Assignment 6: Part 77 Analysis and Geometric Design Standards

Date Due: October 18, 2021

Instructor: Trani

Problem #1

Figure 1 shows three objects identified as critical in the siting of a new airport. The new airport will have a 7,500-foot long **non-precision** runway. The non-precision runway is expected to operate with visibility minima as low as 3/4 mile. Find if each object constitutes an obstacle to navigation. State the Part 77 imaginary surface applicable to each objects.

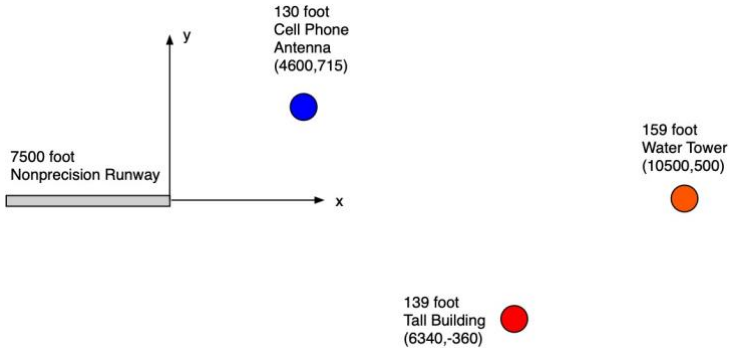


Figure 1. Objects Identified Near a Proposed New Airport.

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

* A - UTILITY RUNWAYS

Use non-precision runway standards as shown in the table above.
Cell phone antenna
4600-200=4400
4400*1500/10000=660
660+500=1160>715
It is in approach surface.
Height=130>129.41=4400/34
The cell phone antenna constitutes an obstruction to navigation because it pierces the approach surface.

Water tower
10500-200=10300>10000
It is outside the approach surface and horizontal surface.

The water tower does not constitute an obstruction to navigation.

Tall building
150*34=5100<6340
It is in the horizontal surface.
Height=139<150
Not an obstruction to navigation.

Problem #2

a) Use the Airbus A321 (see Figure 2) as the critical aircraft to determine the following dimensions at a new airport. The airport will have a single 9,000 foot runway with Instrument Landing System Category 2 (visibility below 1/2 mile). The airport will be located at a site 3,200 feet above sea level.

Figure 2. Frontier Airlines Airbus A321 landing at Cleveland International Airport (A. Trani) .

Item	Dimensions	
	Distance (ft)/Length (ft)	Width (ft)
Approach RPZ	2500	1000 inter 1750 outer
Departure RPZ	1700	500 inter 1010 outer
Runway Safety Area	1000 beyond departure end 600 prior to threshold	500
Runway OFA	1000 beyond departure end 600 prior to threshold	800
Distance between runway to parallel taxiway	400	
Distance between runway centerline and runway exit hold line	250	
Distance between two parallel taxiways	152	
Distance between a taxiway and a taxi lane	152	
Distance between a taxi lane and a fixed or movable object	81	
Distance between a runway centerline and parking area	500	
Runway width		150
Runway shoulder width		25
Taxiway width		50
Taxiway shoulder width		20
Taxiway safety area		118
Taxiway Edge Safety Margin		10
Runway blast pad area	200	200

Problem #3

Assume the same critical aircraft for this problem is the Airbus A321. Find the closest perpendicular distance from the runway centerline that an airline could build a 50-foot tall hangar without violating current standards. Explain the controlling surfaces and dimensions considered in your analysis. Your analysis must consider both Part 77 imaginary surfaces and the inner transitional OFZ surface (three-dimensional surface). Assume the airport has a 8,500 foot precision runway with an instrument landing system (Category 1).

The inner transitional OFZ surface

Airport elevation is 3200 ft.

A321: It is a winglets version in the picture. Wingspan is 117.45 feet.

