PART 3. AIRPORT OBSTRUCTION CHART SURVEYS

CHAPTER 11. INTRODUCTION

The Airport Obstruction Chart (See figure 3-1) (AOC) survey is an extensive field/remote sensing operation, providing aeronautical and other information to support a wide range of National Airspace System (NAS) activities. AOC surveys provide source information on—

- Runways/stopways
- Navigational aids (NAVAIDs)
- 14 CFR Part 77 obstructions
- Aircraft movement and apron areas
- Prominent airport buildings
- Selected roads and other traverse ways
- Cultural and natural features of landmark value
- Miscellaneous and special request items

AOC surveys also establish (if it does not exist already) geodetic control in the airport vicinity based on permanent survey marks accurately connected to the National Spatial Reference System (NSRS) in accordance with AC 150/5300-16, *General Guidance and Specifications for Aeronautical Surveys: Establishment of Geodetic Control and Submission to the National Geodetic Survey*. This control and the associated NSRS connection assures accurate relativity between surveyed points on the airport and between these points and other surveyed points in the NAS, including navigation satellites.

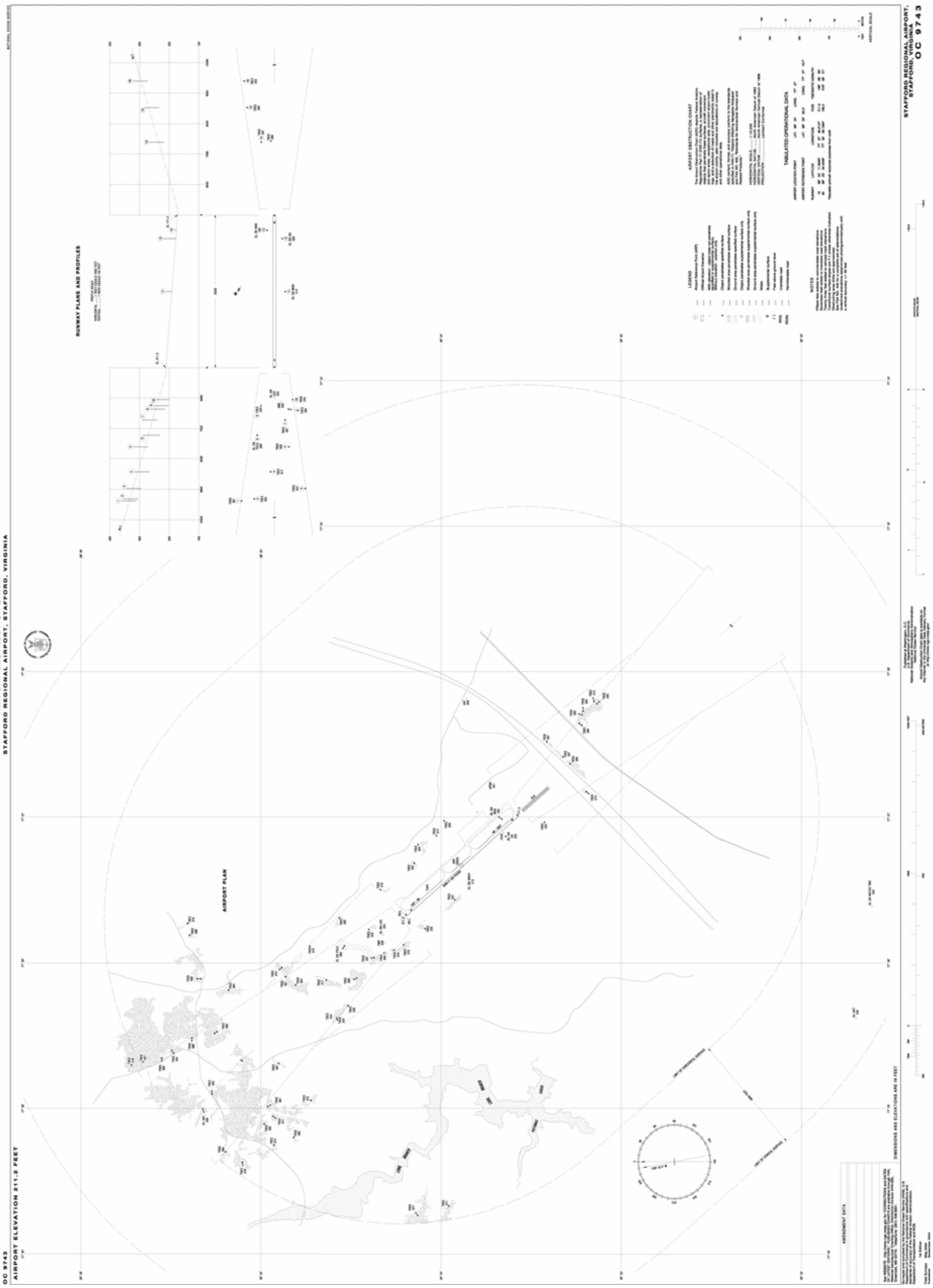


Figure 3-1: Illustrates a typical Airport Obstruction Chart

AOC survey data is used to—

- Develop instrument approach and departure procedures
- Determine maximum takeoff weights for civil aircraft
- Certify airports for certain types of operations, including 14 CFR Part 139
- Update official U.S. Government aeronautical publications
- Provide geodetic control for engineering projects related to runway/taxiway construction, NAVAID sighting, obstruction clearing, road building, and other airport improvement activities
- Assist in airport planning and land use studies in the airport vicinity
- Support miscellaneous activities, such as aircraft accident investigations and special one-time projects

Standards for AOC survey products are described in detail in Chapter 18. Unless otherwise stated, all data provided in accordance with this part must be current at the time of the AOC field survey.

CHAPTER 12.DATUM TIE AND LOCAL CONTROL

Surveys accomplished in accordance with these standards must be tied to the NSRS. Reference determined positions to the North American Datum of 1983 (NAD 83), which is operationally equivalent to and may be used as World Geodetic System of 1984 (WGS 84) values for charting and navigation purposes. Refer to http://www.ngs.noaa.gov/faq.shtml#Transform for clarification of WGS 84 conversions. Reference orthometric heights (MSL elevations) to the North American Vertical Datum of 1988 (NAVD 88).

CHAPTER 13.RUNWAY AND STOPWAY POINTS

Runway location and orientation are paramount to airport safety, efficiency, economics, and environmental impact. This section provides guidance on the location and marking of runway/stopway ends as well as the determination of profile points along the runway. It is extremely important that the runway ends are properly selected, since runway lengths and azimuths are determined from the established positions of the ends. Aircraft safety during takeoff and landing as well as airfield restrictions is dependent upon accurate information derived from the survey of runway ends. The identification of certain points (positions and elevations) along the runway is critical for landings, take-offs, and navigation. (Refer to Appendix 2, Section 2-4, Runway, Stopway, and Displaced Threshold End Identification.)

13-1. DESCRIPTION

Provide runway/stopway data for all runways and stopways with a specially prepared hard surface (SPHS) existing at the time of the field survey. Provide the data for non-specially prepared hard surface (non-SPHS) runways/stopways existing at the time of the field survey if—

- They are depicted in the version of the U.S. Government flight information publication *U.S. Terminal Procedures* current at the time of the field survey,
- The runway/stopway was specially requested by appropriate FAA authorities, or

- The stopway was officially designated a stopway by appropriate airport authorities.

Important points to bear in mind about stopways:

- A stopway is an area beyond the runway, with sufficient strength to support a decelerating aircraft in all weather conditions. It is not a runway safety area.
- A stopway must be designated as such. This means the airport owner/operator determines that a stopway exists and commits to maintaining the area as a stopway, including the appropriate lighting.
- The existence of a stopway means that the runway has a declared accelerate/stop distance, even though it may not be published.

Unless otherwise stated, all runway/stopway points must be on the runway/stopway centerline. Refer to Appendix 2, Section 2-4, Runway, Stopway, Displaced Threshold, End Identification, for detailed descriptions. The number painted on the runway at the time of the field survey must identify runways. Use the runway number published in *U.S. Terminal Procedures* (version current at the time of the field survey) if a number is not painted on the runway.

13-2. RUNWAY LENGTH AND WIDTH

Runway length does not include blast pads or stopway surfaces located at one or both ends of a runway; however, the displaced threshold is included in the physical length of the runway. When the ends of the runway surface have been determined, mark the positions (nail and washer, chisel square, or paint if possible) with a distinctive inscription to ensure future identification. In the runway end sketch, specify the inscription method used.

Runway lengths are determined from the positions of the runway ends. Typically surveyors determine the runway end positions using GPS methodologies. The surveyor will determine runway lengths at the airport and compare the computed length(s) to the lengths published in the Airport Facility Directory. If the computed length, rounded to the nearest foot, is shorter than the published length and the difference cannot be attributed to a runway change, the points identified as the runway ends should be reviewed with the airport authority.

Measure the runway width from the outer edge of the runway, excluding runway shoulders and stopways. The narrowest section of runway should be measured. (Refer to Appendix 2, Section 2-4, Runway, Stopway, Displaced Threshold, End Identification.)

The runway width is the physical width extending over the entire length of the rectangle. Runway widths should be measured to the nearest tenth of a foot (0.1 ft) and the dimension included on the runway end sketch. Discuss the determined runway and associated displaced threshold, stopway, and blast pad dimensions with the airport manager or designated representative and resolve any disagreements or discrepancies in the values before departing the site.

13-3. REQUIRED RUNWAY DATA

Required data for SPHS and non-SPHS runways and stopways are presented in the table below and Figure 3-2.

Table 3-1: Required runway and stopway data

Runway/Stopway Point	Required data							
	SPHS Runway				Non-SPHS Runway			
	Lat	Lon	Elev	Dist	Lat	Lon	Elev	Dist
Airport Elevation			✓	✓[1]			✓	✓[1]
Runway Ends	✓	✓	✓		✓	✓	✓	
Intersection of SPHS Runways			✓	✓[2]				
Displaced Thresholds	✓	✓	✓		✓	✓		
Touchdown Zone			✓					
Stopway Ends			✓	✓[3]			✓	✓[3]
Supplemental Profile Points			✓	✓[2]				
Point Abeam Glideslope	✓	✓	✓					
Point Abeam MLS Elevation Antenna	✓	✓	✓					
Point Abeam Offset Localizer	✓	✓						
Point Abeam Offset LDA	✓	✓						
Point Abeam Offset SDF	✓	✓						
Point Abeam Offset MLS Azimuth	✓	✓						

Note:	When an obstruction survey is performed on a runway with a Non-SPHS the required runway/stopway data will be the same as for a SPHS runway. The touchdown zone elevation is required only for SPHS runways with a landing length equal to or greater than 3,000 feet. A facility is considered offset if located more than 10 feet from the runway centerline/centerline extended.
Distance:	Distance from runway's— [1] Near end for airport elevation [2] Approach end for runway intersections and supplemental profile points [3] Stop end for stopways

A facility is considered offset if located more than 10 feet from the runway centerline/centerline extended.

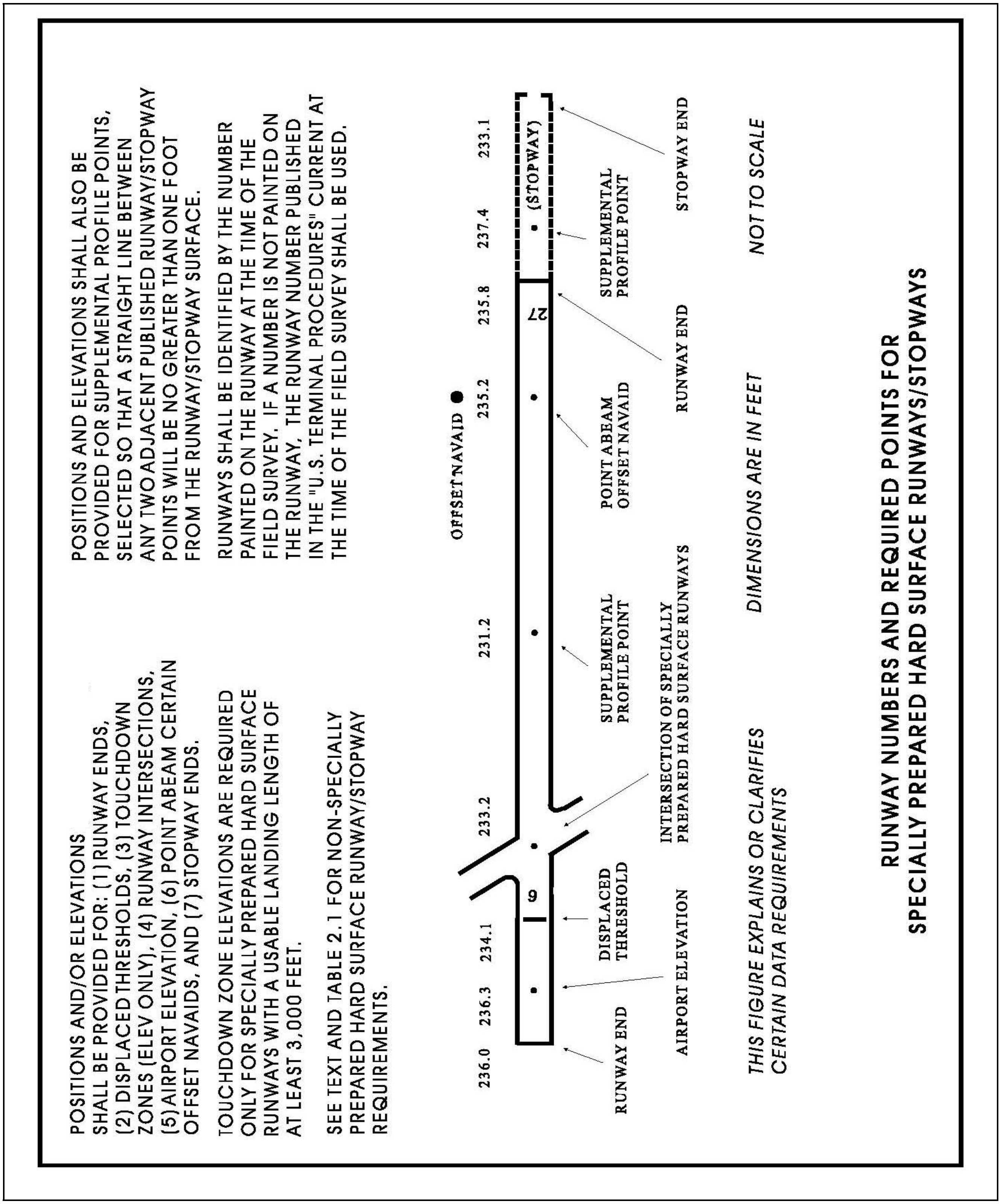


Figure 3- 2: Illustrates the runway numbers and required points for specially prepared hard surface runways/stopways

13-4. REQUIRED ACCURACIES FOR RUNWAY/STOPWAY DATA TABLE

Table 3-2: Runway and stopway data accuracy requirements

Item (Values are in Feet)	Horizontal	Vertical	Ellipsoid
Physical End	1.00	0.25	0.20
Displaced Threshold	1.00	0.25	0.20
Threshold Zone Elevation (TDZE)	N/A	0.25	0.20
Intersection of SPHS Rwys	20.00	0.25	0.20
Supplemental Profile Points	20.00	0.25	N/A
Point Abeam GS	1.00	0.25	N/A
Point Abeam MLSEL	1.00	0.25	N/A
Point Abeam Offset LOC	1.00	N/A	N/A
Point Abeam Offset LDA	1.00	N/A	N/A
Point Abeam Offset SDF	1.00	N/A	N/A
Point Abeam Offset MLSAZ	1.00	N/A	N/A
Stopway Length	2.00	N/A	N/A
Stopway End	N/A	0.25	0.20
Airport Elevation	20.00	0.25	0.20

13-5. RUNWAY/STOPWAY PROFILE

Positions and elevations (on the runway centerline) are required at certain marked points abeam various NAVAIDs and at intermediate points along the runway to establish the elevation of the airport and to define the gradients of the runway.

Runway/stopway profiles may be obtained from GPS observations (static, kinematic, and/or real-time kinematic) or from spirit level/EDM observations. In either case, profiles must begin and end on the runway end points. If GPS is used to determine runway profile, data will be collected twice. If GPS is collected while in motion (i.e. kinematic and/or real-time kinematic GPS) the following requirements apply:

(1). A minimum of five satellites will be used.
(2). Collect one data set in each direction; each data set will be a separate file.
(3). Collect elevations and positions every 50 feet or less along the runway, and interpolate the required intermediate points.
(4). Mean the two data sets.
(5). Provide a graph displaying the two collects. All points will meet the accuracies as stated in Table 3-2.

(6). If a static or a "Stop and Go" GPS technique is used, the following requirements apply:

- A minimum of five satellites will be used.
- Positions and elevations will be collected for all required points (refer to Table 3-1 above).
- Point spacing will be no greater than 600 feet.
- Any points of apparent change in grade are required.
- All points will be collected twice; each data set will be a separate file.
- Mean/average the two data sets.
- Provide a graph displaying the two collects.
- Provide a sketch showing the location of the profile points.
- All points will meet the accuracies as stated in Table 3-2.

(7). If spirit levels are used to collect elevations and positions, the following requirements apply:

- All spirit leveling will be run forward and backward or run in a closed loop.
- The spirit leveling will be referenced to a high accuracy benchmark or the PACS, SACS, or temporary survey mark (TSM). Include at least two such reference elevations to ensure the required check to datum.
- Positions and elevations will be collected at all required points (refer to Table 3-1 above).
- Point spacing will be no greater than 600 feet.
- Any points of apparent change in grade are required.
- Submit a graph displaying the collected data.
- Provide a sketch showing the location of the profile points.
- All points will meet the accuracies as stated in Table 3-2.

13-6. PHOTOGRAPHS AND SKETCHES

Three digital photographs must be taken, as described in below, of all survey nails and washers (those marking runway ends and thresholds).

Figure-3-3: Photograph Type #1 (Eye Level). Photo taken from above the mark, showing an area around the mark about 1 meter in diameter.

Figure 3-4: Photograph Type #2 (Approach). Photo showing tripod over the mark in foreground and approach in the background.

Figure 3-5: Photograph Type #3 (Across Runway). Photo taken from the side of the runway looking across the end of the runway, with a tripod or arrow indicating the end point; include any features used to identify the runway end.

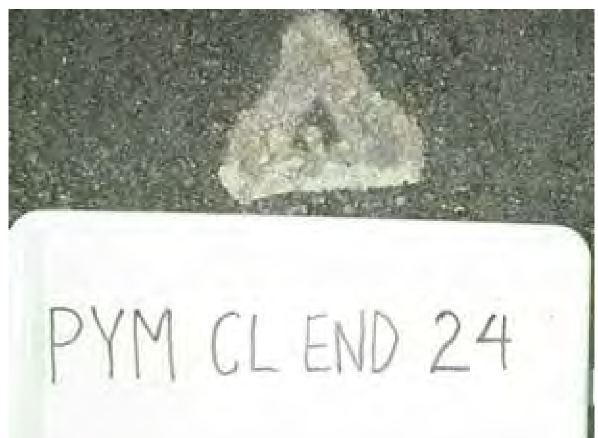


Figure 3-6: Signs should be put in photograph types #1 through #3 showing the runway end designation (name) in large and clearly printed letters. In photograph #3, the cardinal direction (N, NE, etc.) in which the camera is pointed should be included.

CHAPTER 14. DIGITAL PHOTOGRAPH AND FILE NAMING CONVENTIONS

14-1. NAMING CONVENTION

Use the following file naming convention: the airport designator, runway end designator, photo number, and date, followed by the file type extension, as in the example below. Separate each section of the file name with an underscore—except the photo number, which should be preceded by a dash.

	Sample File Name
For runway end point:	LAX_CL_END_RWY_12R-3_04MAY2001.jpg

For the runway end example, “LAX”=location identifier, “CL END RWY 12R”=runway end designator [CL=centerline, END=end, RWY= runway, 12=runway number, and R=right (or C=center, or L=left)], dash, “3”= photo number, and date.

14-2. CAPTION

Provide a caption for each photograph. The caption should include the following information:

- Airport location identifier (LID)
- Runway end designator
- Photo number
- Date the photo was taken

For example, LAX, 12R, 3, 23 Aug 2004. In addition, the caption for photo #2 will include the cardinal direction (N, NE, E, SE, etc.) the camera is pointing.

14-3. SKETCHES

The contractor will complete the following tasks.

- Make a sketch of all runway ends, stopways, and blast pads.
- A field sketch must contain a schematic diagram of the runway end, surface markings, lights, connecting taxiways, stopways, blast pads, and other information.
- Clearly annotate all pertinent lengths and distances on runway end sketches.
- The surveyor is responsible for verifying the information depicted, including all lengths and distances.
- Prepare a sketch of each runway. The sketch must include dimensions and explanations necessary to clarify any possible ambiguities between the actual runway surface and the runway as it appears on the photograph or sketch.

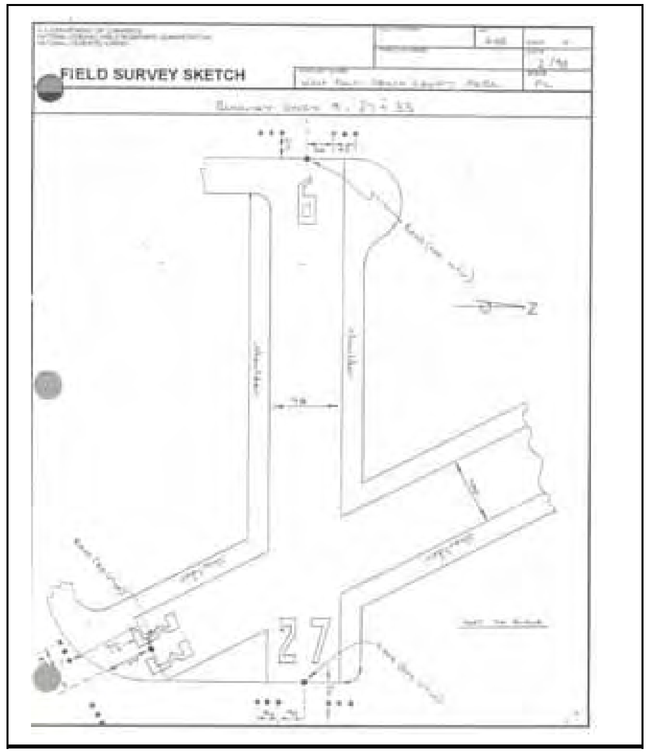


Figure 3-7: Illustrates a prepared sketch of each runway end at an airport

- On the sketch show the usable portion of the surfaced runway if it differs from the surface extent of the runway in either length or width. Consult the airport manager or other designated representative of the airport authority when making this determination.
- The sketch also needs to show the dimensions of any area near or off the runway end designated as "blast pad" or "stopway". Discuss with the airport authorities the definition, use, and designation of these areas if it is unclear.
- Show dimensions and measurements to clarify the relationship of such areas to the physical end of the runway if these areas do not exist.

