



# **FAR Part 77 - Obstructions to Navigation**

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**CEE 4674**

**Airport Planning and Design**

## Outline of this Presentation



- Obstructions to navigation around airports
- Discussion of FAR Part 77
- Examples
- Status of airports in NAS

## FAR Part 77 Basics



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

## What is the Issue?



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

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

## FAA Reponses



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

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

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

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

Source: FAA Part 77

## Obstructions to Navigation



An object constitutes an obstruction to navigation if:

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

## Obstructions to Navigation



- If penetrates the enroute obstacle clearance area (includes turn and termination areas of federal airways)

## FAR Part 77 Imaginary Surfaces

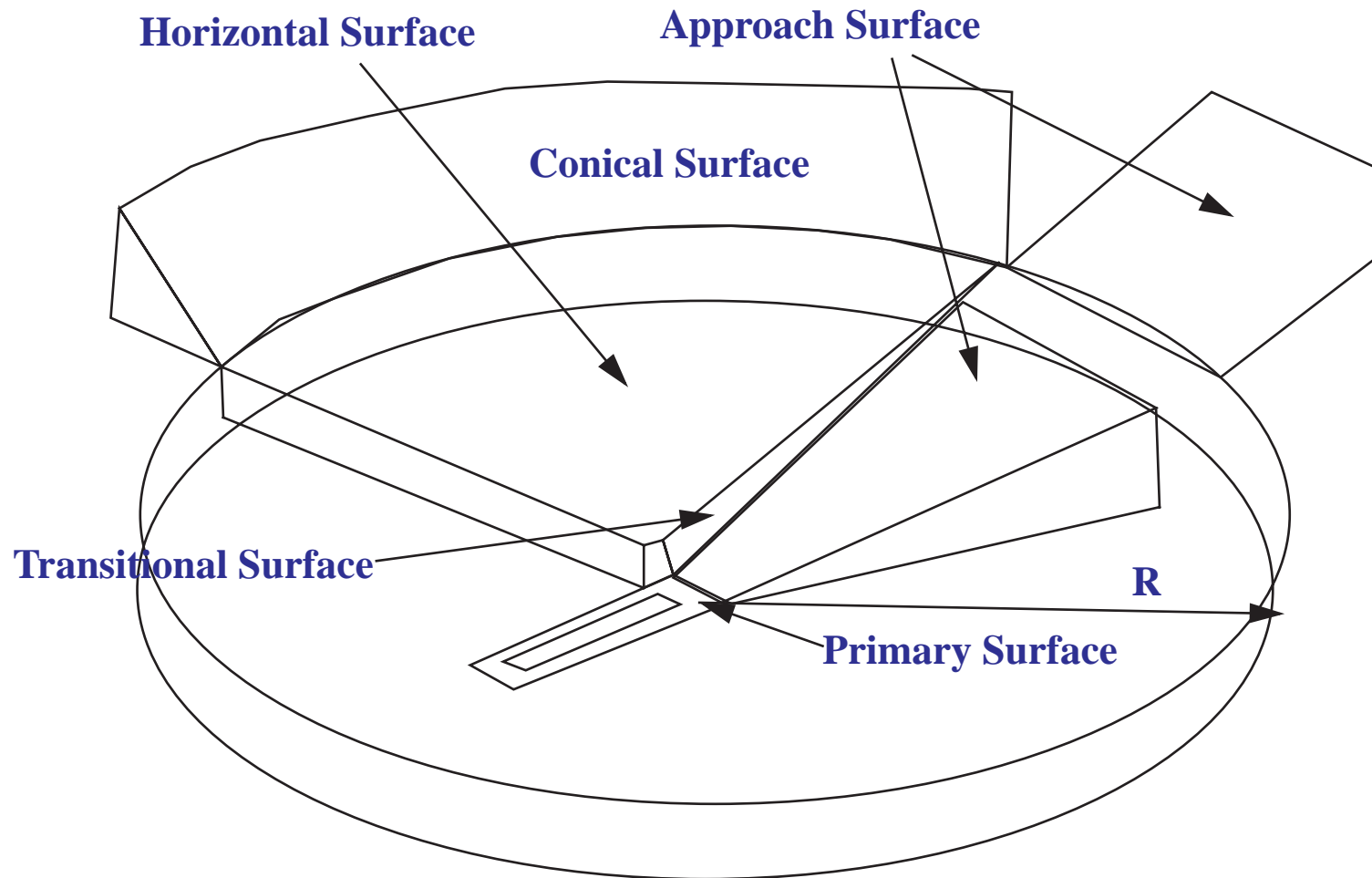


- **Primary** = aligned (longitudinally) with each runway and extends 200 ft. from each runway end
- **Approach** = longitudinally centered with the runway and extends beyond the primary surface
- **Horizontal** = horizontal plane 150 ft. above the established airport elevation. Constructed by swinging arcs around the end of the primary surface
- **Conical** = 20:1 slope surface extending beyond the horizontal surface
- **Transitional** = constructed to join approach and horizontal or approach and transitional surfaces

