Assignment 4

Date Due: September 24, 2021 Instructor: Trani

Problem 1

Use Google Earth and Airnav.com to learn about the runway features of the Virginia Tech/Montgomery County Executive Airport (BCB). The current airport is designed for Runway Design Code (RDC) group C-II and visibility minima of one mile. Last summer, the airport expanded the runway to 5,500 feet and the airport infrastructure improved to accommodate medium size corporate jets like the Bombardier Challenger 350 (see Figure 1). Because half of the passengers using the Roanoke-Blacksburg Regional Airport in Roanoke commute from Blacksburg, the future BCB airport may expand to include commercial services. Assume that such services may include flights from BCB to Atlanta and Chicago using Embraer 145-XR aircraft (see information about Embraer aircraft in the links to aircraft manufacturers on our web site).

a) Find the new RDC code of the airport if commercial services are offered with EMB-145-XR aircraft. Assume the visibility minima will stay at 1 mile using the existing Instrument Landing System Localizer system at the airport.

EMB-145-XR AAC group C, ADG group II

RDC code C-II

b) Find the runway length needed to operate Embraer 145-XR to ATL and ORD with full passengers. Is the existing runway sufficient?

Airport Elevation: 2119.5ft Design Temperature:83F (28.3C)

Use the Embraer APM to estimate runway length instead of FAA AC.

ISA temperature at 2119.5ft is 10.85C

Although 10.85+15+1.7=27.55<28.3, we still use ISA+15

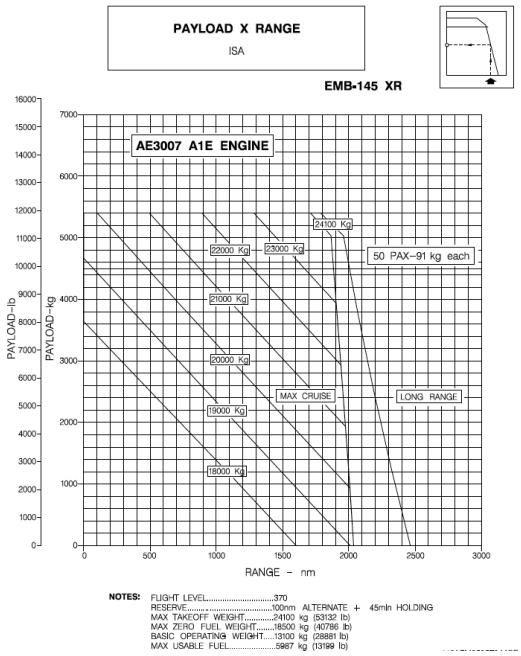
Assume MTOW and AE3007 A1 ENGINES and flap setting: 9°