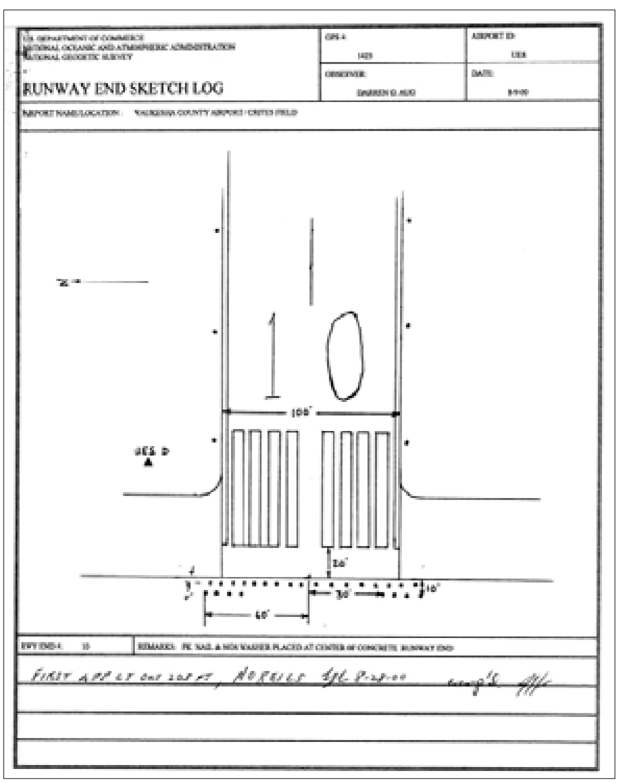


Fig 3-8: Illustrates the proper method of depicting a specific runway end

- Clarify the sketch with notes and dimensions to identify discrepancies between the physical runway ends as they exist on the ground and as they appear on the imagery.
- Depict the runway numbers painted on the runways in the sketch. Show the approximate relationship between the runway number and the runway end threshold point on the sketch.
- Date each sketch and include the line painted under the runway number if it exists. It should be noted if numbers are not painted on the runway. Additional examples of airports sketches are available for reference in Appendix 2, Section 2-3.

CHAPTER 15. NAVIGATIONAL AIDS

An integral part of the airport system is the visual and electronic navigational aids (NAVAIDs) to assist pilots in navigating both on the airport and en route. A NAVAID is any visual or electronic device, airborne or on the surface, providing point-to-point guidance information or position data to aircraft in flight. FAA operates over 4,000 ground-based electronic NAVAIDs, each broadcasting navigation signals within a limited area. FAA also provides a variety of approach lighting systems to assist the pilot in transitioning from instrument reference to visual reference for landing. A NAVAID survey is the process of determining the position and/or elevation of one or more NAVAIDs and adjunctive points on associated runways or runway centerlines extended. A NAVAID survey may be combined with other aeronautical surveys, or it may be entirely independent. For certain electronic and visual NAVAIDs, the position of the established horizontal survey point must be determined. The horizontal survey point may be determined by either field survey or remotely sensed means. The horizontal survey point may be the center of the NAVAID or, when the NAVAID is composed of more than one unit, the center of the array. A position is required if, and only if, the NAVAID is associated with the airport being surveyed. If the NAVAID is also an obstruction, the obstruction requirements and accuracies also apply.

Survey data is required for NAVAIDs meeting all of the following three criteria:

- The NAVAID is listed in Table 3-3 below.
- The NAVAID is located within 10 nautical miles of the Airport Reference Point. See Appendix 2, Section 2-1, Airport Reference Point Computation.
- The NAVAID is associated with an instrument approach procedure for the airport being surveyed and the procedure is published in the version of the U.S. Government flight information publication *U.S. Terminal Procedures* current at the time of the field survey.

In addition to the NAVAIDs identified above, Airport Surveillance Radars and Air Route Surveillance Radars located within 14 CFR Part 77 limits for the airport being surveyed, and not located on a military aerodrome, must be surveyed. For any NAVAID off the airfield, a sketch is required, with dimensions, showing the NAVAID and its compound (area) and the point surveyed. Table 3-4 identifies what data must be collected and reported for each type of NAVAID. If a NAVAID is encountered that is not listed, contact the FAA Airport Surveying–GIS Program Manager for guidance.

15-1. ELECTRONIC NAVAIDS

Determine the position (and sometimes the elevation, depending on the NAVAID) for electronic NAVAIDs associated with the airport. The accuracy requirements for electronic NAVAIDs vary; refer to Table 3-3, Navigational Aids, for the required accuracy of the NAVAID being surveyed.

15-2. VISUAL NAVAIDS

To enhance visual information during the day when visibility is poor and at night, it is essential to provide visual aids that are as meaningful to pilots as possible. These aids provide visual clues to the pilot about the aircraft's alignment and height in relation to the airport or runway. Visual NAVAIDs consist of a variety of lighting and marking aids used to guide the pilot both in the air and on the ground. Determine the position of the horizontal survey point for the visual aids as defined in Table 3-3. The position of the horizontal survey point may be the center of the NAVAID, the center of the unit array when the NAVAID is composed of more than one unit, or, in the case of approach light systems, the first and last lights.

Table 3-3 lists the Horizontal Survey Point (HSP), Vertical Survey Point (VSP), and accuracy requirements for the electronic and visual NAVAIDS normally found on and around airports. The accuracy values are in feet and are relative to the nearest PACS, SACS, or TSM. Paragraph 15-3 provides sample images of most typical NAVAIDs. These images depict the horizontal and vertical survey points for each of the identified NAVAIDs.

Table 3-3: Navigational Aids

ELECTRONIC NAVAIDS				
NAVAID	Horizontal Survey Point (HSP)	Vertical Survey Point (VSP)	HORZ	VERTICAL ORTHO
Air Route Surveillance Radar (ARSR)	**(1)**	**(2)**	20.00 **(5)**	100.00
Airport Surveillance Radar (ASR)	**(1)**	**(2)**	20.00 **(5)**	10.00
Distance Measuring Equipment (DME):	Center of Antenna Cover	Center of Antenna Cover	1.00	1.00
Frequency Paired with LOC **(3)**	Center of Antenna Cover	Center of Antenna Cover	1.00	1.00
Frequency Paired with MLSAZ **(3)**	Center of Antenna Cover	**(2)**	20.00 **(5)**	20.00
Frequency Paired with NDB	Center of Antenna Cover	**(2)**	20.00 **(5)**	20.00
Frequency Paired with VOR Not Frequency Paired	Center of Antenna Cover	**(2)**	20.00 **(5)**	20.00
Fan Marker (FM)	Center of Antenna Array	**(2)**	20.00 **(5)**	20.00
Localizer (LOC) **(4)**	Center of Antenna Supporting Structure	**(2)**	1.00	1.00
Glide Slope (GS)	Center of Antenna Supporting Structure	**(2)**	1.00	0.25
End Fire Type (GS)	Phase Center Reference Point	Phase Center Reference Point	1.00	0.25
Inner Marker (IM)	Center of Antenna Array	**(2)**	20.00	20.00
Middle Marker (MM)	Center of Antenna Array	**(2)**	20.00	20.00
Outer Marker (OM)	Center of Antenna Array	**(2)**	50.00	20.00
Back Course Marker (BCM)	Center of Antenna Array	**(2)**	50.00	20.00

Table 3-3: Navigational Aids (continued)

NAVAID	Horizontal Survey Point (HSP)	Vertical Survey Point (VSP)	HORZ	VERTICAL ORTHO
ELECTRONIC NAVAIDS				
Localizer Type Directional Aid (LDA)	Center of Antenna Supporting Structure	**(2)**	1.00	1.00
MLS Azimuth Guidance (MLSAZ)	Phase Center Reference Point	Phase Center Reference Point	1.00	1.00
MLS Elevation Guidance (MLSEL)	Phase Center Reference Point	Phase Center Reference Point	1.00	0.25
Non-directional Beacon (NDB)	Center of Antenna Array	**(2)**	20.00 **(5)**	20.00
Simplified Directional Facility (SDF)	Center of Antenna Supporting Structure	**(2)**	1.00	1.00
Tactical Air Navigation (TACAN)	Center of Antenna Cover	**(2)**	20.00 **(5)**	100.00
VHF Omni Directional Range (VOR)	Center of Antenna Cover	**(2)**	20.00 **(5)**	100.00
VOR/TACAN (VORTAC)	Center of Antenna Cover	**(2)**	20.00 **(5)**	100.00
VISUAL NAVAIDS				
Airport Beacon (APBN)	**(1)**	**(2)**	20.00 **(5)**	20.00
Visual Glide Slope Indicators	Center of Antenna Array	**(2)**	20.00	10.00
REIL	Center of Light	**(2)**	20.00	10.00
Approach Lights (ALS)	Center of first and last lights	**(2)**	20.00	10.00

Notes:

(1) The HSP will be the axis of antenna rotation if possible. If the antenna is covered, the HSP will be the center of the antenna cover.

(2) The VSP for these items will be the intersection of the ground, gravel, concrete pad, or other base and plumb line through the HSP. When access to this point is impractical, elevation of the VSP will be approximated.

(3) DME mid-point elevations are required only when the DME is frequency paired with an Instrument Landing System or Microwave Landing System.

(4) When LOC clearance and course array antennas are both present, only the course array antenna will be surveyed.

(5) The horizontal accuracy requirement for these items is 50 feet when not located on a public use airport or military field.

* A compass locator within 50 feet of an Instrument Landing System marker is considered collocated at the position of the marker. Other NAVAIDs are not considered collocated unless their HSPs are the same.

Table 3-4: Electronic NAVAIDs

NAVAID	NAVAID RWY &/or ID [5]	ABEAM POINT	LAT	LONG	ELEV
Air Route Surveillance Radar (ARSR)	ID	N/A	Y	Y	Y
Airport Surveillance Radar (ASR)	ID	N/A	Y	Y	Y
Distance Measuring Equipment (DME)	RWY#_ID	N/A	Y	Y	Y
Glide Slope (GS)	RWY#_ID	Y	Y	Y	Y
Glide Slope-End Fire type (GS)	RWY#_ID	Y	Y	Y	Y
Localizer (LOC)	RWY#_ID	Y	Y	Y	Y
Middle Marker (MM)	RWY#_ID	N/A	Y	Y	Y
Locator/Outer Marker (LOM/OM)	RWY#_ID	N/A	Y	Y	Y
Inner Marker (IM)	RWY#_ID	N/A	Y	Y	Y
Back Course Marker (BCM)	RWY#_ID	N/A	Y	Y	Y
Fan Marker (FM)	ID	N/A	Y	Y	Y
Localizer Type Directional Aid (LDA)	RWY#_ID	Y	Y	Y	Y
MLS Azimuth Guidance (MLSAZ)	RWY#_ID	Y	Y	Y	Y
MLS Elevation Guidance (MLSEL)	RWY#_ID	Y	Y	Y	Y
Non-Directional Beacon (NDB)	ID	N/A	Y	Y	Y
Simplified Directional Facility (SDF)	RWY#_ID	Y	Y	Y	Y
Tactical Air Navigation (TACAN)	ID	N/A	Y	Y	Y
VHF Omni Directional Range (VOR)	ID	N/A	Y	Y	Y
VOR/TACAN (VORTAC)	ID	N/A	Y	Y	Y

[5] Explanation and examples: ID – the facility lettered identifier i.e. ASR **[DDD]** and RWY#_ID – the runway end number (for which the facility serves) underscore the facility identifier: **LOM! (12_RTE).**

Table 3-5: Visual NAVAIDs

NAVAID	NAVAID RWY &/or ID	ABEAM POINT	LAT	LONG	ELEV
Airport Beacon	NA	N/A	Y	Y	Y
ALS	RWY#	N/A	Y	Y	Y
REIL	RWY#	N/A	Y	Y	Y
VASI	RWY#	N/A	Y	Y	Y
PAPI	RWY#	N/A	Y	Y	Y
PLASI	RWY#	N/A	Y	Y	Y
PVASI	RWY#	N/A	Y	Y	Y
TVASI	RWY#	N/A	Y	Y	Y
TRCV	RWY#	N/A	Y	Y	Y
TDR	RWY#	N/A	Y	Y	Y

Note:
Visual NAVAIDs are associated with the runway end they serve; the Airport Beacon is an exception (i.e. ALS! (12); APBN).

15-3. NAVIGATIONAL AID HORIZONTAL AND VERTICAL SURVEY POINT REFERENCE INFORMATION

NAVIGATIONAL AID DESCRIPTION

Airport Beacon (APBN)

Airport Beacon is a visual navigational aid; they are used to guide pilots to lighted airports with a sequence of yellow, green, and/or white light. A beacon is normally operated from dusk until dawn. If the beacon is on during other hours it typically indicates that the airport is operating under instrument flight rules

DESCRIPTION OF POINT OBSERVED

The horizontal survey point is located at the center of rotation axis. The no vertical survey point is required.

PHOTO

NAVIGATIONAL AID

Air Route Surveillance Radar (ARSR)

The long-range radar equipment used in controlled airspace to manage traffic is the air route surveillance radar (ARSR) system. There are approximately 100 ARSR facilities to relay traffic information to radar controllers throughout the country. Each air route surveillance radar site can monitor aircraft flying within a 200-mile radius of the antenna.

DESCRIPTION OF POINT OBSERVED

The horizontal survey point (HSP) is the center of the radar dome. The vertical survey point (VSP) is the ground at the base of the tower.

PHOTO

NAVIGATIONAL AID DESCRIPTION

Air Surveillance Radar (ASR)

Air Surveillance Radar is designed to provide relatively short-range coverage in the airport vicinity and to serve as an expeditious means of handling terminal area traffic The ASR detects and displays an aircraft's position in the terminal area. ASR provides range and azimuth information but does not provide elevation data. Coverage of the ASR can extend up to 60 nautical miles.

DESCRIPTION OF POINT OBSERVED

The horizontal survey point is located at the center of rotation axis. The vertical survey point is located at ground level on a centerline of the horizontal survey point.

PHOTO

NAVIGATIONAL AID

Distance Measuring Equipment (DME)

Distance measuring equipment – DME measures the distance directly from the aircraft to the ground station. This measurement is referred to as slant range distance. The difference between a measured distance on the surface and the DME slant range is greatest when an aircraft is directly over the station, at which time it actually measures altitude. DME is often co-located with other navigational systems.

DESCRIPTION OF POINT OBSERVED

The horizontal and vertical survey point is located at center of antenna cover NOTE: Elevation is only needed when frequency paired with ILS or Microwave landing system.

PHOTO

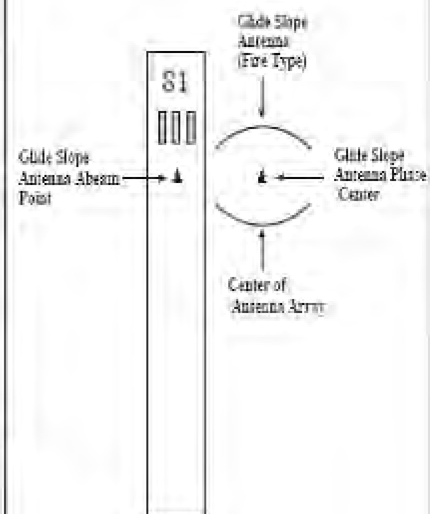
NAVIGATIONAL AID

INSTRUMENT LANDING SYSTEM (FIRE TYPE)

DESCRIPTION OF POINT OBSERVED

The horizontal and vertical survey point on the glide slope is the top center of antenna array for obstruction purposes. Note: the antenna phase center is computed by taking the mean between each antenna array and computed at ground level. Note: abeam points must be computed in conjunction with all glide slope antennas. Abeam points are located on the centerline of the runway, perpendicular to the glide slope antenna.

PHOTO



NAVIGATIONAL AID

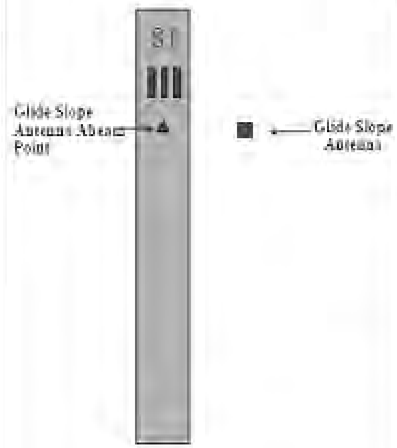
Glide Slope Antenna (Non Fire Type)

The Glide Slope informs the pilot with the airplane's vertical position relative to the ideal approach. The Glide Slope antenna is located off one side of the runway, approximately abeam the touchdown point (typically 1000 feet past the approach end of the runway). The standard glide-slope path is 3 degrees slope.

DESCRIPTION OF POINT OBSERVED

The horizontal and vertical survey point observed on the glide slope is the top center of supporting structure (for obstruction purposes), and an additional vertical survey point is at ground level center of supporting structure. NOTE: abeam points must be computed in conjunction with all glide slope antennas. Abeam points are located on the centerline of the runway, perpendicular to the glide slope antenna.

PHOTO



NAVIGATIONAL AID

Inner Marker

Inner Marker is used only for Category II operations. Marker Beacons are to alert the pilot that an action is needed. This information is presented to the pilot by audio and visual cues.

DESCRIPTION OF POINT OBSERVED

The horizontal survey point for the inner marker is the center of the antenna array. There is no vertical survey point requirement.

PHOTO

NAVIGATIONAL AID DESCRIPTION

LOCALIZER (LOC)

The Localizer informs the pilot with the airplane's horizontal position relative to runway centerline. The Localizer broadcasts from beyond the departure end of the runway with a horizontal antenna array. Course width is adjusted to provide full-scale deflection left or right at 350 feet off centerline when over the approach end of the runway. Course width varies with runway length.

DESCRIPTION OF POINT OBSERVED

The Horizontal and Vertical Survey Point is located at the center of antenna supporting structure.

PHOTO

NAVIGATIONAL AID DESCRIPTION

MLSAZ

The MLS is a precision approach and landing guidance system which provides position information and various ground-to-air data. The position information is provided in a wide coverage sector and is determined by an azimuth angle measurement (MLSAZ)

DESCRIPTION OF POINT OBSERVED

The Horizontal and Vertical Survey Point is located at the phase center reference point.

PHOTO

NAVIGATIONAL AID DESCRIPTION

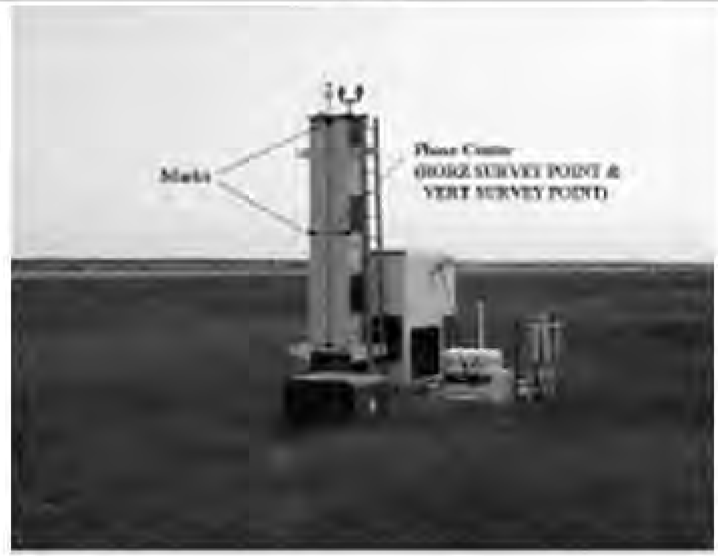
MLS ELEVATION GUIDANCE (MLSEL)

The elevation station transmits signals on the same frequency as the azimuth station. A single frequency is time-shared between angle and data functions. The elevation transmitter is normally located about 400 feet from the side of the runway between runway threshold and the touchdown zone.

DESCRIPTION OF POINT OBSERVED

The Horizontal and Vertical Survey Point is located at the Phase Center Reference Point.

PHOTO



NAVIGATIONAL AID DESCRIPTION

NONDIRECTIONAL BEACON (NDB)

Non-Directional Beacon (NDB) is another ground-based navigational aid used throughout the United States. The NDB system is the oldest form of electronic navigation still in regular use. By transmitting low to medium frequencies to an automatic direction finder located in the aircraft, pilots can use the NDB system to navigate to and from the ground-based station. NDB's may be co-located with an ILS system. NDB's may also provide a non-precision approach.

DESCRIPTION OF POINT OBSERVED

The horizontal survey point is located at the Center of Antenna Array. No vertical required.

PHOTO

NAVIGATIONAL AID DESCRIPTION

MIDDLE MARKER (MM)

Middle Marker (MM) beacon is located 2,000 to 6,000 feet (600 to 1 800 m) from the runway threshold. The middle marker defines a point along the glideslope of an ILS normally located at or near the point the point of decision height.

DESCRIPTION OF POINT OBSERVED

The Horizontal Survey Point is located at the Center of Antenna Array. No vertical required.

PHOTO

NAVIGATIONAL AID

Runway End Identifier Lights (REIL)

Runway End Identifier Lights (REIL) consists of high intensity white strobe lights placed on each side of the runway to enable rapid and positive identification of the runway threshold. REILs are typically installed on runways where an approach lighting system is not available.

DESCRIPTION OF POINT OBSERVED

The horizontal survey point (HSP) observed is the top center of light. No vertical required.

PHOTO

NAVIGATIONAL AID

Precision Approach Path Indicators (PAPI)

Precision Approach Path Indicators is a visual-approach slope aid approved for use in the United States. This system gives indication that is more precise to the pilot of the approach path of the aircraft and utilizes only one bar. The system consists of four lights on either side of the approach runway. The PAPI are white and red lights arranged in a single row. If you are on the proper glide path, you will see two white lights on the left side of the PAPI light bar and two red lights on the right side.

DESCRIPTION OF POINT OBSERVED

The Horizontal Survey Point on PAPI lights is the center of array. No vertical is required.

PHOTO

NAVIGATIONAL AID

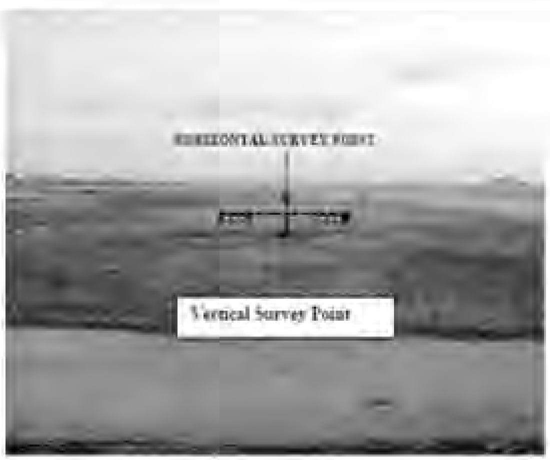
VASI

VISUAL APPROACH SLOPE INDICATOR (VASI) is an optical reference device located on the ground adjacent to the sides of the runway. There is a variety of VASI designs dependent upon the desired visual range and the type of aircraft utilizing the runway. The lenses split the light into red and white beams. If you are approaching the runway on the proper glide path, you see a red light above a white light.

DESCRIPTION OF POINT OBSERVED

The horizontal survey point is the center of array. The Vertical Survey Point is located at ground level on a centerline of the horizontal survey point.

