Assignment 5: Geometric Design Standards

Solution

Problem #1

A new airport is expected to serve Embraer 195 type as the critical aircraft. The runway length is expected to be 2,500 meters. The airport is located at an elevation of 2,100 feet above sea level conditions. The airport will have an instrument landing system and serve approaches with visibility minima down to 1/2 miles (ILS Category I equivalent approach). Determine the following dimensions for your design:

1. The length and width of the approach and departure surfaces for the airport **(use precision approach category surfaces)**
2. The elevation of the horizontal surface above mean sea level conditions **(2,250 feet above MSL)**
3. The width and length of runway blast pad area. **(200 x 200 feet)**
4. The width of the runway and taxiway shoulders. **(25 and 20 feet respectively)**
5. Distance from the runway to a parallel taxiway if high-speed runway exits are to be constructed. **(350 feet minimum for TDG 3 per Figure 4.20, 600 feet recommended due to our discussion in class)**
6. Distance from the runway to a parallel taxiway if only right-angle runway exits are to be provided. **(400 feet)**
7. Width of taxiway safety area.**(118 feet for ADG III)**
8. Minimum distance from the taxiway centerline to a fixed object. **(93 feet)**
9. Minimum perpendicular distance from the runway centerline to a hangar with height 30 meters. **(H critical is 45.84 feet, Minimum distance to clear Inner transitional OFZ is 515.1 feet). See Figure 1.**

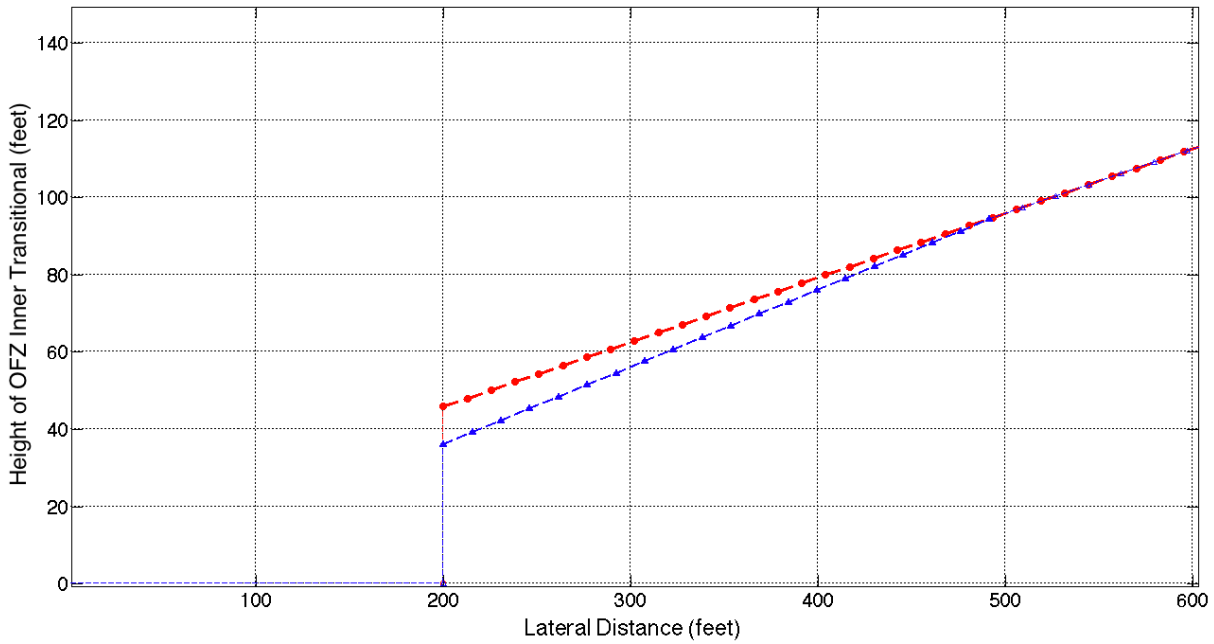

Figure 1. Inner transitional OFZ.

Problem #2

The airport authority wants to know if the objects near an airport constitute obstacles to navigation. The proposed location of the these objects is shown in Figure 1. Determine if each object is an obstruction to navigation. State which surface is critical (i.e., in violation). The runway shown in Figure 2 is a 2,700 meter precision runway.

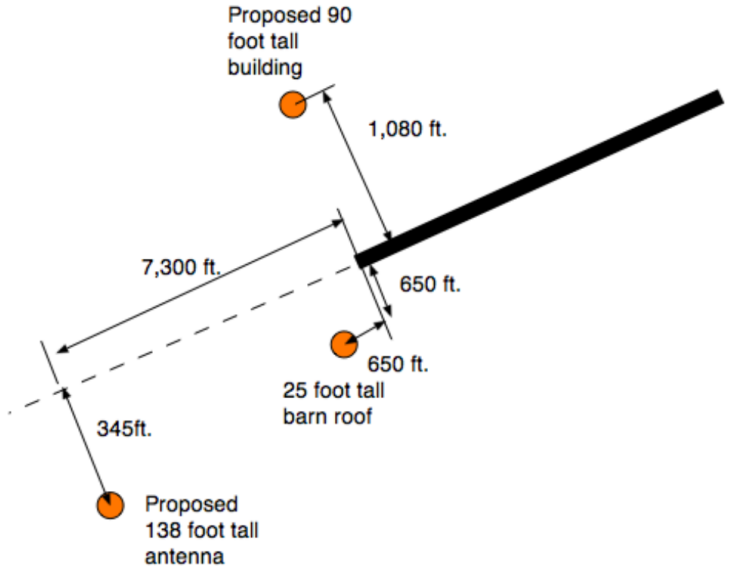

Figure 2. Potential obstructions to navigation.