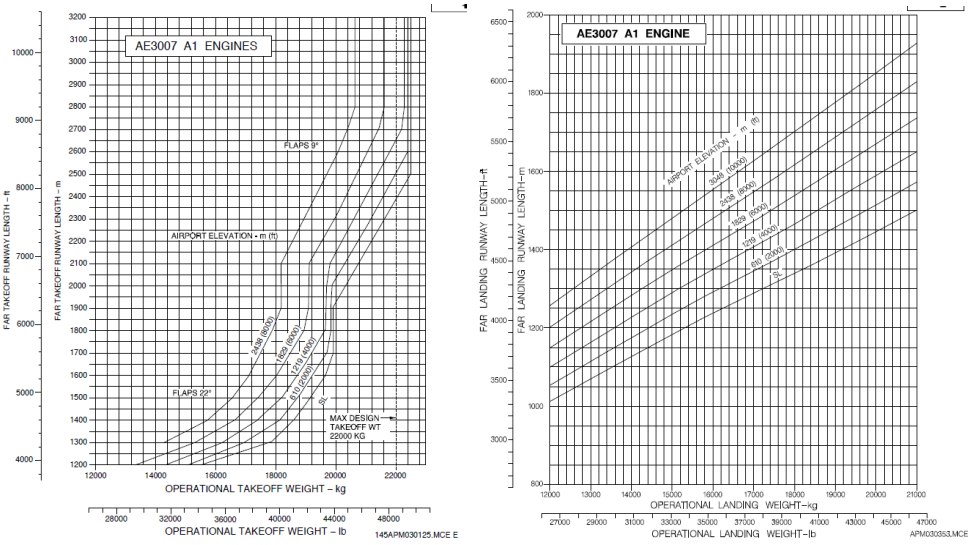
Takeoff distance=8,200ft

Assume maximum operational landing weight flaps setting 45°

Landing distance=5200ft*1.15=5980ft

Since Embraer 145-XR requires 8200 feet runway for takeoff, the existing runway is not sufficient to operate at full load. However, the aircraft can operate from 5,500 feet with takeoff weight restrictions. Look at the figure below. The EMB 145 XR can operate from a 5,500 feet runway with a maximum takeoff weight of 19,500 kgs. Look at the payload-range diagram for the EMB-145 XR. With a DTW of 19,500 kgs, the aircraft can fly ~500 nm (BCB-ORD is 450 nm or 477 nm adjusted for the typical 1.06 detour factor) and still carry 4000 kgs of payload (~40 passengers). The issue is if the airline is willing to fly every departure from BCB at 80% load factor. This is a difficult proposition because airlines do not make money unless they fly load factors of 75% or more. The service from BCB to ORD would be very marginal from both the runway length and profit point of view.





c) Since the Embraer 145-XR (see Figure 2) is out of production today (many still fly with US airlines), investigate changes to runway width, runway length needed to operate Embraer 170 aircraft in the future at BCB.

Embraer 170 STD AAC group C ADG group III MTOW 82012 lbs

Runway width 150 ft (current runway is 100 feet wide)

Assume MTOW and CF 34−8E5 ENGINE and flap setting: 2 (ISA+15C)

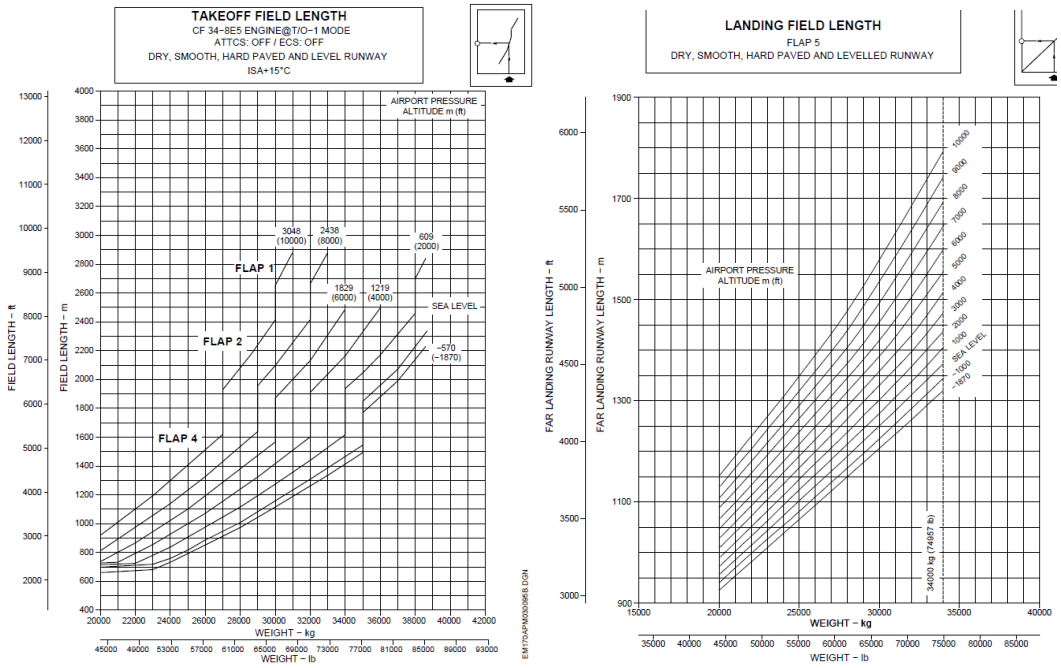
ATTCS: OFF / ECS: OFF

Takeoff distance=9,350ft

Assume maximum allowable landing weight flaps setting 5

Landing distance=4,750ft*1.15=5462ft

Embraer 170 requires 9,350 feet runway for takeoff.



d) If Embraer 170 aircraft are operated from BCB, compare the RSA and ROFA dimensions of the existing airport and the future airport if RVR is 1 mile (~5000 feet). Clearly state what is the RDC design code for Embraer 170 operations.

