

UNIT IV	AERODROME DATA, PHYSICAL CHARACTERISTICS AND OBSTACLE RESTRICTION
<p>Aerodrome data - Basic terminology – Aerodrome reference code – Aerodrome reference point – Aerodrome elevation – Aerodrome reference temperature – Instrument runway, physical Characteristics; length of primary / secondary runway – Width of runways – Minimum distance between parallel runways etc. – obstacles restriction.</p>	

Basic terminologies

Aerodrome A defined area on land or water (including any buildings, installations, and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.

Aerodrome beacon Aeronautical beacon used to indicate the location of an aerodrome from the air.

Aerodrome elevation The elevation of the highest point of the landing area.

Aerodrome identification sign A sign placed on an aerodrome to aid in identifying the aerodrome from the air.

Aerodrome reference point The designated geographical location of an aerodrome.

Aerodrome traffic density

- a) Light. Where the number of movements in the mean busy hour is not greater than 15 per runway or typically less than 20 total aerodrome movements.
- b) Medium. Where the number of movements in the mean busy hour is of the order of 16 to 25 per runway or typically between 20 to 35 total aerodrome movements.
- c) Heavy. Where the number of movements in the mean busy hour is of the order of 26 or more per runway or typically more than 35 total aerodrome movements.

Aeroplane reference field length. The minimum field length required for take-off at maximum certificated take-off mass, sea level, standard atmospheric conditions, still air and zero runway slope, as shown in the appropriate aeroplane flight manual prescribed by the certifying

authority or equivalent data from the aeroplane manufacturer. Field length means balanced field length for aeroplanes, if applicable, or take-off distance in other cases.

Apron. A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, fuelling, parking or maintenance. Apron

Geodetic datum. A minimum set of parameters required to define location and orientation of the local reference system with respect to the global reference system/frame.

Geoid. The equipotential surface in the gravity field of the Earth, which coincides with the undisturbed mean sea level (MSL) extended continuously through the continents.

Geoid undulation. The distance of the geoid above (positive) or below (negative) the mathematical reference ellipsoid.

Landing area. That part of a movement area intended for the landing or take-off of aircraft.

Landing direction indicator. A device to indicate visually the direction currently designated for landing and for take-off.

Marker. An object displayed above ground level in order to indicate an obstacle or delineate a boundary.

Marking. A symbol or group of symbols displayed on the surface of the movement area in order to convey aeronautical information.

Near-parallel runways. Non-intersecting runways whose extended centre lines have an angle of convergence/divergence of 15 degrees or less.

Runway. A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.

Runway strip. A defined area including the runway and stopway, if provided, intended:

- a) to reduce the risk of damage to aircraft running off a runway; and
- b) to protect aircraft flying over it during take-off or landing operations.

Taxiway. A defined path on a land aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another, including:

- a) *Aircraft stand taxilane.* A portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.
- b) *Apron taxiway.* A portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron.

- c) *Rapid exit taxiway.* A taxiway connected to a runway at an acute angle and designed to allow landing aeroplanes to turn off at higher speeds than are achieved on other exit taxiways thereby minimizing runway occupancy times.

Taxiway strip. An area including a taxiway intended to protect an aircraft operating on the taxiway and to reduce the risk of damage to an aircraft accidentally running off the taxiway.

Threshold. The beginning of that portion of the runway usable for landing.

Aerodrome data

1. the aerodrome reference point and its geographical coordinates in degrees, minutes and seconds;
2. the outline of the runways by a solid line;
3. the length and width of the runway;
4. the magnetic bearing to the nearest degree of the runway and the runway number;
5. the elevation of the runway centre line at each end of the runway, at the stopway, at the origin of each takeoff and approach area, and at each significant change of slope of runway and stop way;
6. taxiways, aprons and parking areas identified as such, and the outlines by a solid line;
7. stopways identified as such and depicted by a broken line;
8. the length of each stopway;
9. clearways identified as such and depicted by a broken line;
10. the length of each clearway;
11. take-off and approach surfaces identified as such and depicted by a broken line;
12. take-off and approach areas;
13. location of terminal buildings;
14. location of control tower;
15. location of fire station;
16. location of navigation aids;
17. location of isolation bay; and
18. location of helipads;
19. obstacles at their exact location, including;

- a symbol indicative of their type;
- elevation;
- identification;
- limits of penetration of large extent in a distinctive manner identified in the legend;

Aerodrome administration. This will include:

- name, address, telephone and facsimile numbers of the aerodrome operator;
- aerodrome usage;
- aerodrome charges.

