

FAR Part 77 Basics

- Objects affecting navigable airspace
- Federal Aviation Regulation Part 77
- “Federal Regulation 49 CFR Part 77 establishes standards and notification requirements for objects affecting navigable airspace.”
- Available on the web at:
 - <http://www.mopilots.org/legislation/Part77.htm>

- Evaluates the effect of the construction or alteration on operating procedures
- Determines the potential hazardous effect of the proposed construction or alterations on air navigation
- Identifies mitigating measures to enhance safe air navigation
- Charts new man-made or natural objects.

FAR Part 77 allows the “FAA to identify potential aeronautical hazards in advance thus preventing or minimizing the adverse impacts to the safe and efficient use of navigable airspace”

FAA Reponses

Once the FAA as completed an aeronautical study, a determination is made regarding the impact to air navigation. One of three responses is typically issued:

No Objection - “The subject construction did not exceed obstruction standards and marking/lighting is not required. “

Conditional Determination - “The proposed construction/alteration would be acceptable contingent upon implementing mitigating measures (marking and lighting, etc.) “

Objectionable - “The proposed construction/alteration is determined to be a hazard and is thus objectionable. The reasons for this determination are outlined to the proponent.”

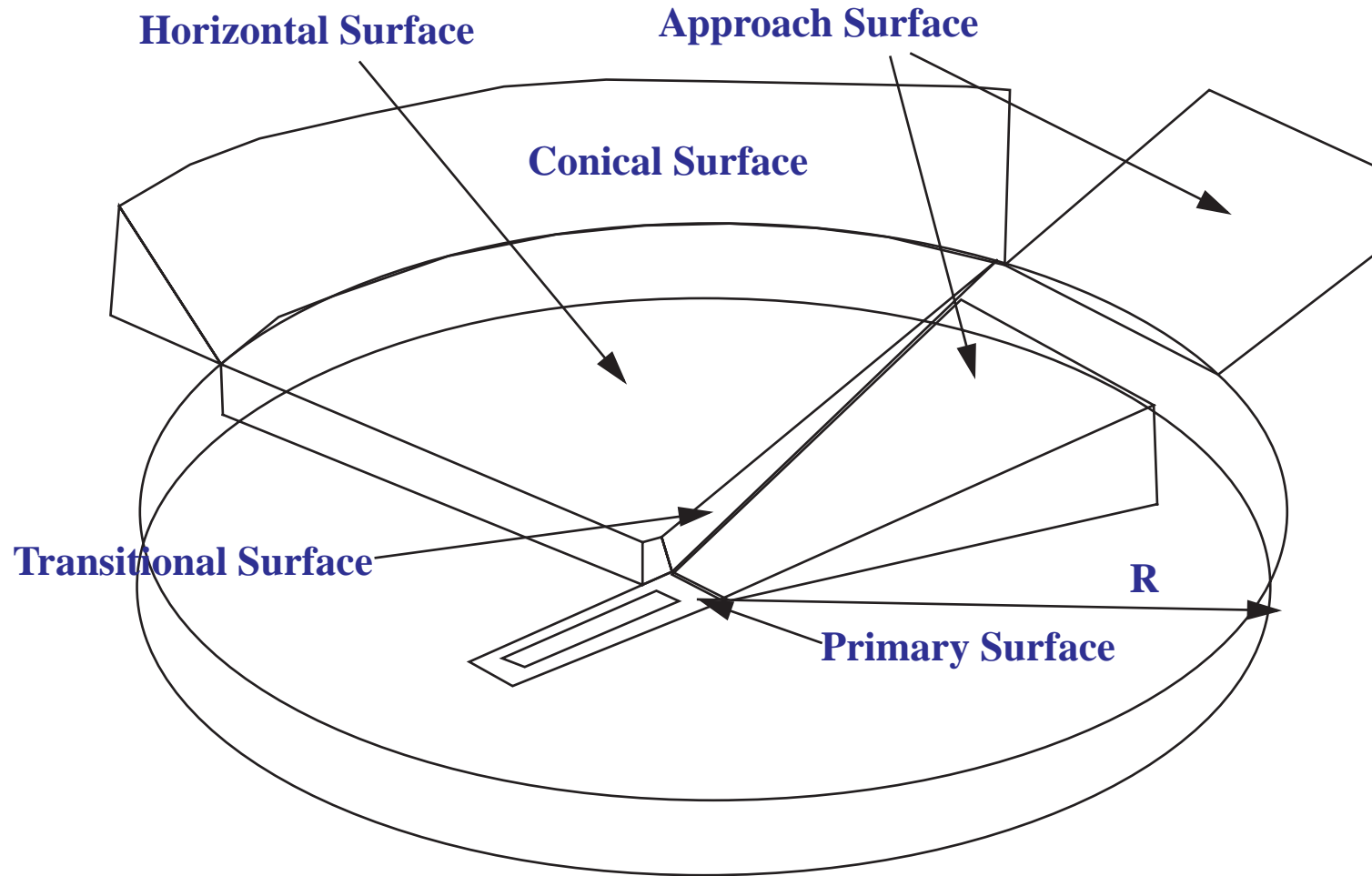
Source: FAA Part 77

Obstructions to Navigation

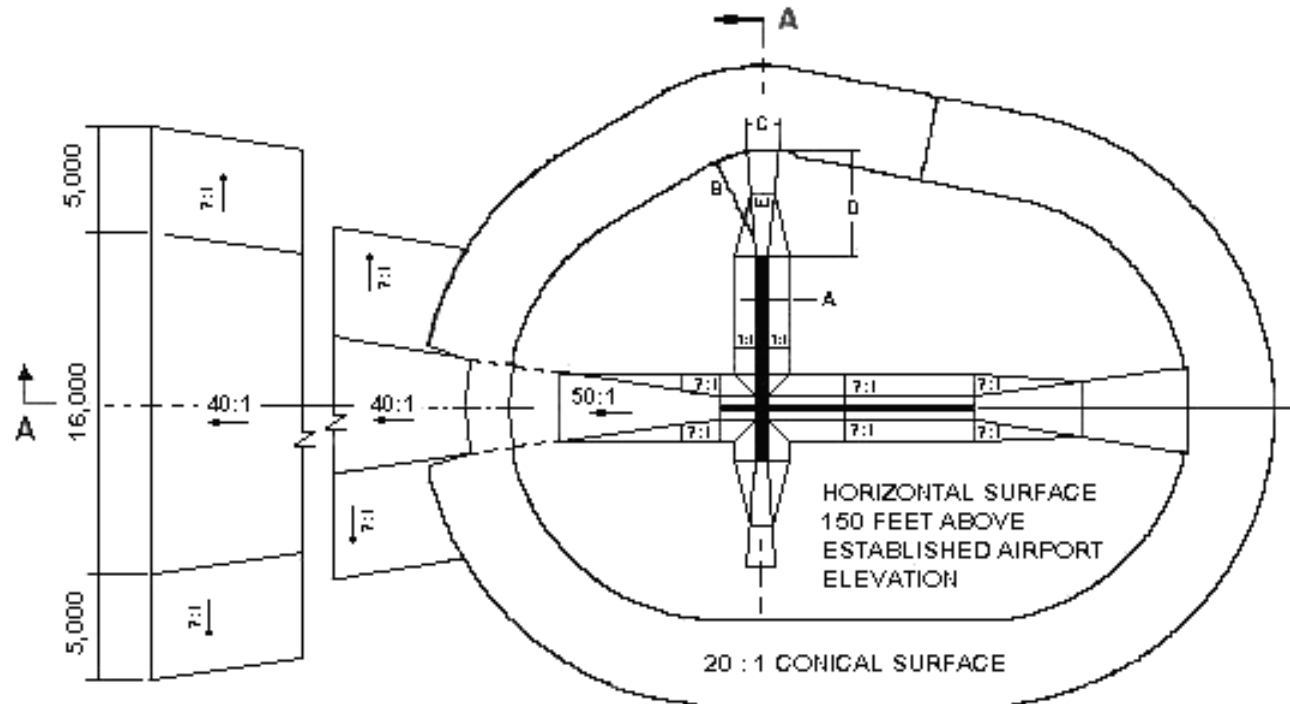
An object constitutes an obstruction to navigation if:

- If 200 ft. above ground level or 200 ft. above the airport elevation (whichever is greater) up to 3 miles (for runway lengths > 3200 ft.) from the airport.
 - Increase 100 ft. every mile up to 500 ft. at 6 miles from the ARP (airport reference point)
- Is 500 ft. or more above ground level at the object site
- If penetrates an imaginary surface (a function of the precision of the runway)
- If penetrates the terminal obstacle clearance area (includes initial approach segment)