Visibility Minimum: Not lower than 1 mile

Existing airport RDC code C-II

Future airport RDC code C- III

The RSA and ROFA dimensions for existing airport and the future airport is the same

Length beyond departure end	1,000 ft
Length prior to threshold	600 ft
Width	500 ft

Dimensions of ROFA:

Length beyond departure end	1000 ft
Length prior to threshold	600 ft
Width	800 ft

e) Compare the dimensions of the approach and departure RPZ surfaces of the existing and the future airport design standard. Comment.

The approach and departure RPZ dimensions for the existing airport and the future airport are the same.

Dimensions of RPZ:

Approach	Length	1700 ft

	Inner Width	500 ft
	Outer Width	1010 ft
	Acres	29.465
Departure	Length	1700 ft
	Inner Width	500 ft
	Outer Width	1010 ft
	Acres	29.465

Figure 1. Bombardier Challenger 350 (A.A. Trani).

Figure 2. Embraer E-145 XR (A.A. Trani).

Problem 2

Familiarize yourself with the FAA AC 150/5220-22B before trying this problem.

a) Review the configuration of Roanoke-Blacksburg Regional Airport using Google Earth. Specifically, look at the the runway thresholds 6 and 24. Would you justify the installation of an Engineering Materials Arresting System (EMAS) at threshold 6? Briefly explain.

The displaced threshold on runway end 24 meets the RSA requirement for landings on runway 24 (600 feet required). The displaced threshold on runway end 24 also meets the RSA requirement for landings on runway 6 (1,000 feet required). No need to install EMAS on the runway 24 end.

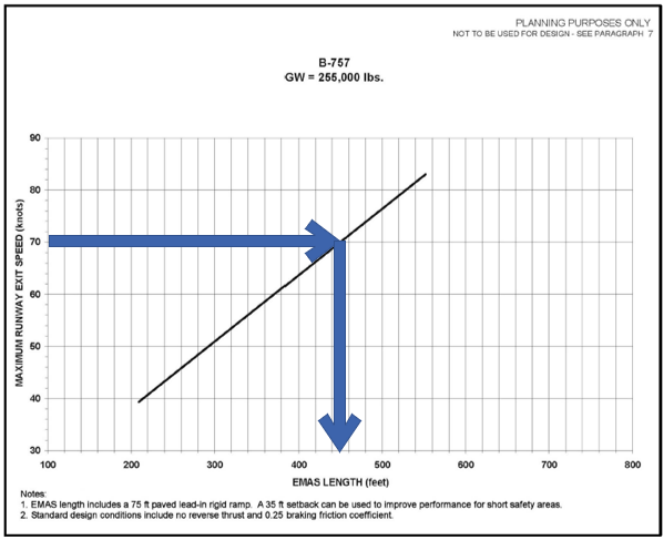
Runway threshold 6 has 180 feet between the start of the runway and the "cliff" to highway I-581. An EMAS would help with an overrun while landing on runway 24. Similarly, the RSA protection for landing on runway 6 600 feet prior to the landing threshold) is not present. The airport could benefit from an EMAS if further relocation of the highway was possible (an expensive project). Airnav lists the following declared distances for runway 24:

TORA:6800 TODA:6800 ASDA:6800 LDA:6010 (in feet)

The LDA published assumes full runway availability for a landing on runway 24 without the required 1,000 feet RSA protection at the end of runway 24. This is inconsistent because technically, the RSA needs to exist on the far end of the landing runway 24. The LDA considering the 1,000 ft RSA on the far end of runway 24 (runway threshold 6) should be 5,200 feet. I am sure the airlines flying to Roanoke plan on that distance available for landing.