a) Antenna is in approach surface. at 7100 feet from end of primary surface the critical height of the approach surface is 142 feet. **The Antenna is not an obstruction to navigation.**

b) Barn roof is not in approach surface since approach surface is 1,000 feet wide at 200 feet from the runway end point. Width of primary surface is 500 feet at 200 feet from runway end. At 450 feet from its starting point, the approach surface height is 9 feet. At that point the approach surface edge is 567.5 feet from the approach surface centerline. Hence the distance from the barn to the approach surface edge is 82.5 feet (650-567.5 ft). At 7:1 the transitional surface rises 11.79 feet above the edge of the approach surface. This provides (9+11.79 = 20.79 feet total height AGL). **The barn is an obstruction to navigation.**

c) The 90 foot tall building is in the Transitional Surface (TS). TS starts at 500 feet from runway centerline and rises at 7:1. In 580 feet of rise the TS height is 82.85 feet. **The proposed building would be an obstruction to navigation.**

Problem #3

a) An airline operates Boeing 747-8 aircraft to an airport with a single precision runway as shown in Figure 2. The airline is proposing building a 80-foot tall hangar to be located 500 feet perpendicular from the runway centerline. Perform the necessary analysis to determine if the proposed hangar violates the runway Obstacle Free Zone (OFZ). The runway is a precision runway with **a Category 1 Instrument Landing System (ILS)**. State the dimensions of the OFZ for this runway.

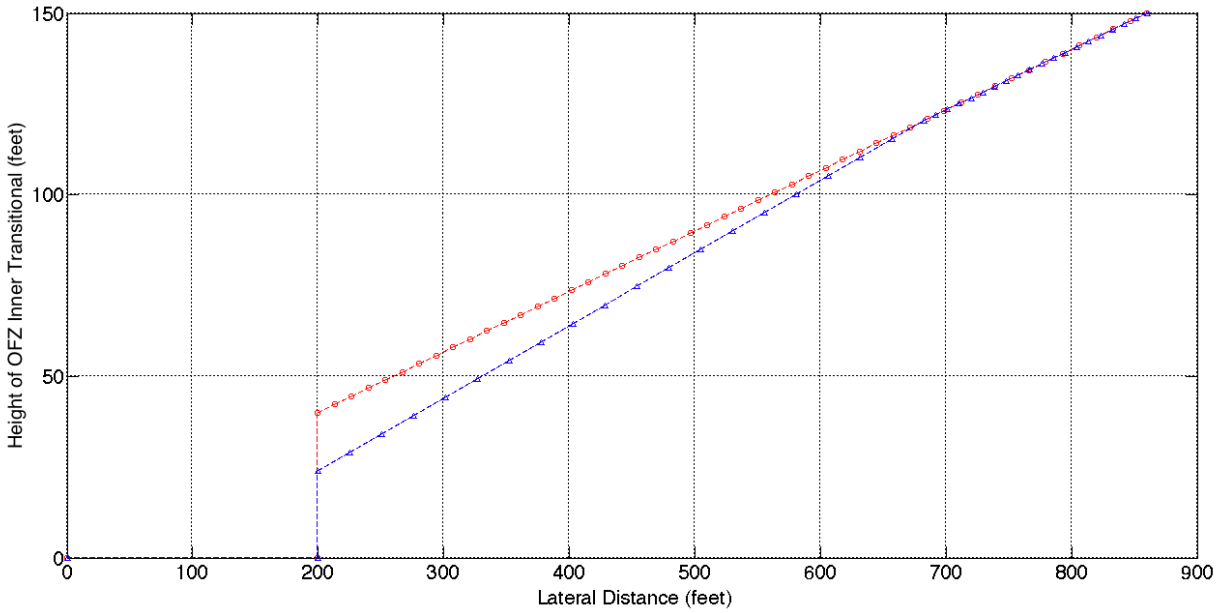

Figure 3. OFZ solution for problem 3. Red line shows the solution for Category 1 approaches.

At 500 feet form runway centerline, the OFZ height can be as high as 89.9 feet as shown in Figure 3. Technically, the building does not violate the inner OFZ. However, the problem is that the same building would be at the edge of the primary runway surface and thus cannot be allowed because it violates the transitional surface at 600 feet. Note that at 600 feet from the runway centerline, the highest building would have to be no higher than 14.28 feet.

Problem #4

The design should employ 16 knots as the critical crosswind component for ADG C-III. The optimal runway orientation is 220 degrees with a coverage of 99.05% using both runway ends.