- If penetrates the enroute obstacle clearance area (includes turn and termination areas of federal airways)

Graphical Depiction



Two-Dimensional Graphical Depiction



Source: <http://www.ngs.noaa.gov/AERO/yplanfar77.gif>

Table with FAR 77 Dimensions

OBSTRUCTION IDENTIFICATION SURFACES FEDERAL AVIATION REGULATIONS PART 77

DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON - PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B		
					C	D	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL APPROACH		NON - PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		A	B	A	B		
					C	D	
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:1	34:1	34:1	*

- A - UTILITY RUNWAYS
- B - RUNWAYS LARGER THAN UTILITY
- C - VISIBILITY MINIMUMS GREATER THAN 3/4 MILE
- D - VISIBILITY MINIMUMS AS LOW AS 3/4 MILE
- * - PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET

Source: <http://www.ngs.noaa.gov/AERO/oisspec.html>

FAR Part 77 Imaginary Surfaces

Surface	Visual		Non-Precision Instrument Runway			Precision Instrument Runway
	A	B	A	C	D	All
Width of Primary Surf. and inner App. Surface	250	500	500	500	1,000	1,000
Radius of Horizontal Surface	5,000	5,000	5,000	10,000	10,000	10,000
Approach Surface at Outer End	1,250	1,500	2,000	3,500	4,000	16,000
Approach Surface Length	5,000	5,000	5,000	10,000	10,000	50,000
Approach Slope	20:1	20:1	20:1	34:1	34:1	50:1 ^a

a. First 10,000 feet the slope is 40:1

A = Utility runways

B = Runway larger than utility

C = Visibility minimums $> 3/4$ of a mile

D = Visibility minimums $= < 3/4$ of a mile

Runway Displaced Thresholds

- Sometimes is not possible to comply with all FAR 77 criteria (specially the five imaginary surfaces)
- Runway displaced thresholds have to be defined to meet the criteria
- NOTE: highways and railroads are considered obstructions that need adjustments as follows:
 - 10 ft. or the height of the tallest vehicle using the road
 - 15 ft. for public roads
 - 17 ft. for interstate highways
 - 23 ft. for railroads (or the highest railroad vehicle)

