Assignment 7: Airport Geometric Design Standards

Date Due: October 28, 2022
Instructor: Trani

Problem 1

A new airport is designed with two satellite terminal buildings as shown in Figure 1. The buildings are designed to accommodate aircraft up to the size of an Airbus A321neo and the standard Airbus A321.

a) Find the dimensions A through R in Figure 1. Make sure that your design allows pilots entering the gate position to maneuver with steering angles no more than 50 degrees. Assume the service roads have 12-foot wide lanes.
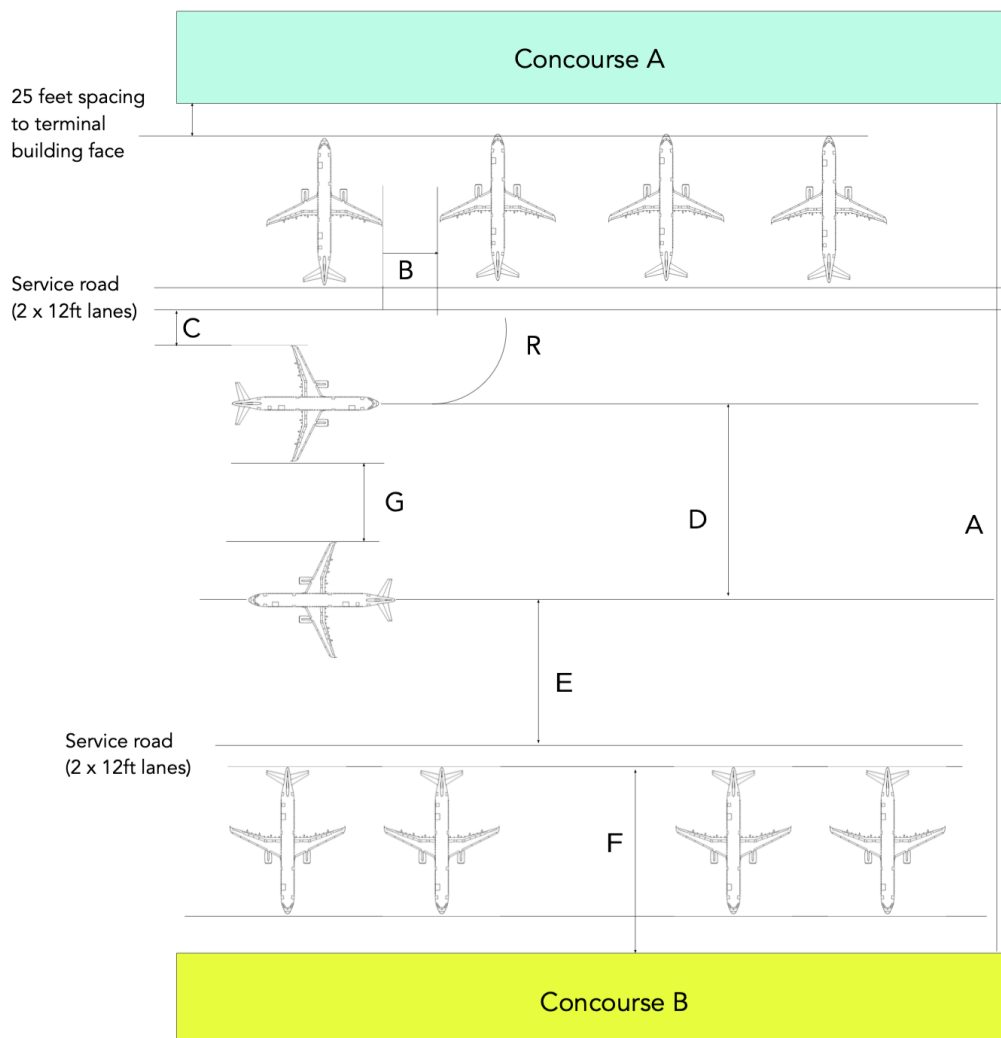

Figure 1. Airport Taxilane Configuration for Problem 1.

b) Estimate the steering angle and wingtip radius of the Airbus A321neo for the centerline radius R selected in part (a) of the problem. Consult Section 4 of the Airbus A321neo airport design document.

c) Compare the dimensions of your design at the gate with the typical gate layout dimensions recommended by Airbus for the A321neo (Section 5 in the manufacturer airport design document). Comment on any differences.

d) Estimate the length of the 50 feet/second engine exhaust contours for the Airbus A321neo with Pratt and Whitney PW1100G engines assuming that the pilot applies engine breakaway power (12% maximum takeoff thrust) while parking the aircraft nose-in towards the terminal building. The engine exhaust contours are included in the Airport Planning and Design aircraft documents (see Section 6).

Problem 2
An airport is expected to have a 135-degree taxiway-taxiway connector (see Figure 2).

a) Specify the dimensions of the 135-degree taxiway connector if the design aircraft is an Airbus A321neo. You can use the FAA taxiway design fillet tool to simplify your analysis. For this design use the minimum centerline radius required by FAA. If the FAA taxiway design tool does not work on your computer, use the tables in Appendix J of the FAA Advisory Circular 150/5300-13B to implement your design.