Visual aids (aeronautical marking and lighting system) This information will include:

- Marking and lighting systems for runways;
- approach lighting system;
- visual approach slope indicator system;
- aerodrome beacon;
- marking and lighting systems for taxiways; and
- any other marking and lighting systems.

Ground services This information will include:

- availability of fuel (ATF);
- automatic terminal information service where provided;
- ground to air communication facilities
- any other services available to pilots.

Aerodrome reference code

1. An aerodrome reference code — code number and letter — which is selected for aerodrome planning purposes shall be determined in accordance with the characteristics of the aeroplane for which an aerodrome facility is intended.
2. The aerodrome reference code numbers and letters shall have the meanings assigned to them in Table.

3. The code number for element 1 shall be determined from Table 1-1, column 1, selecting the code number corresponding to the highest value of the aeroplane reference field lengths of the aeroplanes for which the runway is intended.
4. The code letter for element 2 shall be determined from Table 1-1, column 3, by selecting the code letter which corresponds to the greatest wing span, or the greatest outer main gear wheel span, whichever gives the more demanding code letter of the aeroplanes for which the facility is intended.

Code element 1			Code element 2	
Code number (1)	Aeroplane reference field length (2)	Code letter (3)	Wing span (4)	Outer main gear wheel span ^a (5)
1	Less than 800 m	A	Up to but not including 15 m	Up to but not including 4.5 m
2	800 m up to but not including 1 200 m	B	15 m up to but not including 24m	4.5 m up to but not including 6 m
3	1200 m up to but not including 1800 m	C	24 m up to but not including 36m	6 m up to but not including 9 m
4	1 800 m and over	D	36 m up to but not including 52m	9 m up to but not including 14 m
		E	52 m up to but not including 65m	9 m up to but not including 14 m
		F	65m up to but not including 80m	14m up to but not including 16m
a. Distance between the outside edges of the main gear wheels.				

Aerodrome reference point

- An aerodrome reference point shall be established for an aerodrome.
- The aerodrome reference point shall be located near the initial or planned geometric centre of the aerodrome and shall normally remain where first established.
- The position of the aerodrome reference point shall be measured and reported to the aeronautical information services authority in degrees, minutes and seconds.

Aerodrome and runway elevations

- The aerodrome elevation and geoid undulation at the aerodrome elevation position shall be measured to the accuracy of one-half meter or foot and reported to the aeronautical information services authority.
- For an aerodrome used by civil aviation for non-precision approaches, the elevation and geoid undulation of each threshold, the elevation of the runway end and any significant high and low intermediate points along the runway shall be measured to the accuracy of one-half meter or foot and reported to the aeronautical information services authority.
- For precision approach runway, the elevation and geoid undulation of the threshold, the elevation of the runway end and the highest elevation of the touchdown zone shall be measured to the accuracy of one-quarter meter or foot and reported to the aeronautical information services authority.

Aerodrome reference temperature

- An aerodrome reference temperature shall be determined for an aerodrome in degrees Celsius.
- The aerodrome reference temperature shall be the monthly mean of the daily maximum temperatures for the hottest month of the year (the hottest month being that which has the highest monthly mean temperature). This temperature shall be averaged over a period of five years.

Instrument runway. One of the following types of runways intended for the operation of aircraft using instrument approach procedures:

- a) Non-precision approach runway. An instrument runway served by visual aids and a non-visual aid providing at least directional guidance adequate for a straight-in approach.
- b) Precision approach runway, category I. An instrument runway served by ILS and/or MLS and visual aids intended for operations with a decision height not lower than 60 m (200 ft) and either a visibility not less than 800 m or a runway visual range not less than 550 m.

