Assignment 7: Geometric Design Standards

Date Due: March 31, 2017

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Problem #1

A new commercial airport in **Beijing (China)** is being designed to accommodate Airbus A380-800 class aircraft (see Figure 1). The airport site elevation is 35 meters above sea level. The airport is expected to have 4 parallel precision runways.

Figure 1. Airbus A380-800 Taxiing at Incheon International Airport (A. Trani) .

a) What International criteria are your using to solve this problem?

b) Determine the distance between parallel taxiways.

c) Determine the distance between a runway and a parallel taxiway.

d) Find the minimum runway and shoulder width for this airport.

Problem #2

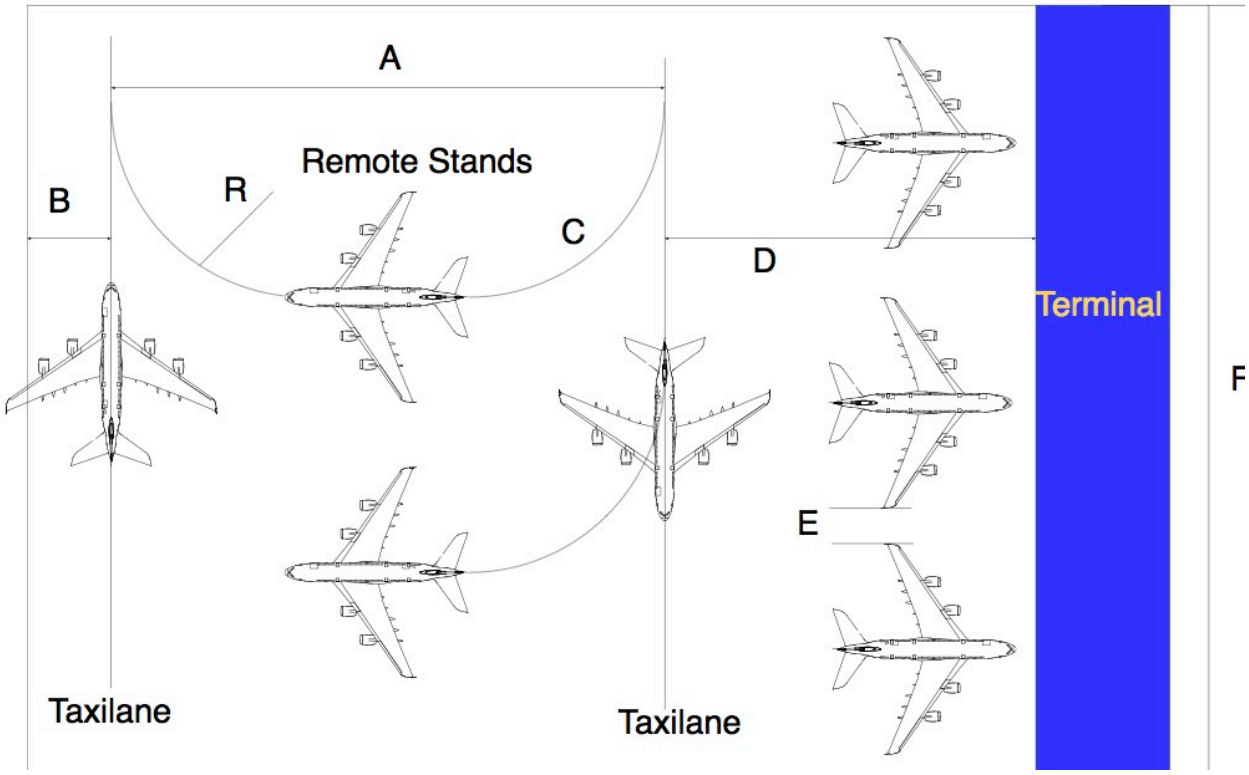


Figure 2. Proposed Gate and Remote Parking Areas for an Airbus A380-800 .