IMAGINARY SURFACES FOR OBSTRUCTION EVALUATION

PART 77

OBJECT IDENTIFICATION SURFACES

Primary Surface: A surface longitudinally centered on a runway. When the runway has a specially prepared hard surface, the primary surface extends 200 feet beyond either end of the that runway; but when the runway has no specially prepared surface, or planned hard surface, the primary surface ends at the physical ends of the runway. The elevation of any point on the Primary Surface is the same as the elevation of the nearest point on the runway centerline. Primary surface widths vary with the classification of the runway; however, the width is uniform throughout and is based on the most precise approach existing or planned for either end of that runway.

Horizontal Surface:

A horizontal plane 150 feet above the established Airport Elevation, the perimeter of which is constructed by swinging arcs of specified radii from the center of each end of the Primary Surface of each runway. Tangents then connect the adjacent arcs. Size of arcs as follows:

- a. For all runways designed visual or utility, the radius of each arc is 5,000 feet.
- b. For PIR and Non-Precision Instrument Runways, the radius of each arc is 10,000 feet.

The radius of the arcs specified for each end of a runway will have the same numerical value, that value being the highest determined for either end of the runway. When a 5,000 foot arc is encompassing by tangents connecting two adjacent 10,000 foot arcs, it shall be disregarded.

Conical Surface:

A surface, which extends upward and outward from the outer limits of the Horizontal Surface for a horizontal distance of 4,000 feet. The slope of the conical surface is 20-1 (5 percent) measured in a vertical plane.

Transitional Surface:

A surface extending outward and upward, at right angles to the runway centerline and runway centerline extended, from the sides of the Primary Surface and the Approach Surfaces.

- a. The slope is 7-1 (14.3 percent) and the surface extends until it intersects the Horizontal or Conical Surface.
- b. A PIR Approach Surface that project beyond the limits of the Conical Surface extends a distance of 5,000 feet measured horizontally from the edge of the Approach Surface. The slope is 7-1 (14.3 percent).

Approach Surfaces:**PIR-PRECISION INSTRUMENT APPROACH**

A surface longitudinally centered, on the extended centerline of the PIR runway, beginning at the end of the Primary Surface and extending outward and upward at a slope of 50:1 (2.0 percent) for a horizontal distance of 10,000 feet and at a slope of 40:1 (2.5 percent) for an additional 40,000 feet. The surface width is that of the Primary Surface at the beginning and increases uniformly to a width of 16,000 feet at a distance of 50,000 feet from the end of the Primary Surface.

D-NONPRECISION INSTRUMENT APPROACH**VISIBILITY MINIMUMS AS LOW AS $\frac{3}{4}$ MILE**

A surface longitudinally centered on the extended centerline of the runway, beginning at the end of the Primary Surface. Primary Surface width at end adjacent to runway end and flaring to 4,000 feet at a distance of 10,000 ft from the end of the Primary Surface. The surface slope is 34-1 (3 percent).

C-NONPRECISION APPROACH**VISIBILITY MINIMUMS GREATER THAN $\frac{3}{4}$ MILE**

Dimensions of the specified runway are predicated on the approach visibility minimums.

A surface longitudinally centered on the extended centerline of the runway, beginning at the end of the Primary Surface. The width of this surface is 500 feet at the end of the Primary Surface and flares to a width of 3500 feet at a distance of 10,000 feet from the end of the Primary Surface. The surface slope is 34-1 (3 percent).

B (V)-VISUAL APPROACH

A surface longitudinally on the extended centerline of the runway, beginning at the end of the Primary Surface. The width at this point is 500 feet and it flares to 1,500 feet at a distance of 5,000 feet from the end of the Primary Surface. The surface slope is 20-1 (5 percent).

A (NP)-NONPRECISION APPROACH (UTILITY RUNWAY)

Utility runways with Non-Precision Approach Surfaces are not affected by visibility minimums. The width of this surface is 500 feet at the end of the Primary Surface and flares to a width of 2,000 feet at a distance of 5,000 feet from the end of the Primary Surface. The surface slope is 20-1 (5 percent).

A surface longitudinally centered on the extended centerline of the runway, beginning at the end of the Primary Surface, and with dimensions predicated upon the permissible approach visibility minimums established for the specific runway end, as follows:

A (V)-VISUAL APPROACH (UTILITY RUNWAY)

The surface begins with a 250-foot width at the end of the Primary Surface and flares to a width of 1,250 feet at a distance of 5,000 feet from the end of the Primary Surface. The surface slope is 20-1 (5 percent)

AREA NAVIGATION APPROACH

OBJECT IDENTIFICATION SURFACES

Primary Surface: The surface is a 1,000 foot wide rectangular in shape and centered on the runway centerline, beginning 200 feet on the approach side

of a runway threshold and extending to 200 feet beyond the opposite runway threshold. The elevation of any point on the Primary Surface is the same as the elevation of the nearest point on the runway centerline.

