# Assignment 8: Runway Exit Placement and Geometric Design

**Date Due: November 8, 2024 (Groups of Two)**

**Groups of Two - answer all questions**

**Individual Effort - answer Problems 1 and 3**

## Problem 1

Use the latest version (4.02) of the Runway Exit Design Model (REDIM) developed by Virginia Tech for FAA to evaluate the performance of runway 36L at Charlotte-Douglas International Airport (CLT). Figure 1 shows the configuration of the runway with four runway exits. Tables 1 and 2 show the runway exits and aircraft fleet mix at CLT.

The current version (REDIM 4) can be downloaded at the link below:

https://atsl.cee.vt.edu/products/runway-exit-design-interactive-model--redim-1.html

The updated MATLAB Runtime should install automatically. However, you can install it separately by downloading it here:

https://atsl-software-downloads.s3.amazonaws.com/redim/MATLAB_Runtimes/MATLAB_Runtime_R2021b_Update_3_win64.exe

Use the example described in the notes to do this exercise.

Use Arnav to find the airport elevation of CLT. Assume an operating temperature of 80 deg.F. and use 90% dry pavement conditions. Run your analysis with Pilot Motivation Factors of 1.0 (default).

Table 1. Runway Exit Characteristics of Runway 36L at CLT Airport.

| Runway Exit | PC Location | Runway Exit Type |
|---|---|---|
| **W7** | 5600 | High-speed exit (~1800-foot radius) |
| **W8** | 6750 | High-speed exit(~1800-foot radius) |
| **W9** | 8500 | Right-angle |
| **W** | 8800 | Right-angle |

