Quiz 2 - Solution

Open Notes and Internet

Instructor: A.A. Trani

Instructions

Write your solutions in the spaces provided. Add any additional pages with calculations as needed. Make sure each additional page has your name.

Honor Code Pledge

The information provided in this exam is my own work. I have not received information from another person while doing this exam.

_____ (your signature/name)

Problem # 1 (40 points)

a) Determine if a new 540-foot tall antenna to be constructed 5.3 miles away from an existing airport (see Figure 1) is an obstacle to navigation. The airport has a single 7,800 feet **non-precision runway (see Figure 1)**. The antenna (if permitted) will be constructed along the extended runway centerline. Examine all the rules of FAR Part 77 that apply at the location of the proposed antenna.

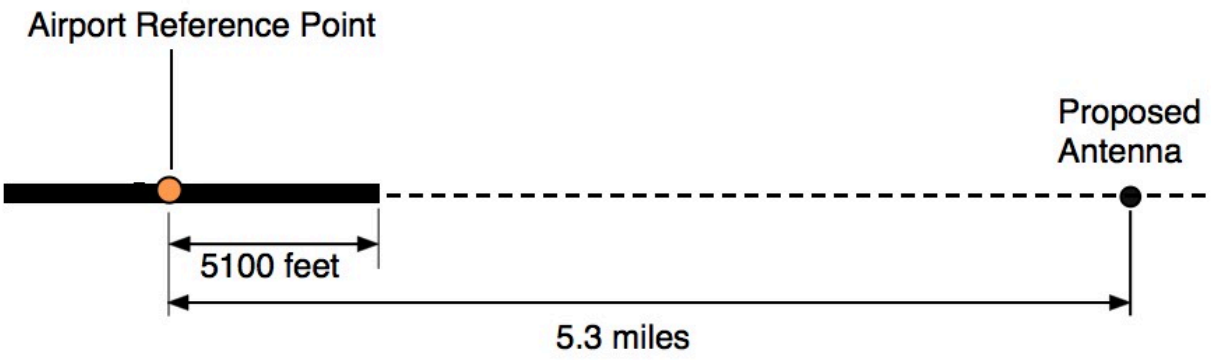


Figure 1. Runway Configuration for Problem 1.

Solution: Any object greater than 500 feet above the ARP is considered an obstruction to navigation. Remember that the rule says that objects above 200 feet within a radius of 3 miles from ARP are obstacles. The height increases 100 feet (300 feet) at 4 miles, 400 feet at 5 miles and 500 feet at 6 miles from the ARP. The summary of the FAR Part 77 standards (see page 6 of the notes) states:

In the **United States,** an object constitutes an obstruction to navigation if:

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

b) A building developer proposes building a 154-foot tall parking structure to be located 7,980 feet from the approach end of a **precision runway**. The building would be located 1,600 feet to the left of the extended centerline of the runway. Determine if the proposed structure is an obstruction to navigation. Explain why.

Solution: The building is 7780 feet from the start of the approach surface. At a slope of 50:1 the height of the approach surface at the location of the building is 155.6 feet. However, at a location 7,500 feet from the start of the approach surface, the horizontal surface dominates. The horizontal surface is 150 above ground level. The proposed building will be an obstruction to navigation.

c) Find the percent coverage for all-wind conditions at the future Blacksburg-Montgomery County airport (KBCB) - after the runway extension - using the FAA Wind Rose tool. The critical aircraft after runway extension is C-II.

Cross Wind Component Used ____16 _ (knots)

Use 16 knots as the critical crosswind component. Download the data from the FAA web site. Create a PRN file. Using runway orientation of 117 degrees (true runway orientation) and using 60 knots for tailwind, the runway meets the critical crossing with 99.98%. Note: all wind data is reported based on

Percent Coverage _____99.98_ (%). The wind rose is shown below.

