

Assignment 6: Obstruction Analysis and Geometric Design Standards

Solution

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Problem #1

Use the Elevation Profile function in Google Earth to check obstructions to the NW of the Roanoke-Blacksburg Regional Airport (ROA). Here is the analysis to be done.

- a) Create a straight path from runway 16 threshold as demonstrated in class. Make sure the path segment is 8 miles long and aligned with runway 34 heading (see Figure 1).
- b) Create an elevation profile using the Google Earth tool and identify the “peaks” of the elevation profile within 8 statute miles.
- c) Estimate if the “peaks” identified constitute natural obstacles to navigation for a **precision runway**. You only need to check the peaks identified in your elevation plot. Use the FAR Part 77 standard to do the analysis.

After creating a straight path using Google Earth, we identify at least two peaks within 8 nm of the runway threshold 16. Both peaks violate the FAR Part 77 approach surface.

- d) Estimate if the “peaks” identified constitute natural obstacles to navigation for a **non-precision runway**. You only need to check the peaks identified in your elevation plot. **Use the FAR Part 77 standard to do the analysis.**

Google Earth is a first-order approximation of the potential violations of FAR Part 77. A more comprehensive survey of actual obstacles is carried out during the design and designation of runways. Runway 16 is a non-precision runway. According to Arnav database (data from FAA), runway 16 has no obstructions as a non-precision runway. If you still detected the peaks as obstructions, the actual survey data probably would have more reliability than the Google Earth information.

- e) Given the analysis in parts (3) and (4), tell me what type of runway is runway 16 (i.e, approaching from the NW).

Non-precision as reported by Arnav. Runway markings are non-precision.

- f) Verify your answer in part (5) with the runway markings.

Runway markings are non-precision (see figure below).



g) Is Runway 34 a precision runway? Briefly explain.

Yes it is a precision runway.

h) Verify (with geometric and numerical calculations) the reason on why runway 24 at ROA is a non-precision runway. Hint: look at the terrain in the NE quadrant.

Terrain in the NE quadrant limits runway 24 to be a non-precision runway.

Problem #2

Use Google Earth and Airnav to answer the following questions for Boston Logan International Airport.

- 1) Determine if the 174-foot tall building shown in Figure 2 constitutes an obstruction to navigation for landings on runway 14. According to the runway markings in Google Earth, Runway 14 is a visual runway.

The hotel is clearly an obstruction to navigation at 174 feet (1364 feet from the runway end). Violates the approach surface for 14.

- 2) Are landings allowed on runway 14? Explain.

No. Runway 14 can only be used for departures.

- 3) BOS runway 15R has 62-foot tall tree located 3,040 ft. from runway, 140 ft. left of centerline (see Figure 3). Check if the tree is an obstruction to navigation. Check the runway precision in the Airnav site.

Runway 15R is a precision runway. The 62-ft. Tall tree is an obstruction to navigation. It violates the approach surface. There is 2840 feet from the start of the approach surface. Therefore, the critical height of the approach surface is 56.8 feet ($2840/50$). The tree needs to be reported to pilots as an obstruction.

- 4) Use Google Earth to determine the distance between runway centerline to taxiway (B) centerline. Find if the distance complies with ADG V standards. Runway 15R has an instrument landing system with visibility minima down to 1/2 mile. The largest aircraft operating at BOS is a Boeing 747-400. You can find airport maps at:

