Quiz 2

Solution

Instructor: Trani

Instructions

Write your solutions in a single Word file and create a PDF file. Cut and Paste all your answers using screen captures. Show all your work. Label your file with your last name and CEE4674. Email your PDF solutions to my email address (vuela@vt.edu). In the email header use the words **CEE 4674 Quiz2**.

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 (30 points)

The wind observations contained in the companion file were collected several years ago at a rural location being considered as a potential airport site.

a) Using the information provided, estimate the best runway orientation for this location. The aircraft population operating at the airport will be single-engine and twin engine aircraft with Runway Design Codes A-I and BI.

The FAA states that for the stated RDC we need to use 10.5 knots of design crosswind. Refer to Table 3-1 in FAA AC 150/5300-13a.

Table 3-1. Allowable crosswind component per Runway Design Code (RDC)

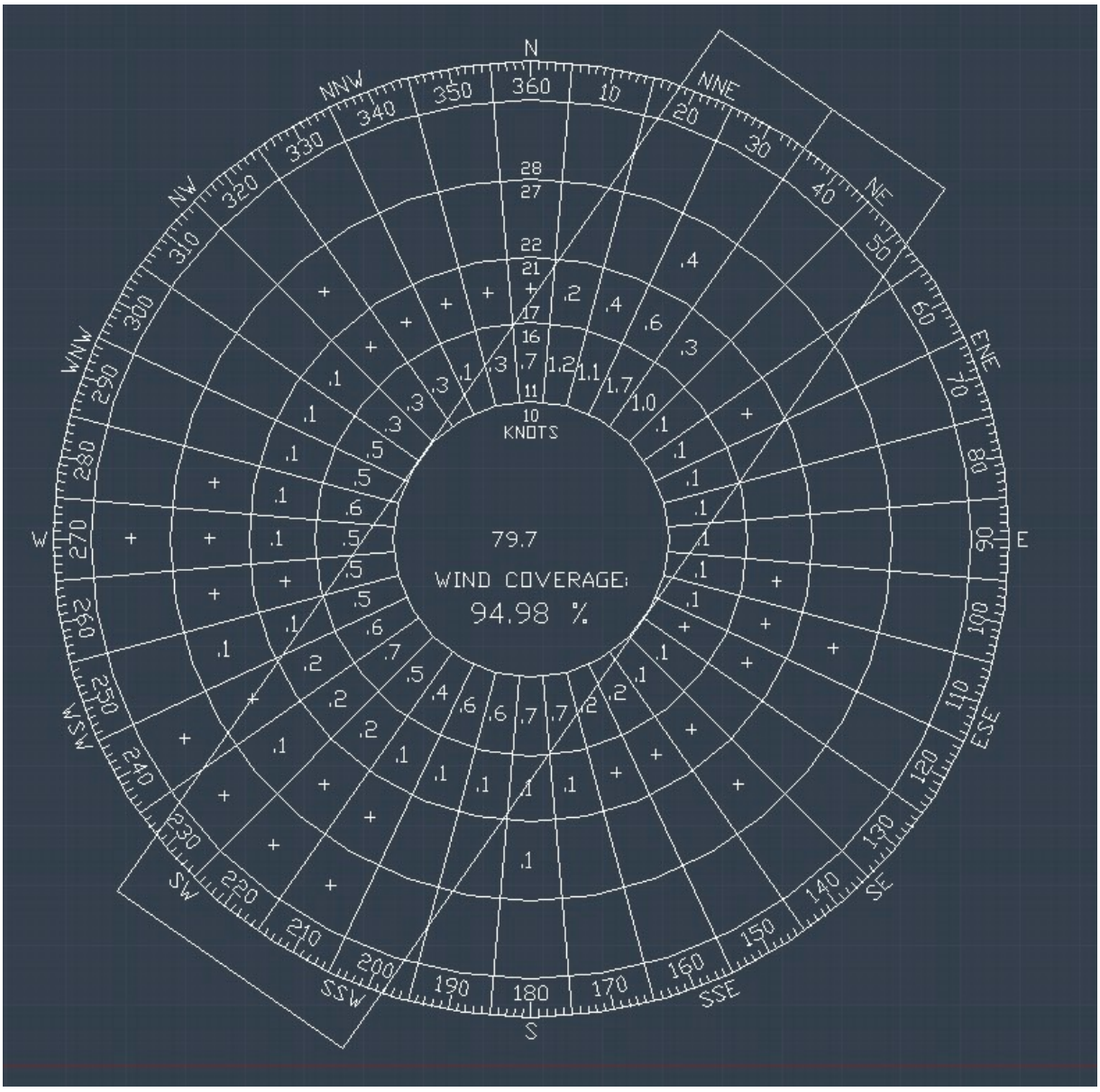
RDC	Allowable Crosswind Component
A-I and B-I *	10.5 knots
A-II and B-II	13 knots
A-III, B-III, C-I through D-III D-I through D-III	16 knots
A-IV and B-IV, C-IV through C-VI, D-IV through D-VI	20 knots
E-I through E-VI	20 knots

* Includes A-I and B-I small aircraft.