PHOTO



NAVIGATIONAL AID

Very High Frequency Omni-directional Range Station (VOR)

VHF Omni-directional Range (VOR) – The VOR is a ground based short distance navigation aid (NAVAID) which provides continuous azimuth information in the form of 360 radials to or from a station. It is used for en route navigation as well as non-precision approaches. The VOR system is present in three slightly different navigation aids (NAVAIDs): VOR, VOR/DME, and VORTAC. By itself, it is known as a VOR, and it provides magnetic bearing information to and from the station. When DME is also installed with a VOR, the NAVAID is referred to as a VOR/DME. When military tactical air navigation (TACAN) equipment is installed with a VOR, the NAVAID is known as a VORTAC. DME is always an integral part of a VORTAC. Regardless of the type of NAVAID utilized (VOR, VOR/DME or VORTAC), the VOR indicator behaves the same.

DESCRIPTION OF POINT OBSERVED

The horizontal survey point is located on the top center of antenna cover. The vertical survey point is located at ground level center of structure.

PHOTO

NAVIGATIONAL AID

Very High Frequency Omni-directional Range Station(VOR)

VHF Omni-directional Range (VOR) – The VOR is a ground based short distance navigation aid (NAVAID) which provides continuous azimuth information in the form of 360 radials to or from a station. It is used for en route navigation as well as non-precision approaches. The VOR system is present in three slightly different navigation aids (NAVAIDs): VOR, VOR/DME, and VORTAC. By itself, it is known as a VOR, and it provides magnetic bearing information to and from the station. When DME is also installed with a VOR, the NAVAID is referred to as a VOR/DME. When military tactical air navigation (TACAN) equipment is installed with a VOR, the NAVAID is known as a VORTAC. DME is always an integral part of a VORTAC. Regardless of the type of NAVAID utilized (VOR: VOR/DME or VORTAC), the VOR indicator behaves the same.

DESCRIPTION OF POINT OBSERVED

The horizontal survey point is located on the top center of antenna cover. The vertical survey point is located at ground level center of structure.

PHOTO

NAVIGATIONAL AID / WEATHER AID DESCRIPTION

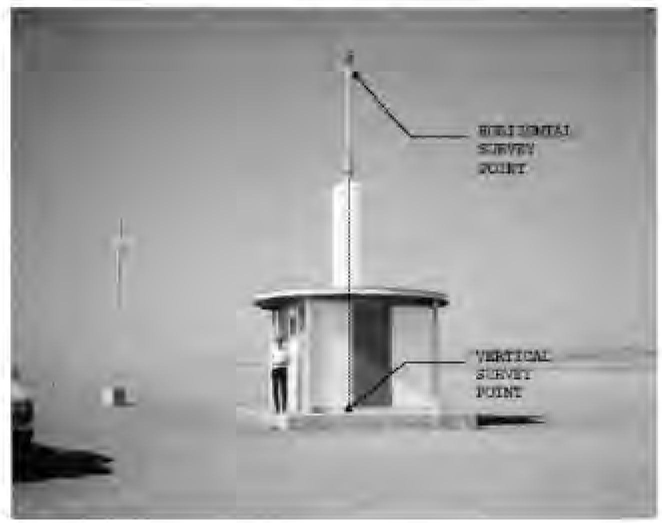
Very High Frequency Omni-directional Range Station (VOR WITH DME)

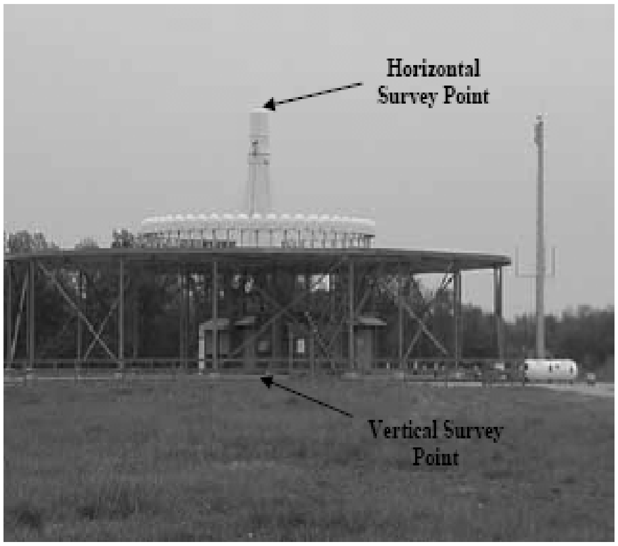
VOR/DME: If the VOR station is equipped with distance measuring equipment (DME), the signals can also be used to determine the distance to the station. It also provides navigation guidance for en route navigation and non-precision approaches.

DESCRIPTION OF POINT OBSERVED

The horizontal survey point is located on the top center of antenna cover. The vertical survey point is located at ground level center of structure.

PHOTO



NAVIGATIONAL AID
VORTAC The VORTAC is simply a VOR and TACAN co-located and providing the same navigational assistance.
DESCRIPTION OF POINT OBSERVED
The horizontal survey point is located on the top center of antenna cover. The vertical survey point is located at ground level center of structure.
PHOTO


CHAPTER 16. OBSTRUCTIONS

The airspace around an airport is comprised of several imaginary three-dimensional obstruction identification surfaces (OIS), as defined in 14 CFR Part 77. These surfaces provide the criteria for determination of obstructions to navigable airspace. The supplemental instructions provided by the contracting official in the SOW will specify the approach category (condition) to which each runway end approach must be surveyed. The specified approach category (Visual, Utility, Non-Precision, Precision) for each runway end, the position and elevation of each runway end, and the airport elevation will determine the limits of the associated Primary, Horizontal, Conical, and Transitional surfaces to be surveyed. The surveyor must provide the required obstruction representation to these surfaces.

One reason an object is considered an obstruction to air navigation is if it penetrates one of the required surfaces. The elevation required for any obstacle to obstruct an imaginary surface depends on the location of the obstacle within the airspace of the airport.. Survey teams must develop the ability to quickly judge the location of an object in the field relative to the various imaginary surfaces. The survey team must understand the definitions and interrelations between the various imaginary surfaces.

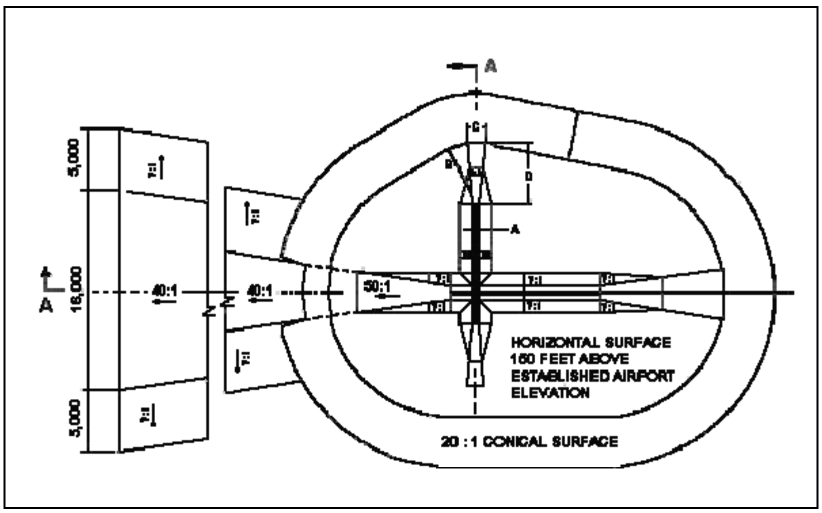


Fig 3-9: Illustrates the different 14 CFR Part 77 surfaces

16-1. DEFINITION

An obstruction, for purposes of this section, is any non-frangible obstacle penetrating an OIS, as defined in 14 CFR Part 77. A supplemental obstruction is any non-frangible obstacle penetrating an OIS defined as a supplemental OIS by appropriate FAA authorities.

16-2. OBSTRUCTION IDENTIFICATION SURFACES (OIS)

All airport surveys will include analysis of the Primary, Horizontal, Conical, and all associated transitional surfaces.

16-2-1. Precision Instrument Runway Surfaces – Category PIR

16-2-1-1. PIR Primary Surface: The primary surface is a 1,000-foot-wide rectangle centered on the runway centerline that begins and ends 200 feet from the physical end of the runway. The transitional surfaces associated with the primary surface, extend outward and upward perpendicular to the runway centerline at a slope of 7 to 1 (14.29 percent approximately) from the edge of the primary and the approach surfaces until they intersect the horizontal or conical surface.

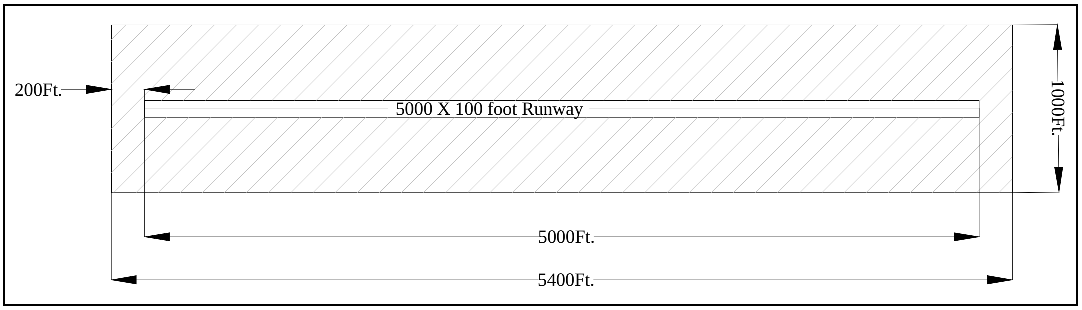


Figure 3-10: The hatched area around the runway, depicts the dimensions of the primary surface for a precision instrument runway

Table 3-6: Primary surface dimensional criteria – PIR

Surface begins:	200 feet on approach side of each runway threshold
Length:	Distance between runway thresholds plus 400 feet
Width of the surface at point of beginning:	1,000 feet (500 feet either side of centerline)
Width of surface at end point:	1,000 feet (500 feet either side of centerline)
Slope of surface:	See elevation.
Elevation:	The surface follows the contours of the runway centerline. At each threshold, the surface is at the same elevation as the threshold and continues at that elevation to the 200-foot point.

16-2-1-2. PIR Approach Surface: A PIR approach surface is longitudinally centered on the extended centerline of a PIR runway, beginning at the end of the primary surface and extending outward and upward at a slope of 50 to 1 (2.0 percent) for a horizontal distance of 10,000 feet and at a slope of 40 to 1 (2.5 percent) for an additional 40,000 feet. This surface width is 1,000 feet wide at the point of 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.

16-2-1-3. PIR Approach Surface for an LPV Approach: The airport survey performed to support development of an LPV approach should use the PIR approach surface specified in 16-2-1-2, except the total length may be reduced to no less than 20,000 feet from the point of origin. A length between 20,000 and 50,000 feet may be specified at the discretion of the Regional Airports Division to meet local requirements.

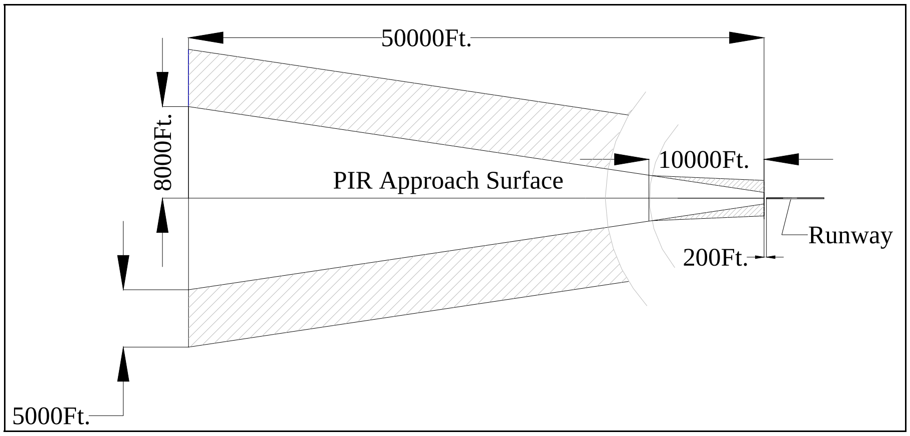


Figure 3-11: Depicts the plan view dimensional criteria of the PIR approach surface

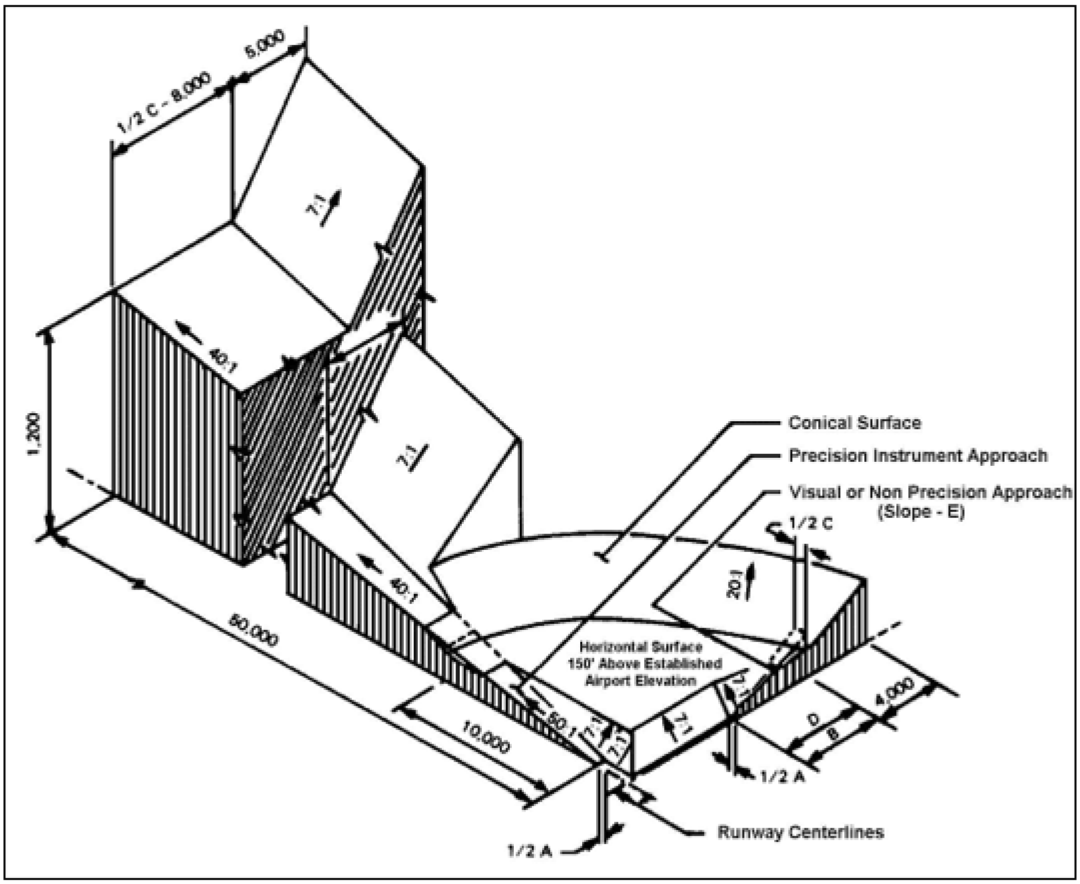


Figure 3-12: Provides an isometric view of the 14 CFR Part 77 surfaces

Table 3-7: Primary approach surface dimensional criteria – PIR

Surface begins:	200 feet on approach side of threshold (at end of primary surface)
Length:	50,000 feet
Width of the surface at point of beginning:	1,000 feet (500 feet either side of centerline)
Width of surface at end point 50,000 feet:	16,000 feet (8000 feet either side of centerline)
Slope of surface:	50:1 (2%) for first 10,000 feet 40:1 (2.5%) for last 40,000 feet
Elevation:	Beginning Elevation: Threshold Elevation Elevation at 10,000 feet: 200 feet above threshold Elevation Elevation at 50,000 feet: 1,200 feet above Threshold Elevation

16-2-1-4. PIR Transitional Surfaces: These surfaces extend outward and upward perpendicular to the runway centerline at a slope of 7 to 1 (approximately 14.29 percent) from the edge of the approach surfaces until they intersect the horizontal or conical surface. The portion of the PIR approach surface extending 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 to 1 (14.3 percent).

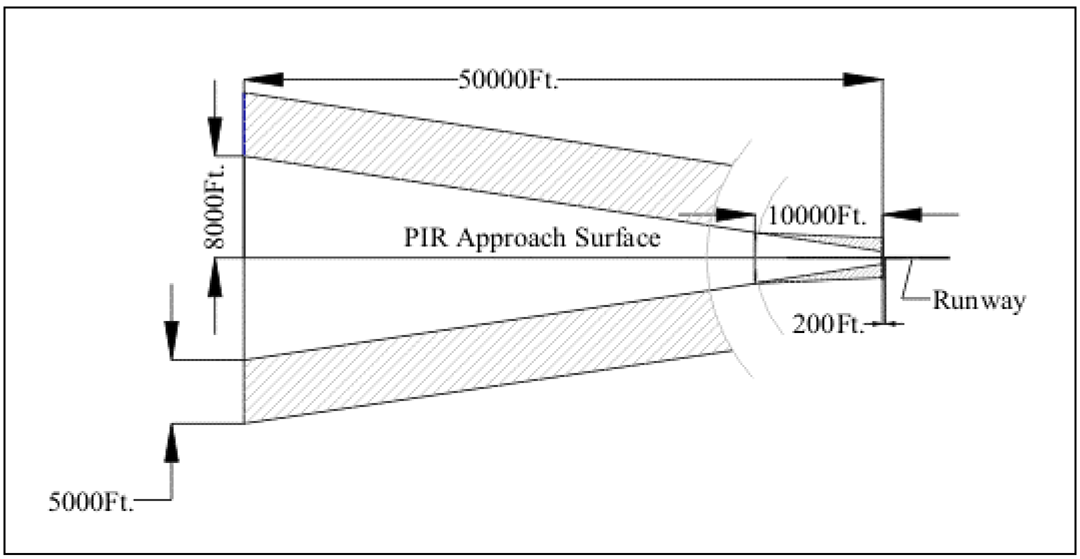


Figure 3-13: Depicts the plan view dimensional criteria of the PIR transitional surfaces (hatched areas)

Table 3-8: Transitional surface dimensional criteria – PIR

Surface begins:	200 feet. on approach side of threshold (at end of primary surface)
Length:	Computed using formula ((Airport Elev. – Runway End Elev.) + 150) ÷ 0.0200
Width of the surface at point of beginning:	Computed using formula ((Airport Elev. – Runway End Elev.) + 150) ÷ 0.1428571
Width of surface at end point 50,000 feet:	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).
Slope of surface:	7:1 (14.28571%) perpendicular to runway centerline/centerline extended

16-2-2. Non-Precision Runway Surfaces – Category D (NP-D).

At their discretion, FAA Regional Airports Divisions may specify the use of the Non-Precision D surface for airport surveys supporting LPV instrument approaches.

16-2-2-1. Non-Precision – D Primary Surface: The primary surface is a 1,000-foot-wide rectangle centered on the runway centerline, beginning 200 feet on the approach side of a runway threshold and extending to 200 feet on the approach side of the opposite runway threshold. The transitional surfaces associated with the primary surface extend outward and upward perpendicular to the runway centerline at a slope of 7 to 1 (approximately 14.29 percent) from the edge of the primary and the approach surfaces until they intersect the horizontal or conical surface.

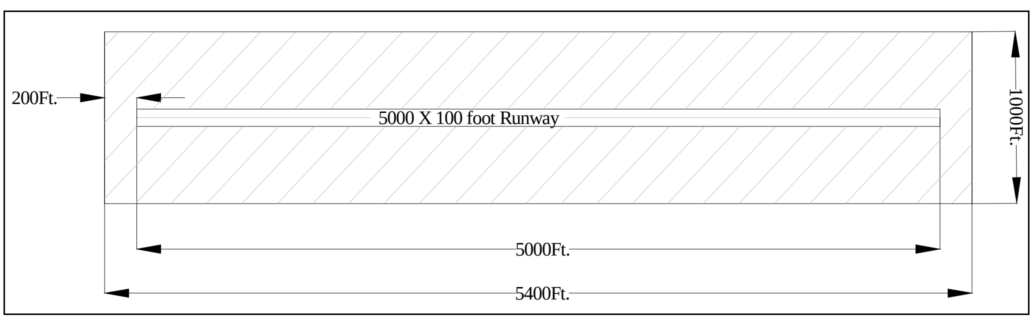


Figure 3-14: The hatched area surrounding the runway is the NP-D primary approach surface

Table 3-9: Primary surface dimensional criteria – NP-D

Surface begins:	200 feet on approach side of each runway threshold
Length:	Distance between runway thresholds plus 400 feet
Width of the surface at point of beginning:	1,000 feet (500 feet either side of centerline)
Width of surface at end point:	1,000 feet (500 feet either side of centerline)
Slope of surface:	See elevation.
Elevation:	The surface follows the contours of the runway centerline. At each threshold, the surface is at the same elevation as the threshold and continues at that elevation to the 200-foot point.

16-2-2-2. NP-D Approach Surface: This surface is longitudinally centered on the extended centerline of the runway, beginning at the end of the primary surface and with dimensions based on the permissible approach visibility minimums established for the specific runway end. The visibility minimum for the D is as low as ¾ mile. The primary surface width at end adjacent to runway end and flaring to 4,000 feet at a distance of 10,000 feet from the end of the primary surface. The surface slope is 34 to 1 (approximately 3 percent).

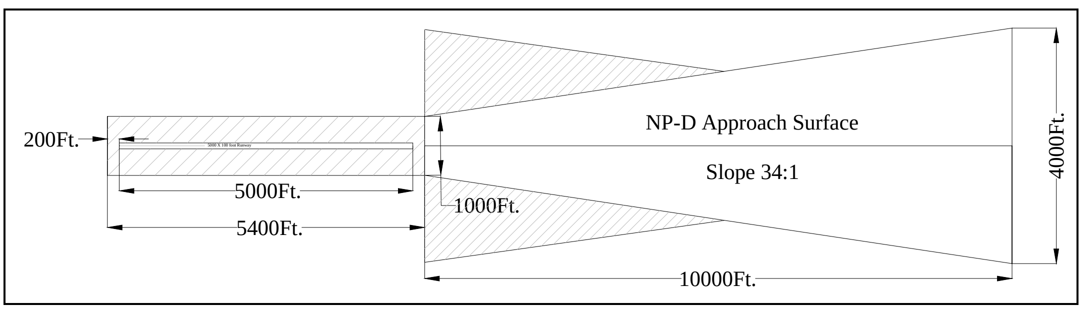


Figure 3-15: Depicts the plan view dimensional criteria of the NP-D primary approach surface

Table 3-10: Primary surface dimensional criteria – NP-D

Surface begins:	200 feet on approach side of each runway threshold
Length:	10,000 feet
Width of the surface at point of beginning:	1,000 feet (500 feet either side of centerline)
Width of surface at end point:	4,000 feet (2000 feet either side of centerline)
Slope of surface:	34:1 (2.94117%)
Elevation:	Beginning: Elevation of Threshold End Point: 294.1 feet above threshold elevation

16-2-2-3. NP-D Transitional Surfaces: These surfaces extend outward and upward perpendicular to the runway centerline at a slope of 7 to 1 (approximately 14.29 percent) from the edge of the primary and the approach surfaces until they intersect the horizontal or conical surface.

