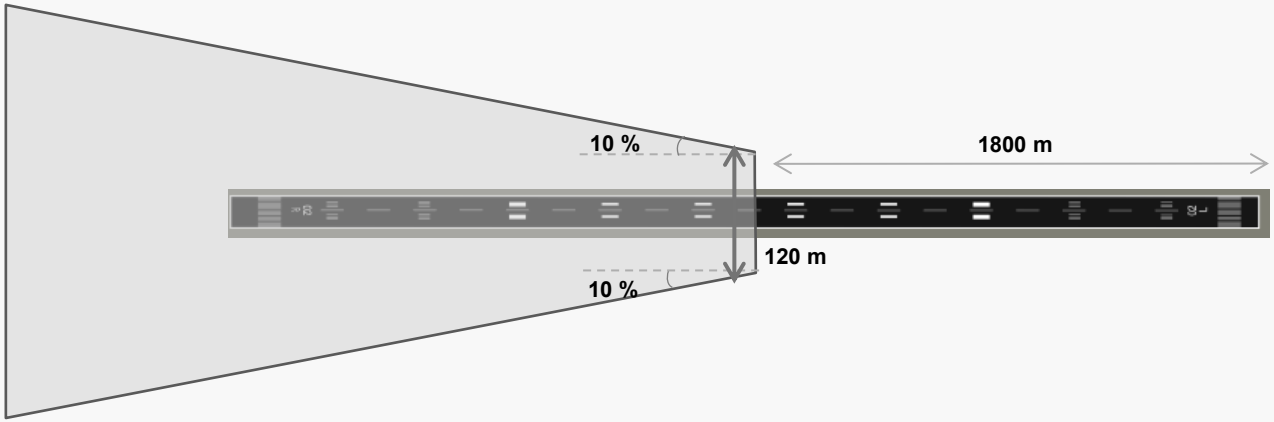
Purpose: Implemented on precision approach runways, where the balked landing might be initiated at low height above the threshold and the climb phase of the manoeuvre is not necessarily covered by the inner transitional surfaces.

Description: An inclined surface located at a specified distance after the threshold, extending between the inner transitional surfaces.

OFS: Balked Landing

ADG V Precision

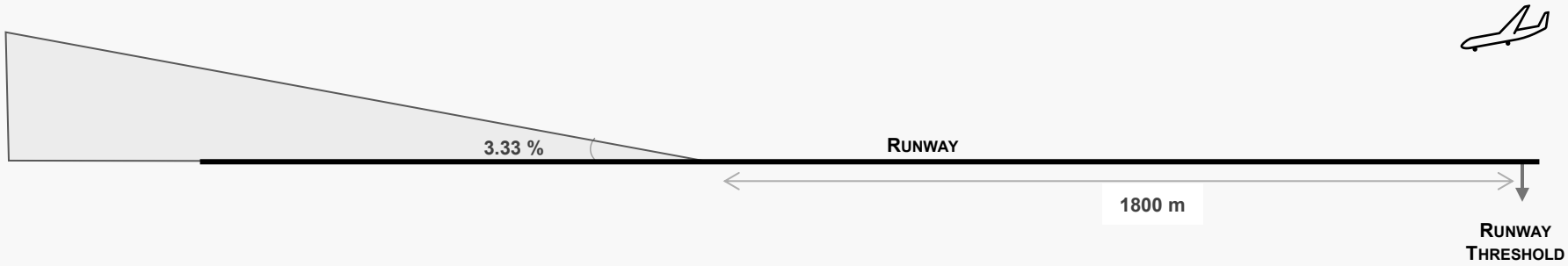
New: Plan | New: Cross Section | New: Balked + Inner Approach + Inner Transitional | Axonometric



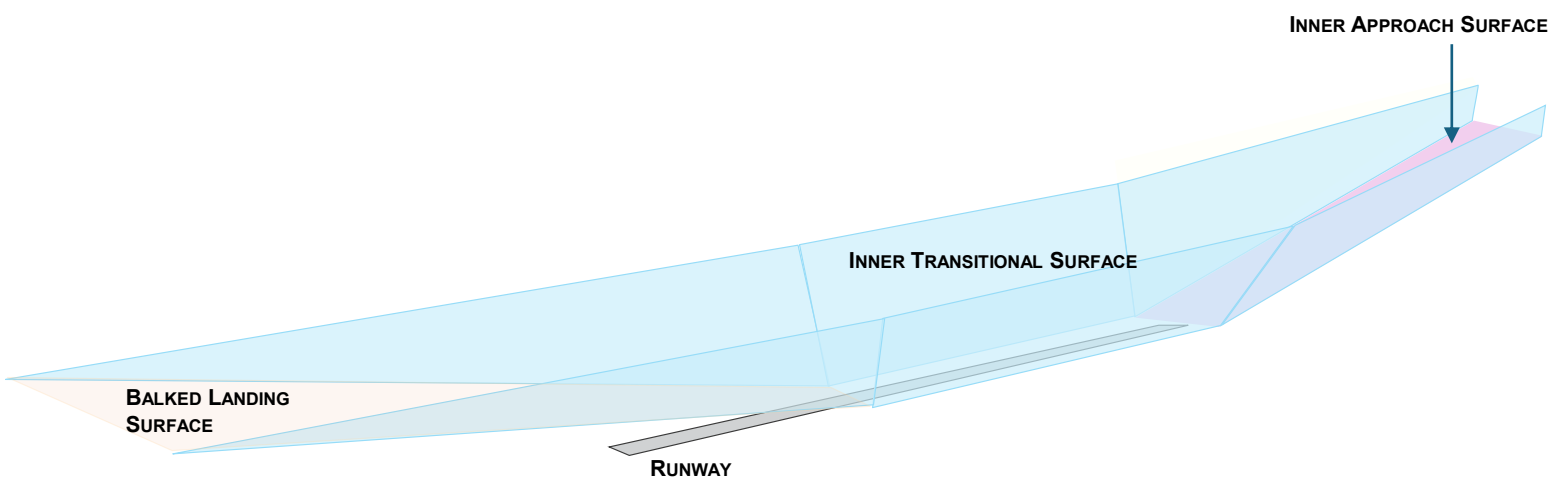
OFS: Balked Landing

ADG V Precision

New: Plan | New: Cross Section | New: Balked + Inner Approach + Inner Transitional | Axonometric