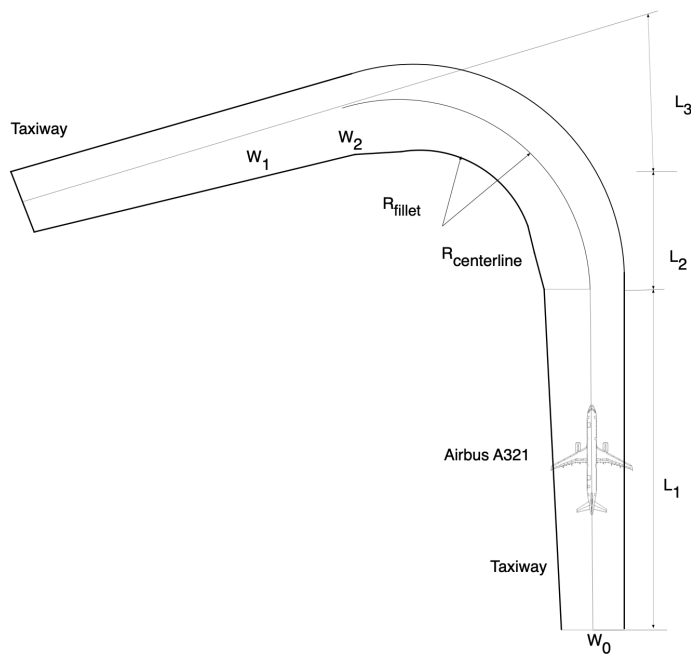b) Draw your solution in the CAD application of your choice (no hand sketches accepted).

Figure 2. 135-degree Turn Taxiway-Taxiway Intersection for Airbus A321neo.

Problem 3

An airport is expected to have two parallel taxiways as shown in Figure 3. Taxiway Romeo is designed for aircraft of the size of the Airbus A380. Taxiway Alpha is limited to aircraft such as the Airbus A330-900.

a) Specify the dimensions in Figure 3 to satisfy the FAA design requirements. Before solving the problem, read Section 4.5.2 of the FAA Advisory Circular 150/5300-13B.

b) Find the dimensions of the taxiway shoulders in the design.

c) Find the taxiway edge safety margin used in the design.

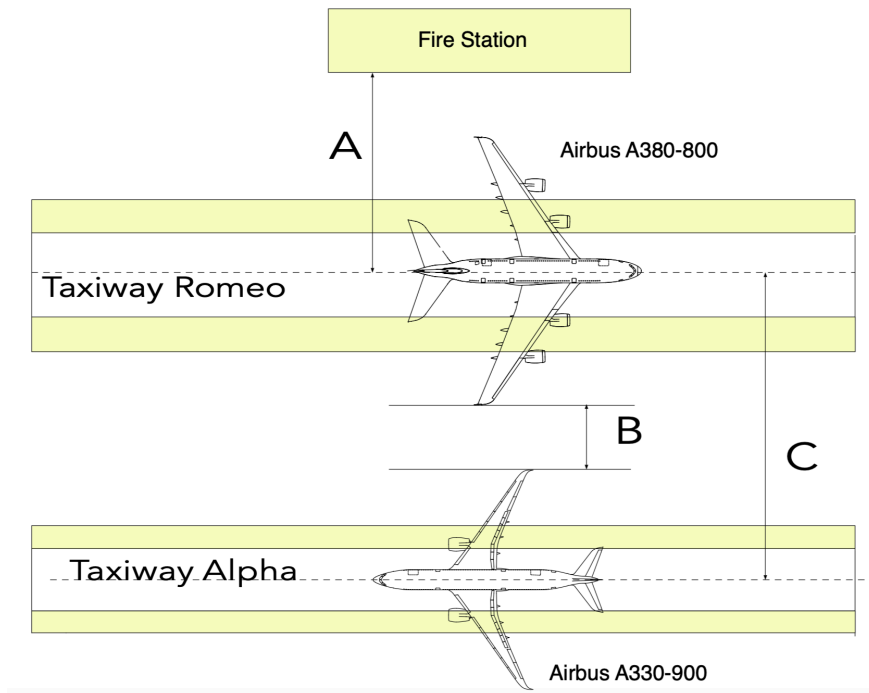d) State the dimensions of the Taxiway OFA and Taxiway Safety Area (TSA) for both taxiways.

Figure 3. Taxiway Design for Problem 3.

Problem 4

Use the FAA/Virginia Tech Landing Events Database to answer the following questions. Use data for year 2019 in your analysis. You can download the Landing Events Database at: https://atsl.cee.vt.edu/products/runway-exit-design-interactive-model--redim-.html.

a) Find the median (50%) arrival threshold ground speed for Boeing 777-200 landing IAD airport runway 1R. Is the reported speed consistent with the approach speeds reported in the FAA AC 150/5300-13B? Comment.

b) Find the median (50%) speed at the Point of Curvature (i.s., start of the turn) for Boeing 777-200 landing at IAD airport runway 1R and using high-speed exit K4.

c) For Boeing 737-800 landings at IAD airport runway 1R find the percent of landings taking exits K2, K4 and K6. Comment on any pattern observed.

d) Find the median runway occupancy times (fuselage out) for Boeing 737-800 landings at IAD airport runway 1R taking exits K2, K4 and K6. Comment on the pattern observed.