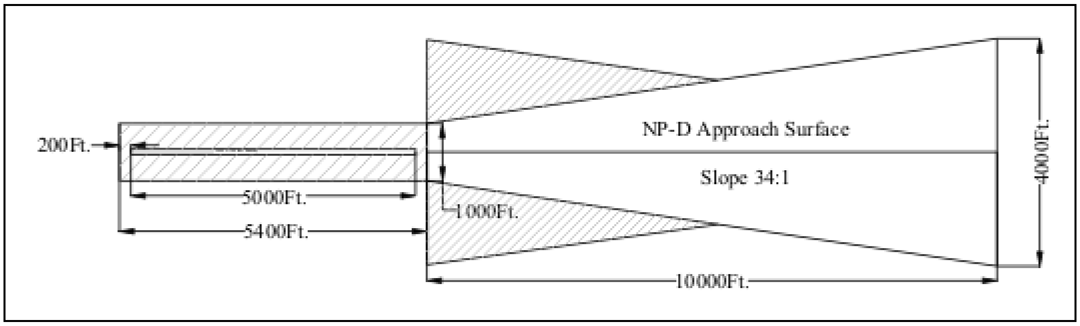


Figure 3-16: Depicts the NP-D approach surface and the transitional surfaces (hatched areas)

Table 3-11: Transitional surface dimensional criteria – NP-D

Surface begins:	200 feet on approach side of each runway threshold
Length:	Computed Using formula ((Airport Elev. – Runway Elev.) + 150) ÷ 0.0294117
Width of the surface at point of beginning:	Computed using formula ((Airport Elev. – Runway End Elev.) + 150) ÷ 0.1428571
Width of surface at end point:	The transitional surface extends until it reaches the horizontal or conical surface.
Slope of surface:	7:1 (14.28571%)

16-2-3. Non-Precision Runway Surfaces – Category C (NP-C)

16-2-3-1. NP-C Primary Surface: The primary surface is a 500-foot-wide rectangle centered on the runway centerline, beginning 200 feet on the approach side of a runway threshold and extending to 200 feet on the approach side of the opposite runway threshold. The transitional surfaces associated with the primary surface extend outward and upward, perpendicular to the runway centerline at a slope of 7 to 1 (approximately 14.29 percent) from the edge of the primary and the approach surfaces until they intersect the horizontal or conical surface.

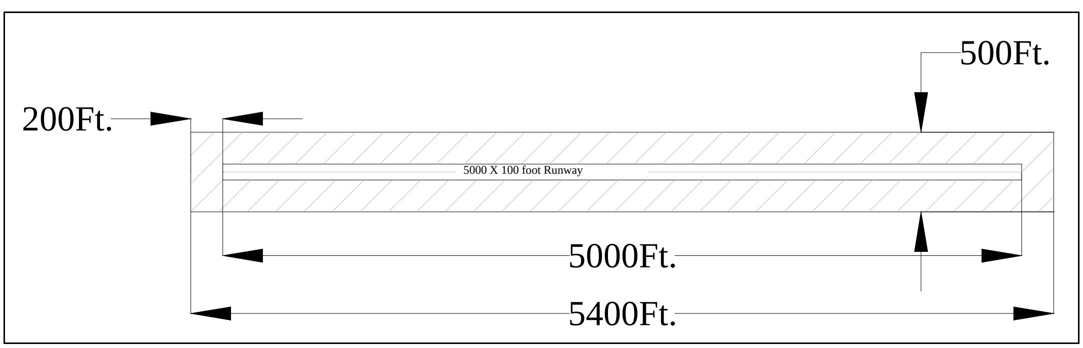


Figure 3-17: Depicts the NP-C primary surface (hatched areas)

Table 3-11: Primary surface dimensional criteria – NP-C

Surface begins:	200 feet on approach side of each runway threshold
Length:	Distance between runway thresholds plus 400 feet
Width of the surface at point of beginning:	500 feet (250 feet either side of centerline)
Width of surface at end point:	500 feet (250 feet either side of centerline)
Slope of surface:	See elevation.
Elevation:	The surface follows the contours of the runway centerline; at each threshold, the surface is at the same elevation as the threshold and continues at that elevation to the 200-foot point.

16-2-3-2. NP-C Approach Surface: A surface longitudinally centered on the extended centerline of the runway, beginning at the end of the primary surface and with dimensions based on the permissible approach visibility minimums established for the specific runway end. The visibility minimum for the NP-C is greater than ¾ mile. The NP-C approach surface is the width of the primary surface at the point of beginning and flares to 3,500 feet at a distance of 10,000 feet from the end of the point of beginning. The surface slope is 34 to 1 (3 percent).

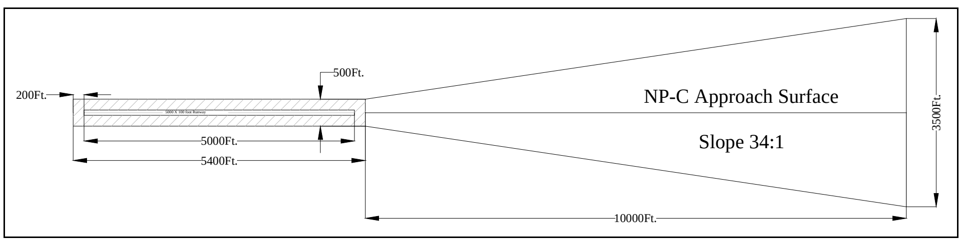


Figure 3-18: Depicts the NP-C approach surface (hatched areas)

Table 3-12: Approach surface dimensional criteria – NP-C

Surface begins:	200 feet on approach side of each runway threshold
Length:	10,000 feet
Width of the surface at point of beginning:	500 feet (250 feet either side of centerline)
Width of surface at end point:	3500 feet (1,750 feet either side of centerline)
Slope of surface:	34:1 (2.94117%)
Elevation:	Beginning: Elevation of threshold End Point: 294.1 feet above threshold elevation

16-2-3-3. NP-C Transitional Surfaces: Transitional surfaces extend outward and upward, perpendicular to the runway centerline at a slope of 7 to 1 (approximately 14.29 percent) from the edge of the primary and the approach surfaces until they intersect the horizontal or conical surface.

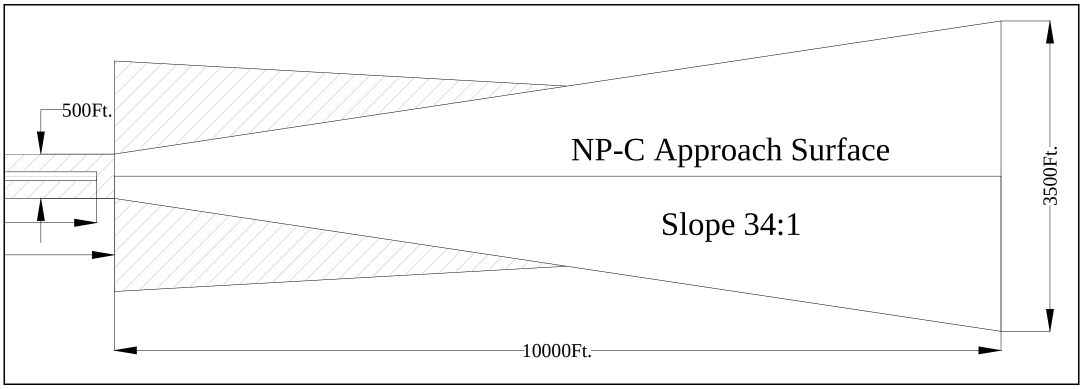


Figure 3-19: Depicts the NP-C approach and approach transitional surfaces (hatched areas)

Table 3-13: Approach transitional surface dimensional criteria – NP-C

Surface begins:	200 feet on approach side of each runway threshold
Length:	Computed using formula ((Airport Elev. – Runway Elev.) + 150) ÷ 0.0294117
Width of the surface at point of beginning:	Computed using formula ((Airport Elev. – Runway Elev.) + 150) ÷ 0.1428517
Slope of surface:	34:1 (2.94117%)

16-2-4. Non-Precision Runway Surfaces – Category ANP

16-2-4-1. ANP Primary Surface: The primary surface is a 500-foot-wide rectangle centered on the runway centerline, beginning 200 feet on the approach side of a runway threshold and extending to 200 feet on the approach side of the opposite runway threshold. The transitional surfaces associated with the primary surface, extend outward and upward perpendicular to the runway centerline at a slope of 7 to 1 (approximately 14.29 percent) from the edge of the primary and the approach surfaces until they intersect the horizontal or conical surface.

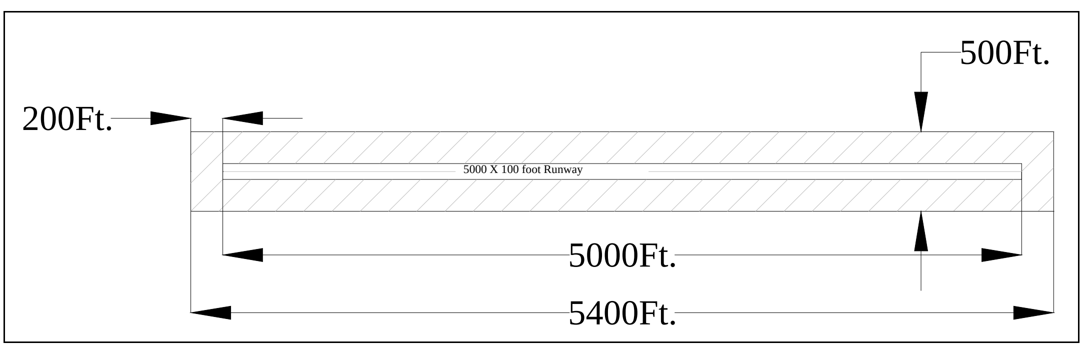


Figure 3-20: Depicts the NP-C primary surface (hatched areas)

Table 3-14: Primary surface dimensional criteria – ANP

Surface begins:	200 feet on approach side of each runway threshold
Length:	Distance between runway thresholds plus 400 feet
Width of the surface at point of beginning:	500 feet (250 feet either side of centerline)
Width of surface at end point:	500 feet (250 feet either side of centerline)
Slope of surface:	See elevation
Elevation:	The surface follows the contours of the runway centerline; at each threshold, the surface is at the same elevation as the threshold and continues at that elevation to the 200-foot point.

16-2-4-2. ANP Approach Surface: Utility runways with non-precision approach surfaces are not affected by visibility minimums. The width of these surfaces 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 to 1 (5 percent).

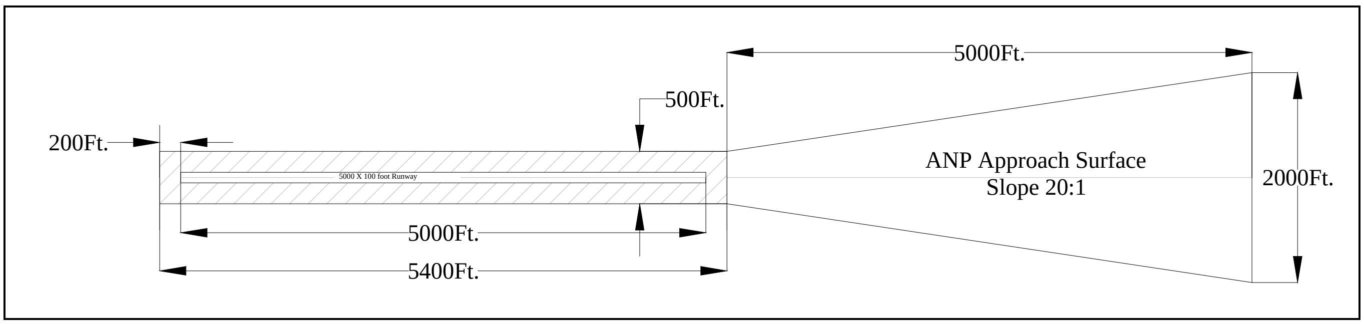


Figure 3-21: Depicts the ANP approach surface dimensions

Table 3-15: Approach surface dimensional criteria – ANP

Surface begins:	200 feet on approach side of each runway threshold
Length:	5,000 feet
Width of the surface at point of beginning:	500 feet (250 feet either side of centerline)
Width of surface at end point:	2,000 feet (1000 feet either side of centerline)
Slope of surface:	20:1 (5.000%)
Elevation:	Beginning: Elevation of threshold End Point: 250 feet above threshold elevation

16-2-4-3. ANP Approach Transitional Surfaces: Transitional surfaces extend outward and upward, perpendicular to the runway centerline at a slope of 7 to 1 (approximately 14.29 percent) from the edge of the primary and the approach surfaces until they intersect the horizontal or conical surface.

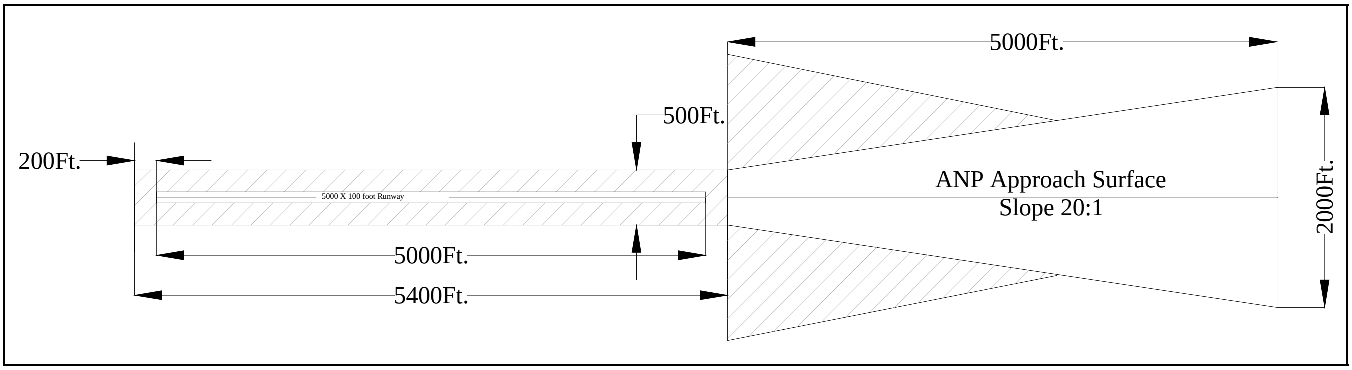


Figure 3-22: Depicts the ANP Transitional Surface Dimensions

Table 3-16: Approach transitional surface dimensional criteria – ANP

Surface begins:	200 feet on approach side of each runway threshold
Length:	Computed Using formula ((Airport Elev. – Runway Elev.) + 150) ÷ 0.0500
Width of the surface at point of beginning:	Computed Using formula ((Airport Elev. – Runway Elev.) + 150) ÷ 0.1428517
Slope of surface:	20:1 (5.00%)

16-2-5. Visual Runway Surfaces – Category BV

16-2-5-1. BV Primary Surface: The primary surface is a 500-foot-wide rectangle centered on the runway centerline, beginning 200 feet on the approach side of a runway threshold and extending to 200 feet on the approach side of the opposite runway threshold. The transitional surfaces associated with the primary surface extend outward and upward perpendicular to the runway centerline at a slope of 7 to 1 (approximately 14.29 percent) from the edge of the primary and the approach surfaces until they intersect the horizontal or conical surface.

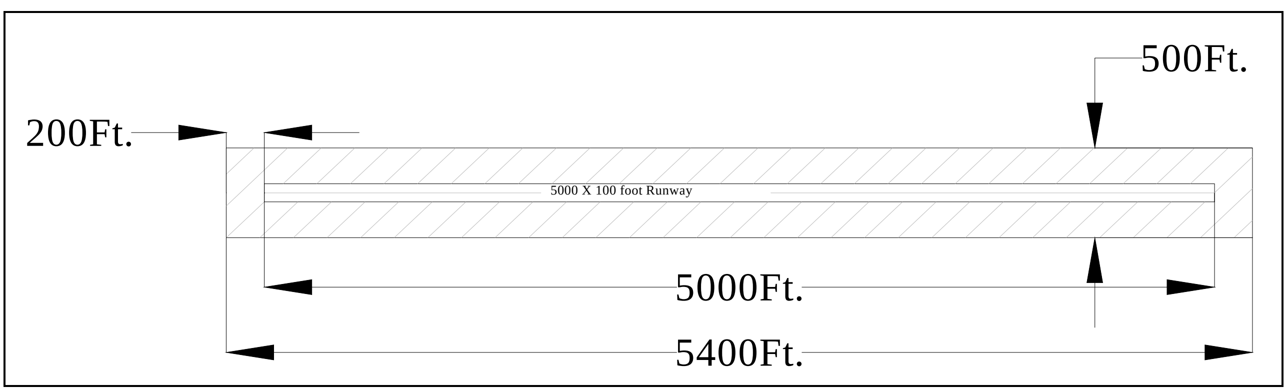


Figure 3-23: Depicts the BV primary surface (hatched areas)

Table 3-17: Primary surface dimensional criteria – BV

Surface begins:	200 feet on approach side of each runway threshold
Length:	Distance between runway thresholds plus 400 feet
Width of the surface at point of beginning:	500 feet (250 feet either side of centerline)
Width of surface at end point:	500 feet (250 feet either side of centerline)
Slope of surface:	See elevation.
Elevation:	The surface follows the contours of the runway centerline; at each threshold, the surface is at the same elevation as the threshold and continues at that elevation to the 200 foot point.

16-2-5-2. BV Approach Surface: When the runway is not a utility runway, the visual runway approach surface is centered 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 to 1 (5 percent).

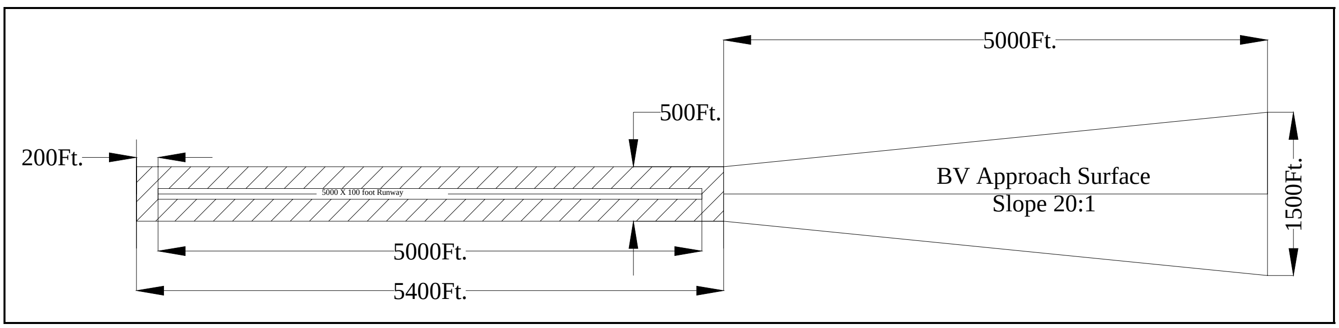


Figure 3-24: Depicts the BV approach surface

Table 3-18: Approach surface dimensional criteria – BV

Surface begins:	200 feet on approach side of each runway threshold
Length:	5,000 feet
Width of the surface at point of beginning:	500 feet (250 feet either side of centerline)
Width of surface at end point:	1,500 feet (750 feet either side of centerline)
Slope of surface:	20:1 (5.000%)
Elevation:	Beginning: Elevation of threshold End Point: 250 feet above threshold elevation

16-2-5-3. BV Approach Transitional Surface: Transitional surfaces extend outward and upward, perpendicular to the runway centerline at a slope of 7 to 1 (approximately 14.29 percent) from the edge of the primary and the approach surfaces until they intersect the horizontal or conical surface.

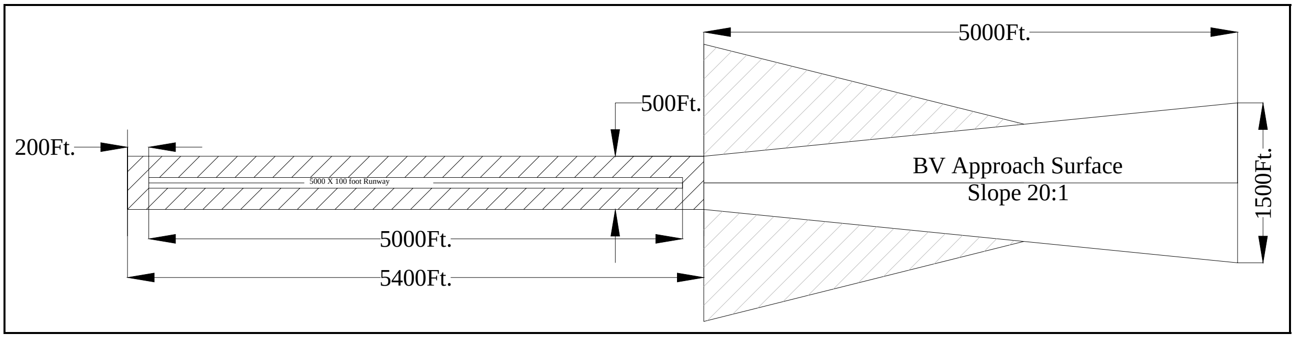


Figure 3-25: Depicts the BV approach transitional surface (hatched areas)

Table 3-19: Approach transitional surface dimensional criteria – BV

Surface begins:	200 feet on approach side of each runway threshold
Length:	Computed Using formula ((Airport Elev. – Runway Elev.) + 150) ÷ 0.0500
Width of the surface at point of beginning:	Computed Using formula ((Airport Elev. – Runway Elev.) + 150) ÷ 0.1428517
Slope of surface:	20:1 (5.00%)

16-2-6. Visual Runway Surfaces – Category AV

16-2-6-1. AV Primary Surface: The primary surface is a 250-foot-wide rectangle centered on the runway centerline, beginning 200 feet on the approach side of a runway threshold and extending to 200 feet on the approach side of the opposite runway threshold. The transitional surfaces associated with the primary surface extend outward and upward perpendicular to the runway centerline at a slope of 7 to 1 (approximately 14.29 percent) from the edge of the primary and the approach surfaces until they intersect the horizontal or conical surface.

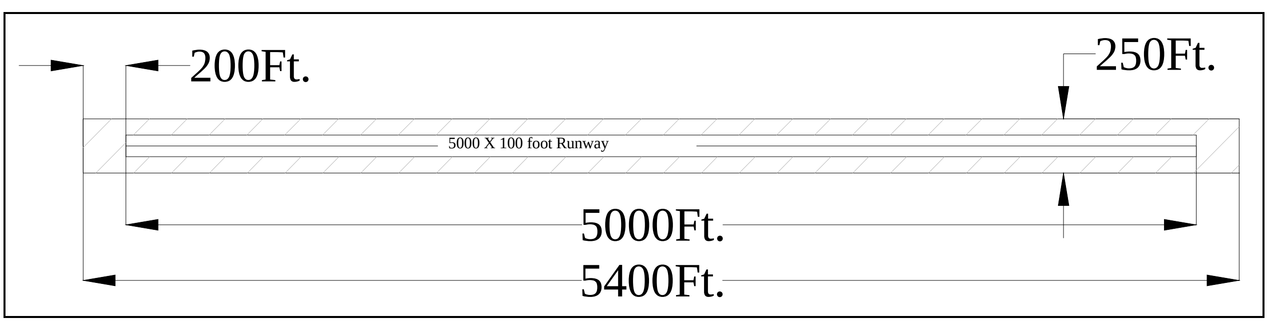


Figure 3-26: Depicts the AV primary surface (hatched areas)

Table 3-20: Primary surface dimensional criteria – AV

Surface begins:	200 feet on approach side of each runway threshold
Length:	Distance between runway thresholds plus 400 feet
Width of the surface at point of beginning:	250 feet (125 feet either side of centerline)
Width of surface at end point:	250 feet (125 feet either side of centerline)
Slope of surface:	See elevation.
Elevation:	The surface follows the contours of the runway centerline; at each threshold, the surface is at the same elevation as the threshold and continues at that elevation to the 200 foot point.