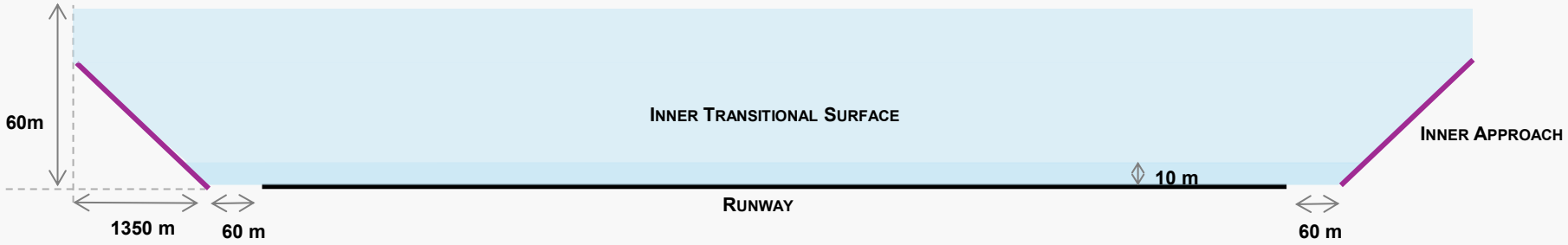
Obstacle Free Zone



OFS: Inner Transitional Surface: Non instrument, Non precision

For ADG V

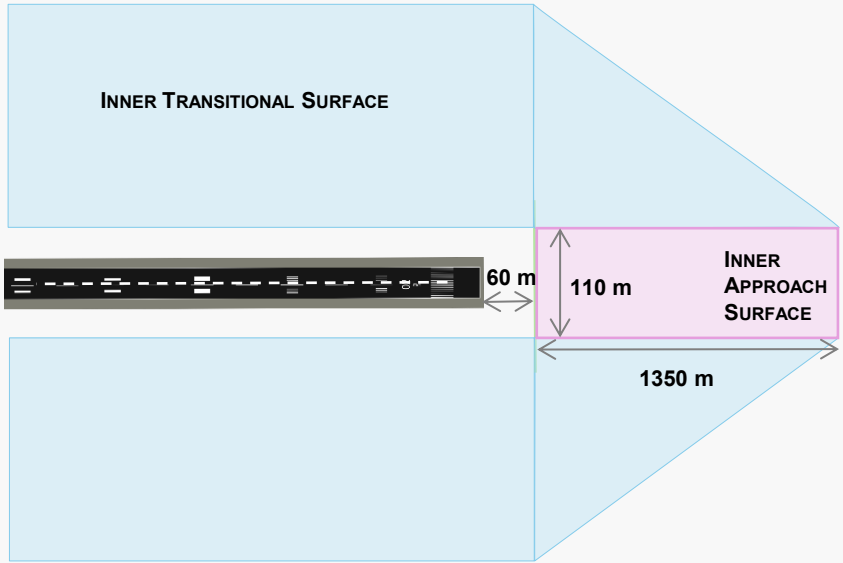
New: Plan | New: Plan, extended | New: Cross section (short end) | New: Cross section (long end) | Compared



OFS: Inner Transitional Surface: Non instrument, Non precision

For ADG V

New: Plan | New: Plan, extended | New: Cross section (short end) | New: Cross section (long end) | Compared



Obstacle Evaluation Surfaces (OES)

Applied **in addition to the OFS**, where operations may differ between aerodromes. OES

- Are based on PANS-OPS criteria
- Safeguard flight operations
- Delineate the volume of airspace where the existence obstacles could impact operations

The standard OES detailed in Annex 14, Volume I, Chapter 4 address **most common flight operations and operating minima**.

Depending on the flight operations and procedures available at an aerodrome, specific OES may be required. These could be

- **adaptations** of the standard OES,
- **tailored OES** to fit the operations at an aerodrome.

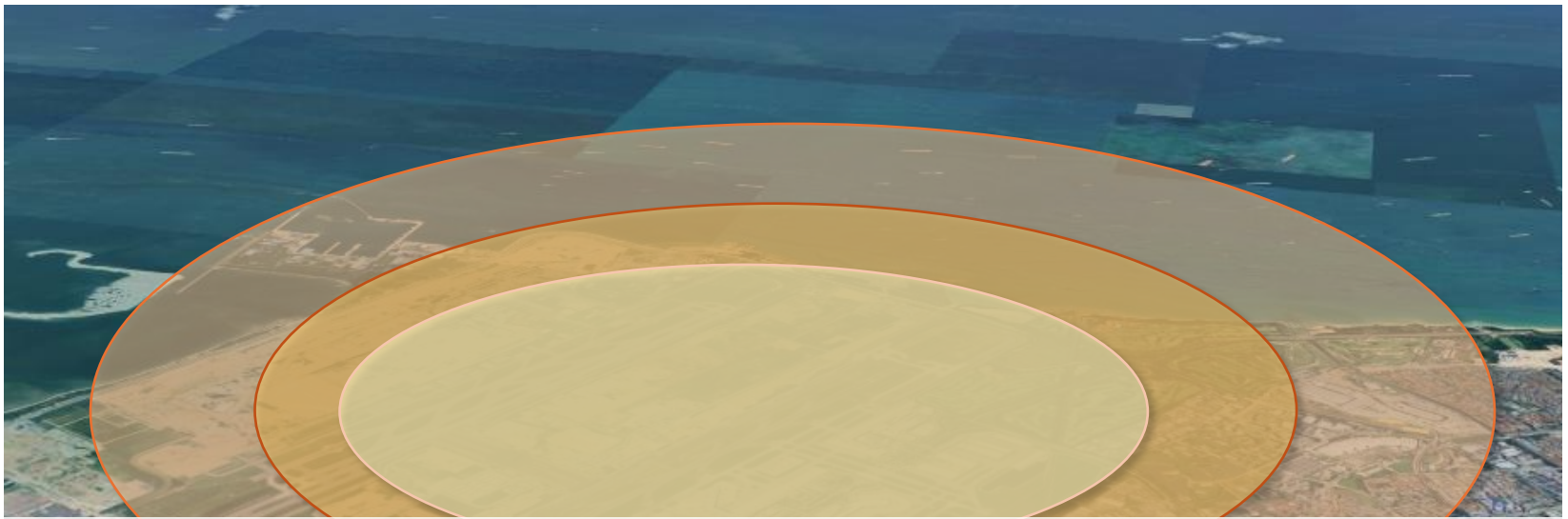
Obstacle Evaluation Surfaces

Characteristics

- Below and beyond the OFS
- May be adapted or tailored
- Penetration of these surfaces may impact operations
- Penetration of OES to be assessed