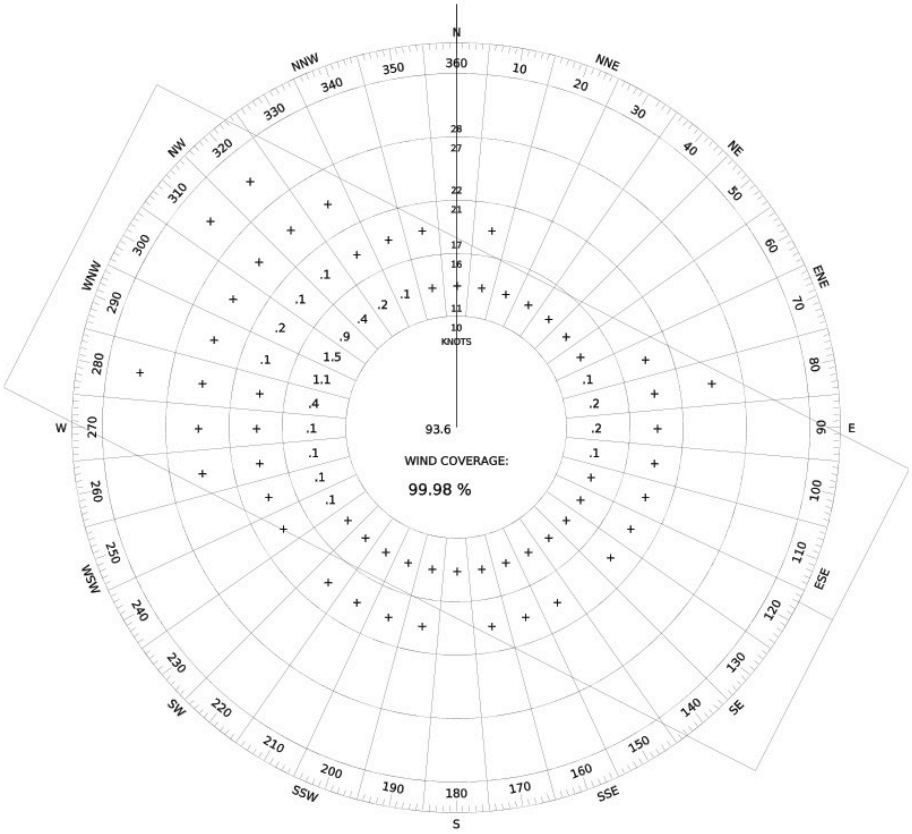


Figure 1a. Wind Rose for all Weather Conditions.

Problem #2 (40 points) - Short Answer

Use the Boeing 757-200 (see Figure 2) as the critical aircraft to determine the following dimensions at a new airport. The airport has a single 8,500 feet runway with Instrument Landing System Category 1 (visibility minima of 1/2 mile). The airport will be located at 1,500 feet above mean sea level conditions.

Figure 2. Boeing 757-200 landing at ORD Airport (A. Trani).

Part A

Runway RDC Code Used - **C-IV and TDG 5**

Blast pad area dimensions _ **200 x 200 (ft)**

Holding position to runway centerline distance - 250 feet + 1500/100 = **265 feet (ft)**
Note: According to Note 8 in the FAA AC 150/5300-13A. “For ADG-IV, V, and VI, the holding distance is increased 1 foot for each 100 feet above sea level”.

Runway shoulder width - 25 (ft)

Runway width - 150 (ft)

Centerline radius of a 30-degree acute angle runway exit - 1500 (ft) - see Figure 4.22 in FAA AC 150/5300-13A.

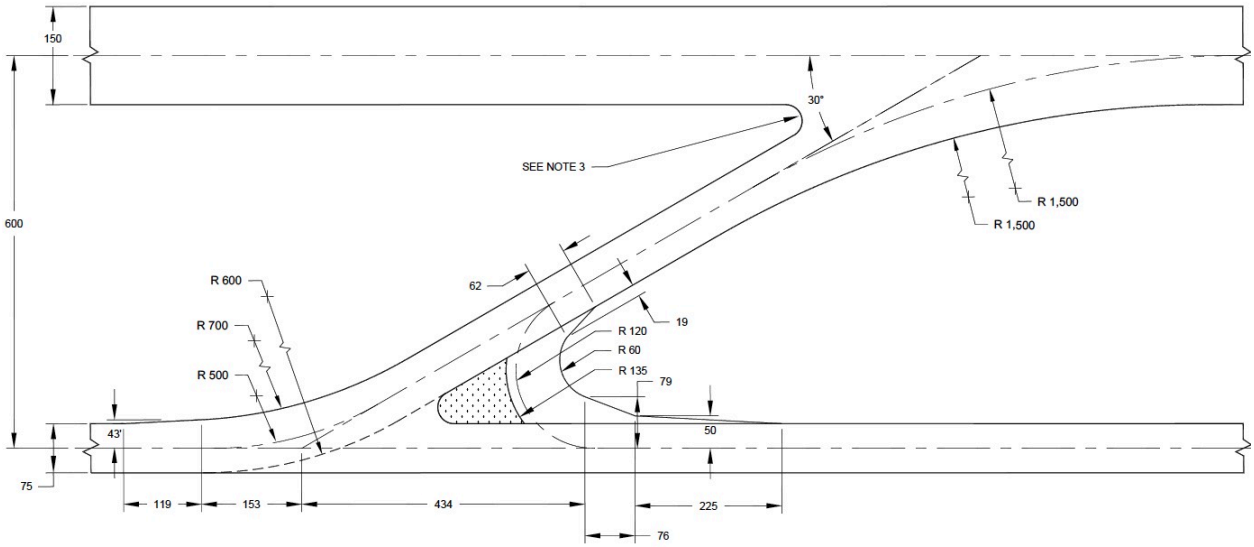


Figure 2a. Acute Angle High Speed Runway Exit.