16-2-6-2. AV Approach Surface: When the runway is a utility runway, the width begins at 250 feet 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 primary surface. The surface slope is 20 to 1 (5 percent).

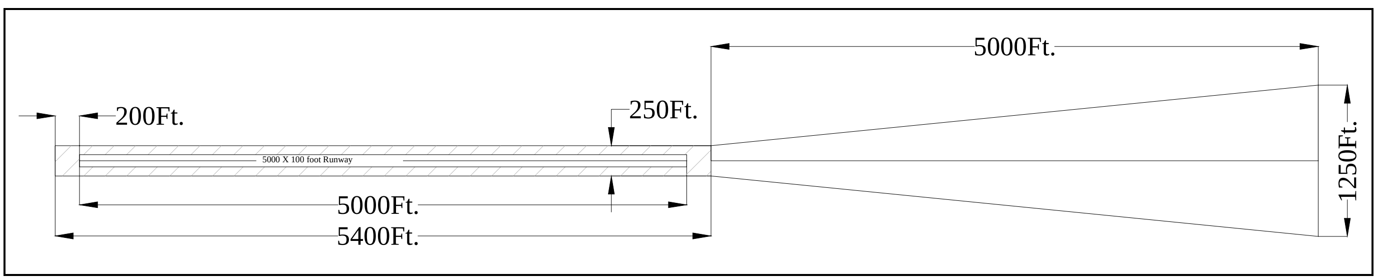


Figure 3-27: Depicts the AV approach surface

Table 3-21: Approach surface dimensional criteria – AV

Surface begins:	200 feet on approach side of each runway threshold
Length:	5,000 feet
Width of the surface at point of beginning:	250 feet (125 feet either side of centerline)
Width of surface at end point:	1,250 feet (625 feet either side of centerline)
Slope of surface:	20:1 (5.000%)
Elevation:	Beginning: Elevation of threshold End Point: 250 feet above threshold elevation

16-2-6-3. AV Approach Transitional Surfaces: These surfaces extend outward and upward, perpendicular to the runway centerline at a slope of 7 to 1 (approximately 14.29 percent) from the edge of the primary and the approach surfaces until they intersect the horizontal or conical suffice.

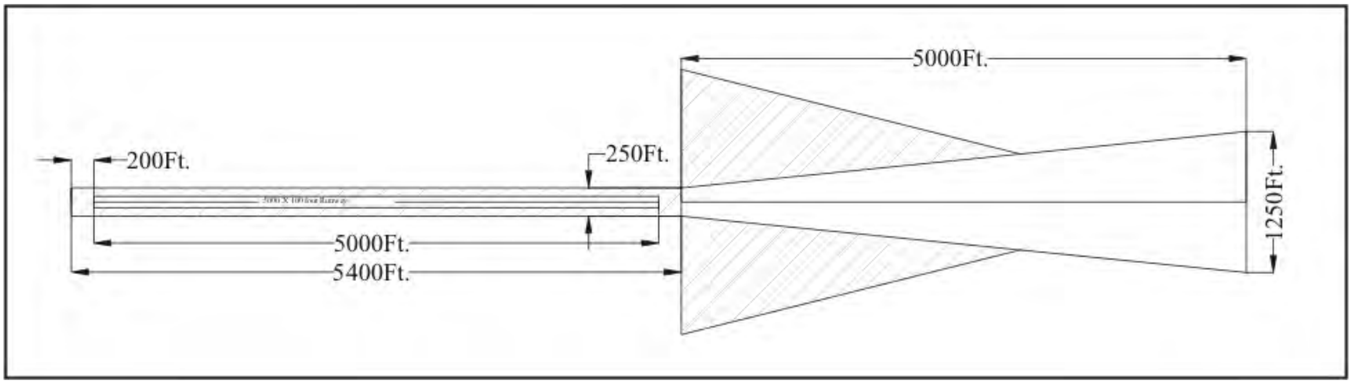


Figure 3-28: Depicts the AV approach transitional surface (hatched area)

Table 3-22: Approach transitional surface dimensional criteria – AV

Surface begins:	200 feet on approach side of each runway threshold
Length:	Computed Using formula ((Airport Elev. – Runway Elev.) + 150) ÷ 0.0500
Width of the surface at point of beginning:	Computed Using formula ((Airport Elev. – Runway Elev.) + 150) ÷ 0.1428517
Slope of surface:	20:1 (5.00%)

16-2-7. HORIZONTAL SURFACE

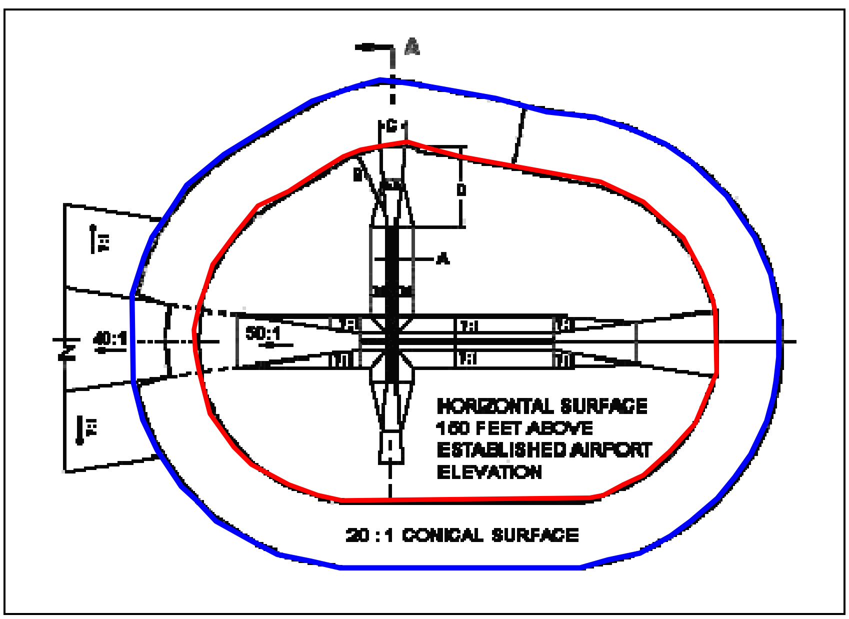


Fig. 3-30: Illustrates the outer limits of the Horizontal (red line) and Conical (blue line) Surfaces in a multi-runway configuration

A horizontal surface is 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. The sizes of the arcs are as follows:

- For all runways designated visual or utility, the radius of each arc is 5,000 feet.
- For precision and non-precision runways, the radius of each arc is 10,000 feet.

The radius of the arc specified for each end of a runway will have the same mathematical value, which is the highest determined value for either runway end. When tangents connecting two adjacent 10,000-foot arcs encompass a 5,000-foot arc, it must be disregarded.

16-2-8. CONICAL SURFACE

The conical surface 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 to 1 (5 percent), measured in a vertical plane.

16-2-9. SUPPLEMENTAL SURFACES

These are surfaces applied to Airport Obstruction Charts when there is a requirement for additional obstruction data. Dimensions, slopes, etc. are the same as previously specified; however, they are used under conditions that do not meet the definitions. For example, a visual runway may be charted as both a visual runway and a non-precision runway. When such is the case, the non-precision surfaces will be designated “Supplemental Surface” on the chart. The requirement for supplemental surfaces is restricted to primary, approach, and transitional areas. The specified horizontal and conical surfaces charted are not affected by the addition of supplemental surfaces. The limits of the transitional surfaces for the supplemental data are based on the horizontal and conical surface limits associated with the supplemental approach surface.

16-3. OBSTACLE ACCURACIES

The accuracy standards for the obstructions/obstacles are presented in the table on the following page. When an obstacle is selected for its obstruction value only (for example, meteorological apparatus), obstruction accuracies apply.

Table 3-23: Obstacle accuracies

ITEM (VALUES ARE FEET)		HORZ	VERTICAL ORTHO	VERTICAL ELLIP	VERTICAL AGL
Non-manmade obstacles and manmade obstacles less than 200 feet AGL penetrating the following Obstruction Identification Surface(s):					
	Primary Surface	20	3	N/A	N/A
	Those areas of an Approach Surface within 10,200 feet of the runway end	20	3	N/A	N/A
	Those areas of Primary Transition Surface within 500 feet of the Primary Surface	20	3	N/A	N/A
	Those areas of an Approach Transition Surface within 500 feet of the approach surface and also within 2,766 feet of the runway end	20	3	N/A	N/A
	Those areas of a Primary Transition Surface further than 500 feet from the Primary Surface	200	10	N/A	N/A
	Those areas of an Approach Transition Surface further than 500 feet from an Approach surface and also within 10,200 feet of the runway end	200	10	N/A	N/A
	The Horizontal Surface	50	10	N/A	N/A
	Those areas of an Approach Surface further than 10,200 feet from the runway end	50	10	N/A	N/A
	Those areas of an Approach Transition Surface further than 10,200 feet from the runway end	50	10	N/A	N/A
	The Conical Surface	50	10	N/A	N/A
Manmade objects equal to or greater than 200 feet AGL that penetrate the following Obstruction Identification Surfaces:					
	A Primary Surface	20	3	N/A	10
	Those areas of an Approach or Approach Transition Surface within 10,200 feet of the runway end	20	3	N/A	10
	The Primary Transition Surface	20	3	N/A	10
	An Approach or Approach Transition Surface further than 10,200 feet from the runway end	50	10	N/A	10
	The Horizontal Surface	50	10	N/A	10
	The Conical Surface	50	10	N/A	10

Notes:

- Accuracies are relative to the nearest PACS, SACS, HRP, or TSM.
- Distances relative to the threshold or runway end are measured along the runway centerline or centerline extended to the abeam point.

16-4. SPECIAL CASES

16-4-1. Catenaries

In most cases, the position and elevation of supporting towers will adequately represent catenaries. These towers must be treated as any other potential obstruction. However, if one or both towers are outside the limits of the OIS, the catenary itself may become a significant obstruction. In these cases, provide a position and elevation on the imaginary straight line connecting the tops of the two adjacent catenary support towers at the highest point within the OIS. Designate the elevation of this point as an estimated maximum elevation (EME).

16-4-2. Vehicular Traverse Ways

Treat a vehicular traverse way as any other potential obstruction, but include the appropriate vehicle height allowance in the elevation. Refer to Paragraph 16-4-8 for possible exemptions regarding vehicular traverse ways. Vehicle height allowances are as follows:

Non-interstate roads	**15 feet**
Interstate roads	**17 feet**
Railroads	**23 feet**

16-4-3. Mobile Obstructions

Representative obstructions that are mobile within a defined area (except vehicles on roads and railroads and vessels, which are treated under separate headings) must have their obstructing travel limits determined. Furnish an EME for each of these obstructing mobile obstacle areas. If a non-obstructing mobile obstacle is outward from the runway end, is the highest obstacle in the primary area or first 2,000 feet of an approach, and is higher than the runway end, an EME point must be provided at the point nearest to the runway centerline end. Travel limits need not be determined. Include the word **"MOBILE,"** which always implies an EME, in the obstacle name (e.g. "MOBILE CRANE AREA").

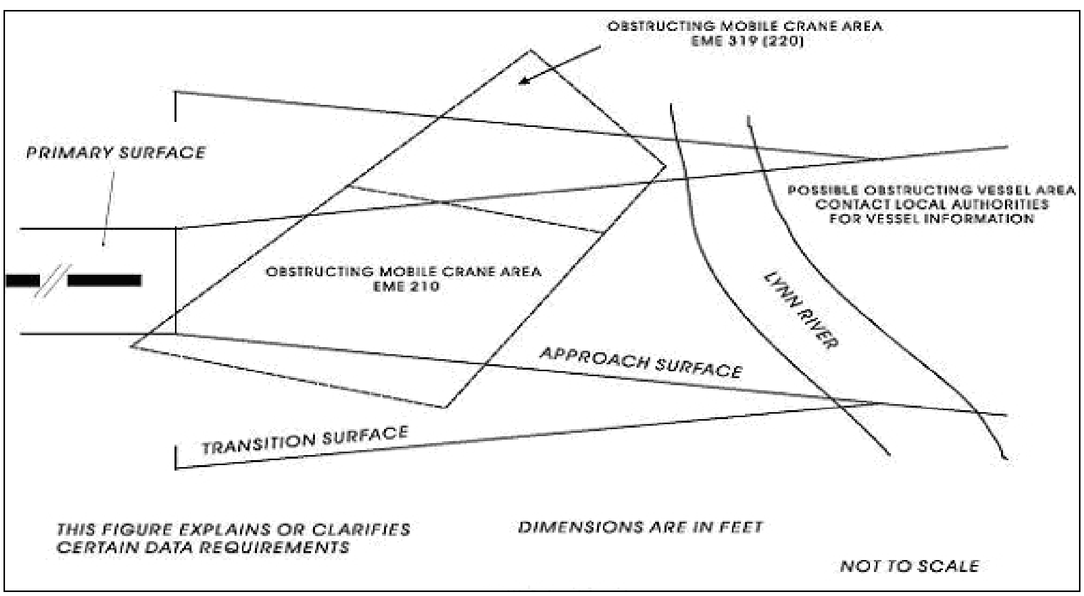


Figure 3-31: Illustrates the requirements for obstructing mobile areas

16-4-4. Obstructions Under Construction

Identify representative objects under construction (e.g. **"BUILDING UNDER CONSTRUCTION**"). Determine the elevation of the obstacle at the time of the survey. However, if a construction crane extends above the feature under construction, it is necessary and sufficient to determine the elevation and position of the crane.

16-4-5. Vessels

Because of uncertainties in determining maximum vessel heights, travel limits, and frequency of passage, vessel heights and locations are typically not provided. However, if a possible obstructing condition exists, capture the extents of the travel limits in the geospatial vector file and detail the any other information such as maximum vessel height, travel limits, and frequency of passage obtained from local authorities in the project report.

16-4-6. Manmade Obstacles Equal to or Greater than 200 Feet Above Ground Level (AGL)

The AGL elevation must be determined for the required manmade obstacles equal to, or greater than, 200 feet AGL. Measure the height from the highest point of ground in contact with either the obstacle or the structure on which the obstacle rests.

16-4-7. Supplemental Obstructions

Accomplish an obstruction survey of a supplemental OIS when specifically requested by the appropriate airport sponsor or State aviation or FAA authorities. Accomplish the survey of supplemental obstructions in addition to the survey specified in 14 CFR Part 77 for existing conditions. Penetrations of the supplemental OIS are supplemental obstructions. The supplemental OIS must conform to one of the OIS standards defined in 14 CFR Part 77. Criteria for the selection of supplemental obstructions are the same as the criteria for the selection of other obstructions.

16-4-8. Obstruction Exemptions

The measurement and consideration of the following obstructions is not required:

(1). Vegetation that obstructs both by less than 3 feet and has a maximum cross-sectional diameter no greater than ½ inch where transected by an obstruction surface.

(2). Annual vegetation, such as annual weeds, corn, millet, and sugar cane.

(3). Frangible obstacles. Frangible obstacles are under the control of airport authorities with locations fixed by function. Frangible structures retain their structural integrity and stiffness up to a designated maximum load, but on impact from a greater load, they break, distort, or yield in such a manner as to present the minimum hazard to aircraft. Examples are runway and taxiway signs and many approach light structures.

(4). Roads with restricted public access intended for airport/facility maintenance only. This exemption does not apply to airport service roads associated with other airport operations, such as food, fuel, and freight transportation.

(5). Construction equipment and debris, including dirt piles and batch plants, that are—

(a). Temporary in nature.

(b). Under the control of airport authorities.

(c). Located on airport property

(6). Vessels. If a possible obstructing condition exists, make an entry into the project plan cautioning that vessels might obstruct certain 14 CFR Part 77 surfaces (Approach or Primary versus Horizontal, Conical, or Transition OIS) at certain times and that further investigation, travel limits, and frequency of passage is advised. This exemption does not apply to vessels permanently moored.

(7). Individual parked aircraft. Show on the AOC paved aircraft movement and apron areas and approximate locations of unpaved tiedown areas. However, the location and maximum elevation of individual parked aircraft should not be determined or provided as part of an AOC survey. This exemption does not apply to aircraft permanently parked for display purposes.

16-4-8. Meteorological Apparatus

Measurement and consideration of meteorological apparatus is not required unless it is determined for its obstruction value.

16-5. OBSTACLE SELECTION

Obstruction selection must include a representation of obstacles penetrating the 14 CFR Part 77 OIS at the time of the field survey. The appropriate airport sponsor or State aviation or FAA authorities must identify the exact surfaces required for consideration for the survey. Additionally, certain non-obstructing obstacles may be required in the first 2,000 feet of an approach area. The special cases that apply to obstructions (refer to Paragraph 16-4) also apply to these required non-obstructing obstacles. Note that required obstacles may be EME points for mobile obstacle areas (refer to Figure 3-29).

16-5-1. OIS Obstacles Requirements

16-5-1-1. Determine and report the following obstructions in the primary surface.

(1). The highest obstruction outward from the runway end (the area located between the runway end and the beginning of the approach surface).

(2). The highest obstruction and the highest non-manmade obstruction in each 3,000-foot (approximately) section of the primary area on each side (left and right) of the runway.

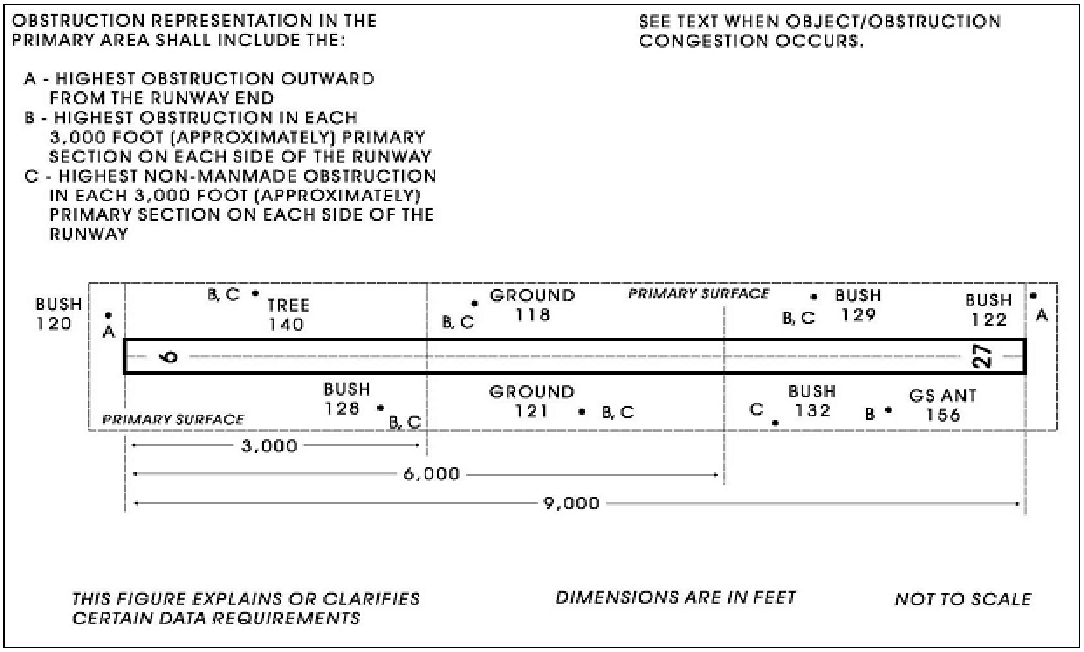


Figure 3-32: Illustrates the obstacle selection requirements in the primary surface

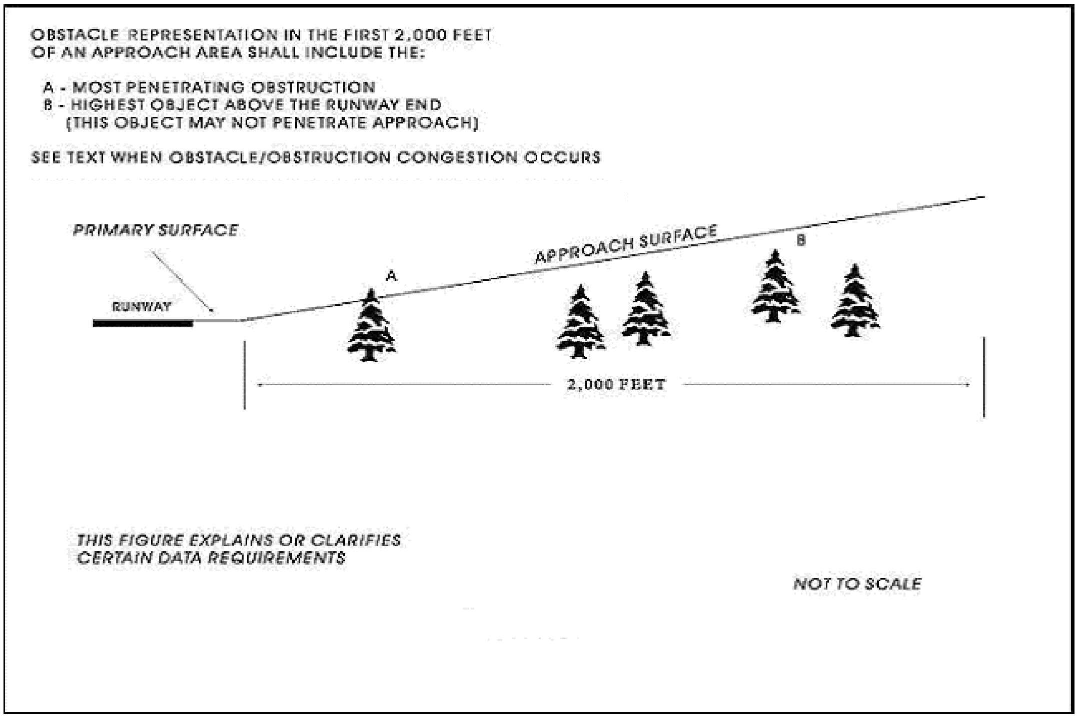
16-5-1-2. Determine and report the following obstructions in the approach surface.

(1). The highest obstacle within the first 2,000 feet of an approach area and higher than the runway approach end. This obstacle may or may not penetrate the approach surface and may be a non-obstructing EME point.

(2). The most penetrating obstruction in the first 2,000 feet of an approach area.

(3). The highest obstruction in each of the following zones of the approach:

(a). First 10,000 feet,
(b). First 20,000 feet,
(c). First 30,000 feet,
(d). First 40,000 feet, and
(e). The approach area.



(f). Figure 3-33: Illustrates the requirements in the first 2,000 feet of the approach.