Obstacle Evaluation Surfaces

OES: Horizontal Surfaces

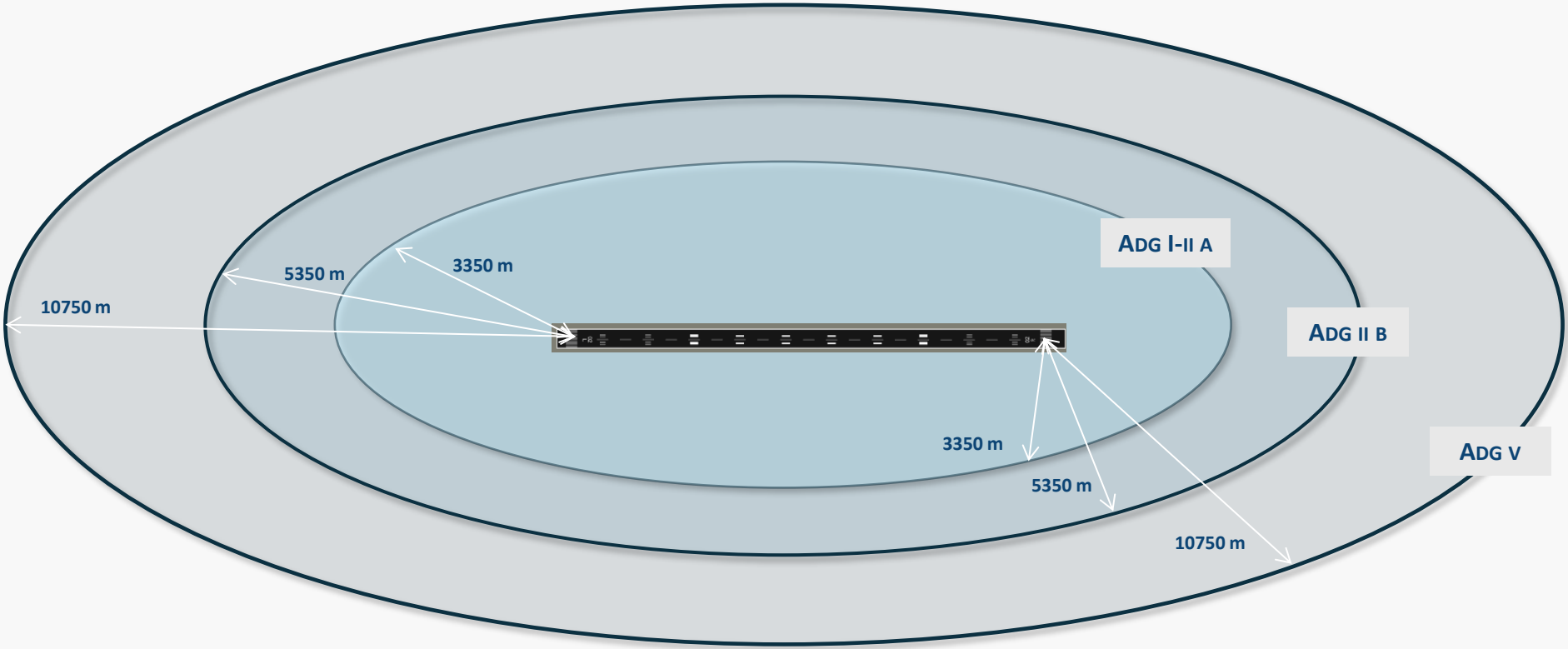


Purpose: Protect the airspace for **circling operations**. The horizontal surface also provides some protection for visual circuits and terminal instrument flight procedures, including PBN approaches, early turning missed approaches and early turning departures.

Description: A surface, or a combination of surfaces, located in a horizontal plane, or in a series of horizontal planes, above an aerodrome and its environs.