Transitional Surface:

A surface extending outward and upward, starting from the runway threshold from the edge of the Approach Surface. The surface width is 600 feet at the beginning and increases uniformly to a width of 6,376 feet at a distance of 52,000 feet from the threshold. The slope is 7-1 (14.3 percent).

.

Approach Surface:

ANAPC -PRECISION, CONVENTIONAL LANDING

A surface longitudinally centered, on the extended centerline of the runway, beginning at the end of the Primary Surface and extending outward and upward at a slope of 50:1 (2.0 percent) for a horizontal distance of 2566 feet and at a slope of 34:1 (3.0 percent) for an additional 47,434 feet. The surface width is that of the Primary Surface (800 feet) at the beginning and increases uniformly to a width of 4,400 feet at a distance of 50,200 feet from the Threshold.

Missed Approach:

A surface longitudinally centered, on the extended centerline of the runway, beginning at 1300 feet outboard from the approach runway threshold, width of surface is 2,333.3 feet and 22 feet above the threshold elevation. The surface extending outward and upward at a slope of 40:1 (2.5 percent) for a horizontal distance of 7800 feet. The surface width is 2,333.3 feet at the beginning of the missed approach and increases uniformly to a width of 6,200 feet at a distance of 7,800 feet from the end of the Primary Surface.

Plan view of AREA NAVIGATION APPROACH OIS

- [Precision Approach, Primary, and Transition](#)

- [Missed Approach](#)

**Obstruction Representation in AREA NAVIGATION
APPROACH OIS**

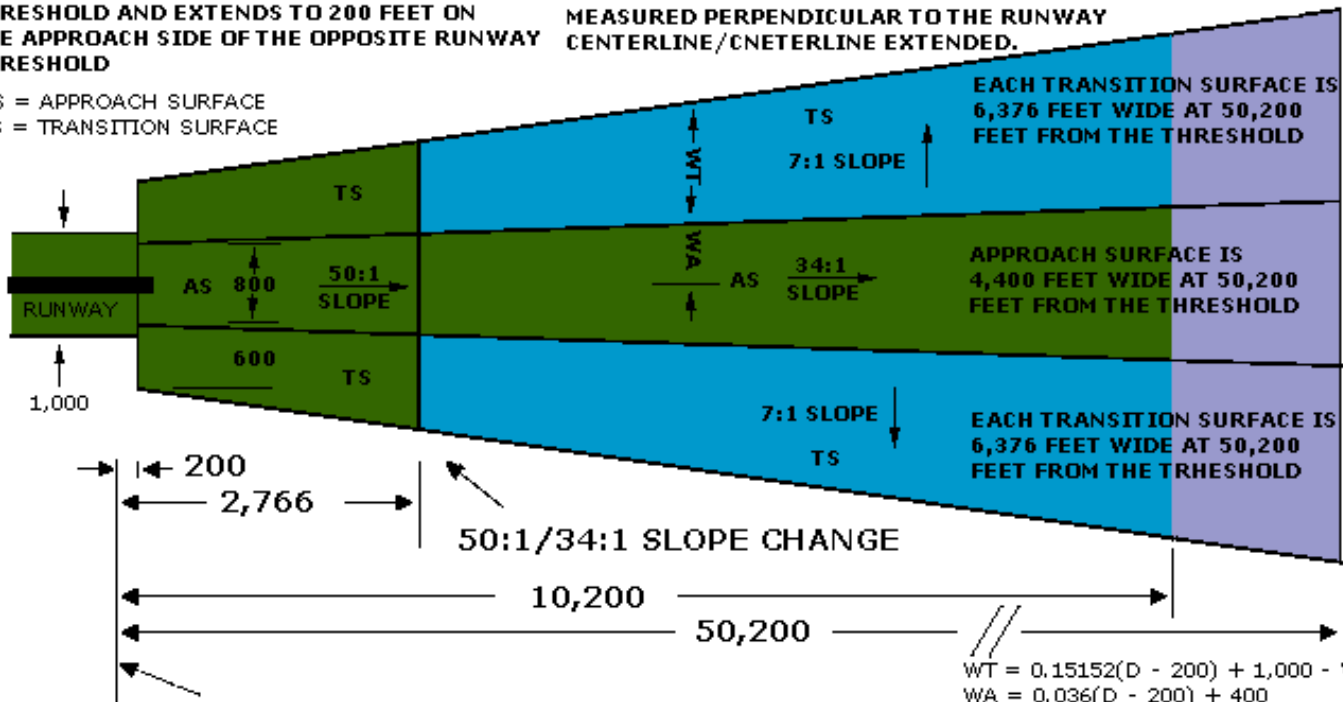
- [Approach \(first 2,566 feet\)](#)
- [Approach \(from 2,566 feet to 50,000 feet\)](#)
- [Transition](#)
- [Missed Approach](#)

**Obstruction [accuracy requirements](#) in AREA NAVIGATION
APPROACH OIS**

THE PRIMARY SURFACE IS 1,000 FEET WIDE, RECTANGULAR IN SHAPE, AND CENTERED ON THE RUNWAY CENTERLINE. IT BEGINS 200 FEET ON THE APPROACH SIDE OF A RUNWAY THRESHOLD AND EXTENDS TO 200 FEET ON THE APPROACH SIDE OF THE OPPOSITE RUNWAY THRESHOLD

ANA OIS PRECISION APPROACH, PRIMARY, AND TRANSITIONS
 TRANSITION SURFACES ARE ADJACENT TO THE APPROACH SURFACE. WIDTH AND SLOPE ARE MEASURED PERPENDICULAR TO THE RUNWAY CENTERLINE/CNETERLINE EXTENDED.