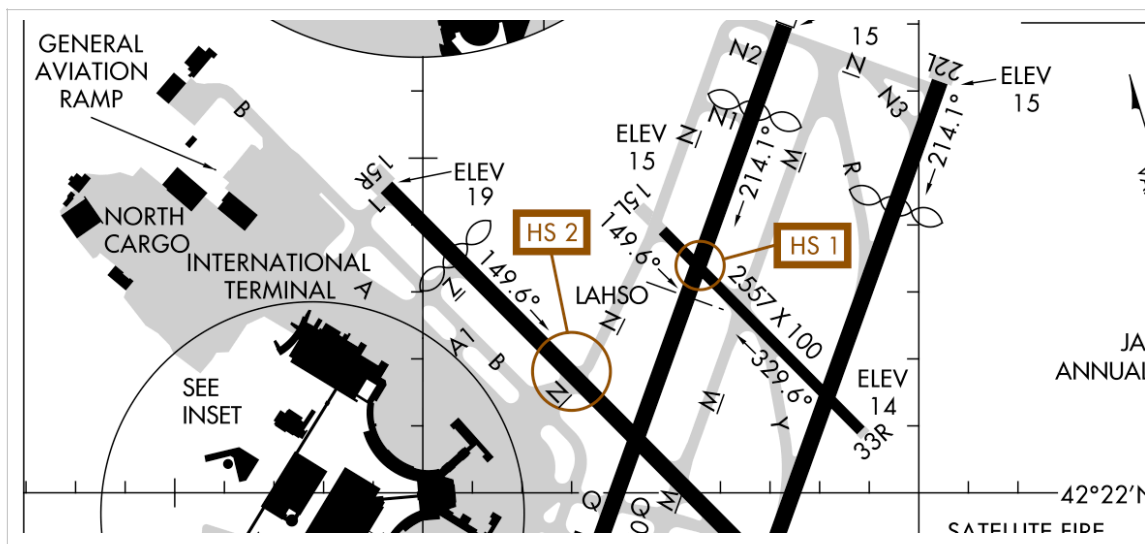


Figure. Boston International Airport.

Taxiway Bravo (B) is located 400 feet from the runway 15R centerline. The airport is near sea level conditions. The minimum separation is 400 feet. If the airport operates below 1/2 mile visibility, the runway separation would be 500 feet.

Table. Taxiway and Runway Separation Criteria.

RUNWAY SEPARATION				
<i>Runway centerline to:</i>				
Parallel runway centerline	H	<i>Refer to paragraph 3.9</i>		
Holding Position ⁸		250 ft	250 ft	280 ft
Parallel taxiway/taxilane centerline ^{3,5}	D	400-500 ft	400-500 ft	400-500 ft
Aircraft parking area	G	<i>Refer to paragraph 5.4.1.2</i>		
Helicopter touchdown pad		<i>Refer to AC 150/5390-2</i>		

Note: Values in the table are rounded to the nearest foot. 1 foot = 0.305 meters.

Footnotes of importance to the problem:

- 3. The standard runway centerline to parallel taxiway centerline separation distance is 400 feet (122 m) for airports at or below an elevation of 1,345 feet (410 m); 450 feet (137 m) for airports between elevations of 1,345 feet (410 m) and 6,560 feet (2,000 m); and 500 feet (152 m) for airports above an elevation of 6,560 feet (2,000 m).
- 5. For approaches with visibility less than 1/2-statute mile (0.8 km), the separation distance increases to 500 feet (152 m).

Problem #3

Figure 4 shows three objects identified as critical in the siting of a new airport. The new airport will have a 10,300-foot long **precision** runway. The precision runway is expected to operate with visibility minima as low as 1/2 mile.

- a) Find if each object constitutes an obstacle to navigation. State the Part 77 imaginary surface applicable to each object.

The parking structure does not violate the approach surface. The critical height of the approach surface at the location of the parking structure is 58 feet.

Cell phone antenna lies in the transitional surface. Note that the approach surface has a width of 2780 feet at 15200 feet from the primary surface. Recall, the primary surface is 1000 feet wide for a precision runway. The approach surface opens at an angle of 15 degrees.

At 15,200 feet from the primary surface, the critical height of the approach surface is 330 feet. The transitional surface slopes at 7:1 from the edge of the approach surface. The cell phone antenna does not violate the transitional surface.

The 100-foot building is in the transitional surface. The transitional surface slopes at 7:1 from the edge of the approach surface. The critical height of the transitional surface at 1300 feet from the runway centerline is 114.28 feet. The building does not violate the transitional surface.

- b) Find if the 56-foot tall parking structure violates the Precision Runway Approach Surfaces defined in the FAA AC 150/5300-13B (called Surfaces 5 and 6 in the AC).
- c) If any of the objects is an obstruction to navigation, propose a mitigation strategy.