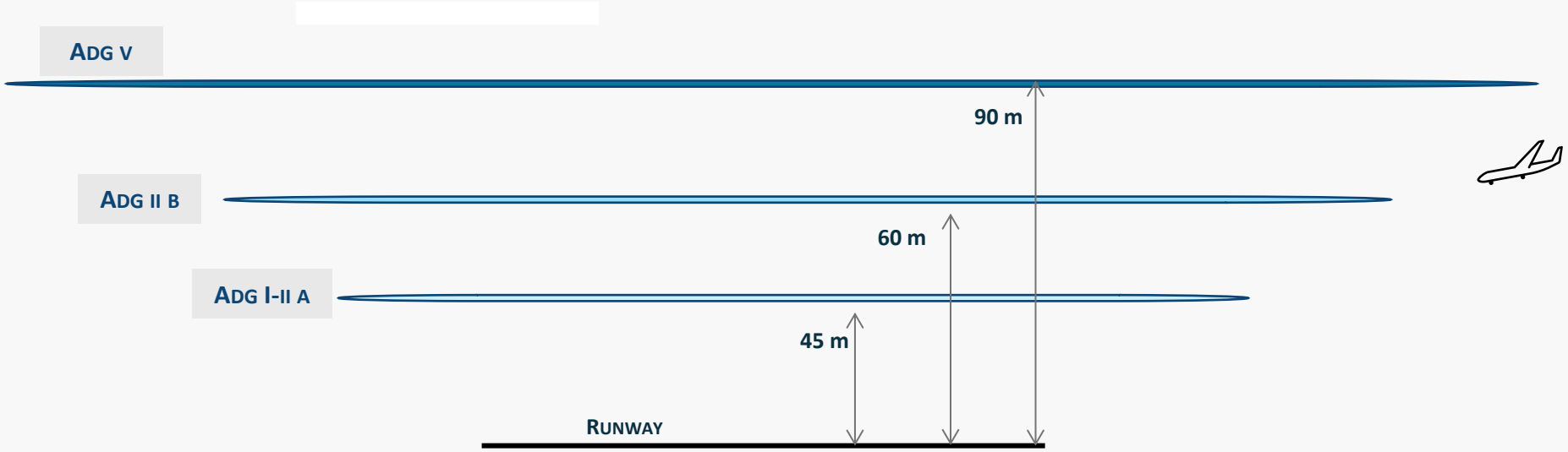
OES: Horizontal Surfaces

Plan | Cross Section



OES: Horizontal Surfaces

Plan | **Cross Section**



OES: Surface for Straight-in Instrument Approach

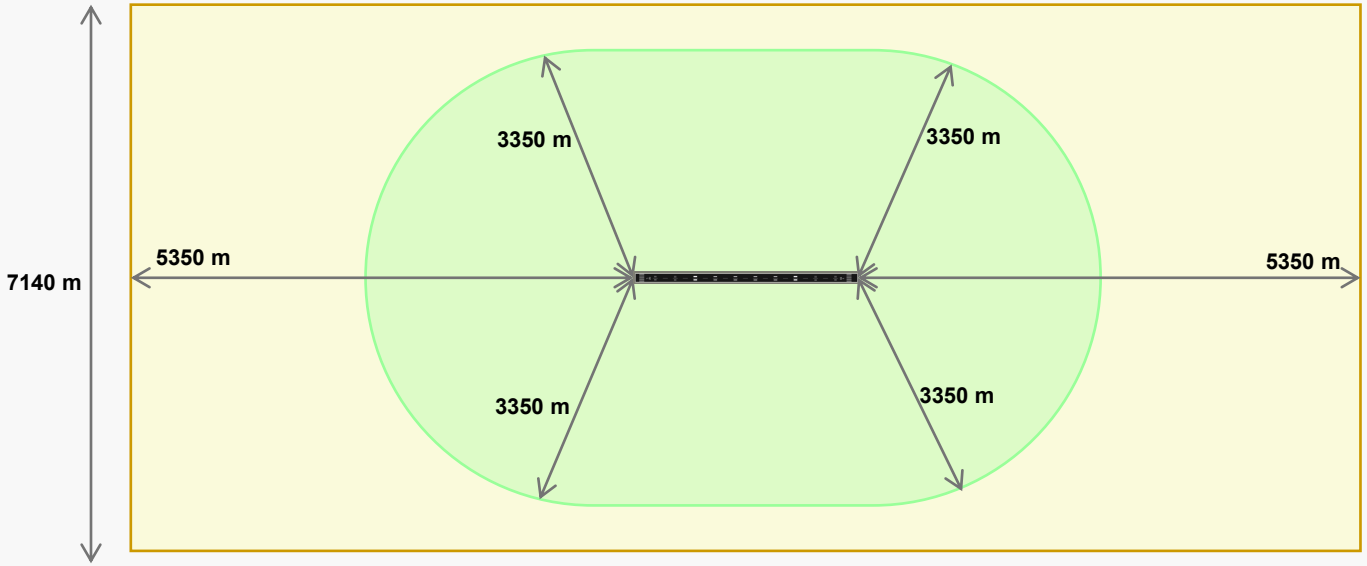
Purpose: Establish the airspace where obstacles may have an impact on **straight-in instrument approaches**, where the horizontal surface(s) or parts thereof are not established.

Description: A combination of surfaces, located in a series of horizontal planes above an aerodrome and its environs.

Straight In Instrument Approach

For ADG V

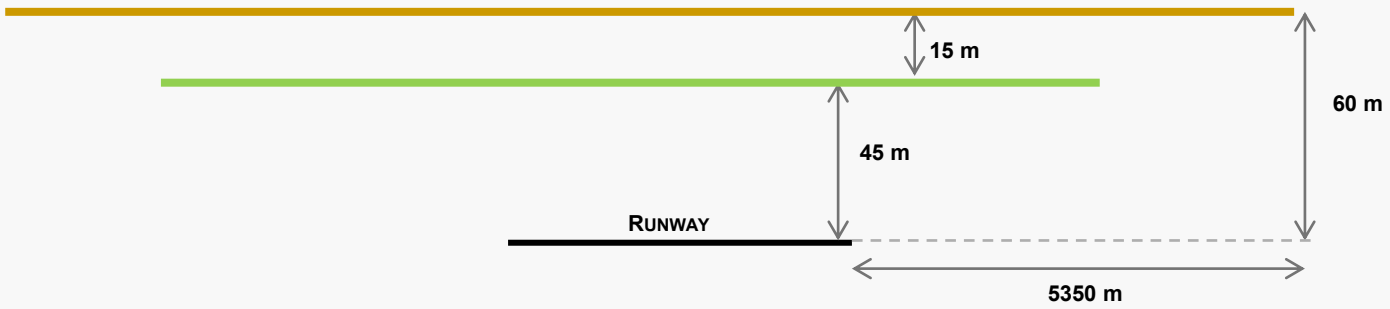
Plan view | Cross Section View | Axonometric View



Straight In Instrument Approach

For ADG V

Plan view | Cross Section View | Axonometric View



OES: Surface for Precision Approach

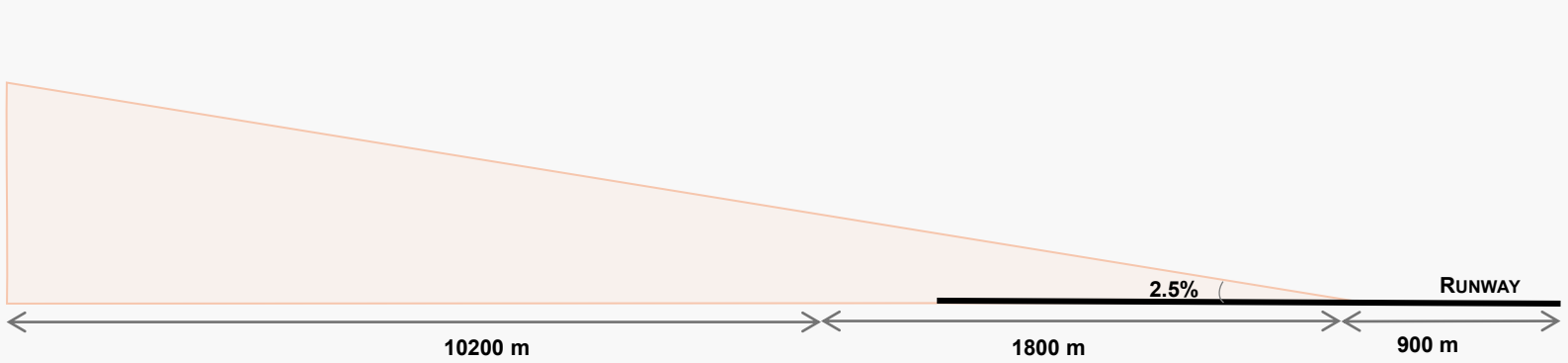
Purpose: Establish the airspace where obstacles may have an impact on **common straight-in precision approach procedures** (using ILS, ground-based augmentation system (GBAS) or satellite-based augmentation system (SBAS) CAT I).

