Assignment 3: Runway Length and EMAS Design

Date Due: February 9, 2015 Instructor: Trani

Problem 1

A new airport will be constructed in a 4000 acre land located 2,500 feet above sea level. The new airport site has a design temperature of 25 degrees Celsius. The critical design aircraft for the airport is the Boeing 747-8 and shown in Figure 1.

Table 1. Aircraft for Airport in Problem 1.

Aircraft	Engine	Remarks
Boeing 747-8 (passenger) 987,000 Maximum Takeoff Weight	GEnx 2B engines	Passenger configuration with a total of 513 seats

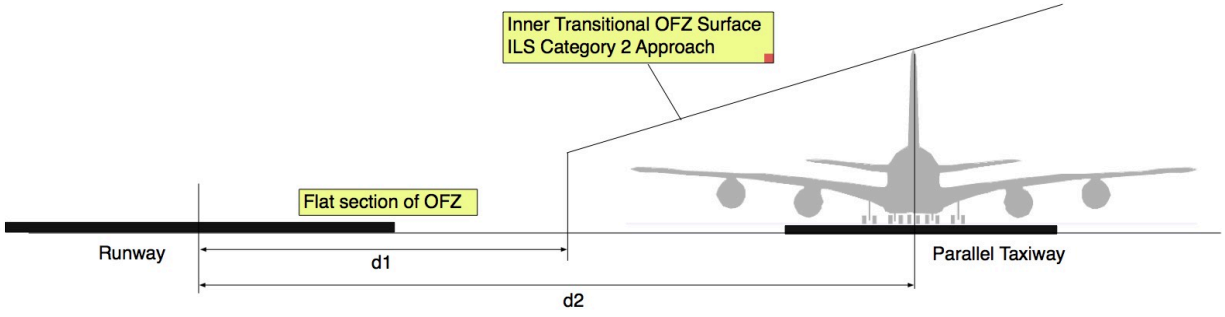
Figure 1. Boeing 747-8 Passenger Version (A.A. Trani).

a) Find the runway length required to satisfy FAA and EASA regulations to operate the critical aircraft without takeoff restrictions from the new airport. State the temperature profile used in your calculations.

b) Find the dimensions of the runway safety area, runway protection zones, object free areas and obstacle free zone (including dimensions of the inner transitional surface) for the runway at the new airport. The new runway is expected to have a Category 2 Instrument Landing System (ILS) with visibility minima of 1200 feet RVR.

c) Draw all 4 basic runway protection areas to scale using Autocad or any drawing program of your choice (planview drawing is OK).

d) Find the dimensions of distances d1 and d2 (shown in the diagram below) to satisfy the new runway OFZ surface. Note that the distance d2 is the minimum distance between the runway centerline to a parallel taxiway allowing the critical aircraft tail to be outside the inner transitional OFZ volume.



Problem 2

La Guardia Airport (LGA) has installed EMAS systems on all the runway ends. Assume the critical aircraft operating at LGA and used in the EMAS installation is the Boeing 757-200 (pictured below).

Figure 2. Boeing 757-200 Lining up and Waiting at CLT Airport (A.A. Trani).

a) Use Google Earth and estimate the length of the EMAS systems installed at runways ends 4 and 31.

b) Using the guidance of the Advisory Circular 150/5220-22A estimate the length of an EMAS installation to stop the critical aircraft at the design speed of 70 knots.

c) If the values estimated in parts (a) and (b) are not the same, estimate the maximum exit speed the EMAS systems at LGA would contain the critical aircraft. Explain.

Problem 3

Read the short article about airport Approach Lighting Systems (ALS) in Wikipedia (https://en.wikipedia.org/wiki/Approach_lighting_system) and answer briefly.

a) What is the purpose of the ALS system.

b) How many types of Medium-intensity Approach Lighting Systems are listed in article?

c) Who controls the runway lights at an airport with a control tower?

d) Can the approach lights of the ALS system be installed inside the RSA area?

Problem 4

Use Google Earth and Airnav.com to learn about the runway features of the Virginia Tech/Montgomery County Executive Airport (BCB). The current airport is designed for Runway Design Code (RDC) group B-II and visibility minima no less than one mile. The airport has approach capability with a localizer and 1 mile visibility conditions. A new runway expansion to 5,500 feet is planned to allow RDC group C-II to operate at the airport with the same visibility minima as the existing airport. C-II include medium size corporate jets like the Cessna Citation X (see Figure 3) and the Gulfstream G350.

a) Compare the RSA and ROFA dimensions of the airport using the old and new design standards. Comment.

b) Estimate the length of the displaced threshold on runway end 30 to satisfy the new RSA requirement. Explain why a displaced threshold is needed on runway 30 today.

c) Compare the dimensions of the approach and departure RPZ surfaces of the old and new design standard. Comment.

Figure 3. Cessna Citation X at BCB Airport (A.A. Trani). One of the Fastest Civilian Aircraft Flying Today (Mach 0.925 Maximum Speed).