

**Purdue University**  
**School of Civil Engineering**  
**CE 361 Introduction to Transportation Engineering**

**Homework 9**

**AIRPORT FORECASTS, CAPACITY, AND DELAY**

**Posted: Wed. 17 November 2004**  
**Revisions to Problem 2 on 29 November 2004**  
**Due: Fri. 3 December 2004**

Dear Consultant(s):

Rozelle Airport (ROZ) is becoming a popular destination for business and leisure air travel. Please demonstrate your facility with basic airport analysis methods by completing and submitting the exercises below.

Note: You must submit this HW as a member of a group of at least two and no more than four CE361 students. As usual, the top sheet of the material submitted must be signed by each group member.

1. (20 points) **Forecasting air travel using the FAA "Share Model"**. Forecast the *total operations and total passenger traffic* at Rozelle Airport for the years 2005, 2010, 2015, 2020, and 2025. A spreadsheet file "roz04.xls" with *exactly* the *format* of FTE Table 11.6 will be emailed to you. It will contain historical data for ROZ, along with FAA and local forecasts. Attach a hardcopy of your completed spreadsheet to your HW. Notes: (1) Because Rozelle is a smaller airport, use four digits after the decimal point for ROZ's stature. (2) Your choice of *Planning Factors* may differ from other analysts', so you must provide a brief explanation for each of the values you chose and show the values clearly.
2. **Airport capacity and delay**. The "210" entry in FTE Table 11.15 should be "174". All entries in FTE Table 11.16 are correct.
  - A. (12 points) What is the capacity of the airport when Visual Flight Rules are in effect? Use the format of Table 11.16. (Suggestion: Build a spreadsheet to duplicate the contents of Table 11.16, then modify it to fit the data in this problem.)
  - B. (8 points) If 34 aircraft per hour per hour land under VFR conditions at an airport with capacity 50 landings per hour, what mean delay does FTE Equation 11.6 estimate? Use a standard deviation of 20 seconds. What is the maximum number of arriving aircraft that the airport can receive in an hour, while maintaining a mean delay of no more than 0.5 minutes?
3. **Airport capacity with a known sequence of operations**. Because of scheduled flights and filed general aviation flight plans, the expected sequence of operations at ROZ for the time period beginning 5:30PM today can be given below. Subscript "a" means the aircraft (S, L, or H) is arriving (landing) and "d" means departing (taking off).

Ld, Sd, La, Sa, Ld, La, Sa, La, Sd, Ld, La, Hd

  - A. (12 points) Using information in Tables 11.14, 11.16, and 11.17, create a table just like Table 11.18 that summarizes the time between operations for each pair of consecutive aircraft. What is the total elapsed time between the first and last operations listed above?
  - B. (8 points) What is the capacity (ops/hr) of ROZ during the period studied?

4. **Runway configurations and capacity.** For a certain future year, ROZ's operations are expected to be 42% Class A, 8% Class B, 32% Class C, and 18% Class D aircraft.
- (10 points) Calculate the Mix Index for ROZ in that year. If ROZ's runway-use configuration is No. 1, what will ROZ's Hourly Capacity be under VFR and IFR conditions? What will ROZ's Annual Service Volume be?
  - (10 points) If ROZ is expected to have 157,000 operations in that year, calculate ROZ's Delay Factor for that year. Use Fig 11.24 to estimate average aircraft delay.
5. **Runway length and takeoff weight.** ROZ Airport lies at elevation 2000 ft. Its temperature in the summer seldom exceeds 90°F. An airline has expressed an interest in serving ROZ with Boeing 727-200 aircraft. The airport management wants to know if ROZ's 7000-foot runway is long enough for a 727. If not, how long must the runway be? Note that one end of the runway is 23 ft higher than the other end.
- (2 points) What is the MATOW for a 727 at 2000 ft and 90°F? What is the Reference Factor for a 727 at 2000 ft and 90°F?
  - (4 points) How long must the runway be to permit the MATOW found in Part A? What is the MATOW for the current runway at ROZ? Show how you found these values.
  - (14 points) If the 727 will be offering service to an airport 400 miles away, how many passengers can be carried, given the current runway? Show the steps in your analysis.