Description: A complex surface consistent with the Basic ILS

Surface for Precision Approaches

For ADG V

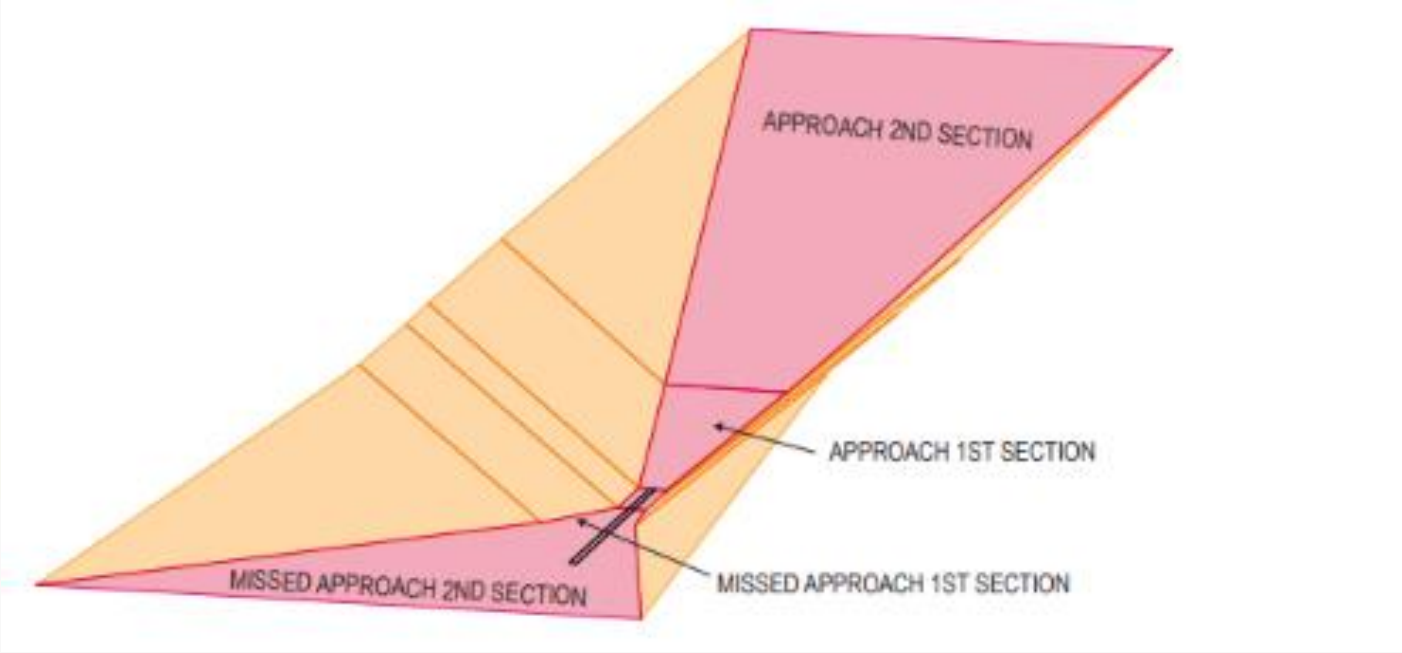
Plan view | Cross Section View | Axonometric View



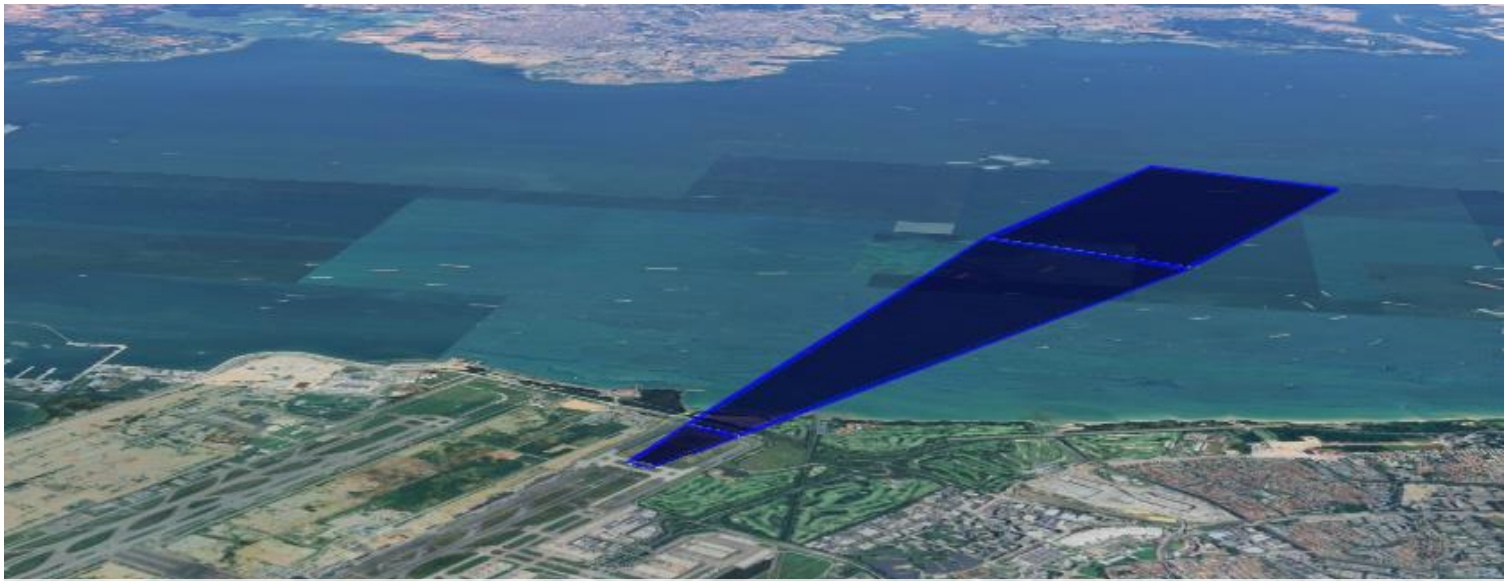
Surface for Precision Approaches

For ADG V

Plan view | **Cross Section View** | **Axonometric View**



OES: Take-off Climb Surface



Purpose: Establish the airspace where obstacles may have an impact on aircraft operating limitations **during take-off under non-critical operating conditions**.