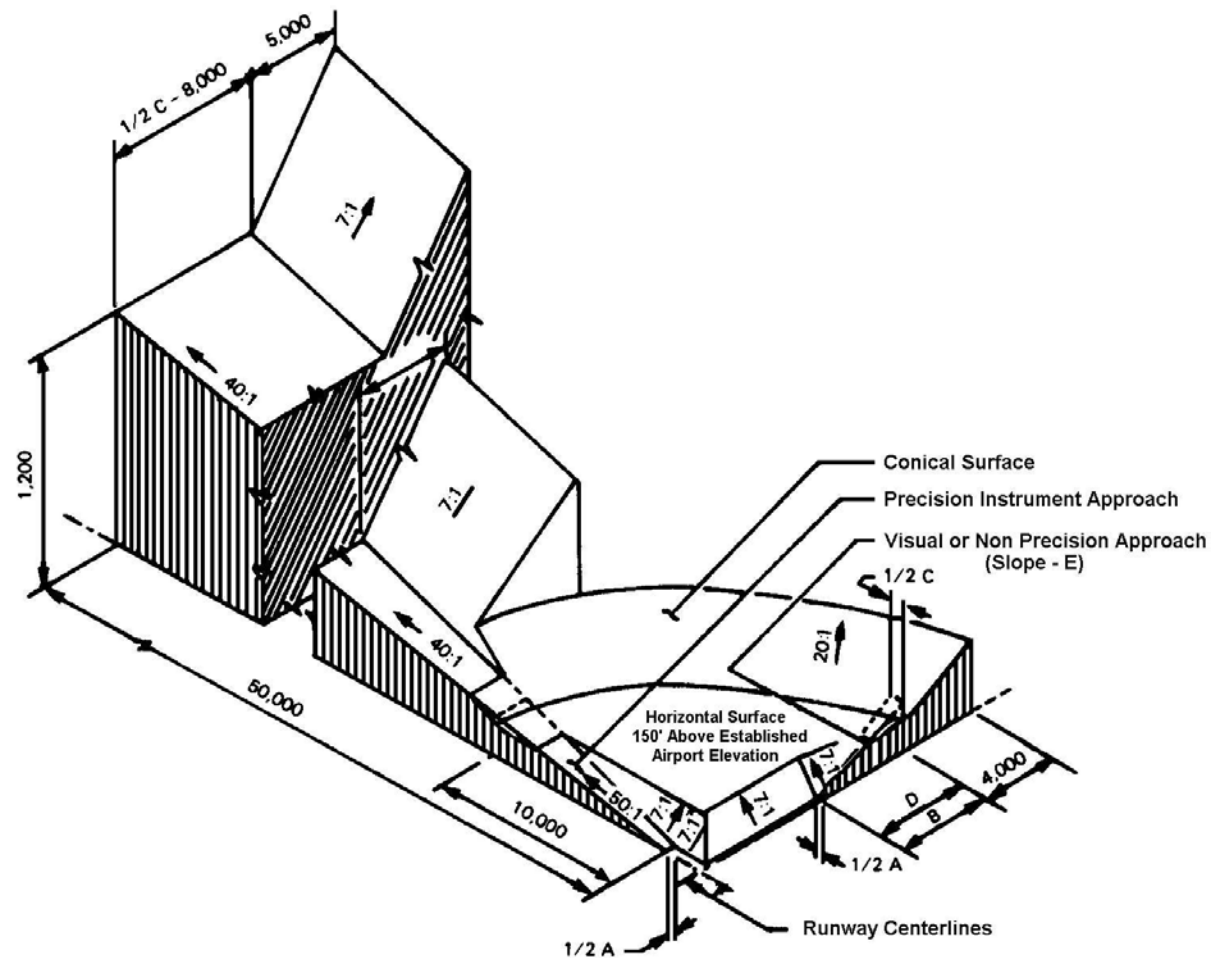




# Graphical Depiction

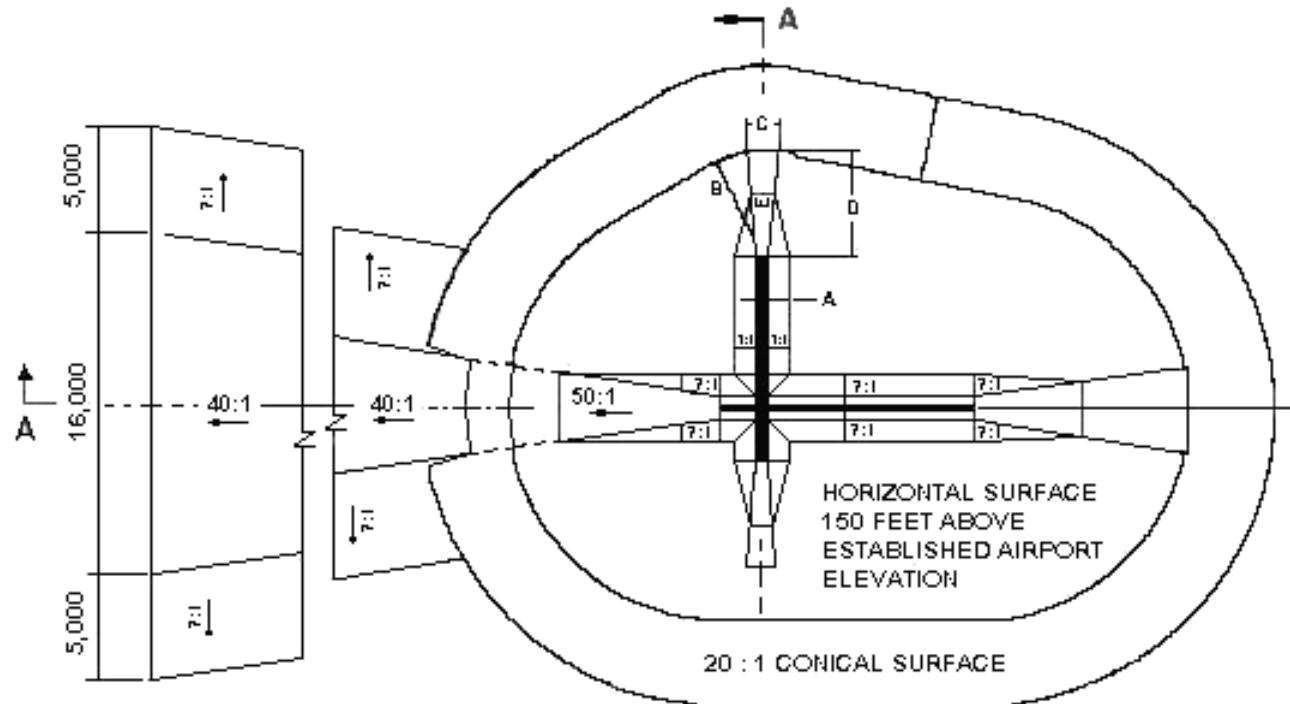


# Imaginary Surfaces



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

# Two-Dimensional Graphical Depiction



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

# Table with FAR 77 Dimensions



## OBSTRUCTION IDENTIFICATION SURFACES FEDERAL AVIATION REGULATIONS PART 77

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

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

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

# FAR Part 77 Imaginary Surfaces



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

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



A = Utility runways

B = Runway larger than utility

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

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

## Runway Displaced Thresholds



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

## Example Problem



The end of a precision runway at San Bernardo Airport is located 3,000 ft. from a newly constructed elevated Light Rail Transit (LRT) line as shown in the Figure.

a) Is the pantograph pole an obstruction to navigation? Explain.

b) Suggest alternatives to use Runway 34 if this one cannot be relocated. Explain the runway length limitations for departures and arrivals to comply with FAR Part 77.