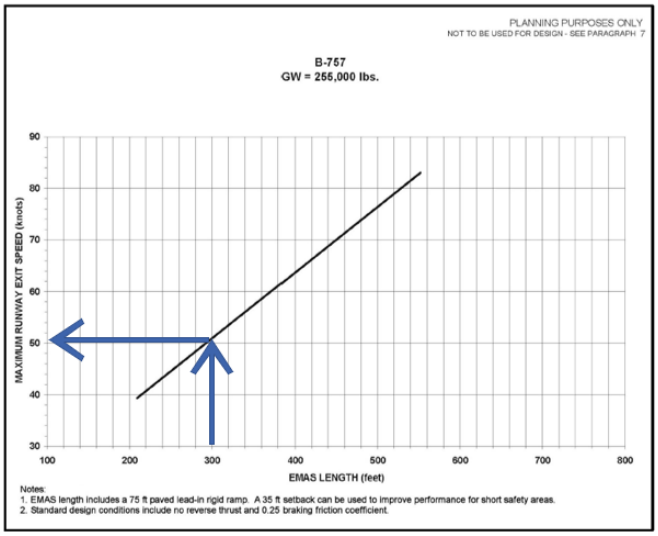
b) If an EMAS system is installed on threshold 6, estimate the size of the arrestor bed if the critical aircraft operating at ROA is a Boeing 757-200 (see Figure 3). Use the standard EMAS design speed in your analysis.

The standard EMAS design speed is 70 kts. The length of EMAS is about 450 feet.



c) Look at the EMAS installed on runway threshold 16 at ROA. Estimate the maximum runway exit speed supported by the EMAS system installed if the critical aircraft is the Boeing 757-200.

The length of EMAS on runway threshold 16 at ROA is about 300 feet. So, the maximum runway exit speed is about 51 knots.



d) Look at the EMAS installed on runway threshold 31 at La Guardia Airport (LGA). Estimate the maximum runway exit speed supported by the EMAS system installed at LGA. The critical aircraft is also a Boeing 757-200.

The length of EMAS on runway threshold 31 at LGA is about 330 feet. So, the maximum runway exit speed is about 56 knots.

Figure 3. Boeing 757-200 (A.A. Trani).

Problem 3

Use Google Earth and Airnav (www.airnav.com) as needed, to answer the following short questions.

Kansai International Airport (KIX)

a) Can the airport conduct simultaneous approaches to runways 24R and 24L in Instrument meteorological conditions? Explain the ICAO rule that applies and the distance between the two runways in question.

Yes. 1035 meters (3395 ft) for independent parallel approaches. The distance between the two runways is about 1.44 miles (more than the minimum needed).

Dallas-Fort Worth International Airport (DFW)

a) Can DFW conduct simultaneous approaches to three runways at DFW in IMC conditions? Select the three most likely runways used for arrivals if the wind is reported from the North (0 degrees) at 8 knots. Explain the FAA rule used and the distance between the runways in question. Remember, aircraft prefer to land against the wind. State the reason for your runway selection and mention the distance between the runways selected.

Note Runway 18R/36L at Dallas-Fort Worth (DFW) Airport has been closed for rehabilitation.

Yes. Since the wind is reported from the North and aircraft prefer to land against the wind, the candidate landing runways can be :