Part B

Determine distances RW, RN, and DT for the cargo building shown in Figure 3. In your design use a maximum steering angle of 50 degrees. Assume no tire slip. The aircraft are assumed to taxi out under their own power.

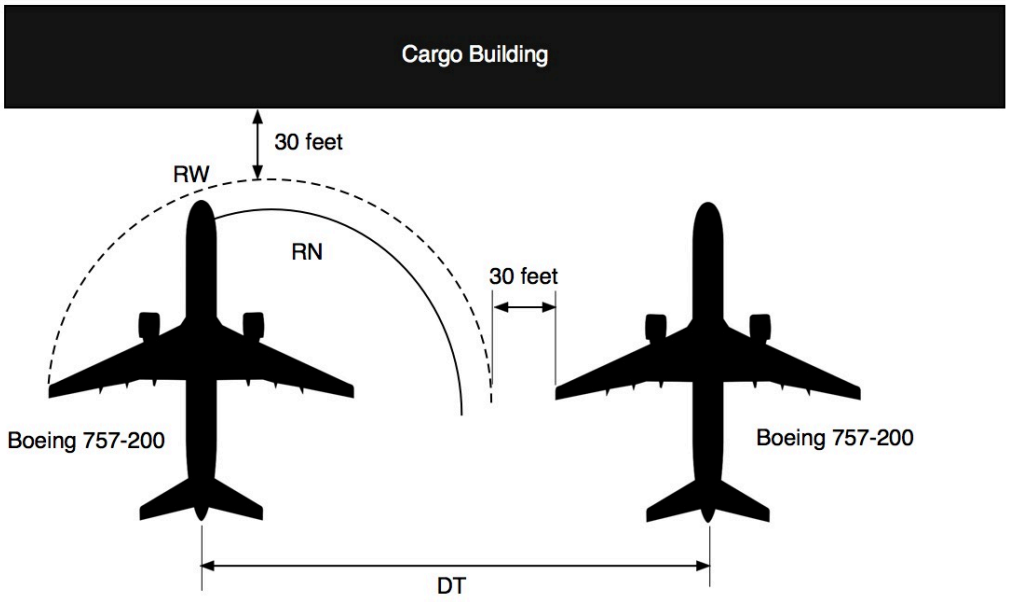
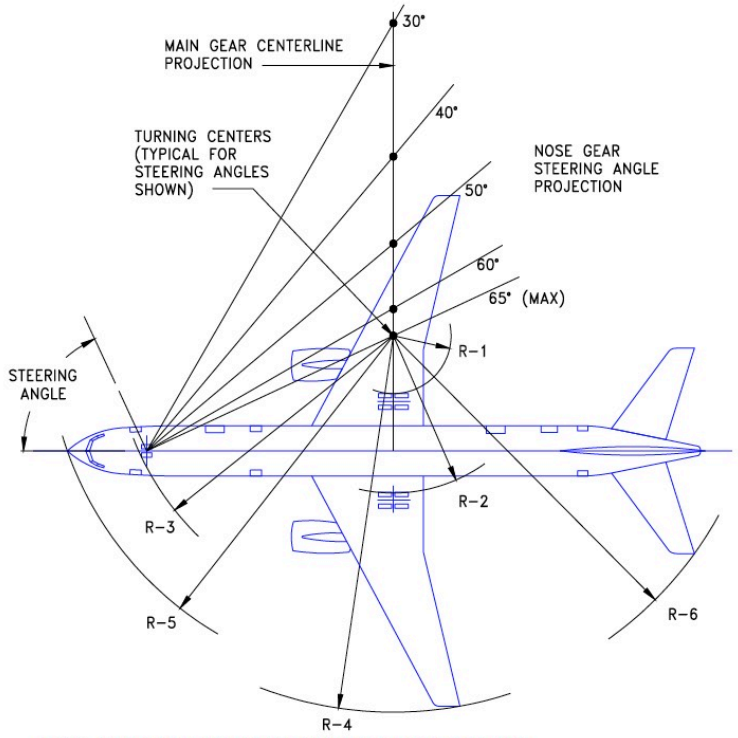


Figure 3. Cargo Facility for Problem 2.