AS = APPROACH SURFACE
 TS = TRANSITION SURFACE



THRESHOLD LOCATION (DISPLACED IN THIS CASE)

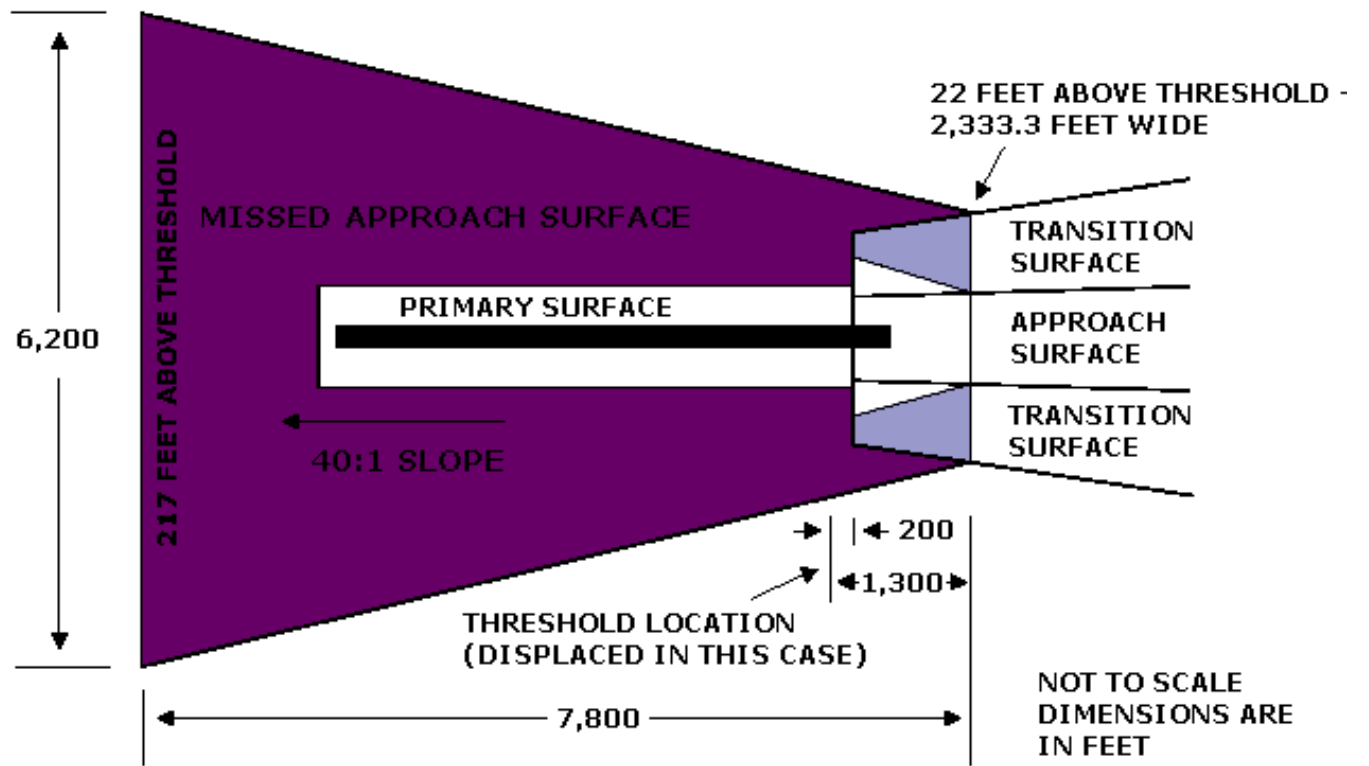
DIMENSIONS ARE IN FEET

NOT TO SCALE

$$WT = 0.15152(D - 200) + 1,000 - WA$$

$$WA = 0.036(D - 200) + 400$$

WHERE: D = DISTANCE FROM THRESHOLD AS MEASURED ALONG APPROACH CENTERLINE

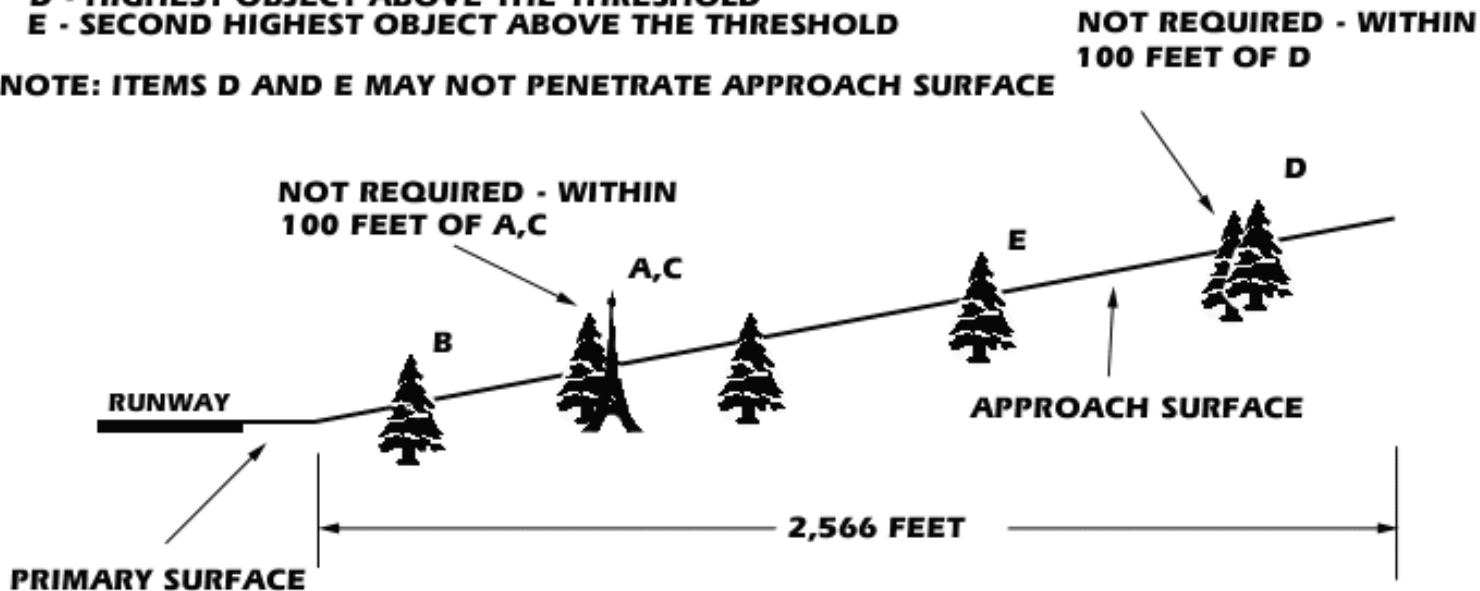


ANA OIS
MISSED PRECISION APPROACH

OBJECT REPRESENTATION IN THE FIRST 2,566 FEET OF A PRECISION APPROACH AREA SHALL INCLUDE THE:

- A - MOST PENETRATING OBSTRUCTION**
- B - SECOND MOST PENETRATING OBSTRUCTION**
- C - MOST PENETRATING MAN-MADE OBSTRUCTION**
- D - HIGHEST OBJECT ABOVE THE THRESHOLD**
- E - SECOND HIGHEST OBJECT ABOVE THE THRESHOLD**

NOTE: ITEMS D AND E MAY NOT PENETRATE APPROACH SURFACE

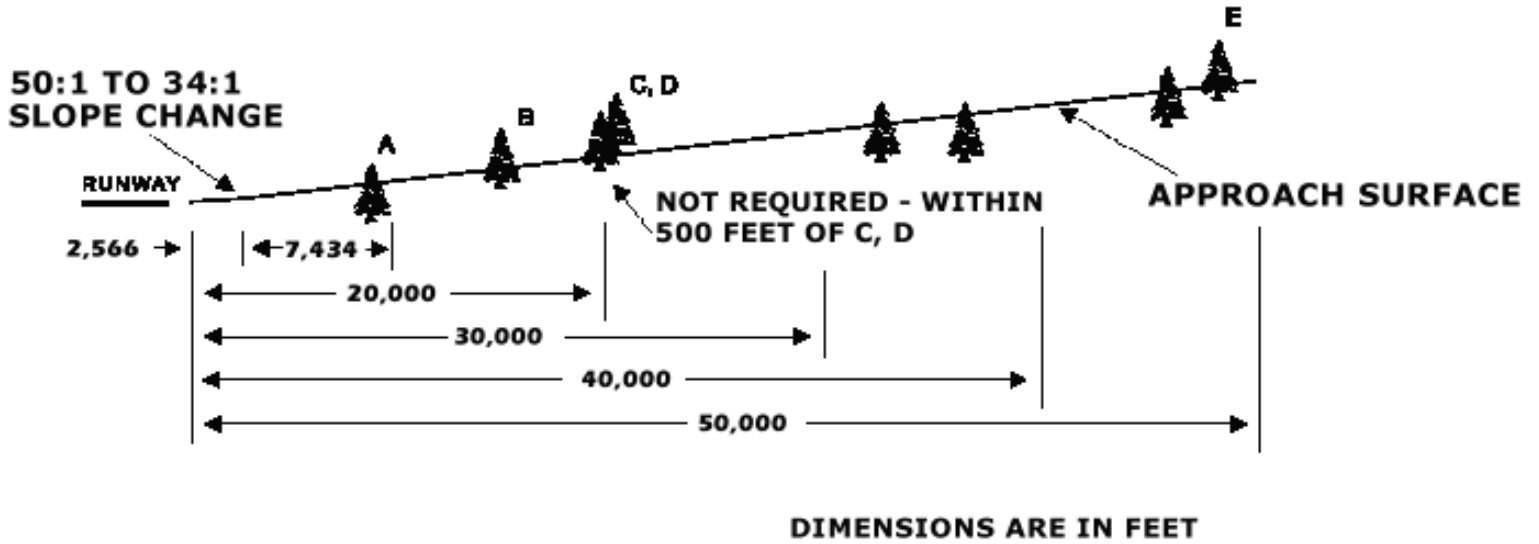


NOT TO SCALE

SIGNIFICANT OBSTACLES IN FIRST 2,566 FEET OF A PRECISION APPROACH AREA

OBSTRUCTION REPRESENTATION IN A PRECISION APPROACH AREA SHALL INCLUDE THE:

- A - HIGHEST OBSTRUCTION BETWEEN 2,566 FEET AND 10,000 FEET**
- B - HIGHEST OBSTRUCTION IN THE FIRST 20,000 FEET**
- C - HIGHEST OBSTRUCTION IN THE FIRST 30,000 FEET**
- D - HIGHEST OBSTRUCTION IN THE FIRST 40,000 FEET**
- E - HIGHEST OBSTRUCTION IN THE APPROACH AREA**



OBSTACLE REPRESENTATION IN THE PRECISION APPROACH AREA

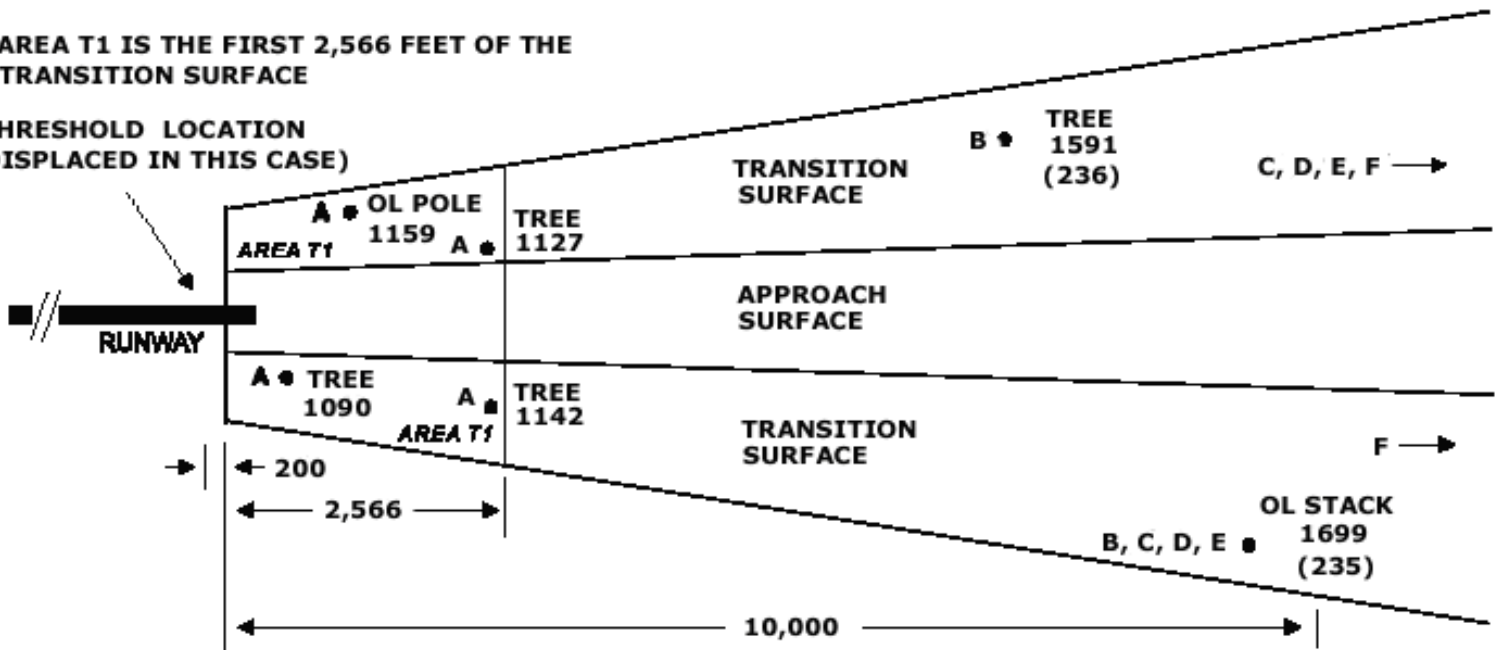
OBSTRUCTION REPRESENTATION IN EACH TRANSITION AREA SHALL INCLUDE:

- A - TWO HIGHEST OBSTRUCTIONS IN AREA T1**
- B - HIGHEST OBSTRUCTION IN THE FIRST 10,000 FEET**

- C - HIGHEST OBSTRUCTION IN THE FIRST 20,000 FEET**
- D - HIGHEST OBSTRUCTION IN THE FIRST 30,000 FEET**
- E - HIGHEST OBSTRUCTION IN THE FIRST 40,000 FEET**
- F - HIGHEST OBSTRUCTION IN EACH TRANSITION AREA**