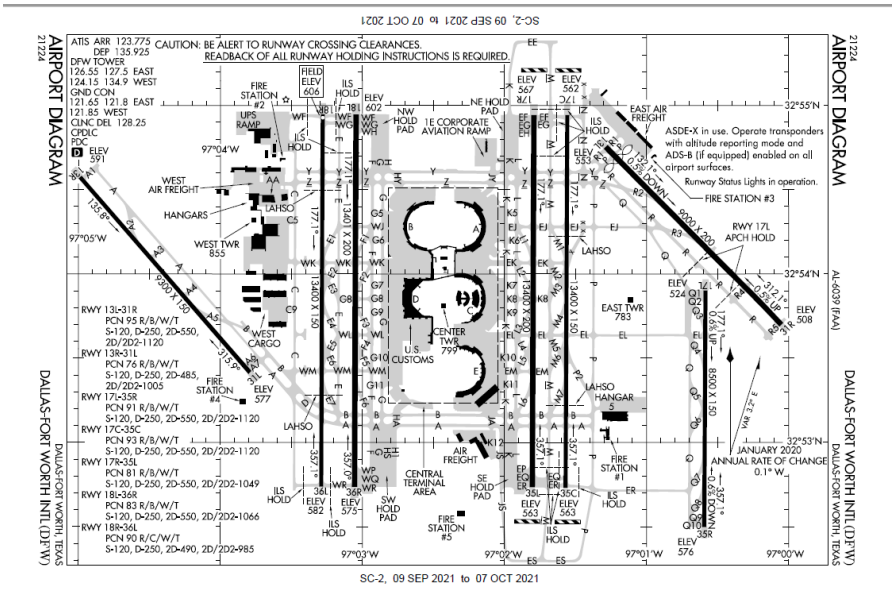
36L (when completed), 35C, 35R. They can be operated independently and simultaneously.

The distance between 17C/35C and 17L/35R is about 5000ft. Airport elevation is 606.4 ft.

The distance between 17C/35C and 17R/35L is about 1200ft.

The distance between 17R/35L and 18L/36R is much greater than 5000ft.

So, the available runway for triple simultaneous approaches are 18L/36R, 17R/35L and 17L/35R or 18L/36R, 17C/35C and 17L/35R.

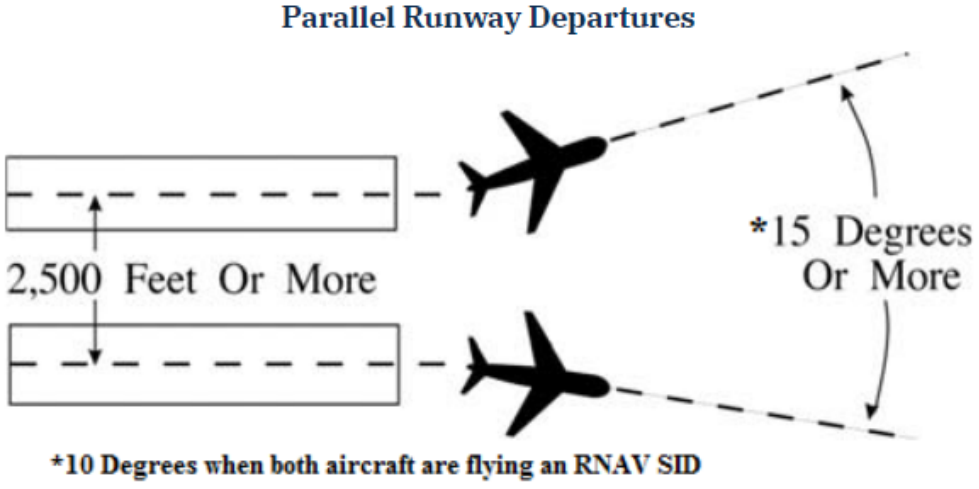


b) Can ATC conduct simultaneous departures using two runways at DFW in IMC conditions? Explain the FAA rule used and the distance between the runways in question.

Yes. For instance, runway 17C/35C and runway 17L/35R. The distance between the two runways is 5000ft.

Between simultaneous departures from parallel runways/helicopter takeoff courses, authorize simultaneous takeoffs if the centerlines/takeoff courses are separated by at least 2,500 feet and courses diverge by 10 degrees or more immediately after departure.

(https://www.faa.gov/air_traffic/publications/atpubs/atc_html/chap5_section_8.html#:~:text=Between%20simultaneous%20departures%20from%20parallel,or%20more%20immediately%20after%20departure)



San Francisco International Airport (SFO)

a) Can simultaneous approaches be conducted to runways 28R and 28L in good weather (VMC) conditions? Briefly explain the procedure.

Yes. Independent simultaneous arrivals can be conducted using the SOIA procedure described in class. The centerline between 28R and 28L is about 750 feet.

b) Is a Precision Runway Monitor necessary for operations at SFO? You can review the following document. https://www.faa.gov/training_testing/training/prm/media/PRM_training.pdf.