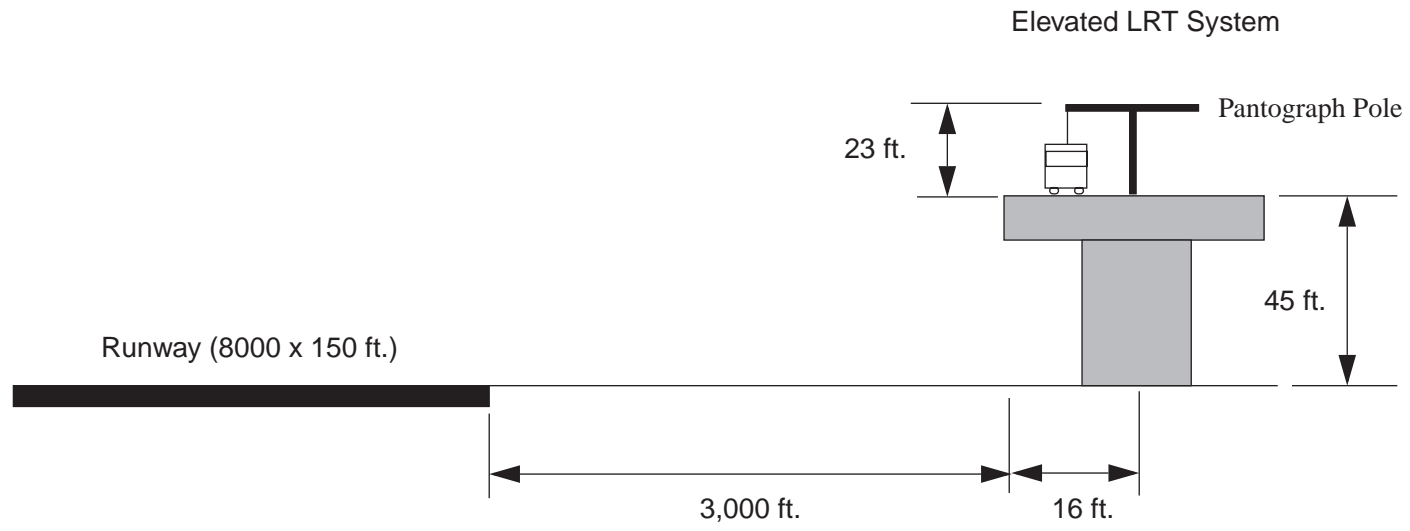
Elevated Freeway Section at San Bernardo Runway 34.