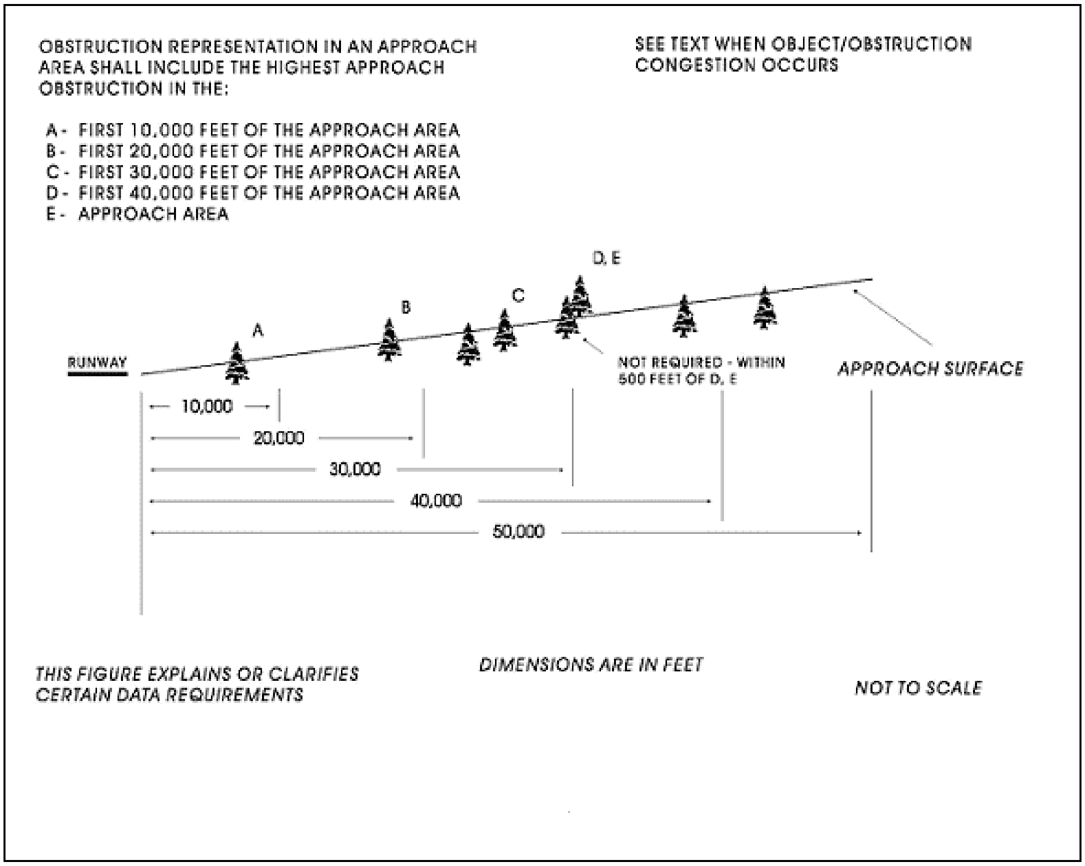


Figure 3-34: Illustrates the requirements in the approach

16-5-1-3. Determine and report the following obstructions in the Transition Surfaces:

(1). The highest obstruction in each 3,000-foot zone (approximately) of each primary transition to the horizontal surface. (The primary transition surface adjacent to the primary surface at each runway end must be extended an additional 200 feet (to cover an approximately 3,200- foot zone) to include the area adjacent to the 200-foot zone of the primary runway end. Refer to Figure 3-35.)

(2). The highest obstruction in each approach transition to the horizontal surface.

(3). The highest obstruction in each approach transition in the first 20,000 feet beyond the horizontal surface.

(4). The highest obstruction in each approach transition beyond the horizontal surface.

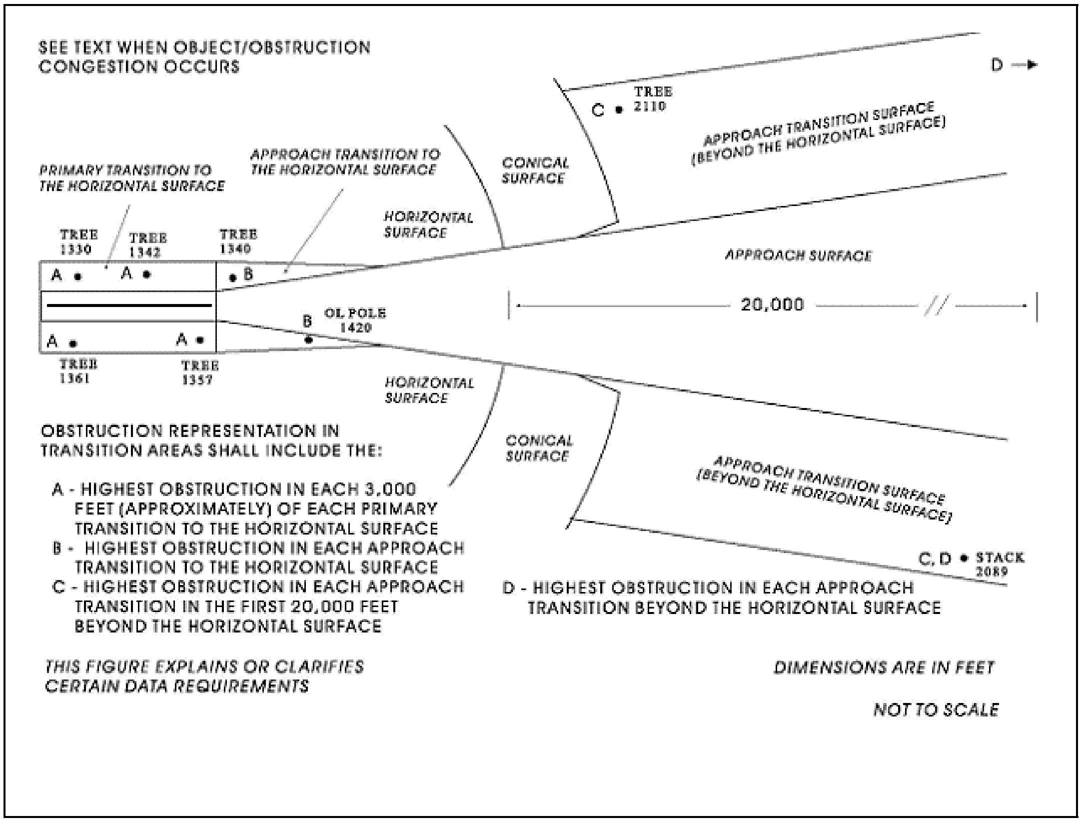


Figure 3-35: Illustrates the requirements in the transitional surfaces

16-5-1-4. Determine and report the following obstructions in the Horizontal and Conical Surfaces:

(1). The highest obstruction in either the horizontal or conical surface in each quadrant of the Part 77 survey area as defined by the meridian and parallel intersecting at the airport reference point (refer to Appendix 2, Section 2-1, to compute the airport reference point).

16-5-2. Area Limit Obstruction Requirements

An obstruction must be represented within the limits of each obstructing area to be compiled on the AOC. This representation must include the following:

(1). The highest obstruction within each obstructing area.

(2). The highest obstruction within that portion of an obstructing area that penetrates an approach surface.

(3). The highest obstruction within that portion of an obstructing area that penetrates a primary surface.

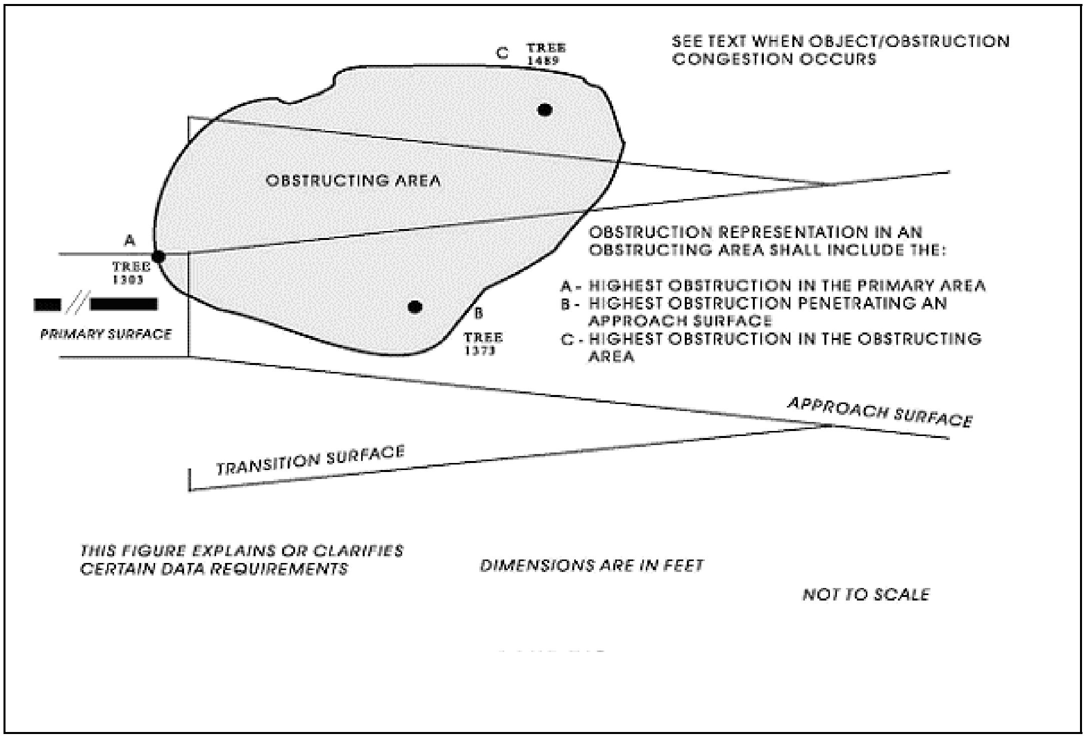


Figure 3-36: Illustrates the requirements for obstructing areas for approach, primary, and horizontal surfaces

16-5-3. Density Selection

In some cases, strict adherence to the obstacle selection criteria listed above might result in congestion or inadequate obstruction representation. To minimize these situations, the following guidelines must be followed in obstacle selection:

(1). If obstacles that are required in the primary area or first 10,000 feet of an approach area are located within 100 feet of each other, the lower obstacle may be omitted.

(2). If obstacles that are required outside the primary or first 10,000 of an approach area are located within 500 feet of each other, the lower obstacle may be omitted. (Note: Required primary or approach obstacles must not be omitted because of the close proximity of higher obstacles outside of the primary or approach areas).

(3). When a required obstacle is omitted because of congestion, a replacement obstacle/obstacles must be selected, if possible, that meets the spacing criteria.

(4). Occasionally, additional obstruction information may be useful in representing certain obstructing conditions. While a rigorous selection criterion is not practical, information useful to obstruction clearing activities should be considered in the selection.

16-6. AIRPORT OBSTRUCTION CHECKLIST

The surveyor will complete an Airport Obstruction Chart checklist (refer to Appendix 2, Section 2-2, Recommended Data Collection Forms) to ensure the require selection criteria above are as a minimum the minimum are met to satisfy the requirements in these General Specifications. The Airport Obstruction Checklist will be generated by the surveyor in the field as a guide to ensure the required areas were analyzed before leaving the field. The AOC checklist (refer to, is provided as a project deliverable to show that the analysis and requirements for each of the zones was completed.

CHAPTER 17.FINAL PROJECT REPORT

A Final Project Report must be delivered after the data has been collected and processed. Describe any changes from the submitted Survey and Quality Control Plan. The following describes the content and format of the report:

17-1. INTRODUCTION

(1). Airport Obstruction Chart (AL/AOC) number. Request this information from the FAA Airport Surveying–GIS Program Manager.
(2). Location Identifier (LID)
(3). Name of airport
(4). City
(5). State
(6). Contractor point of contact, including name, company name, address, telephone number, email
(7). Details of the Statement of Work
(8). Start and end dates of project

17-2. CONDITIONS AFFECTING PROGRESS

Discuss any equipment failures, weather, scope of project, site accessibility, reconnaissance, and/or any other problems affecting progress.

17-3. REMOTE SENSING WORK

(1). Chronology: Provide a brief description of the progression of the work.
(2). Remote Sensing Methodology: Provide a brief summary and details of any changes from information included in the Survey and Quality Control Plan.
(3). Imagery and Datums: Report on the type of imagery that was used and the method used to reference the horizontal and vertical control.
(4). Data Collection: Report on the methods and types of features collected by remote sensing. Include the accuracy of the imagery and the software used with version numbers.
(5). Obstacles: Report on the obstacles that were collected to satisfy the requirements listed in Part 3, Paragraph 16-5, Obstacle Selection. Refer to the obstruction checklist in Appendix 2, Section 2-2.
(6). Unusual Circumstances: Describe unusual circumstances; explain how and why special methods and/or procedures were followed.

17-4. FIELD WORK

(1). Chronology: Provide a brief description of the progression of the work.
(2). Interviews with Airport Officials: Provide a brief summary of all meetings with airport officials (refer to Part 1, Paragraph 8-5, Interviews).

(3). Reconnaissance: Provide a listing of NOAA survey marks recovered and those not recovered. Provide a listing of any new marks set. Include descriptions of any airport changes found, such as a new NAVAID (refer to Part 1, Paragraph 8-6, Reconnaissance).

(4). Instrumentation: Provide a listing of equipment used in the survey, including model and serial numbers, and maintenance reports.

(5). Survey Methodology: Provide a brief summary and details of any changes from information included in the Survey and Quality Control Plan. List horizontal and vertical datums used and published dates of NGS survey control.

(6). Survey Work: Provide general discussion and details of any problems:

- (a). List runways where obstructions were determined/evaluated.
- (b). Discuss PACS, SACS, and any other previous control used.
- (c). Discuss runway profiling and include, at minimum, the following:
  - (i). Profile method.
  - (ii). Any problems with runway length.
  - (iii). Discussions with manager.
  - (iv). Any changes.
  - (v). Whether authorities agreed (or disagreed) with runway dimensions surveyed.
- (d). Discuss NAVAIDs: Include, at least, statement that all NAVAIDs were surveyed and descriptions of any new NAVAIDs. State any changes to NAVAIDs. For example, list NAVAIDs that are new and commissioned, new and not commissioned (estimated date to be commissioned), decommissioned, or to be decommissioned (estimated date). State the source of information.
- (e). Discuss Obstructions: State whether this was a new or revision survey, whether all obstructions included in the Exchange File were verified or marked for deletion, whether additional obstructions were determined in all specified surfaces as necessary, and if there were any other changes. Make a definitive statement that all OISs were inspected and the required data was submitted.
- (f). Advisory Information: Identify photographs containing airport features. Discuss changes to the airport since the date of photography and the photograph showing the change. Make a definitive statement that photography (with any annotations) is current and accurately depicts airport features (when applicable) and that any clearing or topping of trees/grading of obstructing ground that has occurred since the date of photography.

17-5. DATA PROCESSING

(1). Hardware

(2). Software

(3). Methodologies

(4). Quality Reviews: Provide a brief summary of methods used to help ensure high quality data and details of any changes from the Survey and Quality Control Plan. List all problems found and discuss corrective action taken.

(5). File Naming Convention
(6). File Formats and Medium

17-6. ANALYSIS OF RESULTS

Discuss the results, especially any unusual circumstances or problems, any deviation from the Statement of Work, and/or any results that exceed specifications, including those already reported in weekly email status reports.

17-7. RECOMMENDATIONS

Include any suggestions for improving future work.

17-8. SIGNATURE BLOCK

The contractor’s signature is required to indicate concurrence that all requirements have been met.

17-9. ANNEXES

The following annexes are required to be submitted in the Final Project Report.

- Annex 1, Airport Survey Diagrams: A map showing the outline of the runways and the survey network at the airport with GPS vectors and angles and distances observed.

CHAPTER 18. DELIVERABLES

The following must be delivered to the FAA Airport Surveying–GIS Program Manager and the Airport Authority:

18-1. LABOR, EQUIPMENT, ETC.

The contractor will provide all labor, equipment, supplies, and materials to produce and deliver the products as required under these General Specifications.

18-2. SURVEYS AND QUALITY CONTROL PLAN

Before any field work begins, the contractor will submit to NGS OC, a Survey and Quality Control Plan covering all work (refer to Part 1, Chapter 5). NGS will review this plan as soon as possible and respond with an approval or comment letter (or email) as soon as possible, normally within 5 working days. Field work will begin after the contractor receives the approval letter (or email).

18-3. PROJECT STATUS REPORTS

The contractor will submit project status reports via email to the airport authority, FAA Airport Surveying–GIS Program Manager and Airport Authority/FAA POCs every week until the work is complete. These reports should be brief and contain the current information in the text of the email.

18-4. FINAL PROJECT REPORT

Submit a Final Project Report covering the Airport Obstruction Chart survey (refer to Part 3, Paragraph 18-4, Final Project Report). For each airport, the contractor will submit a Final Project Report summarizing the work performed under these General Specifications and the Statement of Work (SOW), including the survey methodologies used to perform the work and a description and analysis of the quality control performed (refer to Part 1, Chapter 5, Survey and Quality Control Plan), description of the recovered/established geodetic control (Part 1, Paragraph 8-6, Reconnaissance), and discussion of any unusual circumstances, discrepancies, and deviations from these General Specifications or the SOW.

18-5. DIGITAL FILES

The contractor will submit all original and final data in digital files used in the computation and analysis of the data in a compressed (zipped) archive file along with the submission of the data in a geospatial vector format. Submit these files to the Airport Surveying-GIS web site. The files are used by NGS to recreate and verify the survey data provided by the surveyor. . This zipped data archive file must include the following files in addition to any file containing data related to the survey:

(1). Data logger output:
- (a). Observation Logs (both Raw Observations and Direct Edits)
- (b). Obstruction Zone Analysis
- (c). AOC Checklists
- (d). ASCII Input Files (such as GPS files)

(2). Additional files to be included in the zip file:
- (a). Any electronic files containing data related to a survey project (charts, checklists, notes, etc.)
- (b). Field sketches, diagrams, and plans in PDF:
    - (i). New runway end point or new runway, displaced threshold, or stopway
    - (ii). New taxi area
    - (iii). New ramp area
    - (iv). All off-field electronic NAVAIDs
    - (v). Photo reference point
    - (vi). Graphics of the runway profile points (two runs – digital file)
    - (vii). Sketch (distance from the starting end) showing the locations of the profile points (digital file)
- (c). Digital images from hand-held camera:
    - (i). New runway end point, displaced threshold, and stopways
    - (ii). NAVAIDs
- (d). Raw GPS Observation files:
    - (i). Submit original raw GPS data files in both the manufactures download format and in RINEX II format
    - (ii). Binary files containing ionosphere modeling information
- (e). Final processed data files with format:
    - (i). If GPS, include vector reduction and adjustment files

(ii). All files necessary to recreate the project must be included

(f). Geospatial Vector Files

18-6. TRANSMITTAL LETTER

In the data submission package, the contractor will include a transmittal letter listing all items submitted to NGS. One copy of the transmittal letter must be forwarded to NGS, one copy to the FAA Airport Surveying–GIS Program Manager and one with the deliverables package to the airport authority.

Appendix 1 – Additional References, Glossary and Contractions

Section 1-1: References and Project Materials to Review

The contractor must become thoroughly familiar with each of the following documents and guidance.

A. The requirements in these General Specifications and attachments.

B. DOT/FAA AC 150/5300-16, General Guidance and Specifications for Aeronautical Surveys - Establishment of Geodetic Control and Submission to the National Geodetic Survey, http://www.faa.gov/airports_airtraffic/airports/resources/advisory_circulars/

C. DOT/FAA AC 150/5300-17, General Specifications and guidance for Aeronautical Surveys - Airport Imagery Acquisition and Submission to the National Geodetic Survey, http://www.faa.gov/airports_airtraffic/airports/resources/advisory_circulars/

D. Input Formats and Specifications of the National Geodetic Survey Data Base, The "Blue Book," http://www.ngs.noaa.gov/FGCS/BlueBook/

E. DOT/FAA AC 150/5340-1, Standards for Airport Markings, http://www.faa.gov/airports_airtraffic/airports/resources/advisory_circulars/

F. DOT/FAA AC 150/5210-20, Ground Vehicle Operations on Airports, http://www.faa.gov/airports_airtraffic/airports/resources/advisory_circulars/

G. DOT/FAA Advisory Circular No. 150/5340–18, Standards for Airport Sign Systems, http://www.faa.gov/airports_airtraffic/airports/resources/advisory_circulars/

H. NGS Aeronautical Survey Program. http://www.ngs.noaa.gov/AERO/aero.html

I. FAA Web site for location identifiers: http://www.faa.gov/airports_airtraffic/air_traffic/publications/atpubs/LID/LIDHME.htm

J. FAA Web site for airport managers: http://www.faa.gov/airports_airtraffic/airports/

K. Listing of airports with PACS and SACS and the dates that they were observed is available at: http://www.ngs.noaa.gov/cgi-bin/airports.prl?TYPE=PACSAC

L. Aeronautical Information Manual, Official Guide to Basic Flight Information and ATC Procedures: http://www.faa.gov/airports_airtraffic/air_traffic/publications/ATpubs/AIM/index.htm

APPROPRIATE PAGES FROM U.S. TERMINAL PROCEDURES
U.S. Terminal Procedures are published in 20 loose leaf or perfect bound volumes covering the conterminous U.S., Puerto Rico, and the Virgin Islands. A Change Notice is published at the midpoint between revisions in bound volume format. The latest edition of the U.S. Terminal Procedures can be obtained from FAA Aeronautical chart agents. The Terminal Procedures Publications include:

A. Instrument Approach Procedure (IAP) Charts: IAP charts portray the aeronautical data that is required to execute instrument approaches to airports. Each chart depicts the IAP, all related navigation data, communications information, and an airport sketch. Most procedures are designated for use with a specific electronic NAVAID, such as Instrument Landing System (ILS), Very High Frequency Omnidirectional Range (VOR), Nondirectional Radio Beacon (NDB), etc.

B. Airport Diagrams: Full page airport diagrams are designed to assist in the movement of ground traffic at locations with complex runway/taxiway configurations and provide information for updating geodetic position navigational systems aboard aircraft. (Note: Airport Diagrams are not available for all airports.)

APPROPRIATE PAGES FROM AIRPORT/FACILITY DIRECTORY
The Airport/Facility Directory is a manual that contains data on public use and joint use airports, seaplane bases, heliports, VFR airport sketches, NAVAIDS, communications data, weather data sources, airspace, special notices, and operational procedures. The Airport/Facility Directory includes data that cannot be readily depicted in graphic form: e.g., airport hours of operation, types of fuel available, runway data, lighting codes, etc. The Airport/Facility Directory is published every 56 days by the National Aeronautical Charting Office, FAA. The latest edition of the Airport/Facility Directory can be obtained from FAA Aeronautical chart agents.

FAA NATIONAL FLIGHT DATA DIGEST (NFDD)
A daily (except weekends and Federal holidays) publication of flight information appropriate to aeronautical charts, aeronautical publications, Notices to Airmen, or other media serving the purpose of providing operational flight data essential to safe and efficient aircraft operations.

FAA FORM 5010, AIRPORT MASTER RECORD
The FAA Form 5010 is prepared for all public-use airports. This master record contains comprehensive data on airports, including obstacles. Much of the information on FAA Form 5010 comes from unverified sources. Often, obstacle heights and positions are estimates that have not been measured and verified by instruments. For these reasons, the Airport Master Record is to be consulted for information purposes only.

Section 1-2: Glossary

Accuracy - The degree of conformity with a standard, or a value accepted as correct. Precision is the degree of uniformity of repeated measurements or events. For example, repeat measurements of the distance between two points may exhibit a high degree of precision by virtue of the relative uniformity of the measurements. However, if a "short" tape were used in the measurements, accuracy would be poor in that the measured distance would not conform to the true distance between the points. Surveying and mapping accuracy standards should include three elements: (1) a stated variation from a true value or a value accepted as correct, (2) the point to which the new value is relative, and (3) the probability that the new value will be within the stated variation. For example, "Horizontal accuracy will be 10 cm relative to the nearest Continuously Operating Reference Station (CORS) at the 95 percent confidence level."