Runway Orientation (deg)	Coverage (%)	Runway Orientation (deg)	Coverage (%)
0	92.94	**100**	86.76
10	94.14	**110**	86.26
20	94.68	**120**	86.29
30	94.95	**130**	86.75
35	**94.98**	**135**	87.15
40	94.86	**140**	87.63
50	94.11	**150**	88.76
60	92.57	**160**	90.17
70	90.89	**170**	91.60
80	89.13	**180**	92.94
90	87.74		

Optimal runway orientation seems to be 35 degrees/215 degrees. The coverage is 94.98%. Not quire 95%.

b) Would a single runway satisfy the FAA runway coverage requirements? Briefly Comment.
No it needs a second crosswind runway.



Wind Rose for a single runway. Runway orientation is 35/215 degrees.

Problem # 2 (40 points)

An airport located at sea level conditions has a single runway as shown in Figure 1. The airport serves three airlines operating medium size transport aircraft such as the Boeing 757 and Boeing 737-900. The runway is a precision runway with an instrument landing system (Cat 1) with RVR 2400 feet.

a) Estimate if the 181-foot antenna is an obstruction to navigation. If the antenna is an obstruction to navigation explain how will this affect the operations at the airport.

Boeing 757 is the critical aircraft and belongs to C-IV. The antenna is aligned with the extended runway centerline, therefore, check both horizontal and approach surfaces.

The approach surface at a point 9200 feet from the end of the primary surface is 184 feet in height. However, at that point the horizontal surface dominates at 150 feet. The antenna is an obstruction to navigation.

b) Using the declared distance concept, find the Landing Distance Available (LDA) for aircraft landing on runway 27. In your analysis provide full Runway Safety Area (RSA) protection as required by the FAA.

Since the antenna is an obstruction we have to raise the approach slope of the runway or displace the threshold. To satisfy the the 50:1 approach surface as we approach runway 27, we need a 1,700 for displaced threshold. This reduces LDA. However, we also need 1,000 foot RSA at the opposite end of runway 27. This makes the LDA:

LDA (27) = 9300 ft - 1700 ft - (1000-520) ft = 7,120 feet.

c) Find the Landing Distance Available (LDA) for aircraft landing on runway 09.

The minimum RSA requirement for landings on runway 09 is 600 feet prior to the runway. However the road is elevated 10 feet and a vehicle traversing that road needs to be considered. Use 17 feet according to FAA criteria. This yields 27 feet total that could penetrate the approach imaginary surface.

The approach surface is 6.4 feet tall at a point 520 feet from the end of the runway (accounting for 200 feet of the primary surface). This means the landing threshold on runway 09 needs to be displaced by 1,030 feet (20.6 x 50 ft).

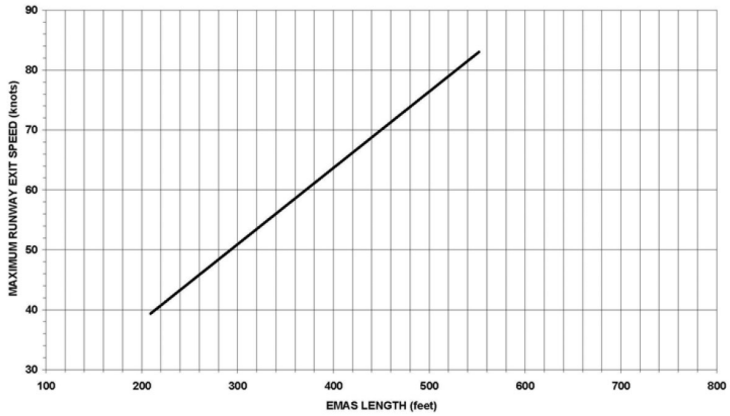
LDA (09) = 9300 ft - 1030 ft = 8,270 feet

d) Find the Accelerate and Stop Distance Available (ASDA) while taking off on runway 27.

We need to protect 1,000 ft RSA on the opposite end of runway 27. The ASDA is then,

ASDA = 9300 ft - (1000-520) ft = 8,820 feet

e) If an arrestor bed is installed at the runway threshold 09, estimate the size of the EMAS required and the benefit to LDA and ASDA estimated in parts (b) and (c) of this problem.



An arrestor bed for a Boeing 757 needs to be 450 feet. The benefit to LDA is that 480 feet would be available (LDA = 7600 feet) since the arrestor bed is equivalent to the 1,000 ft RSA. Similarly, ASDA would benefit as well since the arrestor bed would provide an ASDA of 9,300 feet.