# Sample View of the Problem



**Try it in class!**



NOT TO SCALE

## Studied 2,223 airports in the Eastern United States

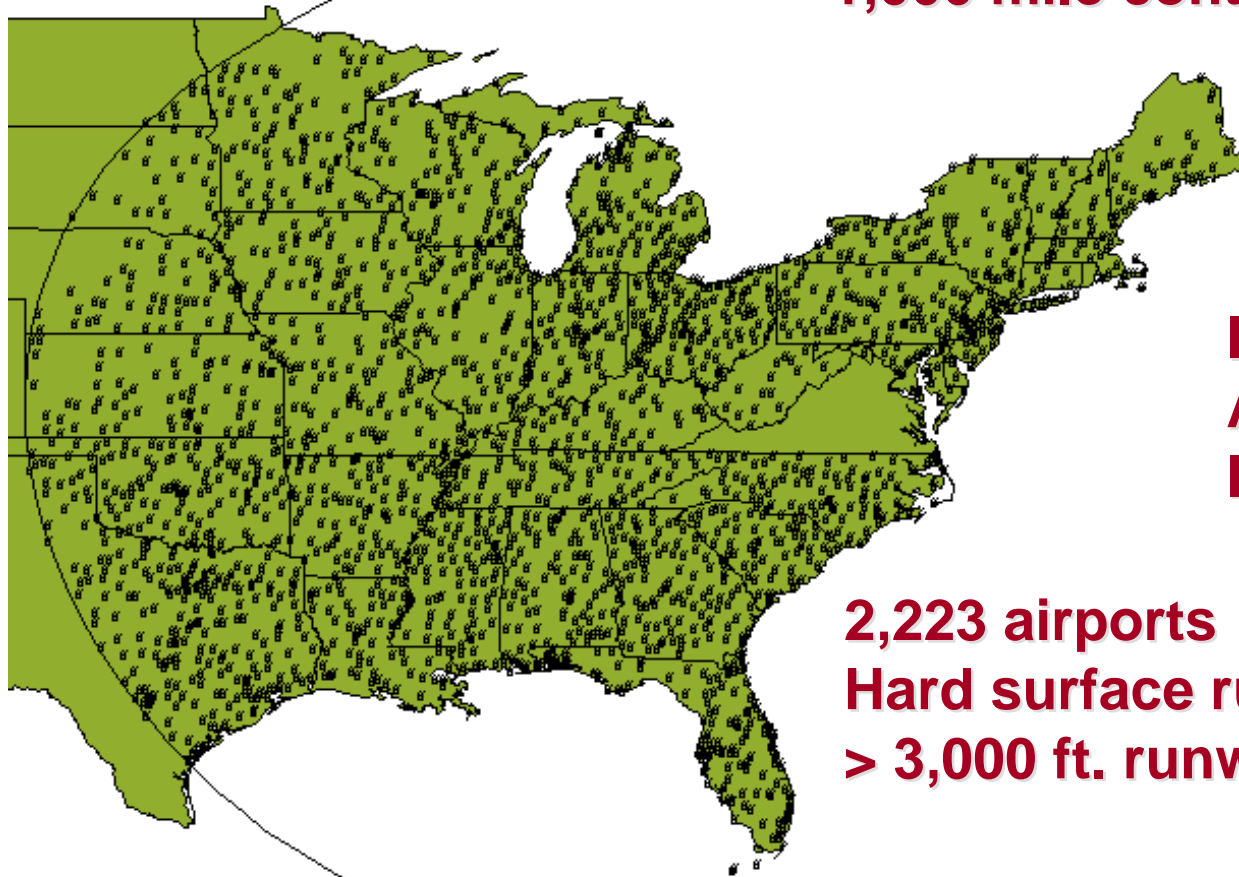


- Studied 2,223 airports in the US.
- Analyzed controlling object for each runway end
- Studied many other characteristics of each runway including their Wide Area Augmentation System qualification surfaces