Abeam Point - The point on a line that is nearest to an off line point. For example, a point on the runway centerline is "abeam" the Glide Slope Antenna when the distance from the centerline point to the antenna is a minimum.

Accelerate-Stop Distance Available - (ASDA) The runway plus stopway length declared available and suitable for the acceleration and deceleration of an airplane aborting a takeoff.

Aeronautical Beacon – A visual navigational aid displaying flashes of white and/or colored light to indicate the location of an airport, a heliport, a landmark, a certain point of a federal airway in mountainous terrain, or an obstruction. (refer to Airport Rotating Beacon under Airport Lighting.)

Air Navigation Facility - Any facility used in, available for use in, or designed for use in, aid of air navigation, including landing areas, lights, any apparatus or equipment for disseminating weather information, for signaling, for radio-directional finding, or for radio or other electrical communication, and any other structure or mechanism having a similar purpose for guiding or controlling flight in the air or the landing and takeoff of aircraft. (refer to Navigational Aid.)

Airport - An area on land or water that is used or intended to be used for the landing and takeoff of aircraft and includes its buildings and facilities, if any.

Airport Elevation - The highest point of an airport's usable runways measured in feet from mean sea level (technically, from the vertical datum.)

Airport Lighting - Various lighting aids that may be installed on an airport. Types of airport lighting include:

- ***Airport Rotating Beacon (APBN)*** - A visual navigational aid operated at many airports. At civil airports, alternating white and green flashes indicate the location of the airport. At military airports, the beacons flash alternately white and green, but are differentiated from civil beacons by dualpeaked (two quick) white flashes between the green flashes.

- ***Approach Light System (ALS)*** - An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams in a directional pattern by which the pilot aligns the aircraft with the extended centerline of the runway on his final approach for landing. Condenser-Discharge Sequential Flashing Lights/Sequenced Flashing Lights may be installed in conjunction with the ALS at some airports.

- ***Omnidirectional Approach Light System (ODALS)*** - Seven omnidirectional flashing lights located in the approach area of a nonprecision approach. Five lights are located on the runway centerline extended with the first light located 300 feet from the threshold and extending at equal intervals up to 1,500 feet from the threshold. The other two lights are located, one on each side of the runway threshold, at a lateral distance of 40 feet from the runway edge, or 75 feet from the runway edge when installed on a runway equipped with a VASI.

- ***Precision Approach Path Indicator (PAPI)*** - A visual approach slope indicator normally consisting of light units similar to the VASI but in a single row of either two or four light units set perpendicular to the runway centerline. The row of light units is normally installed on the left side of the runway. Indications are as follows: Below glide path – all lights red; Slightly below glide path -three lights closest to runway red, other light white; On glide path - two lights closest to runway red, other two lights white; Slightly above glide path - light closest to runway red, other three lights white; Above glide path - all lights white.

- ***Pulsating Visual Approach Slope Indicator (PVASI)*** - A pulsating visual approach slope indicator normally consists of a single light unit projecting a two-color visual approach path into the final approach area of the runway upon which the indicator is installed. The on glide path indication is a steady white light. The slightly below glide path indication is a steady red light. If the aircraft descends further below the glide path, the red light starts to pulsate. The above glide path indication is a pulsating white light. The pulsating rate increases as the aircraft gets further above or below the desired glide slope.

- ***Runway Alignment Indicator Lights (RAIL)*** - Sequenced Flashing Lights that are installed only in combination with other light systems.

- ***Runway End Identifier Lights (REIL)*** - Two Synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification of the approach end of a particular runway.

- ***Threshold Lights –*** Fixed green lights arranged symmetrically left and right of the runway centerline identifying the runway end. When all light units are located outside the runway edge, or runway edge extended, the runway end lights are considered to be “outboard.” If any light unit is located inside the runway edge, or runway edge extended, the lights are considered to be “inboard.”

- ***Tri-Color Visual Approach Slope Indicator (TRVC)*** - A visual approach slope indicator normally consists of a single light unit projecting a three-color visual approach path into the final approach area of the runway upon which the indicator is installed. The below glide path indication is red, the above glide path indication is amber, and the on glide path indication is green.

- ***Visual Approach Slope Indicator (VASI)*** - An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot is ""on path" if he sees red/white, "above path" if white/white, and "below path" if red/red. Some airports serving large aircraft have three-bar VASIs which provide two visual glide paths to the same runway.

Airport Reference Point (ARP) - The approximate geometric center of all usable runways. ARP is not monumented, therefore not recoverable on the ground.

Airport Surface Detection Equipment (ASDE) - Radar equipment specifically designed to detect all principal features on the surface of an airport, including aircraft and vehicular traffic, and to present the entire image on a radar indicator console in the control tower. This is used to augment visual observation by tower personnel of aircraft and/or vehicular movements on the runways and taxiways.

Airport Surveillance Radar (ASR) - Approach control radar used to detect and display an aircraft's position in the terminal area. ASR provides range and azimuth information but does not provide elevation data. Coverage of the ASR can extend up to 60 nautical miles.

Air Route Surveillance Radar (ARSR) - Air route traffic control center (ARTCC) radar used primarily to detect and display an aircraft's position while en route between terminal areas.

Air Route Traffic Control Center (ARTCC) - A facility established to provide air traffic control service to aircraft operating on IFR flight plans within controlled airspace and principally during the en route phase of flight. When equipment and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft.

Apparent Runway/Stopway Surface (ARS) – The surface that approximates a runway or stopway before the surface is squared off, shortened to good pavement, or otherwise adjusted to meet the criteria of a runway or stopway.

Apron - A defined area on an airport or heliport intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking, or maintenance. With regard to seaplanes, a ramp is used for access to the apron from the water.

Area Navigation - A method of navigation that permits aircraft operation on any desired course within the coverage of station-referenced navigational signals or within the limits of a self-contained system capability. Area navigation systems include GPS, Inertial, and LORAN-C.

Area Navigation Approach (ANA) - An instrument approach procedure using an Area Navigation System.

Attributes or Attribute Data - are alphabetical and/or numeric information that describes particular characteristics of a geospatial feature, such as its type, dimensions, usage, occupant, etc.

Azimuth

- ***Astronomic Azimuth*** - At the point of observation, the angle measured from the vertical plane through the celestial pole and the vertical plane through the observed object. The astronomic azimuth is established directly from observations on a celestial body and is measured in the plane of the horizon. Astronomic azimuths differ from geodetic azimuths because of the deflection of the vertical, which can be greater than one minute of arc in extreme cases. Astronomic azimuths may be reckoned clockwise or counter-clockwise, from either north or south, as established by convention.

- ***Geodetic*** - The angle at point A between the tangent to the meridian at A and the tangent to the geodesic from A to B whose geodetic azimuth is wanted. It may be reckoned clockwise from either geodetic north or south as established by convention. Because of earth curvature, the geodetic azimuth from A to B (forward azimuth) differs from the geodetic azimuth from B to A (back azimuth) by other than 180 degrees, except where A and B have the same geodetic longitude or where the geodetic latitude of both points is zero. The geodesic line is the shortest surface distance between two points on the reference ellipsoid. A geodetic meridian is a line on the reference ellipsoid defined by the intersection of the reference ellipsoid and a plane containing the minor axis of that ellipsoid.

- ***Grid*** - The angle in the plane of projection between a straight line and the central meridian of a plane-rectangular coordinate system. Grid azimuths may be reckoned clockwise from either geodetic north or south as established by convention.

- ***Magnetic*** - At the point of observation, the angle between the vertical plane through the observed object and the vertical plane in which a freely suspended symmetrically magnetized needle, influenced by no transient artificial magnetic disturbance, will come to rest. Magnetic azimuths are reckoned clockwise from magnetic north.

Bench Mark - A relatively permanent natural or artificial material object bearing a marked point whose elevation above or below an adopted surface (datum) is known.

Blast Fence - A barrier that is used to divert or dissipate jet or propeller blast.

Blast Pad - A specially prepared surface placed adjacent to the ends of runways to eliminate the erosive effect of the high wind forces produced by airplanes at the beginning of their takeoff rolls.

Catenary - The curve theoretically formed by a perfectly flexible, uniformly dense and thick, inextensible cable suspended from two points. Also a cable suspended between two points having the approximate shape of a catenary.

Clearway - An area beyond the takeoff runway under the control of airport authorities within which terrain or fixed obstacles may not extend above specified limits. These areas may be required for certain turbine-powered operations and the size and upward slope of the clearway will differ depending on when the aircraft was certificated.

Collection - is any combination of data submitted by a provider at a given time.

Compass Locator - A low power, low or medium frequency (L/MF) radio beacon installed at the site of the outer or middle marker of an instrument landing system (ILS). It can be used for navigation at distances of approximately 15 miles or as authorized in the approach procedure.

Control Station - A point on the ground whose position and/or elevation is used as a basis for obtaining positions and/or elevations of other points.

Continuously Operating Reference Station (CORS) - A permanent GPS facility whose GPS receiver continuously provides observables from the GPS satellites, allowing stations occupied temporarily by GPS receivers to be differentially positioned relative to it. CORS are related to the NAD 83 coordinate system at the 1-3 cm level either by being collocated at VLBI sites that were used to define the coordinate system or by being differentially positioned relative to such a collocated GPS station.

Datum - In general, a point, line, surface, or set of values used as a reference. A geodetic datum is a set of constants specifying the coordinate system and reference used for geodetic control (refer to Control Station), i.e. for calculating coordinates of points on the earth. At least eight constants are needed to form a complete datum: three to specify the location of the origin of the coordinate system; three to specify the orientation of the coordinate system; and two to specify the dimensions of the reference ellipsoid. Any point has a unique X, Y, Z datum coordinate which can be transformed into latitude, longitude, and ellipsoid height (height relative to the ellipsoid). A horizontal control datum is a geodetic datum specified by two coordinates (latitude and longitude) on the ellipsoid surface, to which horizontal control points are referenced. A vertical datum is a theoretical equipotential surface with an assigned value of zero to which elevations are referenced. (refer to GEOID).

Datum Tie - The process of determining, through appropriate survey methods, a position (horizontal tie) or elevation (vertical tie) of a new point relative to the position/elevation of a control station with established datum values, such as, a control station in the National Spatial Reference System (NSRS). The new point may be a permanent survey monument. This process ensures that the new point will have the proper relationship to NSRS and to all other points tied to NSRS.

Direction Finder (DF) - A radio receiver equipped with a directional sensing antenna used to take bearings on a radio transmitter. Distance Measuring Equipment (DME) - Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid. DME is usually frequency paired with other navigational aids, such as a VOR or localizer.

Displaced Threshold - A threshold that is located at a point on the runway other than the designated runway end. The displaced area is available for takeoff or rollout of aircraft, but not for landing. A displaced threshold does not mark the end of a runway.

Ellipsoid – Refer to Reference Ellipsoid.

Ellipsoid Height - The distance, taken along the perpendicular to the ellipsoid, between a point and the reference ellipsoid. Ellipsoid heights are positive if the point is above the ellipsoid. Ellipsoid heights are the heights resulting from GPS observations. Ellipsoid height = GEOID Height + Orthometric Height.

Feature - is a manmade or natural object that appears in the real world such as a building, runway, navigational aid or river.

Feature Type - refers to a collection of all features of a given type such as all runways or all buildings. Feature Types are analogous to layers in many GIS applications and are also referred to as Entity Types and Feature Classes in other standards.

Feature Instance -refers to a specific feature such as runway 10/28 at Baltimore Washington International Airport.

Federal Base Network (FBN) - A fundamental reference network of permanently monumented control stations in the United States at a 1 degree x 1 degree nominal spacing, established, maintained, and monitored by the National Geodetic Survey, providing precise latitude, longitude, ellipsoidal height, orthometric height, and gravity values. The FBN is a very precise subset of the National Spatial Reference System.

First Good Pavement (FGP) – The first point on a paved surface through which a perpendicular line to the surface centerline can be constructed to define a runway or stopway end. While this point need not be on the runway/stopway centerline, it must be located so that the resulting runway/stopway surface is rectilinear with full structural integrity to the end. The FGP location is a fundamental factor in establishing runway/stopway length and width.

Flight Path - A line, course, or track along which an aircraft is flying or intended to be flown.

Frangible - A fixture designed to break at a predetermined point when struck by a predetermined force to minimize damage if accidentally struck by an aircraft.

GEOID - The theoretical surface of the earth that coincides everywhere with approximate mean sea-level. The GEOID is an equipotential surface to which, at every point, the plumb line is perpendicular. Because of local disturbances of gravity, the GEOID is irregular in shape.

GEOID Height - The distance, taken along a perpendicular to the reference ellipsoid, between the reference ellipsoid and the GEOID. The GEOID height is positive if the GEOID is above the reference ellipsoid. (GEOID height is negative for the conterminous United States). GEOID Height = Ellipsoidal Height - Orthometric Height.

Geospatial Data, Geospatially Referenced Data or Geospatial Vector Data - Data that identifies the geographic location (2D or 3D coordinates) and characteristics (feature attributes) of natural or constructed features and boundaries on the earth. This information may be derived from remote sensing and surveying technologies. The features are represented by a point, line, or polygon. The position of a point feature is described by a single coordinate pair (or triplet for three dimensional data). The spatial extent of a line feature is described by a string of coordinates of points lying along the line, while the extent of a polygon feature is described by treating its boundary as a line feature. Vector data may be stored in a sequential, a chain node, or a topological data structure.

Global Positioning System (GPS) - A space-based radiopositioning, navigation, and time-transfer system. The system provides highly accurate position and velocity information, and precise time, on a continuous global basis, to an unlimited number of properly equipped users.

Ground Controlled Approach (GCA) - A radar approach system operated from the ground by air traffic control personnel transmitting instructions to the pilot by radio. The approach may be conducted with airport surveillance radar (ASR) only or with both surveillance and precision approach radar (PAR).

Helipad - A small designated area, usually with a prepared surface, on a heliport, airport, landing/takeoff area, apron/ramp, or movement area used for takeoff, landing, or parking of helicopters.

Heliport - An area of land, water, or structure used or intended to be used for the landing and takeoff of helicopters and includes its buildings and facilities if any.

Heliport Reference Point (HRP) - The geographic position of the heliport expressed in latitude and longitude at, (1) the center of the final approach and takeoff (FATO) area or the centroid of multiple FATOs for heliports having visual and nonprecision instrument approach procedures, or (2) the center of the final approach reference area when the heliport has a precision instrument approach.

Horizontal Survey Point - A point that represents the horizontal position of a feature. This point may be located on the feature or located between feature components. For example, the horizontal survey point for a Precision Approach Path Indicator (PAPI) system is the center of the light array which falls between light units.

Inboard/Outboard Lights – Used in reference to runway end and threshold lights. The light configuration is considered “inboard” if the center of any light unit in the light array is located inside the runway edge or edge extended. The light configuration is considered “outboard” if all light centers in the light array are located outside the runway edge or edge extended. In this definition, "light array" includes the lights on both sides of the runway.

Instrument Landing System (ILS) - A precision instrument approach system which normally consists of the following electronic components and visual aids:

Localizer	Middle Marker
Glide Slope	Approach Lighting
Outer Marker	

Instrument Runway - A runway equipped with electronic and visual navigational aids for which a precision or nonprecision approach procedure having straight-in landing minimums have been approved.

International Civil Aviation Organization (ICAO) - A specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport.

Landing Area - Any locality either on land, water, or structure, including airports/heliports, and intermediate landing fields, which is used, or intended to be used, for the landing and takeoff of aircraft whether or not facilities are provided for shelter, servicing, or for receiving or discharging passengers or cargo.

Landing Direction Indicator - A device, usually a tetrahedron, which visually indicates the direction in which landings and takeoffs should be made.

Leveling - The process of determining the difference in elevation between two points. In geodetic leveling, this process results in a vertical distance from a vertical datum.

- ***Direct*** - The determination of differences in elevation by means of a series of horizontal observations on a graduated rod. The leveling instrument maintains a horizontal line of sight through spirit leveling or a compensation mechanism. The rod is observed while it is resting on a point of known elevation (backsight) and then, without disturbing the elevation of the leveling instrument, is observed a second time while resting on the unknown point (foresight). The differential in rod readings is applied to the starting elevation to determine the elevation of the unknown.

- ***Indirect*** - The determination of differences in elevation by means other than differential leveling, such as, trigonometric leveling. In trigonometric leveling, the vertical angle and distance from the instrument to the point of unknown elevation are measured and the difference in elevation between the instrument and the unknown point is then computed using trigonometry.

Local Control - A control station or network of control stations in a local area used for referencing local surveys. Local control may or may not be tied to the National Spatial Reference System (see Control Station).

Localizer (LOC) - The component of an ILS that provides course guidance to the runway.

Localizer Back Course – The course line defined by the localizer signal along the extended centerline of the runway in the opposite direction to the normal localizer approach course (front course.)

Localizer Type Directional Aid (LDA) - A navigational aid used for nonprecision instrument approaches with utility and accuracy comparable to a localizer but which is not part of a complete ILS and is not aligned with the runway.

Long Range Navigation (LORAN) - An electronic navigation system by which hyperbolic lines of position are determined by measuring the difference in the time of reception of synchronized pulse signals from two fixed transmitters. LORAN A operates in the 1750 - 1950 kHz frequency band. LORAN C and D operate in the 100 - 110 kHz frequency band.

Marker Beacon - An electronic navigational facility transmitting a 75 MHz vertical fan or boneshaped radiation pattern to be received by aircraft flying overhead. Marker beacons are identified by their modulation frequency and keying code, and when received by compatible airborne equipment, indicate to the pilot, both aurally and visually, that he is passing over the facility.

- ***Back Course Marker (BCM)* –** When installed, normally indicates the localizer back course final approach fix where approach descent is commenced.

- ***Inner Marker (IM)*** - A marker beacon, used with an ILS Category II precision approach, located between the middle marker and the end of the ILS runway and normally located at the point of designated decision height, normally 100 feet above the touchdown zone elevation, on the ILS Category II approach. It also marks progress during a ILS Category III approach.

- ***Middle Marker (MM)*** - A marker beacon that defines a point along the glideslope of an ILS, normally located at or near the point of decision height for ILS Category I approaches.

- ***Outer Marker (OM*)** - A marker beacon at or near the glideslope intercept altitude of an ILS approach. The outer marker is normally located four to seven miles from the runway threshold on the extended centerline of the runway.

Mean Sea Level (MSL) - The average location of the interface between the ocean and atmosphere, over a period of time sufficiently long so that all random and periodic variations of short duration average to zero.

Metadata - is information about the data itself such as source, accuracy, dates for which the data are valid, and security classification. Metadata is essential in helping users determine the extent on which they can rely on a given data item to make decisions.

Minimum Safe Altitude Warning (MSAW) - A function of the ARTS III computer that aids the controller by alerting him when a tracked Mode C equipped aircraft is below or is predicted by the computer to go below a predetermined minimum safe altitude.

Minimums - Weather condition requirements established for a particular operation or type of operation; e.g., IFR takeoff or landing, alternate airport for IFR flight plans, VFR flight etc.

Missed Approach - A maneuver conducted by a pilot when an instrument approach cannot be completed to a landing.

Movement Area - The runways, taxiways, and other areas of an airport/heliport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports/heliports with a tower, specific approval for entry onto the movement area must be obtained from ATC.

National Airspace System (NAS) - The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations, and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

National Flight Data Center (NFDC) - A facility in Washington, D.C., established by FAA to operate a central aeronautical information service for the collection, validation, and dissemination of aeronautical data in support of the activities of government, industry, and the aviation community. The information is published in the "National Flight Data Digest."

National Flight Data Digest (NFDD) - A daily (except weekends and Federal holidays) publication of flight information appropriate to aeronautical charts, aeronautical publications, Notices to Airmen, or other media serving the purpose of providing operational flight data essential to safe and efficient aircraft operations.

National Spatial Reference System (NSRS) - A network of permanent survey monuments located throughout the United States with accurately determined positions (horizontal network) and/or elevations (vertical network). Gravity values, not always monumented, are also part of NSRS. Responsibility for establishing and maintaining NSRS rests with the National Geodetic Survey under the U.S. Department of Commerce. Current authority is contained in United States Code, Title 33, USC 883a as amended, and specifically defined by Executive Directive, Bureau of the Budget (now Office of Management and Budget) Circular No. A-16 Revised.

Navigable Airspace - Airspace at and above the minimum flight altitude prescribed in the Federal Aviation Regulations, including airspace needed for safe takeoff and landing.

Navigational Aid (NAVAID) - Any visual or electronic device airborne or on the surface which provides point-to-point guidance information or position data to aircraft in flight (refer to Air Navigation Facility)

Nondirectional Beacon (NDB) - An L/MF or UHF radio beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his bearing to or from the radio beacon and "home" or track to or from the station. When the NDB is installed in conjunction with an Instrument Landing System marker, it is normally called a Compass Locator.

Nonprecision Approach Procedure - A standard instrument approach procedure in which no electronic glide slope is provided; e.g., VOR, TACAN, NDB, LOC, ASR, LDS, and SDF approaches.

Notice to Airmen (NOTAM) - A notice containing information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System) the timely knowledge of which is essential to personnel concerned with flight operations.

Obstacle – Any object that has a vertical element to it and may or may not penetrate an obstruction identification surface.

Obstruction - Any object that penetrates an obstruction identification surface.

Obstruction Identification Surface (OIS) - Any imaginary surface authorized by the Federal Aviation Administration to identify obstructions. Any object that penetrates an OIS is an obstruction, by definition.

- ***Specified OIS*** - Any OIS other than a supplemental OIS.

- ***Supplemental OIS*** - An OIS designated by appropriate FAA authorities as a supplemental OIS. A supplemental OIS, when implemented, will normally lie below a specified OIS and is intended to provide additional obstruction information. An object that penetrates a supplemental OIS only is a supplemental obstruction.

Offset NAVAID - A NAVAID used during the final approach segment of a straight in instrument approach and not located on the runway centerline or centerline extended.

Orthometric Height - The distance, taken along the plumb line, between a point and the geoid. Orthometric heights are positive if the point is above the geoid. Orthometric Height = Ellipsoid Height - Geoid Height.

Orthophoto - is an aerial image that has been taken from above (either from and aircraft or a satellite) and has been spatially corrected so that features shown on the photo are displayed in their actual geographic position within a specified range of tolerance.

Outboard Lights - Refer to Inboard/Outboard Lights.

Photogrammetric - refers to the process of creating vector data such as building outlines and elevation contours from stereo imagery, or pairs of images taken of the same location but at different angles.

Positional Accuracy - refers to the difference between a geospatial feature's displayed position and its actual position. Absolute positional accuracy is the difference between a geospatial feature's displayed position and its actual position on the face of the earth. Relative positional accuracy is the difference between a geospatial feature's displayed position and that of other geospatial features in the same data set.

Precision - the smallest separation that can be represented by the method employed to make the positional statement that is the number of units or digits to which a measured or calculated value is expressed and used

Precision Approach Procedure - A standard instrument approach procedure in which an electronic glideslope/glidepath is provided; e.g., GPS, ILS, and PAR approaches.