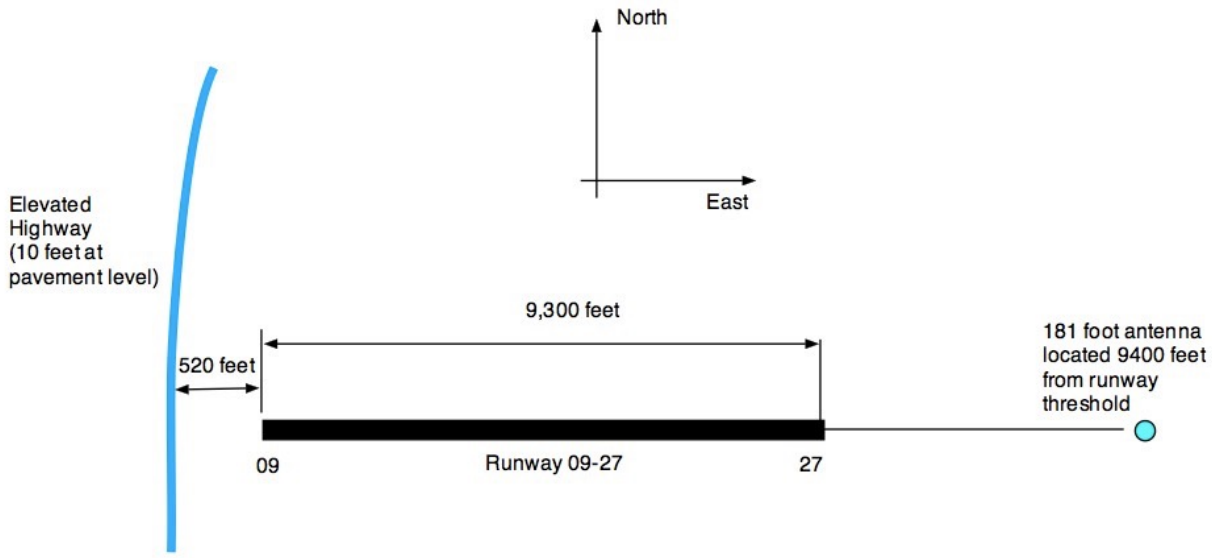


Figure 1. Runway Configuration for Problem 2.

Problem #3 (30 points) - Short Answers

a) Find the minimum taxiway width and taxiway shoulder width for a new taxiway at an airport serving Boeing 757-300 aircraft.

Boeing	757-300	D	IV	5	125.0 (38.10)	44.9 (13.69)	178.5 (54.40)	85.3 (26.00)	73.3 (22.34)	28.2 (8.60)	270,000 (122470)	143

Boeing 757-300 belongs to TDG 5.

Taxiway width = 75 feet (23 meters)

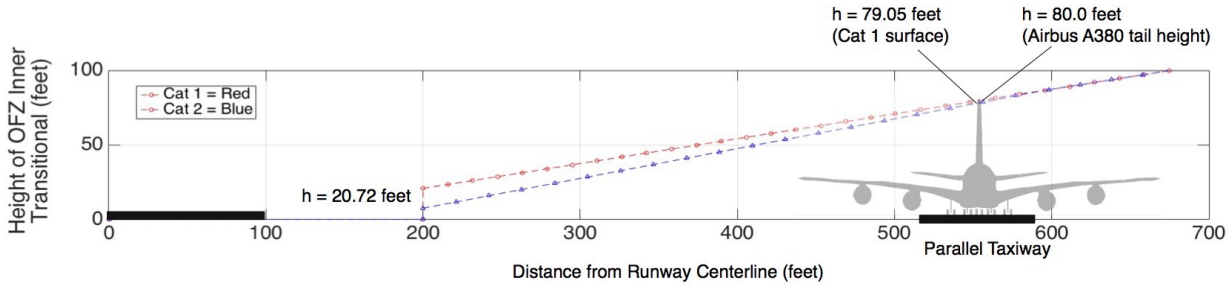
Taxiway shoulder = 25 feet (7.5 meters)

b) A new cargo airport in Colorado is located at 5,200 feet above sea level conditions. The airport is expected to have approaches with visibility minima of 1/2 mile or less. The largest aircraft serving the airport is an Airbus A380 freighter. Find the minimum distance required to construct a parallel taxiway.

Airbus A380 belongs to ADG D-VI.

Runway to Taxiway Distance = 550 feet (see Table 3-7)

c) For problem (b) perform the analysis considering taxiing and holding aircraft clear of the inner-transitional OFZ of the runway. In other words, if an Airbus A380 taxies on the taxiway will the tail of the aircraft penetrate the inner transitional OFZ?



d) A 6000-foot long runway for an airport exclusively used by General Aviation (GA) aircraft has two grades -0.76% and +0.64% with a point of intersection located 2,450 feet from the runway threshold. Find the length of the transition curve needed. Is the airport suitable for GA operations? Briefly explain.

Airport meets the standards for approach groups A and B. The transition length is 1.4*300 (ft) = 420 feet.

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 a Boeing 747-8. In your analysis, consider that Boeing 747-8 park at the gates on both terminals.

Boeing 747-8 is 250.2 feet long and has a wingspan of 224.4 feet.

d = 2.3 * wingspan + 30 + 2(length) + 2 * 30 (buffer to building) + 4 (12 ft) lanes = 1,150 feet (minimum)