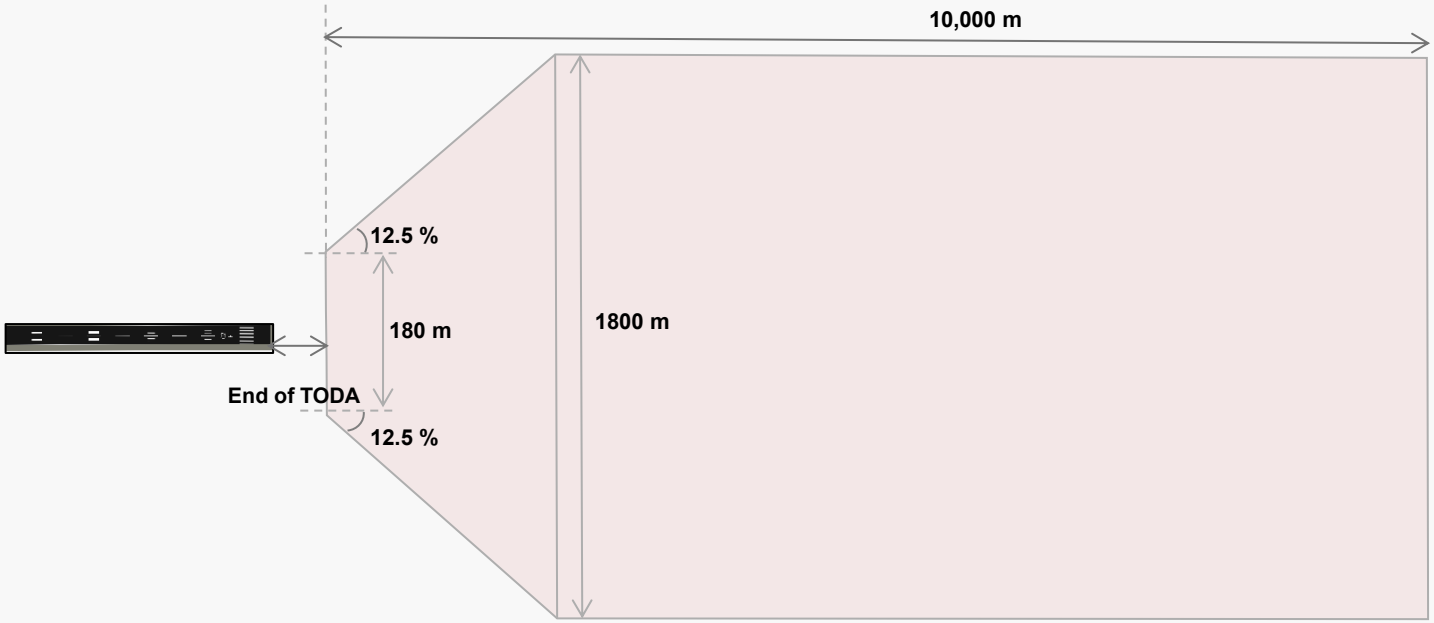
Description: An inclined surface beyond the end of the take-off distance available.