- c) Precision approach runway, category II. An instrument runway served by ILS and/or MLS and visual aids intended for operations with a decision height lower than 60 m (200 ft) but not lower than 30 m (100 ft) and a runway visual range not less than 350 m.
- d) Precision approach runway, category III. An instrument runway served by ILS and/or MLS to and along the surface of the runway
 - A — intended for operations with a decision height lower than 30 m (100 ft), or no decision height and a runway visual range not less than 175 m.
 - B — intended for operations with a decision height lower than 15 m (50 ft), or no decision height and a runway visual range less than 175 m but not less than 50 m
 - C — intended for operations with no decision height and no runway visual range limitations.

PHYSICAL CHARACTERISTICS RUNWAYS

Number and orientation of runways

Many factors affect the determination of the orientation, siting and number of runways. One important factor is the usability factor, as determined by the wind distribution, which is specified hereunder. Another important factor is the alignment of the runway to facilitate the provision of approaches conforming to the approach surface specifications of Chapter 4. In Attachment A, Section 1, information is given concerning these and other factors. When a new instrument runway is being located, particular attention needs to be given to areas over which aeroplanes will be required to fly when following instrument approach and missed approach procedures, so as to ensure that obstacles in these areas or other factors will not restrict the operation of the aeroplanes for which the runway is intended.

1. The number and orientation of runways at an aerodrome shall be such that the usability factor of the aerodrome is not less than 95 per cent for the aeroplanes that the aerodrome is intended to serve.
2. The siting and orientation of runways at an aerodrome should, where possible, be such that the arrival and departure tracks minimize interference with areas approved for

residential use and other noise sensitive areas close to the aerodrome in order to avoid future noise problems.

3. Choice of maximum permissible crosswind components: In the application of para 1., it should be presumed that landing or take-off of aeroplanes is, in normal circumstances, precluded when the cross-wind component exceeds:
 - 37 km/h (20 kt) in the case of aeroplanes whose reference field length is 1 500 m or over, except that when poor runway braking action owing to an insufficient longitudinal coefficient of friction is experienced with some frequency, a cross-wind component not exceeding 24 km/h (13 kt) shall be assumed;
 - 24 km/h (13 kt) in the case of aeroplanes whose reference field length is 1 200 m or up to but not including 1 500 m; and
 - 19 km/h (10 kt) in the case of aeroplanes whose reference field length is less than 1200 m.

4. Data to be used :

The selection of data to be used for the calculation of the usability factor shall be based on reliable wind distribution statistics that extend over as long a period as possible, preferably of not less than five years. The observations used should be made at least eight times daily and spaced at equal intervals of time.

Location of threshold

1. A threshold shall normally be located at the extremity of a runway unless operational considerations justify the choice of another location.
2. When it is necessary to displace a threshold, either permanently or temporarily, from its normal location, account shall be taken of the various factors which may have a bearing on the location of the threshold. Where this displacement is due to an unserviceable runway condition, a cleared and graded area of at least 60 m in length shall be available between the unserviceable area and the displaced threshold. Additional distance shall also be provided to meet the requirements of the runway end safety area as appropriate.

PRIMARY RUNWAY

The actual runway length to be provided for a primary runway shall be adequate to meet the operational requirements of the aeroplanes for which the runway is intended and shall be not less than the longest length determined by applying the corrections for local conditions to the operations and performance characteristics of the relevant aeroplane.

SECONDARY RUNWAY

The length of a secondary runway shall be determined similarly to primary runways except that it needs only to be adequate for those aeroplane, which require to use that secondary runway in addition to the other runway or runways in order to obtain a usability factor of at least 95 percent.

Runways with stopways or clearways:

Where a runway is associated with a stopway or clearway, an actual runway length less than that resulting from application of primary or secondary runway, as appropriate, may be considered satisfactory, but in such a case any combination of runway, stopway and clearway provided shall permit compliance with the operational requirements for take-off and landing of the aeroplanes the runway is intended to serve.