## Case Study Region



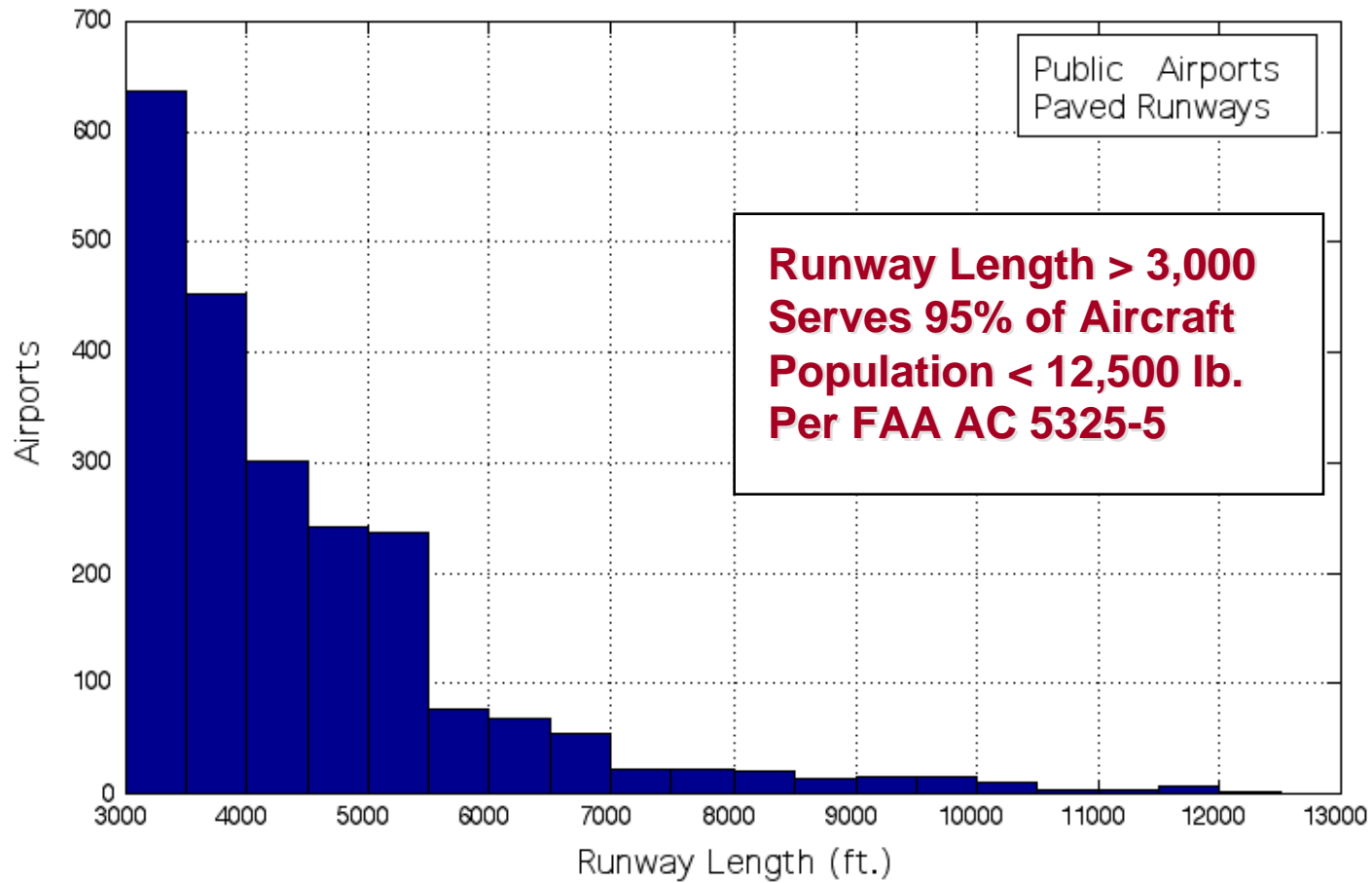
**1,000 mile contour**



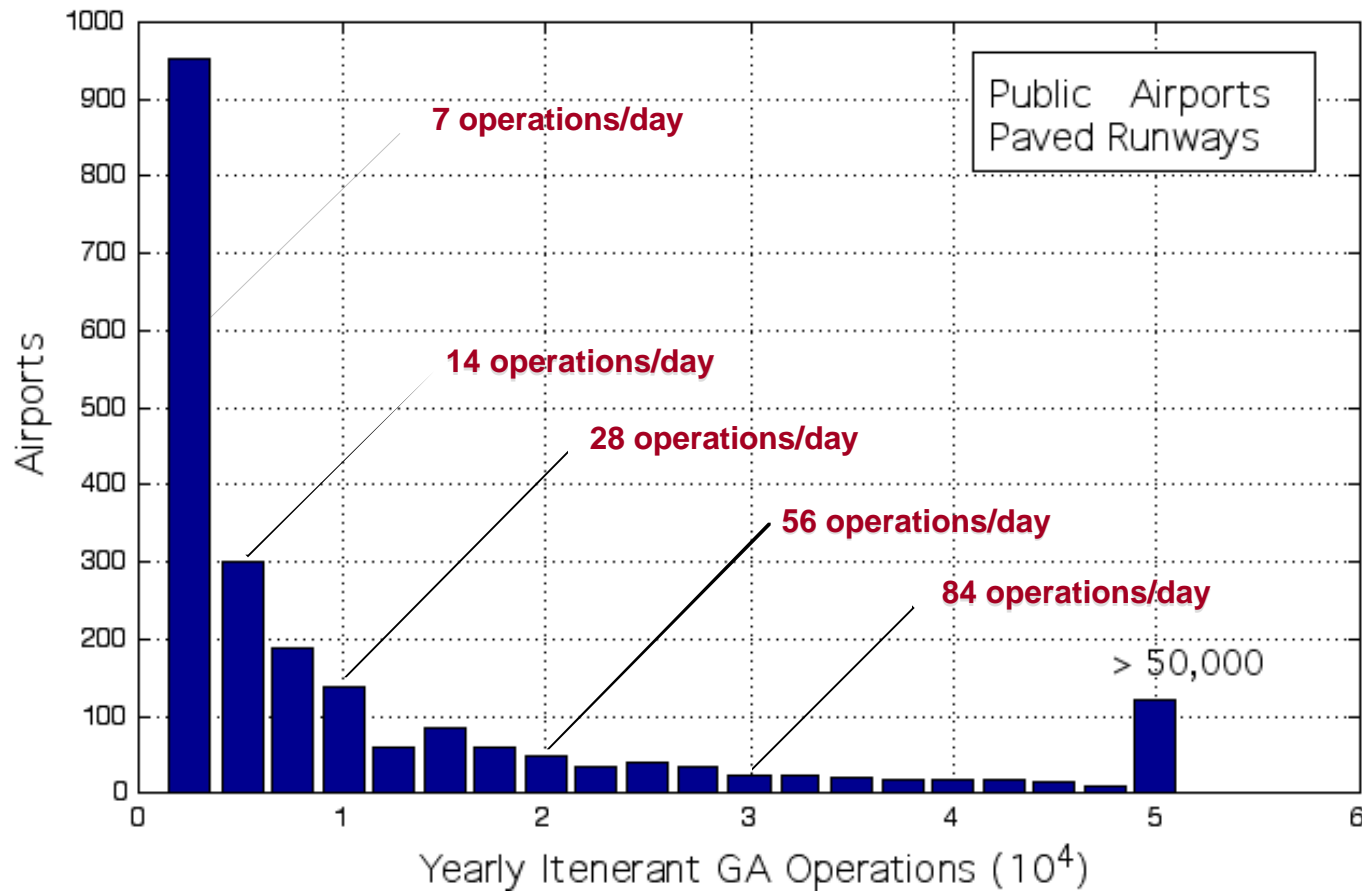
**Includes  
Airports  
In VA**