Take-Off Climb Surface

Plan

Cross Section

For ADG V

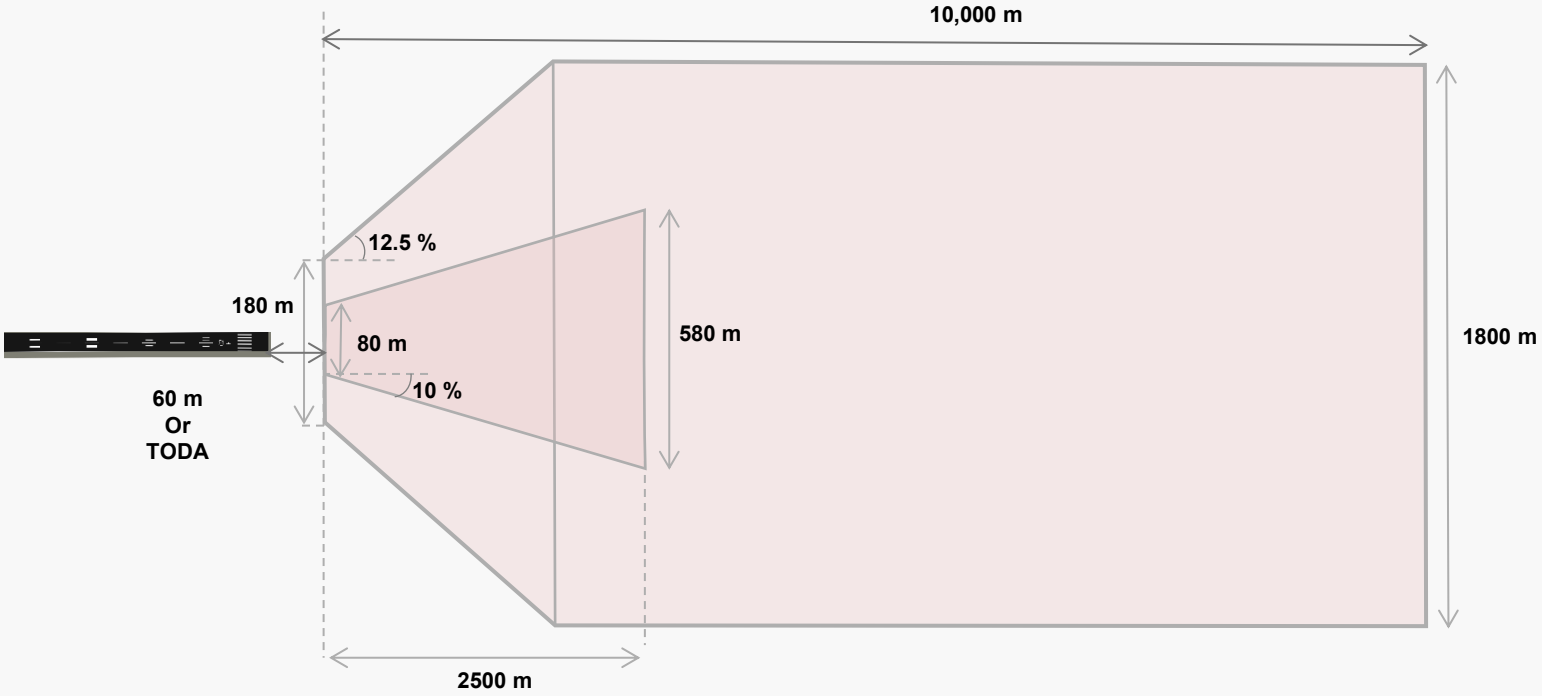


Take-Off Climb Surface

Plan

Cross Section

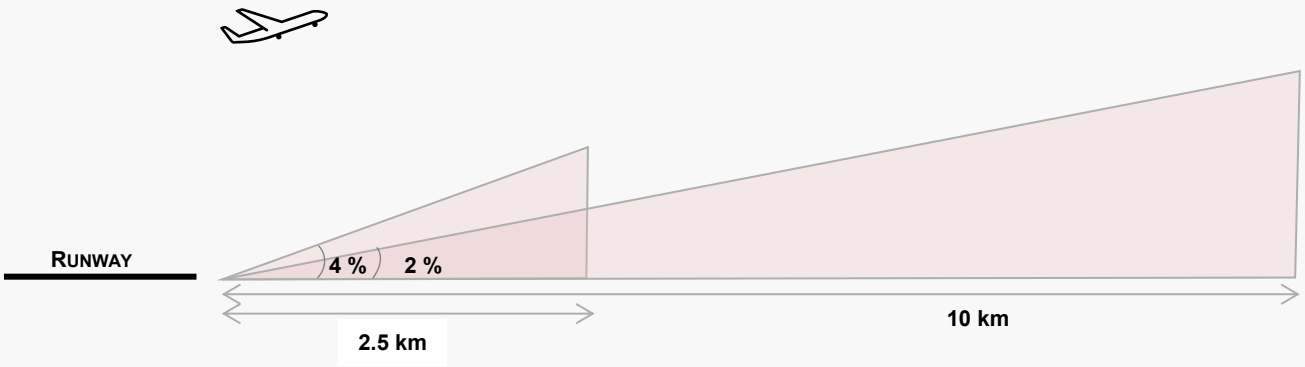
Compared



Take-Off Climb Surface

Plan | **Cross Section**

Compared



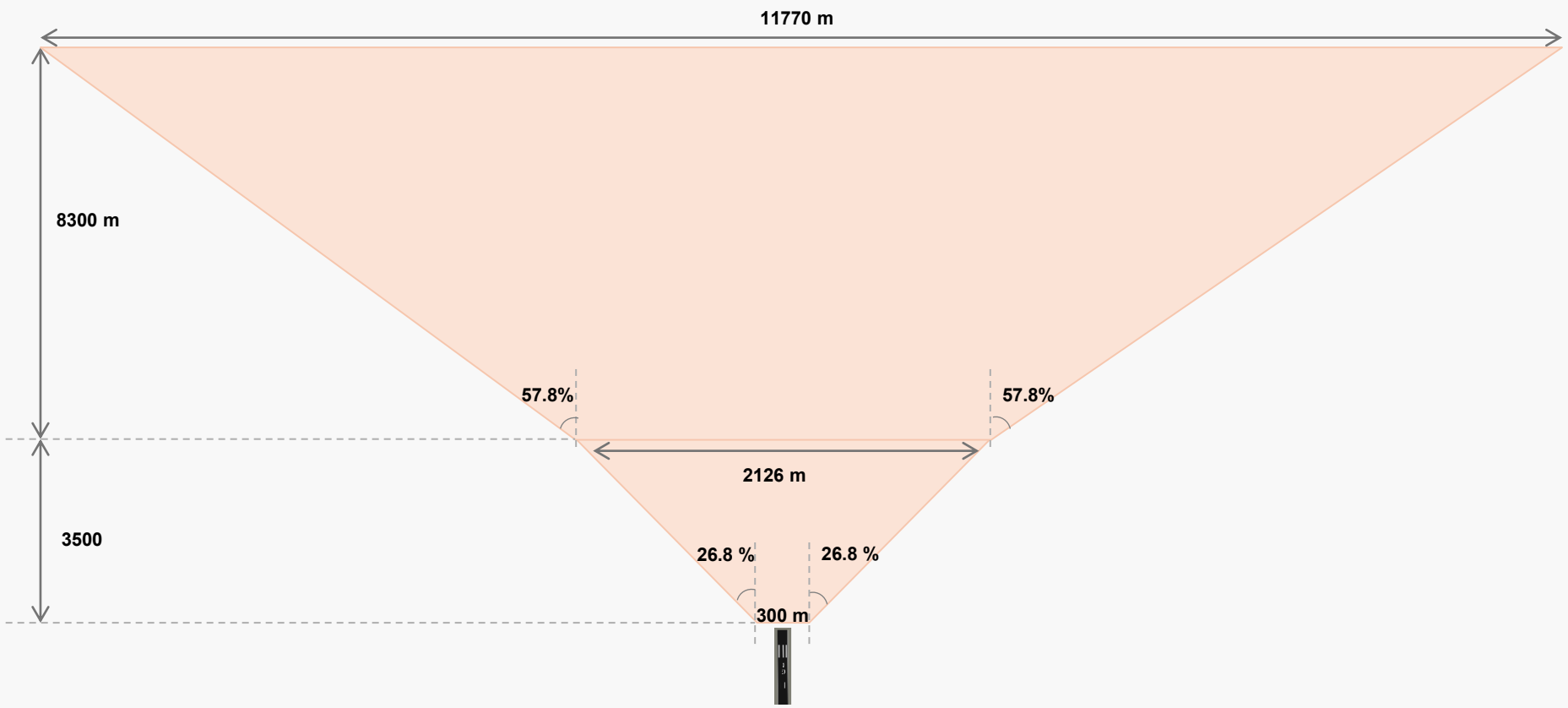
OES: Instrument Departure Surfaces

Purpose: Establish the airspace where obstacles may have an impact on aircraft following an **omnidirectional instrument departure procedure**

Description: An inclined surface, along the runway centre line and its extension after the end of the take-off distance available.