Width of runways

The width of a runway shall be not less than the appropriate dimension specified in the following tabulation:

Code number	Code letter					
	A	B	C	D	E	F
1 ^a	18 m	18 m	23 m	-	-	-
2 ^a	23 m	23 m	30 m	-	-	-
3	30 m	30 m	30 m	45 m	-	-
4	-	-	45 m	45 m	45 m	60 m

The width of a precision approach runway shall be not less than 30 m where the code number is 1 or 2.

Note 1. The combinations of code numbers and letters for which widths are specified have been developed for typical aeroplane characteristics.

Note 2. Factors affecting runway width are given in the ICAO Aerodrome Design Manual,

Minimum distance between parallel runways

1. Where parallel non-instrument runways are intended for simultaneous use, the minimum distance between their centre lines shall be:
 - 210 m where the higher code number is 3 or 4;
 - 150 m where the higher code number is 2; and
 - 120 m where the higher code number is 1.
2. Where parallel instrument runways are intended for simultaneous use subject to conditions specified in the ICAO PANS-ATM (Doc 4444) and the ICAO PANS-OPS (Doc 8168), Volume I, the minimum distance between their centre lines shall be:
 - 1 035 m for independent parallel approaches;
 - 915 m for dependent parallel approaches;
 - 760 m for independent parallel departures;
 - 760 m for segregated parallel operations;

Except that:

- a) for segregated parallel operations the specified minimum distance:
 - may be decreased by 30 m for each 150 m that the arrival runway is staggered toward the arriving aircraft, to a minimum of 300 m; and
 - shall be increased by 30 m for each 150 m that the arrival runway is staggered away from the arriving aircraft;
- b) for independent parallel approaches, combinations of minimum distances and associated conditions other than those specified in the ICAO PANS-ATM (Doc 4444) may be applied when it is determined that such combinations would not adversely affect the safety of aircraft operations.

Strength of runways

A runway shall be capable of withstanding the traffic of aeroplanes the runway is intended to serve.

Surface of runways

1. The surface of a runway shall be constructed without irregularities that would result in loss in friction characteristics or otherwise adversely affect the take-off or landing of an aeroplane.
2. The surface of a paved runway shall be so constructed as to provide good friction characteristics when the runway is wet.
3. Measurements of the friction characteristics of a new or resurfaced runway shall be
4. The average surface texture depth of a new surface shall be not less than 1.0 mm.
5. When the surface is grooved or scored, the grooves or scorings shall be either perpendicular to the runway centre line or parallel to non-perpendicular transverse joints, where applicable, made with a continuous friction measuring device using self-wetting features in order to assure that the design objectives with respect to its friction characteristics have been achieved.

Runway shoulder

1. Runway shoulders shall be provided for a runway where the code letter is D or E, and the runway width is less than 60 m.
2. Runway shoulders shall be provided for a runway where the code letter is F.

OBSTACLE RESTRICTION AND REMOVAL

Introduction

The objectives of the specifications of obstacle limitation surfaces 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. Objects, which penetrate the obstacle limitation surfaces contained in this section, 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. Construction of buildings, trees etc.

Obstacle limitation surfaces (OLS) :

The Obstacle limitation surfaces are imaginary surfaces associated with runways surfaces that define the limits of the aerodrome airspace above which an object becomes obstacle to aircraft operations.

Outer horizontal surface

The outer horizontal surface is a plane located 150m above the reference elevation datum and extending from the upper edge of the extended conical surface for a distance 15000m (radius) from the aerodrome reference point.

Conical surface

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

The limits of the conical surface shall comprise:

- a) a lower edge coincident with the periphery of the inner horizontal surface; and
- b) an upper edge located at a specified height above the inner horizontal surface.

The slope of the conical surface shall be measured in a vertical plane perpendicular to the periphery of the inner horizontal surface.

Approach surface

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

The limits of the approach surface shall comprise:

- a) a horizontal inner edge of specified length perpendicular to the extended centre line of the runway at a distance of 60m before the threshold except in case of visual runways where the code number is 1 the distance is 30m ;
- b) 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;
- c) an outer edge parallel to the inner edge; and

- d) The above surfaces shall be varied when lateral offset, offset or curved approaches are utilized, specifically, two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended centre line of the lateral offset, offset or curved ground track.