**2,223 airports  
Hard surface runways  
> 3,000 ft. runway**

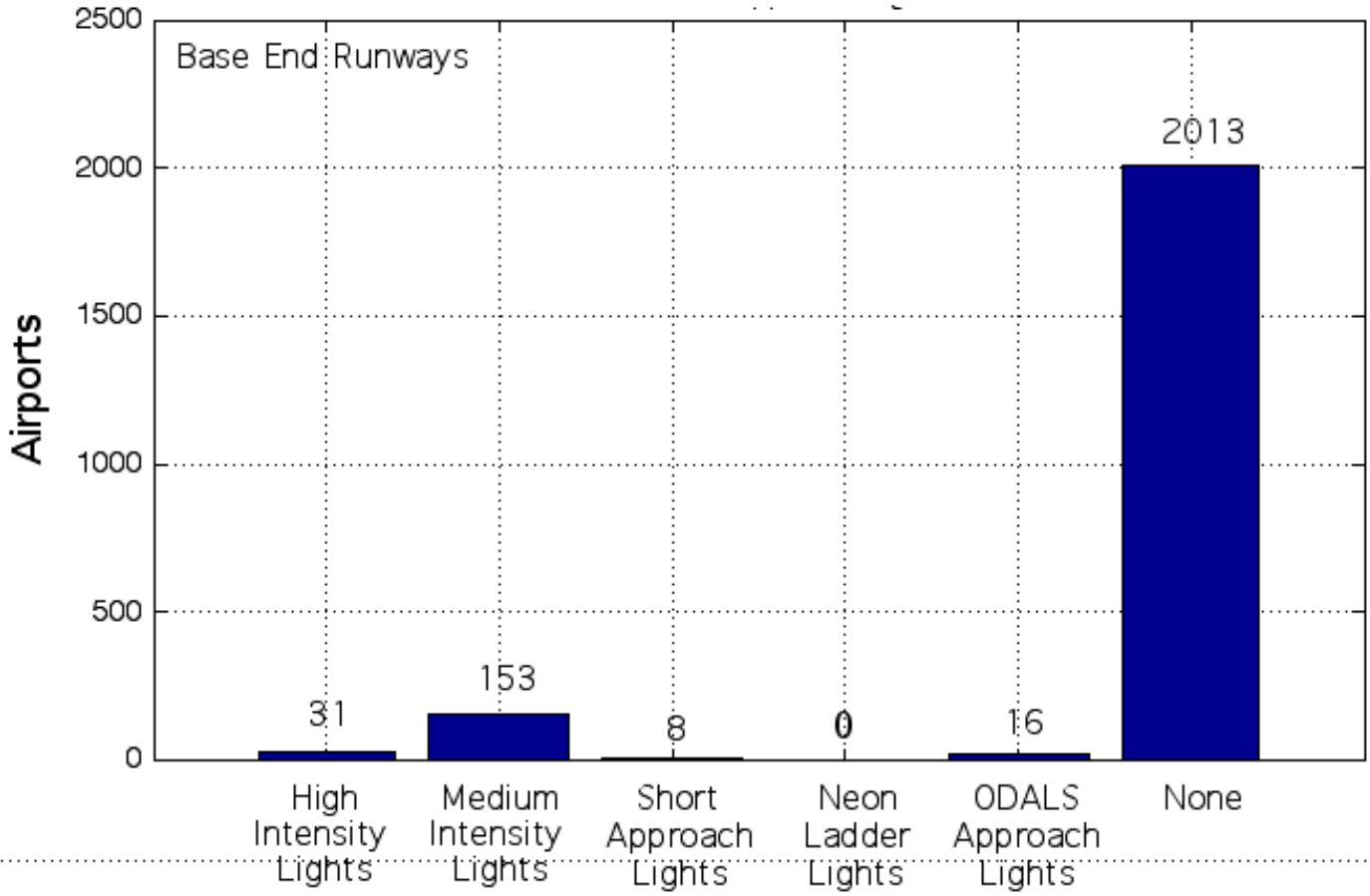
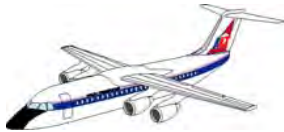
# State of Runway Lengths