AAC group C ADG group III

$H_{feet} = 61 - 0.094(S_{feet}) - 0.003(E_{feet})=61-0.094*117.45-0.003*3200=40.36$feet

the closest perpendicular distance from the runway centerline=(50-40.36)*6+200=257.84ft

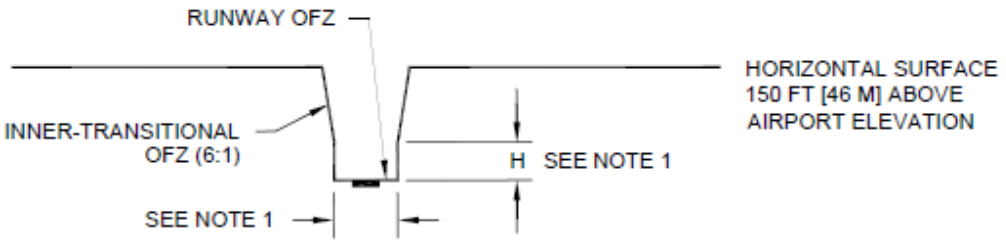
The Part 77 imaginary surfaces

The hangar is in the transitional surface.

50*1050/150=350

The closest perpendicular distance from the runway centerline=350+500=850ft

So, the closest perpendicular distance from the runway centerline is 850ft.



SEE NOTE 4 FOR INFORMATION ON ADDITIONAL VIEWS

RUNWAYS SERVING LARGE AIRPLANES WITH CATEGORY I APPROACH MINIMUMS

Problem # 4

A new airport is expected to have commercial airline operations using aircraft such as the Airbus A321 aircraft (see Figure 1). The longest runway length needed has been determined to be 8,500 feet. The airport is located at an elevation 1,200 feet above mean sea level conditions. The airport will have a precision runway and serve approaches with **visibility minima down to 1/2 mile**. Determine the following dimensions for your design:

a) The elevation of the horizontal surface **above mean sea level conditions**
b) The slope of the Obstacle Clearance Surface (OCS).
c) A company proposes building a 46-foot tall building to be located 4,500 feet from a precision runway. Determine if the proposed building violates the departure surface OCS surface (see Figure 3-4 in FAA AC 150/5300-13a). Assume no clearway is present on this runway.

a. 1200+150=1350ft

b. The slope of the approach OCS is 34:1.

The slope of the departure OCS is 40:1.

	Runway Type	DIMENSIONAL STANDARDS* Feet (Meters) A	B	C	D	E	Slope/ OCS
1	Approach end of runways expected to serve small airplanes with approach speeds less than 50 knots. (Visual runways only, day/night)	0 (0)	120 (37)	300 (91)	500 (152)	2,500 (762)	15:1
2	Approach end of runways expected to serve small airplanes with approach speeds of 50 knots or more. (Visual runways only, day/night)	0 (0)	250 (76)	700 (213)	2,250 (686)	2,750 (838)	20:1
3	Approach end of runways expected to serve large airplanes (Visual day/night); or instrument minimums ≥ 1 statute mile (1.6 km) (day only).	0 (0)	400 (122)	1000 (305)	1,500 (457)	8,500 (2591)	20:1
4	Approach end of runways expected to support instrument night operations, serving approach Category A and B aircraft only. [1]	200 (61)	400 (122)	3,800 (1158)	10,000 [2] (3048)	0 (0)	20:1
5	Approach end of runways expected to support instrument night operations serving greater than approach Category B aircraft. [1]	200 (61)	800 (244)	3,800 (1158)	10,000 [2] (3048)	0 (0)	20:1
6	Approach end of runways expected to accommodate instrument approaches having visibility minimums ≥ 3/4 but <1 statute mile (≥ 1.2 km but < 1.6 km), day or night.	200 (61)	800 (244)	3,800 (1158)	10,000 [2] (3048)	0 (0)	20:1
7	Approach end of runways expected to accommodate instrument approaches having visibility minimums < 3/4 statute mile (1.2 km).	200 (61)	800 (244)	3,800 (1158)	10,000 [2] (3048)	0 (0)	34:1
8 [3,5,6,7]	Approach end of runways expected to accommodate approaches with vertical guidance (Glide Path Qualification Surface [GQS]).	0 (0)	Runway width + 200 (61)	1520 (463)	10,000 [2] (3048)	0 (0)	30:1
9	Departure runway ends for all instrument operations.	0 [4] (0)	See Figure 3-4.				40:1

c. Assume the building is on the runway centerline.

OCS slope is 40:1

Height=46<112.5=4500/40

The proposed building does not violate the departure OCS surface