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

The slope(s) of the approach surface shall be measured in the vertical plane containing the centre line of the runway. An approach surface for an instrument runway is horizontal beyond the point at which it intersects a horizontal plane 150m above the threshold elevation.

Inner approach surface

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

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.

Transitional surface

Transitional surface is a complex surface along the side of the runway strip and part of the side of the approach surface, that slopes upwards and outwards to the inner horizontal surface.

The limits of a 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 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 of the inner horizontal surface.

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.

The slope of the transitional surface shall be measured in a vertical plane at right angles to the centre line of the runway where runway code is 1 or 2 and has a visual or non-precision approach the slope is 20% (1:5). For all other runways the slope is 14.3% (1:7).



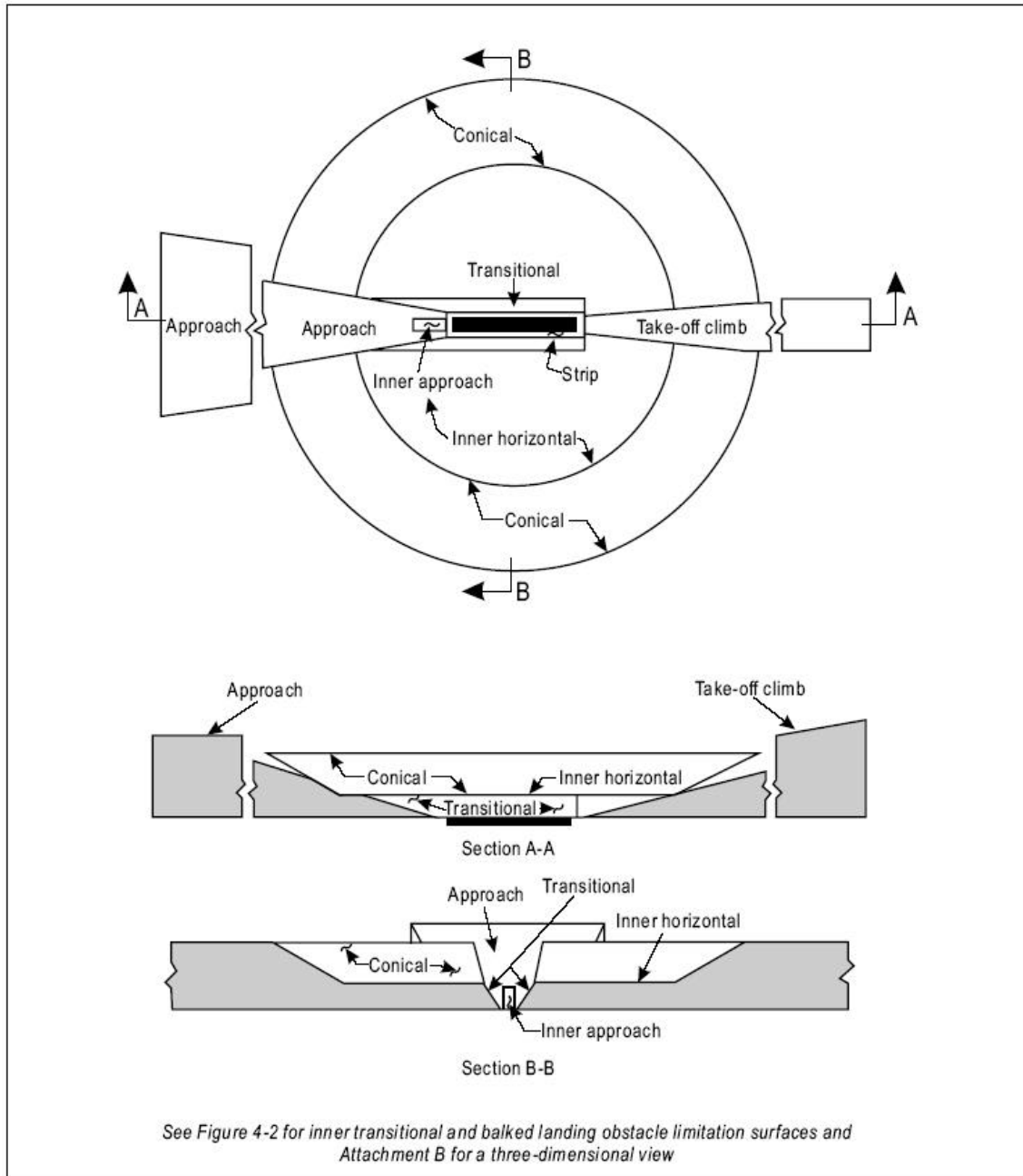


Figure 4-1. Obstacle limitation surfaces

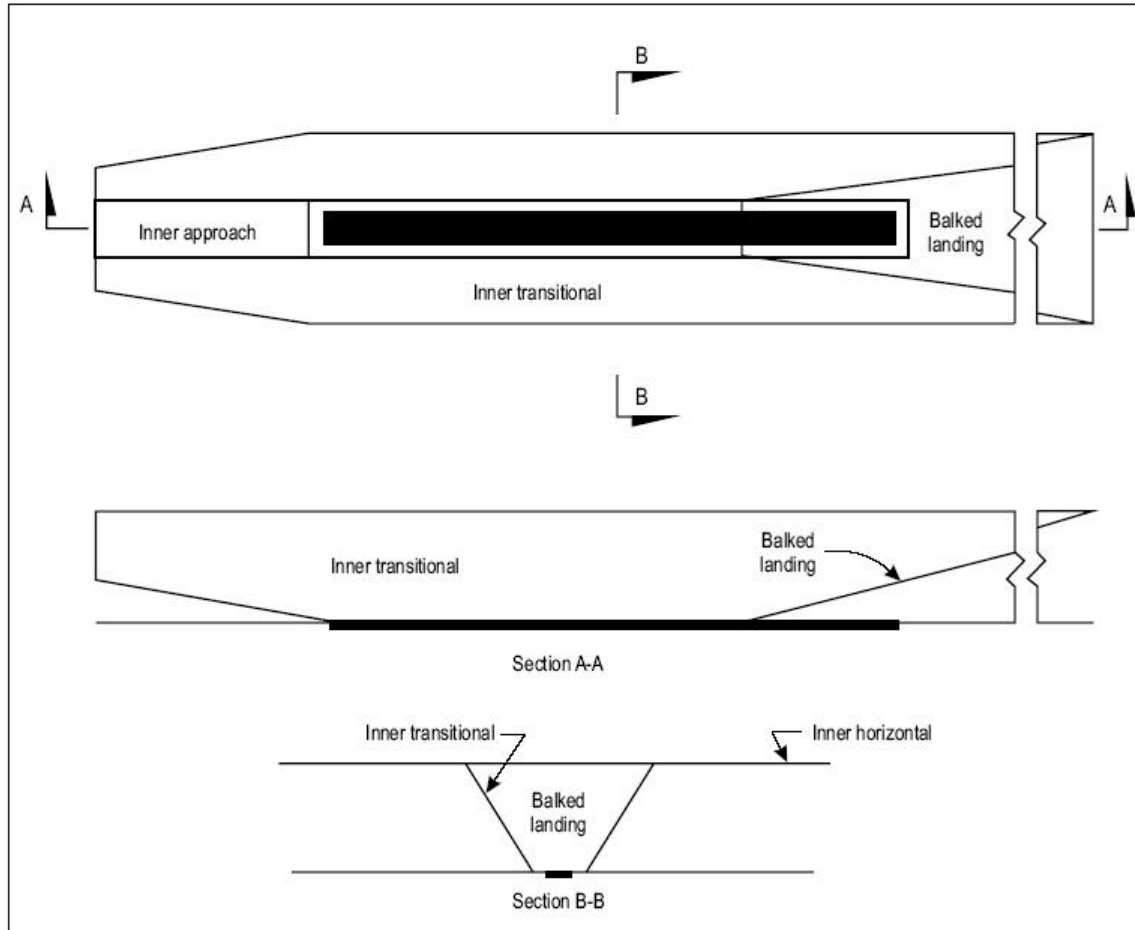


Figure 4-2. Inner approach, inner transitional and balked landing obstacle limitation surfaces