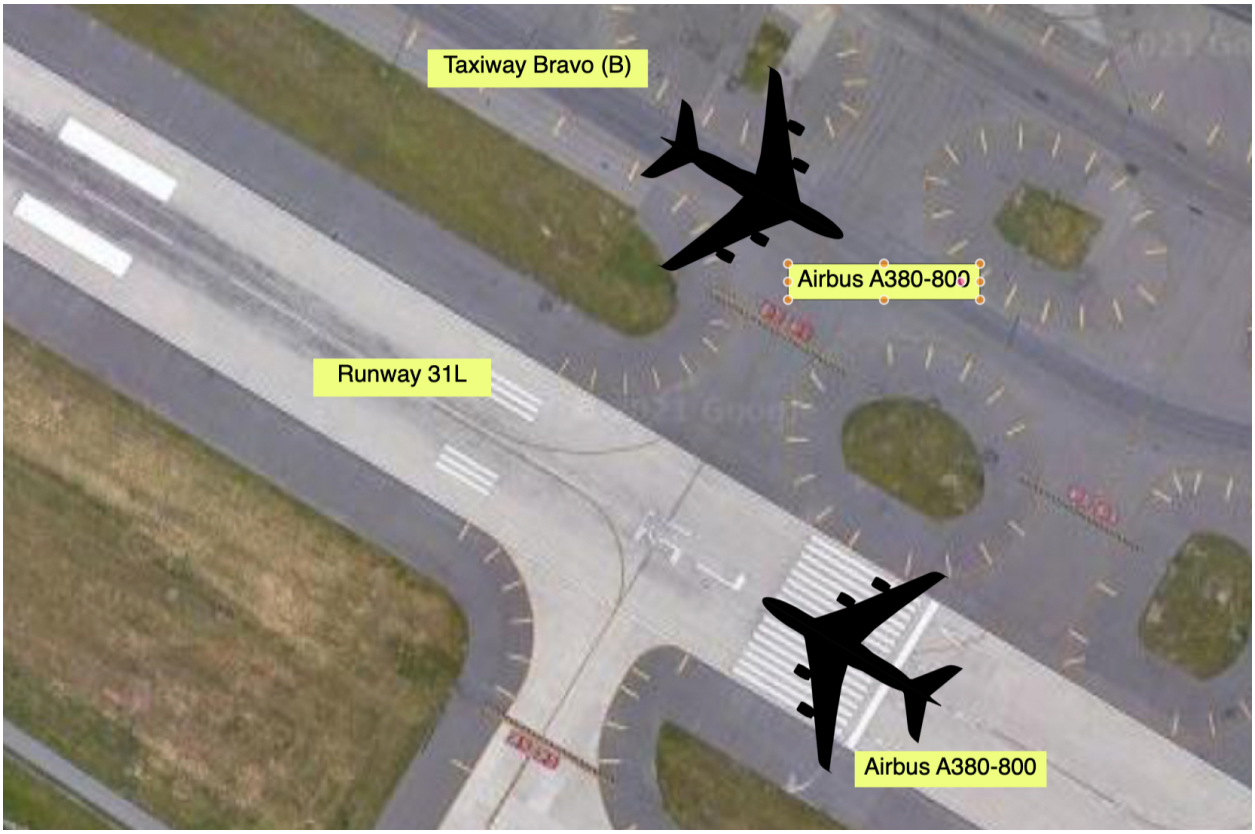
Yes. PRM is required for SOIA. SOIA can be authorized when parallel runway separation is less than 2500 feet and at least 750 feet.

c) Watch movie https://www.youtube.com/watch?v=IwrUxQZPIOo to gain an appreciation of SFO Simultaneous Offset Independent Approaches (SOIA). Are the two aircraft flying the same glide slope? Comment.

No. The glide slope for runway 28L is 2.85 degree. For the runway 28R is 3.00 degree. To differentiate the aircraft. Maybe it is also beneficial for the pilot and air traffic controller.

Problem 4

Use Google Earth application and your knowledge of runway safety areas to answer the following questions. Figure 4 shows a



section of the Runway 31L and Taxiway "Bravo" (B) at the John F. Kennedy International Airport (JFK).