Precision Approach Radar (PAR) - Radar equipment, in some ATC facilities operated by FAA and/or the military services at joint use civil/military locations and separate military installations to detect and display azimuth, elevation, and range of aircraft on the final approach course to a runway. This equipment may be used to monitor certain nonradar approaches, but is primarily used to conduct a precision instrument approach wherein the controller issues guidance instructions to the pilot based on the aircraft's position in relation to the final approach course (azimuth), glidepath (elevation), and distance (range) from the touchdown point on the runway as displayed on the radar scope.

Primary Airport Control Station (PACS) - A control station established in the vicinity of, and usually on, an airport, and tied directly to the National Spatial Reference System. PACS must be declared PACS by the National Geodetic Survey and must meet the specific siting, construction, and accuracy requirements for PACS.

Progressive Taxi - Precise taxi instructions given to a pilot unfamiliar with the airport or issued in stages as the aircraft proceeds along the taxi route.

Published Data - Data officially issued for distribution to the public.

Radio Detection and Ranging (RADAR) - A device which, by measuring the time interval between transmission and reception of radio pulses and correlating the angular orientation of the radiated antenna beam or beams in azimuth and/or elevation, provides information on range, azimuth, and/or elevation of objects in the path of the transmitted pulse.

- ***Primary Radar*** - A radar system in which a minute portion of a radio pulse transmitted from a site is reflected by an object and then received back at the site for processing and display at an air traffic control facility.

- ***Secondary Radar/Radar Beacon (ATCRBS)*** -A radar system in which the object to be detected is fitted with cooperative equipment in the form of a radio receiver/transmitter (transponder). Radar pulses transmitted from the searching transmitter/receiver (interrogator) site are received in the cooperative equipment and used to trigger a distinctive transmission from the transponder. This reply transmission, rather than a reflected signal, is then received back at the transmitter/receiver site for processing and display at an air traffic control facility.

Radar Approach - An instrument approach procedure which utilizes Precision Approach Radar (PAR) or Airport Surveillance Radar (ASR).

Radio Beacon - Refer to Nondirectional Beacon.

Ramp - Refer to Apron.

Reference Ellipsoid - A geometric figure comprising one component of a geodetic datum, usually determined by rotating an ellipse about its shorter (polar) axis, and used as a surface of reference for geodetic surveys. The reference ellipsoid closely approximates the dimensions of the geoid, with certain ellipsoids fitting the geoid more closely for various areas of the earth. Elevations derived directly from satellite observations are relative to the ellipsoid and are called ellipsoid heights.

Relocated Threshold - A threshold that is located at a point on the runway other than the beginning of the full strength pavement. The area between the former threshold and the relocated threshold is not available for the landing or takeoff of aircraft. Thus, a relocated threshold marks the end of the runway. The precise end is on the landing approach edge of the relocated threshold paint bar. The abandoned runway area may or may not be available for taxiing.

Remote Communications Outlet (RCO) - An unmanned communications facility remotely controlled by air traffic personnel. RCOs serve flight service stations. Remote Transmitter/Receivers (RTR) serve terminal ATC facilities.

Runway - A defined rectangular area on a land airport, prepared for the landing and takeoff run of aircraft along its length. Being exactly rectangular, it excludes narrow, rounded, deteriorated, and irregular ends that are not as wide as the general or overall width of the runway. The runway width is the physical width that extends over the entire length of the rectangle. The runway length does not include blast pad, clearway, or stopway surfaces. Displaced thresholds are included in the physical length. Runways are normally numbered in relation to their magnetic direction rounded off to the nearest 10 degrees: e.g., Runway 10, Runway 25.

Runway Centerline – A line connecting the two opposite runway end points, the line may be physically marked on the surface of the runway.

Runway End Point - The point at the runway end, halfway between the edges of the runway.

Runway Length - The straight line distance between runway end points. This line does not account for surface undulations between points. Official runway lengths are normally computed from runway end coordinates and elevations.

Remote Transmitter/Receiver (RTR) – Refer to Remote Communications Outlet

Schema - is a logical diagram that shows the structure and interrelationships between different feature types of the data standard or model.

Secondary Airport Control Station (SACS) - A control station established in the vicinity of, and usually on, an airport, and tied directly to the Primary Airport Control Station. SACS must be declared SACS by the National Geodetic Survey and must meet the specific sitting, construction, and accuracy requirements for SACS.

Simplified Directional Facility (SDF) - A navigational aid used for nonprecision instrument approaches. The final approach course is similar to that of an ILS localizer except that the SDF course may be offset from the runway, generally not more than 3 degrees, and the course may be wider than the localizer, resulting in a lower degree of accuracy.

Spatial Data - is data that depicts a real world feature such as a road, building or runway on a map. The most basic types of spatial data are points, lines and polygons but spatial data can also include orthophotos and other more complex forms of locational information.

Specially Prepared Hard Surface (SPHS) - A concrete, asphalt, or other paved surface, or an unpaved surface that has been specially treated to stabilize the surface, protect the subsurface, or provide a smoother rolling surface for aircraft. Unpaved SPHSs include compacted gravel, and gravel treated with a stabilizing bituminous material.

State Plane Coordinate System - A series of plane-rectangular coordinate systems established by the U.S. Coast and Geodetic Survey for the entire United States, with a separate system for each state. A mathematical relationship exists between state plane and geodetic coordinates, one being easily transformed into the other. The advantage of the State Plane Coordinate System is that it permits survey computations for small areas to be performed using plane trigonometry (as opposed to more complex spherical trigonometry), while still yielding very nearly the true angles and distances between points.

Stopway - An area beyond the takeoff runway, not narrower than the runway and centered upon the extended centerline of the runway, able to support the airplane during an aborted takeoff, without causing structural damage to the airplane, and designated by the airport authorities for use in decelerating the airplane during an aborted takeoff.

Supplemental Profile Point - A runway/stopway point selected so that a straight line between any two adjacent published runway/stopway points will be no greater than one foot from the runway/stopway surface.

Supporting Feature - A feature, such as a runway number or threshold light set, which does not precisely define a runway/stopway survey point, but provides evidence that the survey point was correctly selected?

Surface Model Library - Surface Model Library (SML) refers to an NGS provided library of functions to create and analyze the mathematical surface models of Obstruction Identification Surfaces (OIS). The SML will be available as a Dynamic Link Library (DLL). NGS will update the SML as needed to reflect changes in the definitions of the OIS.

Survey Point Locator (SPL) - A tangible feature, such as the approach side of a threshold bar, or intangible feature, such as a Trim Line, whose intersection with the runway/stopway centerline defines a survey point.

Take-off Distance Available (TODA) - The length of the take-off run available plus the length of the clearway, if provided.

Take-off Run Available (TORA) - The length of the runway declared available and suitable for the ground run of an airplane take-off.

Tactical Air Navigation (TACAN) - An ultra-high frequency electronic rho-theta air navigational aid which provides suitably equipped aircraft a continuous indication of bearing and distance to the TACAN station.

Taxiway - A defined path established for the taxiing of aircraft from one part of an airport to another.

Tetrahedron - A device normally located on uncontrolled airports and used as a landing direction indicator. The small end of the tetrahedron points in the direction of landing.

Threshold (THLD) - The beginning of that portion of the runway available for landing. A displaced threshold (DTHLD) is a threshold that is located at a point on the runway other than the designated beginning of the runway.

Touchdown Zone (TDZ) - The first 3,000 feet of the runway beginning at the threshold.

Touchdown Zone Elevation (TDZE) - The highest elevation in the Touchdown Zone.

Traffic Pattern – The traffic flow that is prescribed for aircraft landing at, taxiing on or taking off from an airport. The components of a typical traffic pattern are upwind leg, crosswind leg, downwind leg, base leg, and final approach.

Transmissometer (TMOM) - An apparatus used to determine visibility by measuring the transmission of light through the atmosphere. It is the measurement source for determining runway visual range (RVR) and runway visibility value (RVV).

Trim Line – An imaginary line, constructed perpendicular to the runway/stopway centerline, which establishes the location of a runway/stopway end or displaced threshold.

V_1- The takeoff decision speed. If a system failure occurs before V_1, the takeoff is aborted. If the failure occurs at or above V_1, the pilot is committed to continue the takeoff.

Vertical Survey Point - A point that represents the elevation position of a feature. This point may be located on the top or base of the feature or located between feature components. For example, the vertical survey point for a Precision Approach Path Indicator (PAPI) system is the ground at the center of the light array that falls between light units.

Vertical Takeoff and Landing (VTOL) Aircraft - Aircraft capable of vertical climbs and/or descents and of using very short runways or small areas for takeoff and landings. These aircraft include, but are not limited to, helicopters.

Very High Frequency Omnidirectional Range Station (VOR) - A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north.

Very High Frequency Omnidirectional Range/Tactical Air Navigation (VORTAC) - A navigation aid providing VOR azimuth, TACAN azimuth, and TACAN distance measuring equipment (DME) at one site.

Visual Approach - An approach conducted on an instrument flight rules (IFR) flight plan that authorizes the pilot to proceed visually and clear of clouds to the airport. The pilot must, at all times, have either the airport or preceding aircraft in sight.

Visual Glideslope Indicator - A navigational aid that provides vertical visual guidance to aircraft during approach to landing by either radiating a directional pattern of high intensity light into the approach area, or providing lighted or unlighted panels which can be aligned by the pilot, thereby allowing the pilot to determine if the aircraft is above, below, or on the prescribed glidepath. (See Airport Lighting).

Waypoint - A predetermined geographical position used for route/instrument approach definition, or progress reporting purposes, that is defined relative to a VORTAC station or in terms of latitude/longitude coordinates.

Wide Area Augmentation System (WAAS) - The total FAA system designed and built to meet the mission needs of insuring satellite integrity for using GPS for required navigation performance (RNP) in the National Airspace System and of improving accuracy to support precision approaches using GPS augmented with the WAAS.

Section 1-3: Contractions and Word Phrases

The following list presents the approved contractions for data.

WORD/ PHRASE	CONTRACTION
A	
Abandoned	ABND
Above Ground Level	AGL
Accelerate-Stop Distance Available	ASDA
Advisory Circular	AC
Architecture, Engineering and Construction	A/E/C
Aeronautical Information Exchange Model	AIXM
Aeronautical Information Service	AIS
Agricultural	AG
Air Route Surveillance Radar	ARSR
Aircraft	ACFT
Airport	ARPT
Airport Beacon	APBN
Airport District Office	ADO
Airport Facility Directory	AFD
Airport Layout Plan or Airport Location Point	ALP
Airport Obstruction Chart	AOC
Airport Reference Point	ARP
Airport Surface Detection Equipment	ASDE
Airport Surveillance Radar	ASR
Airport Traffic Control Tower	ATCT
Airway Beacon	AWYBN
American Institute of Architects	AIA
American National Standards Institute	ANSI
American Society for Testing and Materials	ASTM
Anemometer	AMOM
Antenna	ANT
Approach	APCH
Approach Light	APP LT
Approach Light System	ALS
Area Navigation Approach	ANA
Arresting Gear	A-GEAR
Automated Flight Service Station	AFSS
Automated Surface Observing System	ASOS
Automatic Weather Observing/Reporting System	AWOS

WORD/ PHRASE	**CONTRACTION**
B	
Back Course Marker	BCM
Bridge	BRDG
Building	BLDG
C	
Centerline	C/L
Ceilometer	CLOM
Chimney	CHY
Closed	CLSD
Common Traffic Advisory Frequency	CTAF
Computer Aided Drafting and Design	CADD
Construction	CONST
Continuously Operating Reference Station	CORS
D	
Design File (MicroStation)	DGN
Department of Defense (U.S.)	DOD
Department of Transportation (U.S.)	DOT
Direction Finder	DF
Displaced Threshold	DTHLD
Distance Measuring Equipment	DME
Distance to Centerline	DCLN
Distance to Runway End	DEND
Distance to Threshold	DTHR
Drawing File (AutoDesk or AutoCAD**)**	DWG
E	
Electrical	ELEC
Elevation	EL
Elevation	ELEV
Ellipsoid	ELLIP
Engine Out Departure	EOD
Equipment	EQUIP
Estimated Maximum Elevation	EME
F	
Fan Marker	FM
Federal Aviation Administration	FAA
Federal Geographic Data Committee	FGDC
Flagpole	FLGPL
Flight Service Station	FSS

WORD/ PHRASE	CONTRACTION
G	
Geographic Information System	GIS
Geographic Markup Language	GML
Glide Slope	GS
Global Positioning System	GPS
Ground	GRD
Ground Control Approach	GCA
H	
Hangar	HGR
Height Above Airport	HAA
Height Above Runway	HAR
Height Above Touchdown	HAT
Heliport Reference Point	HRP
Horizontal	HORZ
Horizontal Survey Point	HSP
I	
Inner Marker	IM
Inoperative	INOP
International Civil Aviation Organization	ICAO
International Organization for Standards	ISO
Instrument Flight Rules	IFR
Instrument Landing System	ILS
Instrument Meteorological Conditions	IMC
International Civil Aviation Organization	ICAO
International Earth Rotation Service Terrestrial Reference Frame	ITRF
Intersection	INTXN
L	
Lead In Lighting System	LDIN
Light	LT
Lighted	LTD
Localizer	LOC
Localizer Type Directional Aid	LDA
Locator Middle Marker	LMM
Locator Outer Marker	LOM

WORD/ PHRASE	**CONTRACTION**
M	
Magnetic Variation	VAR
Mean Sea Level	MSL
Microwave	MCWV
Microwave Landing System	MLS
Microwave Landing System Azimuth Guidance	MLSAZ
Microwave Landing System Elevation Guidance	MLSEL
Middle Marker	MM
Monument	MON
N	
National Airspace System	NAS
National Flight Data Center	NFDC
National Flight Data Digest	NFDD
National Geodetic Survey	NGS
National Geodetic Vertical Datum of 1929	NGVD 29
National Geospatial Intelligence Agency	NGA
National Oceanic and Atmospheric Administration	NOAA
National Ocean Service	NOS
National Spatial Reference System	NSRS
Nautical Mile	NM
Navigational Aid	NAVAID
Nondirectional Radio Beacon	NDB
North American Datum of 1927	NAD 27
North American Datum of 1983	NAD 83
North American Vertical Datum of 1988	NAVD 88
Not Commissioned	NCM
Not to Exceed	NTE
Notice to Airmen	NOTAM
O	
Observation	OBS
Obstruction	OBST
Obstruction Identification Surface	OIS
Obstruction Lighted	OL
Obstruction Light On	OL ON
Omnidirectional Approach Light System	ODALS
Orthometric	ORTHO
Out Of Service	OTS
Outer Marker	OM

WORD/ PHRASE	**CONTRACTION**
P	
Point of Contact	POC
Permanent Survey Mark	PSM
Precision Approach Path Indicator	PAPI
Precision Approach Radar	PAR
Primary Airport Control Station	PACS
Pulsating Visual Approach Slope Indicator	PVASI
R	
Railroad	RR
Radio Technical Commission for Aeronautics	RTCA
Reflector	RFLTR
Relocated	RELCTD
Remote Communications Outlet	RCO
Remote Transmitter/Receiver	RTR
Road	RD
Road (Non-interstate)	RD (N)
Road (Interstate)	RD (I)
Runway	RWY
Runway Alignment Indicator Lights	RAIL
Runway End Identifier Lights	REIL
Runway Visual Range	RVR
S	
Secondary Airport Control Station	SACS
Sensitive Security Information	SSI
Simplified Directional Facility	SDF
Spatial Data Standards for Facilities, Infrastructure and Environment	SDSFIE
Specially Prepared Hard Surface	SPHS
Stack	STK
Standard Instrument Departure	SID
Standard Terminal Arrival	STAR
Standpipe	SPIPE
Stopway	STWY

WORD/ PHRASE	CONTRACTION
T	
Tactical Air Navigation Aid	TACAN
Tank	TK
Taxiway	TWY
Temporary	TMPRY
Threshold	THLD
Take-off Distance Available	TODA
Take-off Run Available	TORA
Touchdown Reflector	TDR
Touchdown Zone	TDZ
Touchdown Zone	Elevation TDZE
Tower	TWR
Transmissometer	TMOM
Transmission Tower	TRMSN TWR
Tri-color Visual Approach Slope Indicator	TRCV
U	
Under Construction	UNC
United States Geological Survey	USGS
Until Further Notice	UFN
V	
Vertical	VERT
Vertical Survey Point	VSP
Very High Frequency Omnidirectional Range	VOR
Visual Approach Slope Indicator	VASI
Visual Flight Rules	VFR
Visual Meteorological Conditions	VMC
VOR/Tactical Air Navigation	VORTAC
W	
Wide Area Augmentation System	WAAS
Wind Direction Indicator	WDI
Wind Tee	WTEE
Wind Tetrahedron	WTET
Windsock	WSK
World Geodetic System of 1984	WGS 84
Z	
Z Marker	ZM

CONTRACTION	**WORD/ PHRASE**
A	
ABND	Abandoned
AC	Advisory Circular
ACFT	Aircraft
ADO	Airport District Office
A/E/C	Architecture/Engineering/Construction
AFD	Airport Facility Directory
AFSS	Automated Flight Service Station
AG	Agricultural
A-GEAR	Arresting Gear
AGL	Above Ground Level
AIA	American Institute of Architects
AIS	Aeronautical Information Service
AIXM	Aeronautical Information Exchange Model
ALP	Airport Location Point
ALS	Approach Light System
AMOM	Anemometer
ANA	Area Navigation Approach
ANSI	American National Standards Institute
ANT	Antenna
AOC	Airport Obstruction Chart
APBN	Airport Beacon
APCH	Approach
APP LT	Approach Light
ARP	Airport Reference Point
ARPT	Airport
ARSR	Air Route Surveillance Radar
ASDA	Accelerate-Stop Distance Available
ASDE	Airport Surface Detection Equipment
ASOS	Automated Surface Observing System
ASR	Airport Surveillance Radar
ASTM	American Society for Testing and Materials
ATCT	Airport Traffic Control Tower
AWOS	Automatic Weather Observing/Reporting System
AWYBN	Airway Beacon

CONTRACTION	WORD/ PHRASE
B	
BCM	Back Course Marker
BLDG	Building
BRDG	Bridge
C	
CADD	Computer Aided Drafting and Design
C/L	Centerline
CHY	Chimney
CLOM	Ceilometer
CLSD	Closed
CONST	Construction
CORS	Continuously Operating Reference Station
CTAF	Common Traffic Advisory Frequency
D	
DCLN	Distance to Centerline
DEND	Distance to Runway End
DF	Direction Finder
DGN	Microstation Design File
DME	Distance Measuring Equipment
DoD	Department of Defense (U.S.)
DOT	Department of Transportation (U.S.)
DTHLD	Displaced Threshold
DTHR	Distance to Threshold
DWG	AutoDesk or AutoCAD Drawing File
E	
EL	Elevation
ELEC	Electrical
ELEV	Elevation
ELLIP	Ellipsoid
EME	Estimated Maximum Elevation
EOD	Engine Out Departure
EQUIP	Equipment
F	
FAA	Federal Aviation Administration
FGDC	Federal Geographic Data Committee
FLGPL	Flagpole
FM	Fan Marker
FSS	Flight Service Station

CONTRACTION	WORD/ PHRASE
G	
GCA	Ground Control Approach
GIS	Geographic Information System
GML	Geographic Markup Language
GPS	Global Positioning System
GRD	Ground
GS	Glide Slope
H	
HAA	Height Above Airport
HAR	Height Above Runway
HAT	Height Above Touchdown
HGR	Hangar
HORZ	Horizontal
HRP	Heliport Reference Point
HSP	Horizontal Survey Point
I	
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IM	Inner Marker
IMC	Instrument Meteorological Conditions
INOP	Inoperative
INTXN	Intersection
ISO	International Standards Organization
ITRF	International Earth Rotation Service Terrestrial Reference Frame
L	
LDIN	Lead In Lighting System
LT	Light
LDA	Localizer Type Directional Aid
LMM	Locator Middle Marker
LOC	Localizer
LOM	Locator Outer Marker
LTD	Lighted

CONTRACTION	WORD/ PHRASE
M	
MCWV	Microwave
MLS	Microwave Landing System
MLSAZ	Microwave Landing System Azimuth
Guidance	
MLSEL	Microwave Landing System Elevation
Guidance	
MM	Middle Marker
MON	Monument
MSL	Mean Sea Level
N	
NAD 27	North American Datum of 1927
NAD 83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
NAVAID	Navigational Aid
NCM	Not Commissioned
NDB	Nondirectional Radio Beacon
NFDC	National Flight Data Center
NFDD	National Flight Data Digest
NGA	National Geospatial Intelligence Agency
NGS	National Geodetic Survey
NGVD 29	National Geodetic Vertical Datum of 1929
NM	Nautical Mile
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NOTAM	Notice to Airmen
NSRS	National Spatial Reference System
NTE	Not to Exceed
O	
OBS	Observation
OBST	Obstruction
ODALS	Omnidirectional Approach Light System
OIS	Obstruction Identification Surface
OL	Obstruction Lighted
OL ON	Obstruction Light On
OM	Outer Marker
ORTHO	Orthometric
OTS	Out Of Service

CONTRACTION	WORD/ PHRASE
P	
PACS	Primary Airport Control Station
PAPI	Precision Approach Path Indicator
PAR	Precision Approach Radar
POC	Point of Contact
PSM	Permanent Survey Mark
PVASI	Pulsating Visual Approach Slope Indicator
R	
RAIL	Runway Alignment Indicator Lights
RCO	Remote Communications Outlet
RD	Road
REIL	Runway End Identifier Lights
RELCTD	Relocated
RFLTR	Reflector
RD (I)	Road (Interstate)
RD (N)	Road (Non-interstate)
RR	Railroad
RTCA	Radio Technical Commission for Aeronautics
RTR	Remote Transmitter/Receiver
RVR	Runway Visual Range
RWY	Runway
S	
SACS	Secondary Airport Control Station
SDF	Simplified Directional Facility
SDSFIE	Spatial Data Standards for Facilities, Infrastructure and Environment
SID	Standard Instrument Departure
SPHS	Specially Prepared Hard Surface
SPIPE	Standpipe
SSI	Sensitive Security Information
STAR	Standard Terminal Arrival
STK	Stack
STWY	Stopway

CONTRACTION	WORD/ PHRASE
T	
TACAN	Tactical Air Navigation Aid
TDR	Touchdown Reflector
TDZ	Touchdown Zone
TDZE	Touchdown Zone Elevation
THLD	Threshold
TK	Tank
TMOM	Transmissometer
TMPRY	Temporary
TODA	Take-off Distance Available
TORA	Take-off Run Available
TRCV	Tri-color Visual Approach Slope Indicator
TRMSN TWR	Transmission Tower
TWR	Tower
TWY	Taxiway
U	
UFN	Until Further Notice
UNC	Under Construction
USGS	United States Geological Survey
V	
VAR	Magnetic Variation
VASI	Visual Approach Slope Indicator
VERT	Vertical
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VOR	Very High Frequency Omnidirectional
Range	
VORTAC	VOR/Tactical Air Navigation
VSP	Vertical Survey Point
W	
WAAS	Wide Area Augmentation System
WDI	Wind Direction Indicator
WGS 84	World Geodetic System of 1984
WSK	Windsock
WTEE	Wind Tee
WTET	Wind Tetrahedron
Z	
ZM	Z Marker