Dimension	Boeing 757-200
RW (ft)	114
RN (ft)	80
DT (ft)	~257



NOTES: *ACTUAL OPERATING TURNING RADII MAY BE GREATER THAN SHOWN.
* CONSULT WITH AIRLINE FOR SPECIFIC OPERATING PROCEDURE
* DIMENSIONS ROUNDED TO NEAREST FOOT AND 0.1 METER.

STEERING ANGLE	R1 INNER GEAR		R2 OUTER GEAR		R3 NOSE GEAR		R4 WING TIP		R5 NOSE		R6 TAIL	
(DEG)	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
30	90	27.4	118	35.9	122	37.0	167	50.9	131	39.9	149	45.3
35	72	21.9	100	30.4	106	32.3	149	45.4	117	35.6	133	40.6
40	58	17.5	86	26.1	95	28.9	135	41.1	107	32.6	121	37.0
45	46	14.0	74	22.6	86	26.3	124	37.6	99	30.3	112	34.3
50	36	11.1	64	19.6	80	24.4	114	34.7	94	28.6	105	32.1
55	28	8.5	56	17.1	75	22.8	106	32.2	90	27.3	100	30.4
60	21	6.3	49	14.8	71	21.6	98	30.0	87	26.4	95	28.9
65 (MAX)	14	4.3	42	12.8	68	20.6	92	28.0	84	25.6	91	27.6

Figure 3a. Boeing 757-200 Turning Data (Boeing).

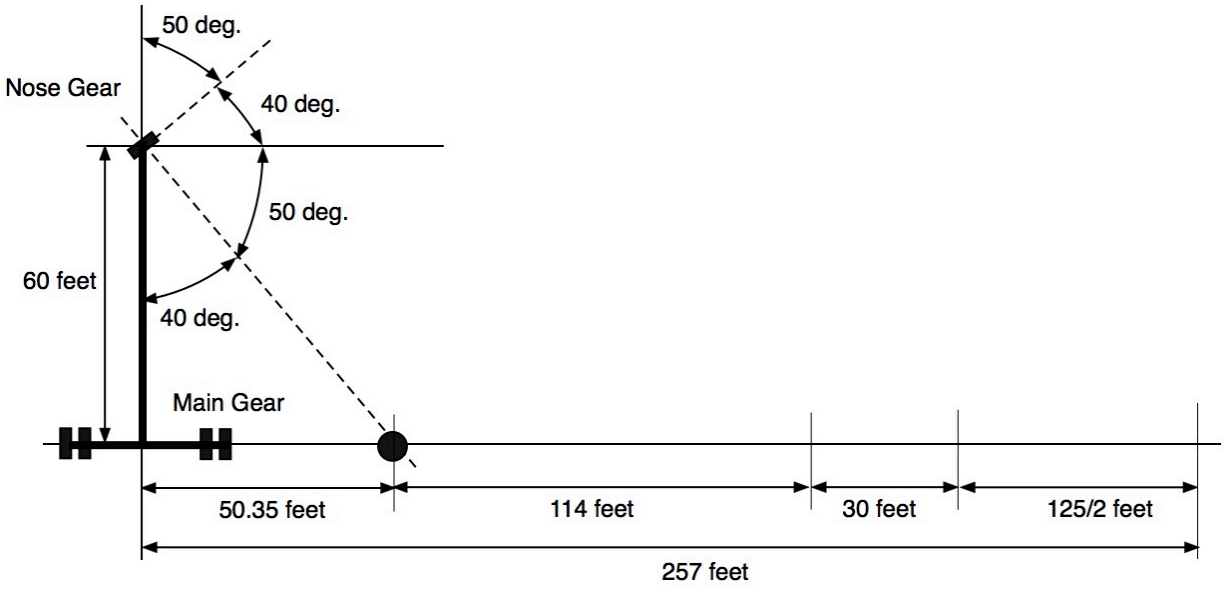


Figure 3b. Solution to Problem 2.

Problem #3 (20 points) - Short Answer

a) According to the FAA Terminal Area Forecast (TAF), estimate the growth (in percent) in passenger enplanements at New York LaGuardia airport between 1990 and 2016.

Enplanements in (1990) = 11,407,887

Enplanements in (2016) = 14,782,532

Total growth in passenger enplanements is 29.6 (%)
Growth per year ~ 1.14%

b) Find the highest number of operations ever at LaGuardia.

Number of Annual operations at LGA - 408,991,operations in the year 2015.