Figure 4. Layout of JFK Airport - Taxiways "Bravo" and Runway 31L.

a) Estimate (using Google Earth) the distance between runway 31L centerline and the parallel taxiway "Bravo".

The distance between runway 31L centerline and the parallel taxiway "Bravo" is about 400 feet.

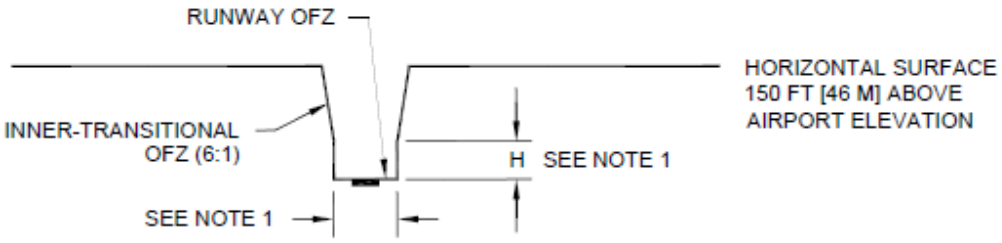
b) Estimate the cross section dimensions of the inner transitional OFZ for runway 31L using the Airbus A380 as the critical aircraft. Retrieve the wingspan data from the Airbus document (or from the FAA AC 150/5300-13a) and the airport elevation from airnav.com. Determine if the vertical tail of the Airbus A380 taxiing on taxiway "Bravo" violates the inner OFZ for runway 31L. In the analysis, assume Instrument Landing System ILS Category 1 operations (i.e., low visibility at the airport).

Airport elevation is 13 ft. Wingspan is 261.65 feet.

A380-800: AAC group D, ADG group VI Tail Height 78.96ft

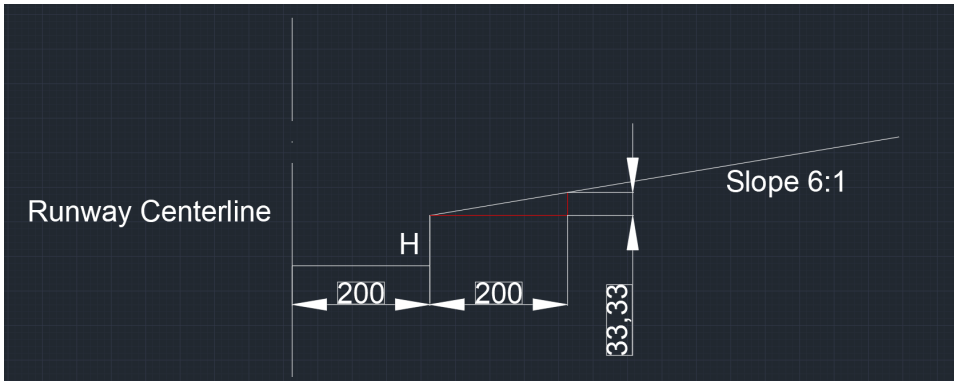
$H_{feet} = 61 - 0.094(S_{feet}) - 0.003(E_{feet})=61-0.094*261.65-0.003*13=36.37feet$

Since 78.96> H+33.33=69.70, **the vertical tail of the Airbus A380 taxiing on taxiway "Bravo" violates the inner OFZ for runway 31L.**



SEE NOTE 4 FOR INFORMATION ON ADDITIONAL VIEWS

RUNWAYS SERVING LARGE AIRPLANES WITH CATEGORY I APPROACH MINIMUMS



c) If the runway 31L is used for departures (the longest runway at JFK), can a second Airbus A380 be taxiing on taxiway "Bravo" when another A380 departs from runway 31L?

No. the vertical tail of the Airbus A380 taxiing on taxiway "Bravo" violates the inner OFZ for runway 31L.

d) Briefly explain the operational implications of having close taxiways to a runway.

Sometimes, having close taxiways to a runway imposes a limitation for the runway operation. For instance, an Airbus 380 cannot taxi on the taxiway when another Airbus 380 departs on runway 31L.