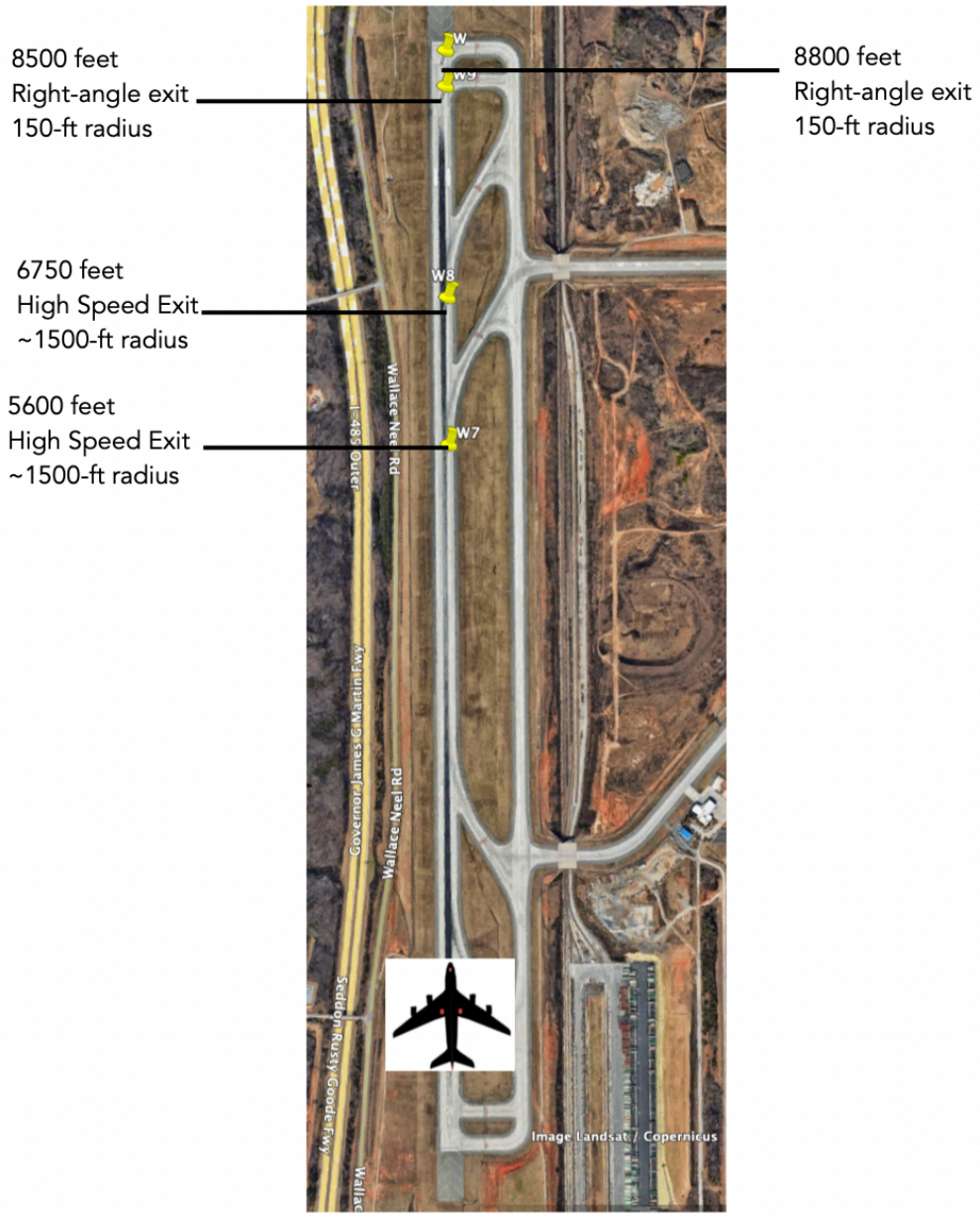


Figure 1. Runway 36L Landing Exit Locations at Charlotte-Douglas International Airport.

*Table 2. Aircraft Fleet Mix to Model Runway Occupancy Times on Runway 36L at CLT Airport.*

| Aircraft ID | Aircraft | Fleet Mix (%) |
|---|---|---|
| **C68A** | Cessna Citation Latitude | 10 |
| **A319** | Airbus 319 | 35 |
| **B738** | Boeing 737-800 | 28 |

| Aircraft ID | Aircraft | Fleet Mix (%) |
|---|---|---|
| **B712** | Boeing 717-200 | 10 |
| **B737** | Boeing 737-700 | 8 |
| **A330** | Airbus 330-300 | 5 |
| **B763** | Boeing 767-300 | 4 |
| **Totals** | | 100 |

a) Estimate the weighted average runway occupancy time (ROT) and the standard deviation of ROT at runway 36L.

b) Show me the runway exit configuration diagram provided by REDIM 4.

c) Estimate the percent of Airbus A319 landings likely to use runway exits W7 and W8. Show the full table of runway exit assignments provided by the model.

d) Estimate the percent of Boeing 737-800 landings likely to use runway exits W7 and W8. Show the full table of runway exit assignments provided by the model.

e) Compare the ruway exit utilization of the Airbus A319 and the Boeing 737-800. Comment on the reasons for possible differences.

f) Find the runway exit at CLT runway 36L that is likely to be used the most . Estimate the percent of all the landings using that exit.

g) Djow me th eplot of REDIM 4 with runway occupancy times for each exit and aircraft.

h) Find if the parallel taxiway W at CLT is compliant with RDC D-V.

## Problem 2

Using the cumulative runway exit distribution charts (see Figure 4-17 in the FAA AC 150/5300-13B) provided in class on pages 73-78 of the Runway Exit Design handout answer the following questions:

a) Estimate the percent of AAC D aircraft that could take a high-speed runway exit located at 6000 feet at an airport located at sea level conditions.

b) Estimate the percent of AAC D aircraft that could take a right-angle runway exit located at 6000 feet at an airport located at sea level conditions.

c) Explain the difference in your estimates for parts (b) and (c).

d) Runway exit A3 (see Figure 2) is a right-angle exit located 4,200 feet from runway threshold 31 at the Virginia Tech Montgomery Executive Airport. Estimate the percent of single-engine piston powered aircraft like the Beechcraft Bonanza V35 that could use runway exit A3 while landing on runway 31..

e) Consider runway exits A3 (located 4,200 feet from runway threshold 31) and runway exit A2 (located 5,250 feet from runway threshold 31) at the Virginia Tech Montgomery Executive Airport. Estimate the cumulative percent of corporate jets like the Dassault Falcon 2000 (see Figure 3) that could use runway exits A3 and A4, respectively.

f) Why do we design two entrance runway exit at the end of runway 31 at BCB? Briefly explain.

