

Assignment 2: Runway Length Analysis

Date Due: February 2, 2018 (Ground Hog Day)

Instructor: Trani

Reading Assignment: Review Chapters 1 through 3 of the FAA Advisory Circular 150/5325-4b before working on this homework.

Problem 1

Design the runway length for a new General Aviation airport to be constructed at a site located 2,450 feet above sea level. Data from a temperature survey indicates a mean daily maximum temperature of the hottest month of 83 degree F. The aircraft fleet mix expected to operate at the airport is shown in Table 1.

Table 1. Expected Aircraft Fleet at Proposed General Aviation Airport. Aircraft in Boldface Text is shown in the Picture.

Aircraft Type	Sampled Aircraft	Sample Picture
Single Engine Piston	Cessna 182, Cirrus SR-22, Raytheon Beech Bonanza A36	
Multi-engine Piston	Raytheon Beech G58 Baron and Diamond DA-62	

- Find the recommended runway length required to serve the aircraft fleet listed in Table 1.
- If the runway at the same airport is designed to accommodate small corporate jets such as the Cessna CitationJet 3 (see Figure 1) instead, estimate the new runway length requirement.
- Estimate the runway length to support turboprop aircraft such as the Raytheon King Air B350 (shown in Figure 2). The King Air B350 carries up to 11 passengers plus two pilots.
- Comment on the differences found in parts (a-c).



Figure 1. Cessna CitationJet 3 (Cessna Model C525B) (A. Trani).



Figure 2. Raytheon Beech King Air B350(A. Trani).

Problem 2

Virginia Tech Montgomery County Executive airport is expanding its single runway (labeled 12-30) to 5,500 feet in length to serve larger corporate jet aircraft. Use the runway length estimation method described in class to **find three representative corporate jets** that could be accommodated in the future at the airport. Find the aircraft design group of each aircraft in your solution.

Problem 3

The Roanoke-Blacksburg Regional Airport (ROA) is in discussion with an airline to start services from Roanoke to Houston (IAH) and to Orlando (MCO). The airline purchased a new Boeing 737-8 Max with characteristics shown in Table 2. For this analysis, use the latest version of the Boeing documents for airport design.

Table 2. Aircraft Considered in the ROA Airport Evaluation.

Aircraft Considered
Boeing 737-8 Max with CFM LEAP-1B28 engines. Aircraft maximum design takeoff weight is 181,000 lb. 162 seats in a two-class layout.

- a) Find the average stage length to be flown between each one of the critical Origin-Destination airport pairs. Use the Great Circle Flight Path mapper link provided in our interesting web sites (<http://www.gcmmap.com/>). Add 6% to the distances estimated by the Great Circle mapping application to account for real Air Traffic route conditions and to account for possible weather deviations from the shortest flight path.
- b) Find the Desired Takeoff Weight (DTW) to fly the proposed routes. Assume 100% passenger load in this analysis.
- c) Find the runway length needed for each one of the aircraft operating the critical route. Determine if ROA has enough runway length to support these flights.
- d) If the runway length estimated in part (c) exceeds the runway length available at ROA, find the runway extension needed to support the proposed flights.

Problem 4

Find the runway length for a new airport to be located 90 miles south of Chicago. The new airport is to be located in a 3,200 acre parcel located 830 feet above sea level. Use temperature data for Peoria, Illinois in solving this problem. Design the runway to provide flexibility to operate flights at Maximum Takeoff Weight from this new airport location. Table 3 shows two representative commercial aircraft to be used in the runway design process.

Table 3. Critical Aircraft to be Considered for Problem 4.

Aircraft	Engine	Remarks
Boeing 737-800 (with winglets)	Two CFM56-7B24/-7B26/-7B27 engines at 26,000 lb (static sea level conditions)	Aircraft with maximum design takeoff weight is 174,200 lb. The aircraft has 160 seats in a two-class layout.
Boeing 787-8	GE Engines Genx (High thrust engines)	Plane has 242 seat three-class configuration. 227,930 kg MTOW.

- a) Find the runway length needed to operate the aircraft shown in Table 3. Propose the runway length needed for the new airport. In your solution state the figure numbers used in the Boeing APM documents.
- b) Comment on the different runway lengths needed to operate a the Boeing 737-800 (winglets) vs the Boeing 787-8 Dreamliner.
- c) if the same Boeing 787-8 is operated from Dubai International Airport (62 feet airport elevation) with a design temperature of 103 degrees F, find the runway length needed.
- d) Explain the differences in runway length as a function of temperature.