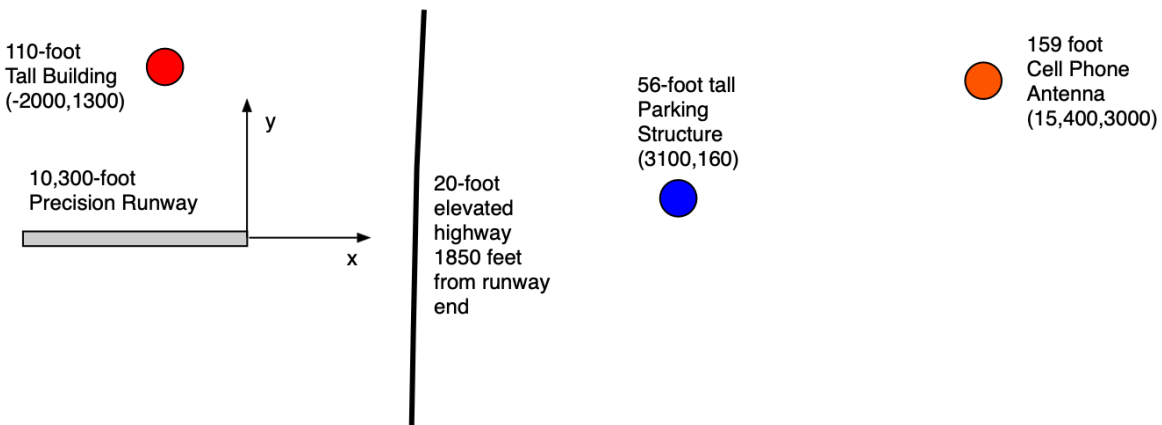


Figure 4. Objects Identified Near a Proposed New Airport.

Problem #4

Use the Embraer 145 as the critical aircraft to determine the following dimensions at a new airport. The airport will have a 8,500 foot runway with Instrument Landing System Category 1 (visibility is 1/2 mile). The airport will be located at a site 4,300 feet above sea level.

Critical Aircraft is C-II (Embraer 145). CMG = 47.42 feet and MGW = 15.72 feet (per FAA ACD database - Excel spreadsheet). Embraer 145 belongs TDG 2B.

Use Table G-8 in FAAAC 150/5300-13B to design the dimensions of the airport.

Item	Dimension(s) Length and width if applicable (in feet)
Approach RPZ	2500 feet length 1000 feet inner width 1750 outer width
Departure RPZ	1700 feet length 500 inner width 1010 outer width
Runway Safety Area	500 feet width 1000 feet length beyond departure end 600 feet prior to runway threshold
Runway OFA	800 feet wide 1000 ft. beyond runway end 600 ft. prior to runway threshold
Distance between runway to parallel taxiway	450 feet because airport elevation is greater than 1,345 feet and less than 6,560 feet (see Note # 5 in Tables of Appendix G)
Distance between runway centerline and runway exit hold line	250 feet
Distance between two parallel taxiways	101.5 feet based on AGD group criteria 162 feet if crossover taxiways with direction reversal between taxiways based on TDG group 102 feet if crossover taxiways with direction reversal between taxiways based on ADG
Distance between a taxiway and a taxilane	94.5 feet based on ADG group criteria
Distance between a taxi lane and a fixed or movable object	62 feet based on ADG group criteria (see Table 4-1)
Distance between a runway centerline and parking area	The distance depends on the disposition of the parking area. Read paragraph 5.4.1.2 No aircraft part should violate the following: a. Runway Object Free Area (ROFA) (paragraph 3.12) b. Taxiway Object Free Area (TOFA) (paragraph 4.5) c. Taxilane Object Free Area (TLOFA) (paragraph 4.5) d. Runway approach or departure surface (paragraph 3.6) e. Runway Visibility Zone (RVZ) (Figure 3-14) f. Runway Obstacle Free Zone (OFZ) (paragraph 3.11) g. Navigational Aid Equipment critical areas (paragraph 6.11) Example: 400 feet
Runway width	100 feet

Item	Dimension(s) Length and width if applicable (in feet)
Runway shoulder width	10 feet
Taxiway width	35 feet based on TDG
Taxiway shoulder width	15 feet
Taxiway safety area	79 feet
Taxiway edge safety margin	7.5 feet
Runway blast pad area	120 x 150 (width)