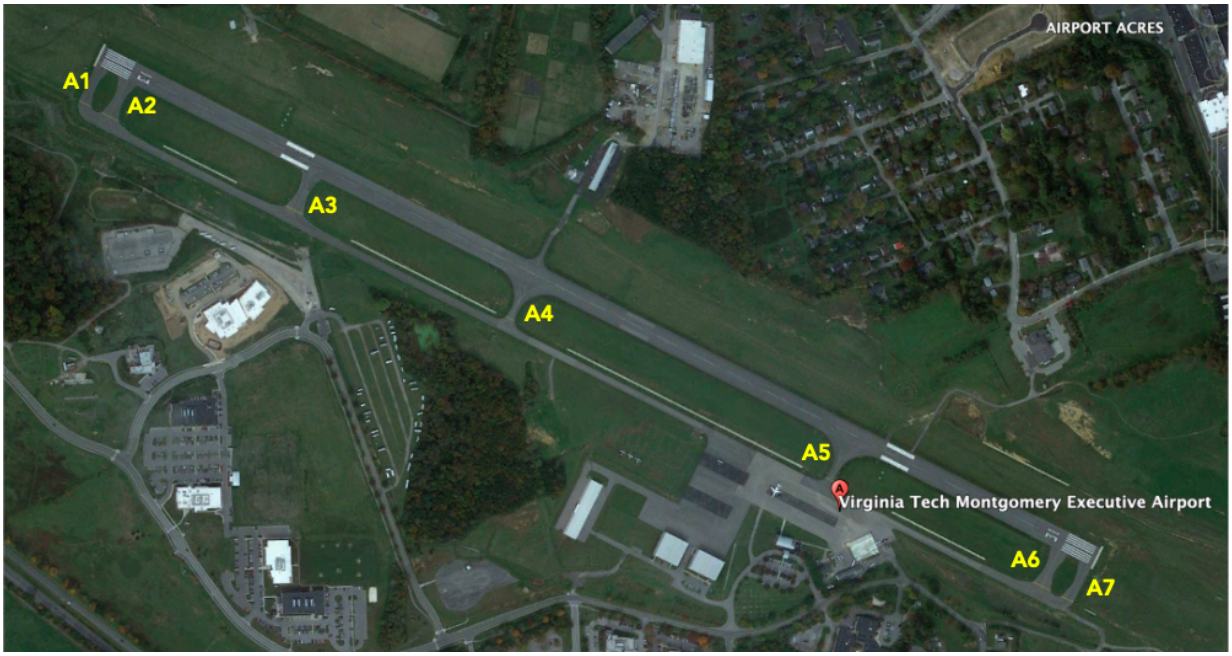


Figure 2. Runway Exit Locations at Virginia Tech Montgomery County Executive Airport.

Figure 3. Dassault Falcon 2000 Landing at BCB Runway 31 (A. Trani).

## Problem 3

A proposed 7,500 ft runway planned for a regional airport is expected to have a total of seven runway exits. The critical aircraft is the Embraer 190 (see Figure 4).


Figure 4. JetBlue Embraer 190 Landing at Reagann National Airport (A. Trani).

(a) Use the cumulative curves to locate two high speed exits allowing 50% and 90% of the critical aircraft AAC class to exit.

(b) Find the **minimum separation between** the runway and a parallel taxiway centerline for your design.

(c) What is the recommended distance between the runway and parallel centerlines to allow efficient runway operations.

(d) Draw to scale the last runway entrance exit for the new runway. Include dimensions. Follow the example on page 43 of the class notes (Runway Design and Exit Locations). In your design, use the recommended distance between the runway and the parallel taxiway (part c).

(e) Draw one of the high-speed runway exits (including dimensions) using the FAA templates provided at: https://www.faa.gov/airports/engineering/airport_design.