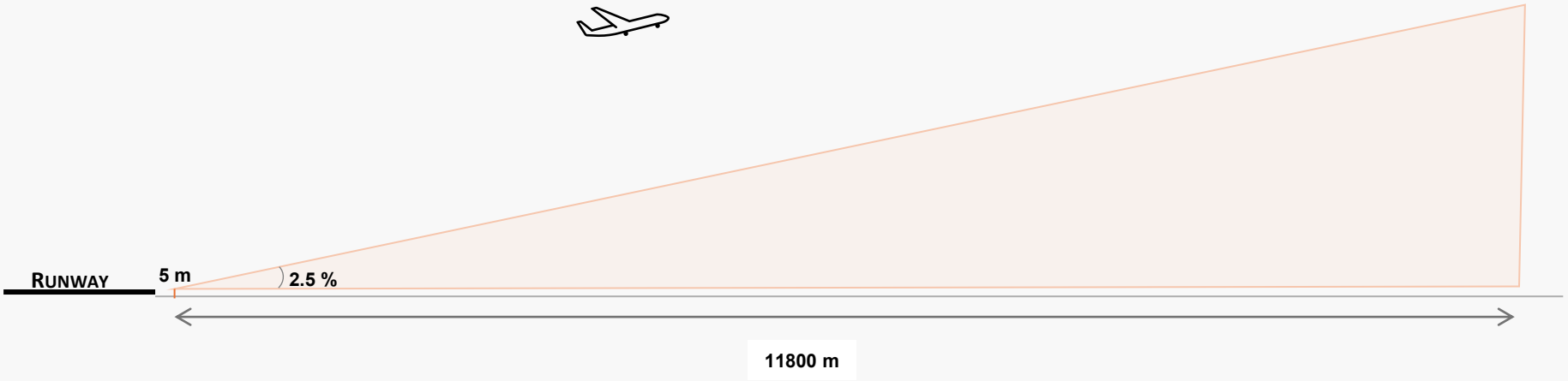
Instrument Departure

Plan | Cross Section



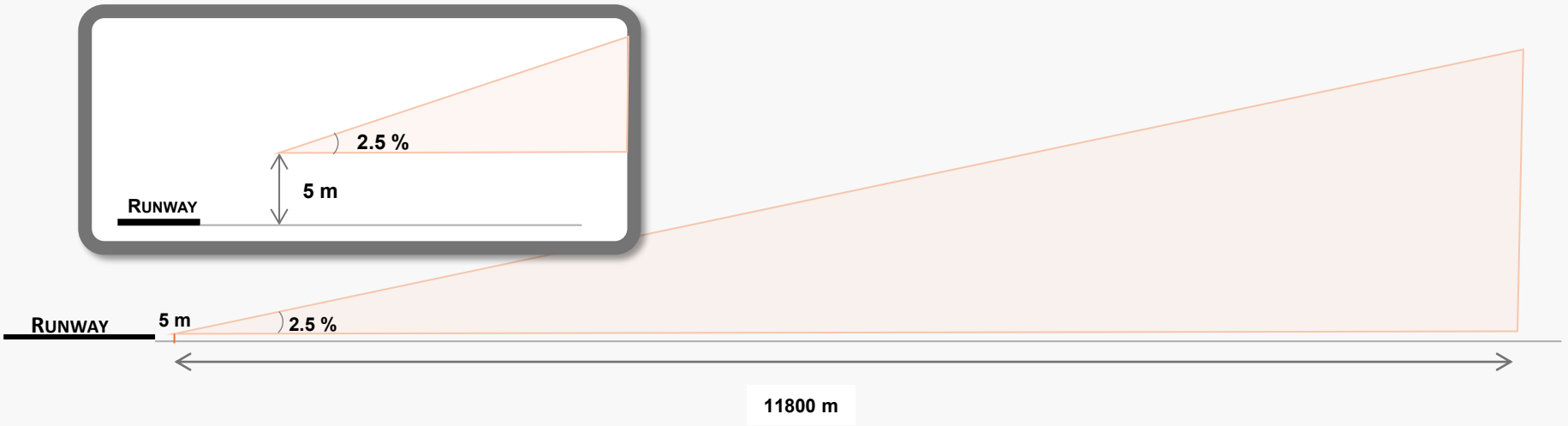
Instrument Departure

Plan View | **Cross Section**



Instrument Departure

Plan View | **Cross Section**



Application based on type of runway

	Non-Instrument	Non-Precision	Precision
Approach	✓	✓	✓
Transitional	✓	✓	✓
Inner horizontal	✓	✓	✓
Conical	✓	✓	✓
Inner Transitional	-	-	✓
Inner Approach	-	-	✓
Balked Landing	-	-	✓

Specific OES

Standard OES

Specific OES

Adapted OES

Tailored OES

Address **most common flight procedures**

- Take off
- Omni directional instrument departures
- Circling and visual traffic pattern
- Instrument approach patterns with common approach minima

Address flight operations and procedures that are **not fully covered** by the standard OES.

Reduce OES in areas where not required, thereby reducing the need for aeronautical studies.

Advantages of new OLS

In general, much less restrictive

- Performance-based
- Safety Driven
- Huge benefits for aerodromes and land use

Clear obstacle restrictions for fixed and mobile objects for all runway types

Holding positions remain

Navigation away from ‘one size fits all’

Adapt surfaces to operations

Summary

- The need to review the OLS to ensure it continues to be effective in safeguarding the airspace against obstacles to ensure safe aircraft operations.
- The revised OLS comprises of OFS and OES
- Standard OES is designed based on PANS-OPS criteria
- OES is dependent on the type of operations and procedures that are conducted on the runway
- Specific OES may be required to safeguard procedures that cannot be sufficiently safeguarded by the standard OES in Annex 14.