AREA T1 IS THE FIRST 2,566 FEET OF THE TRANSITION SURFACE

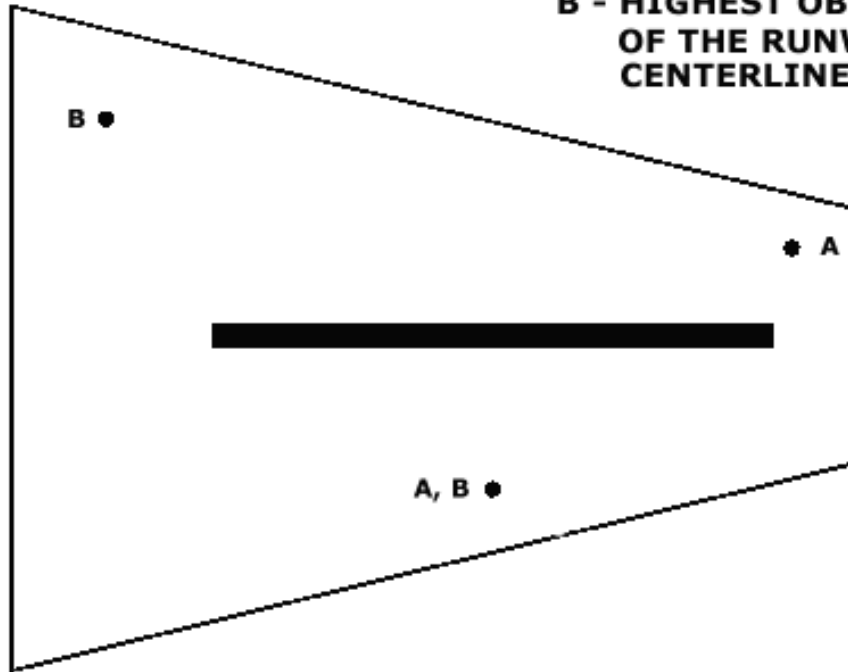
THRESHOLD LOCATION (DISPLACED IN THIS CASE)



OBSTACLE REPRESENTATION IN THE TRANSITION AREAS

OBSTRUCTION REPRESENTATION IN THE MISSED APPROACH AREA SHALL INCLUDE THE :

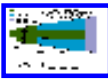

- A - MOST PENETRATING OBSTRUCTION ON EACH SIDE OF THE RUNWAY CENTERLINE OR CENTERLINE EXTENDED**
- B - HIGHEST OBSTRUCTION ON EACH SIDE OF THE RUNWAY CENTERLINE OR CENTERLINE EXTENDED**





NOT TO SCALE

**OBSTACLE REPRESENTATION
IN THE MISSED APPROACH AREA**

OBSTRUCTIONS : ANA APPROACH (CONVENTIONAL LANDING) SURVEYS
(VALUES ARE IN FEET)

ITEM	HORZ	VERTICAL		AGL
		ORTHO	ELLIP	
NON MAN-MADE OBJECTS, AND MAN-MADE OBJECTS LESS THAN 200 FT. AGL, THAT PENETRATE THE FOLLOWING OBSTRUCTION IDENTIFICATION SURFACE:				
A PRIMARY SURFACE	20.00	3.00	3.00	N/A
THOSE AREAS OF AN APPROACH SURFACE WITHIN 10,200 FEET OF THE THRESHOLD	20.00	3.00	3.00	N/A
THOSE AREAS OF AN APPROACH TRANSITION SURFACE WITHIN 2,766 FEET OF THE THRESHOLD (AREA T1)	20.00	3.00	3.00	N/A
THOSE AREAS OF THE APPROACH TRANSITION SURFACE FURTHER THAN 2,766 FEE FROM THE THRESHOLD BUT NOT MORE THAN 10,200 FEET FROM THE THRESHOLD	50.00	20.00	20.00	N/A
THE MISSED APPROACH SURFACE	50.00	20.00	20.00	N/A
THOSE AREAS OF AN APPROACH SURFACE FURTHER THAN 10,200 FEET FROM THE THRESHOLD	100.00	50.00	50.00	N/A
THOSE AREAS OF AN APPROACH TRANSITION SURFACE FURTHER THAN 10,200 FEET FROM THE THRESHOLD	100.00	50.00	50.00	N/A

OBSTRUCTIONS : ANA APPROACH (CONVENTIONAL LANDING) SURVEYS
(VALUES ARE IN FEET)

ITEM	HORZ	VERTICAL		AGL
		ORTHO	ELLIP	
MAN-MADE OBJECTS EQUAL TO OR GREATER THAN 200 FEET AGL THAT PENETRATE THE FOLLOWING OBSTRUCTION IDENTIFICATION SURFACE:				
A PRIMARY SURFACE, THOSE AREA OF THE APPROACH AND TRANSITION SURFACES WITHIN 10,200 FEET OF THE THRESHOLD	20.00	3.00	3.00	10.00
THE MISSED APPROACH SURFACE	20.00	3.00	3.00	10.00
THOSE AREAS OF THE APPROACH AND TRANSITION SURFACES FURTHER THAN 10,200 FEET FROM THE THRESHOLD	50.00	3.00	3.00	10.00

ACCURACIES ARE RELATIVE TO THE NEAREST PACS, SACS, OR HRP

DISTANCES RELATIVE TO THE THRESHOLD OR RUNWAY END ARE MEASURED ALONG THE RUNWAY CENTERLINE OR CENTERLINE EXTENDED TO THE ABEAM POINT.