# Runway Operations



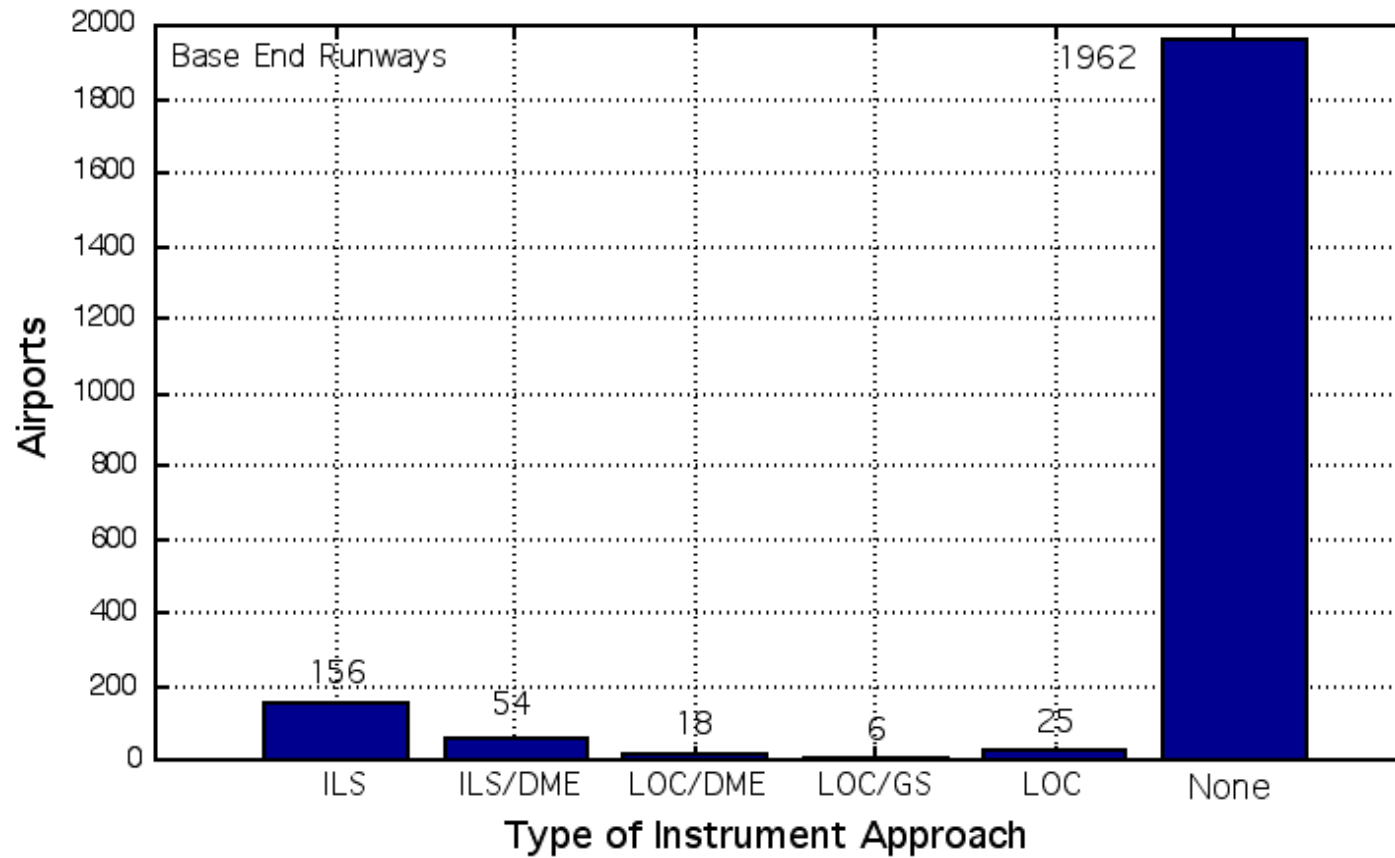
# State of Runway Approach Lights



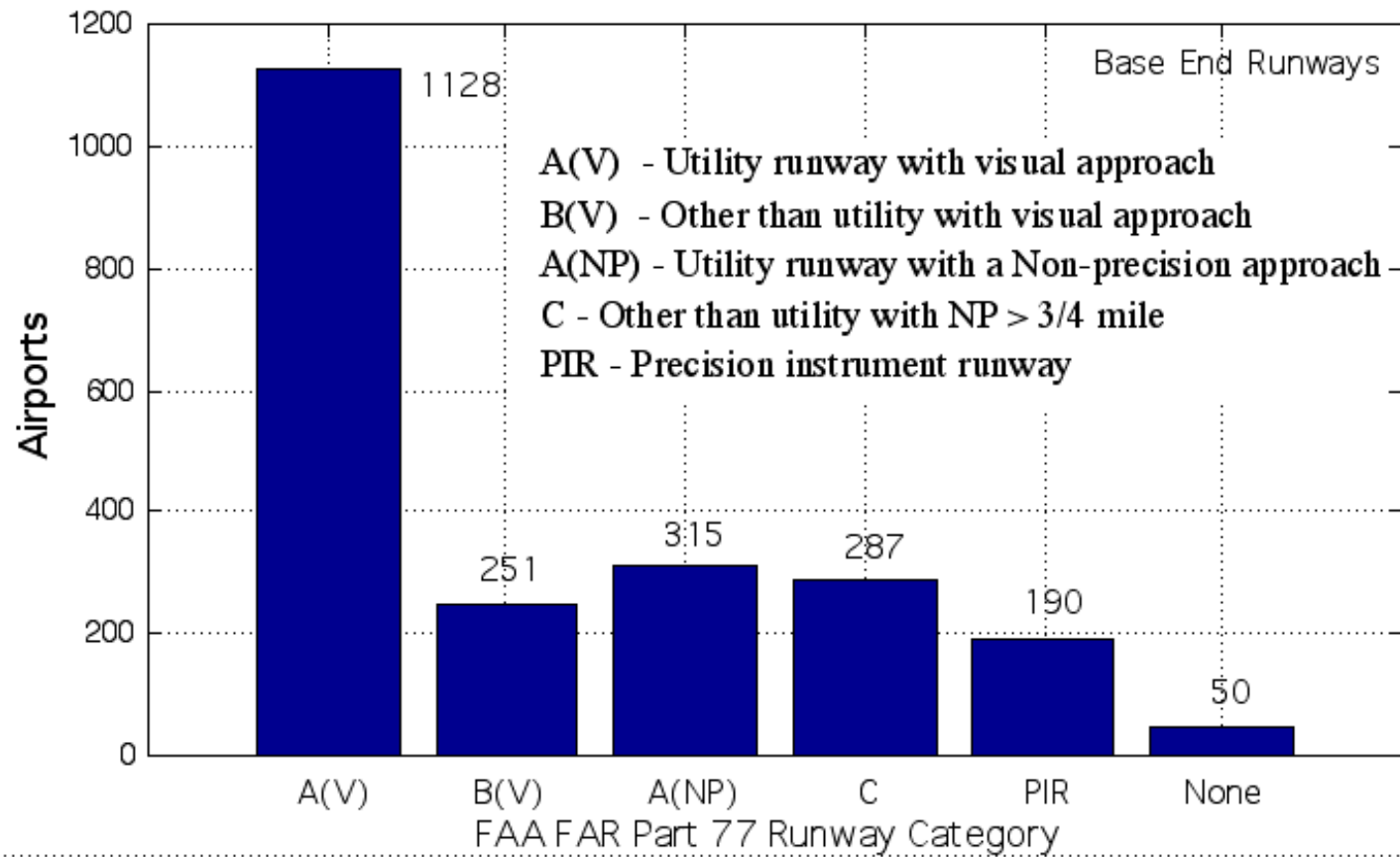
# Type of Approaches Available



Data on GPS approaches is being collected



# FAR Part 77 Design Criteria



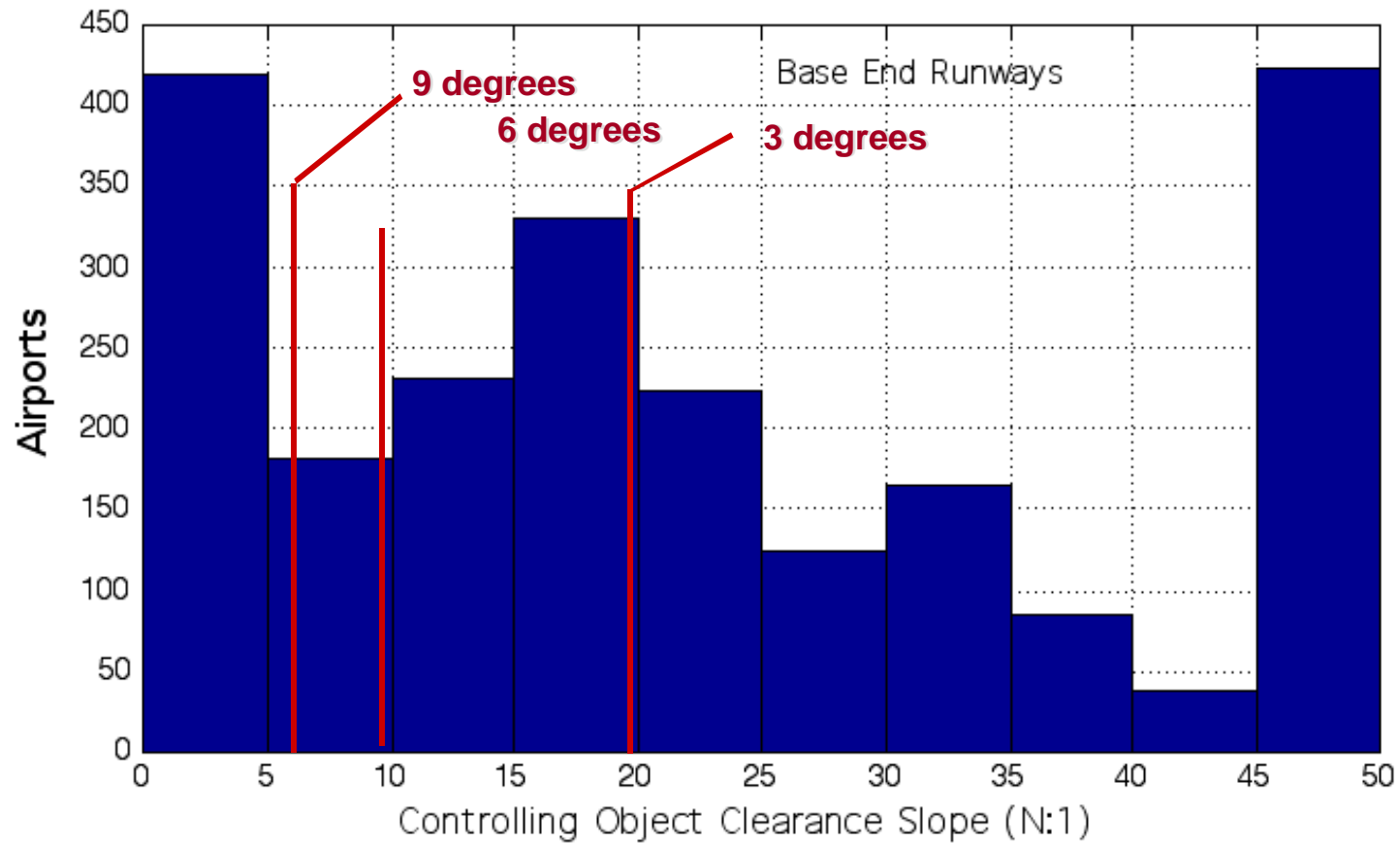


## Remarks

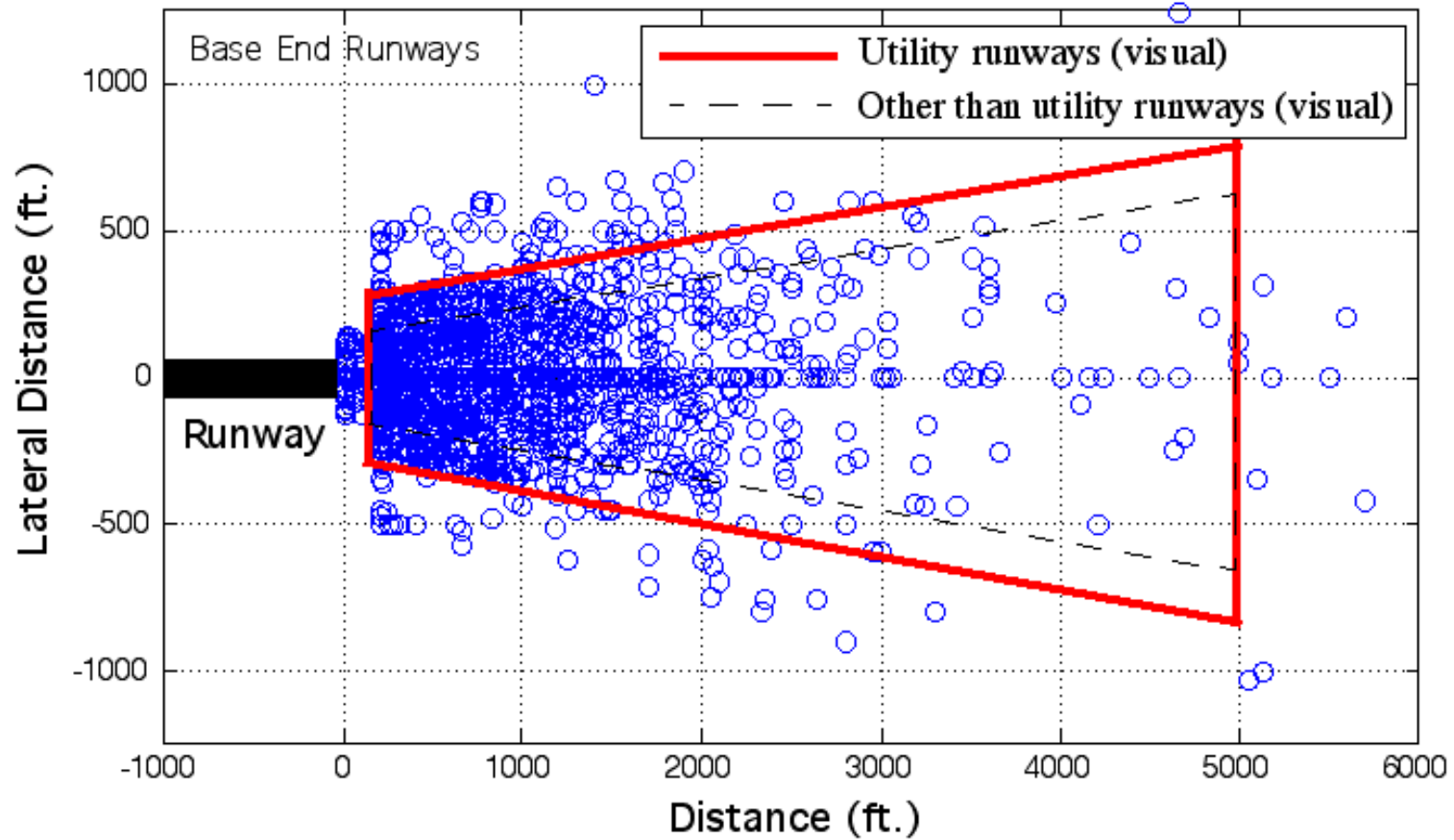


- About 9% of the runways surveyed (at 2,221 airports) has an approach lighting system today
- Today, 11% of the runways have some type of instrument approach (not all precision approaches though)
- The percent of Precision Instrument Runways (PIR) - about 8.5% of all runways surveyed - the number is consistent with the 9% of runways having approach lighting systems (9%)

# Slope of Controlling Objects



# Location of Controlling Objects



## Remarks About Controlling Objects



- More than 62% of the base runway configurations examined (2,221 base runways) have controlling object clearance slopes below 20:1 (quite bad even if off-set or curved approaches are used)
- Under current FAA rules only 19% of the airports surveyed in the FAA database could be candidates for upgrade to Precision Instrument Runway (PIR) criteria given the state of controlling object locations
- Other precision instrument equipment site location considerations would probably reduce this number further