The Port Authority of New York wants your services to design a new terminal capable to accommodate Airbus A380-800 aircraft (see Figure 2).

a) Find the dimensions shown in Figure 2. The radius R should allow the aircraft to maneuver into either one of the taxilanes. Consider all the design principles discussed in class and in the notes.
b) Draw your solution in the CAD program of your choice.
c) To determine dimensions D and A, assume there are two services roads (14-foot wide per lane) at the tails of each aircraft.
d) Design the appropriate dimensions of a cargo area (see Figure 3) that allows same Airbus A380-800 aircraft to taxi out on their own power I(see Figure 3). Specify the critical radius considered in these calculations.

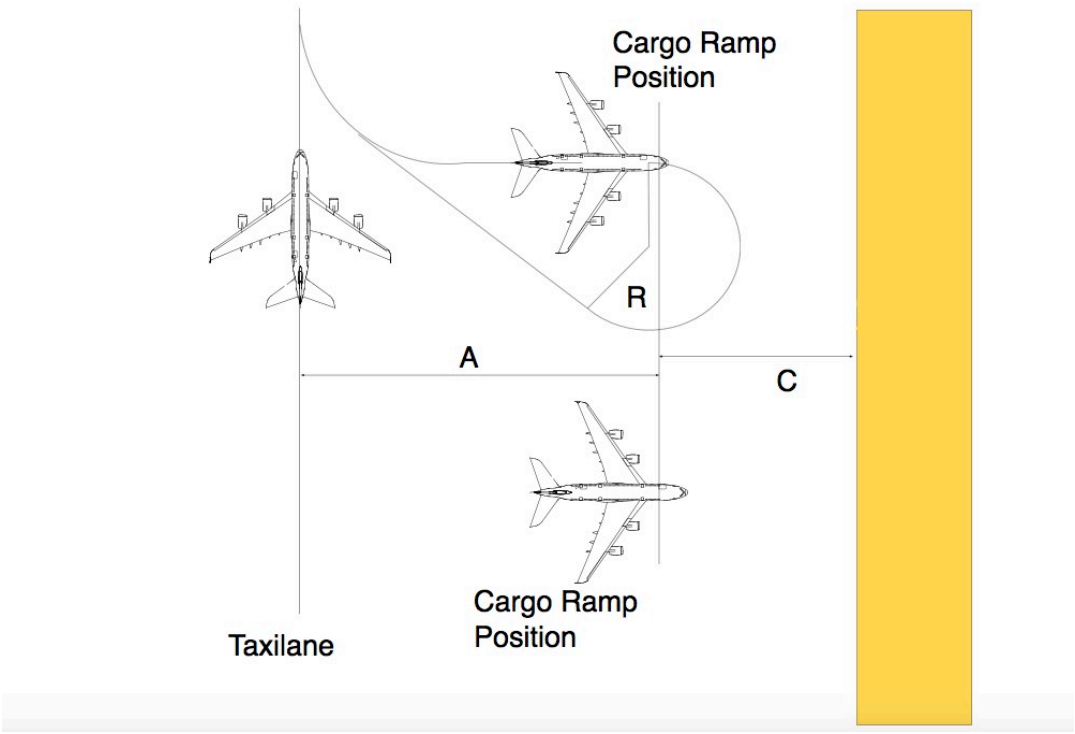


Figure 3.Cargo Terminal Configuration.

Problem # 3

e) Estimate the minimum distance between two terminal buildings if a dual-taxilane system is to be provided between the terminals in question. The critical aircraft is the Airbus A350-900. In your analysis, consider that Airbus A350-900 aircraft will park on both terminal buildings shown below. Provide space for two service roads behind the aircraft.

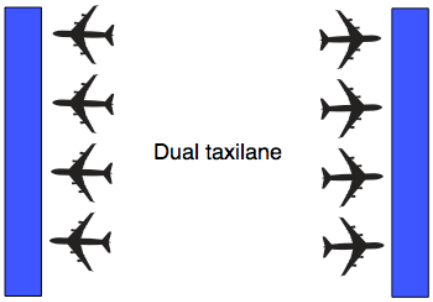


Figure 4. Dual-lane Configuration.

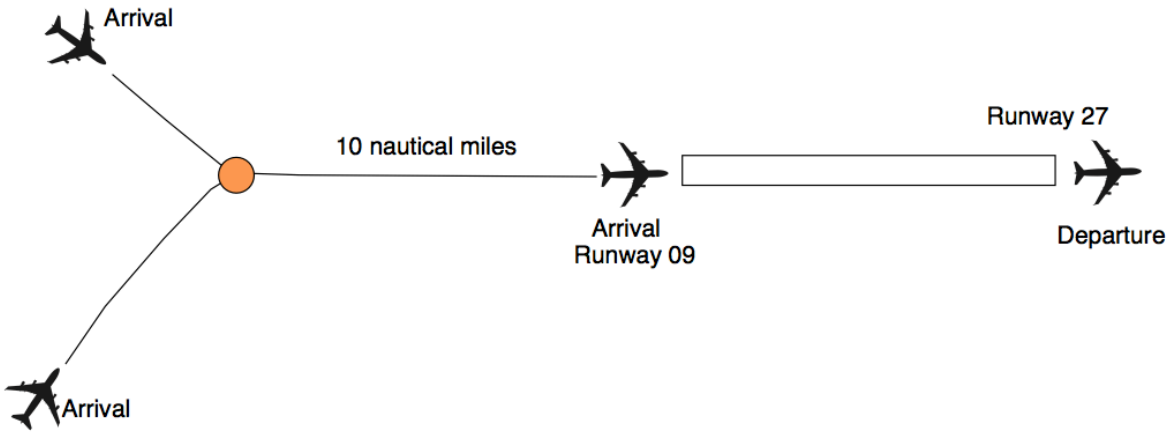
Problem 4

An airport shown in Figure 1 has a single 9,800 feet runway oriented East-West. The airport has a standard airport surveillance radar (ASR) which tracks aircraft up to 60 nautical miles form the airport site. The radar has a scan rate of 4 seconds. Tables 1 and 2 show the typical ATC separations at the airport under IMC conditions. Assume the minimum separations under VMC conditions are reduced by 10% from those observed under IMC conditions. Five aircraft groups operate at the airport. The airport has the following technical parameters: a) in-trail delivery error of 12 seconds (because there is a radar at the site), b) departure-arrival separation for both VMC and IMC conditions is 2 nautical miles, c) probability of violation is 5%. Arriving aircraft are "vectored" by ATC to the final approach fix located 10 miles from the runway threshold (see Figure below). Arrivals follow in-trail after crossing the final approach fix. The airport aircraft mix, runway occupancy times and approach speeds are shown in Figure 5.

You are allowed to modify the spreadsheet provided in class to solve the problem. Show me sample calculations for both opening and closing cases.

a) Calculate the arrival-departure saturation capacity diagram (Pareto diagram) under IMC conditions (show all your work). In your diagram, include at least one point to estimate the departure capacity with 100% arrival priority under mixed runway operations. Show me sample calculations of Tij and Bij so that I can judge your analysis.

b) Repeat part (a) for VMC conditions. Comment on the differences observed. Specifically, comment on the number of departure values obtained with 100% arrivals. Show me sample calculations of Tij and Bij so that I can judge your analysis.



	Small	Large	B757	Heavy	Superheavy
ROT (s)	48	51	60	65	75
Percent Mix (%)	10	55	10	20	5
Vapproach (knots)	120	140	142	155	150

Figure 5. Airport Arrival Occupancy Times and Fleet Mix for Problem 4.

Table 1. Minimum arrival-arrival separations under IMC conditions. Values in are nautical miles. Values Shown Do Not Include Buffers.

Minimum Separation Matrix (nm)		Arrivals-Arrivals			
		Trailing Aircraft (Header Columns)			
Lead (column 1)	Small	Large	B757	Heavy	Superheavy
Small	3	3	3	3	3
Large	4	3	3	3	3
B757	5	4	3	3	3
Heavy	6	5	4	3	3
Superheavy	8	8	8	8	8

Table 2. Minimum departure-departure separations under IMC conditions. Values in are seconds.

Departure-Departure Separation Matrix (seconds)					
		Trailing Aircraft (Header Columns)			
Lead (column 1)	Small	Large	B757	Heavy	Superheavy
Small	60	60	60	60	60
Large	90	60	60	60	60
B757	120	120	60	60	60
Heavy	120	120	120	120	90
Superheavy	150	120	120	120	120