Runway 2-20 Length Justification
Gary Chicago International Airport

January 2019

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1. PURPOSE OF THIS ANALYSIS

The Gary Chicago International Airport (GYY, or the Airport) is in the process of updating its Master Plan. In March 2018, GCIAA obtained FAA approval of the forecast. Since, then the Master Plan team has been assessing airport requirements and alternatives in accordance with the Master Plan update process specified by the FAA. Airport staff and stakeholders intend to seek FAA approval of the future Airport Layout Plan (ALP) in early 2019. The purpose of this document is to provide a runway length analysis and extension justification for FAA review prior to the ALP submittal.

Background

The runway system consists of two runways: Runway 12-30, at 8,859 feet long and 150 feet wide; and Runway 2-20, at 3,604 feet long and 100 feet wide. Both have full-length parallel taxiways.

General aviation makes up the majority of activity at the Airport. Although GYY has received scheduled passenger service intermittently since 2000, there is currently no scheduled service. The Runway 12-30 extension was completed in 2015. In addition, the Airport also added a second FBO in 2015. As a result of this and the growing business aviation market in the Chicago area, the number of based GA aircraft and operations have steadily increased, along with the size of the GA fleet. The Indiana Army National Guard operates a training and maintenance facility on the southwest side of the Airport and houses six based helicopters. Boeing's Corporate Flight Operations are based at GYY with three Boeing Business Jets (BBJs) and three Challengers. Finally, the Airport opened a U.S. Customs Facility for international GA flights in August 2018 and has seen greater than anticipated use.

With this increase in business aviation comes the need for reliability of operations. Corporate charters and flight departments need to be able to operate into and out of GYY in all weather and wind conditions. Wind data indicates that Runway 12-30 provides 93.8% wind coverage at the 13-knot crosswind level, which is below the 95% FAA-specified criteria for wind coverage. Therefore Runway 2-20 must be used during the 6.2% of time when Runway 12-30 cannot safely be used due to the large crosswind component. Additionally, at 3,406 feet in length, Runway 2-20 does not provide adequate departure or arrival length to serve the critical aircraft (ADG B-II). It should be noted that Runway 2-20 has a runway reference code of B-II, while Runway 12-30 is C-III.

Based on analysis in the Master Plan, one of the key elements included in the ALP will be a northward extension of the crosswind Runway 2-20. This document, requested by the FAA's Chicago Airports District Office, outlines justification for the runway extension length to be shown on the future ALP.

2. METHODOLOGY

The runway length analysis was performed according to the methodology of FAA Advisory Circular 150/5325-4B, Runway Length Requirements for Airport Design. The process is illustrated in Table 1.

Table 2-1 – Recommended Runway Length Analysis Methodology

Steps	AC 150/5325-4B Guidance	GYY Runway 2-20 Methodology
1	Identify the list of specific critical design airplanes that will make regular use of the proposed runway for an established planning period of at least 5 years	Runway 2-20 is classified as ADG B-II ADG B-II and smaller aircraft are regular users.
2	Identify the airplanes that will require the longest runway lengths at maximum certificated takeoff weight (MTOW).	Aircraft with MTOW >12,500 lbs. and < 60,000 lbs. Recommended runway length is determined according to a family grouping of airplanes having similar performance characteristics and operating weights.
3	Use Advisory Circular Table 1-1 and the airplanes identified in Step #2 to determine the method that will be used for establishing the recommended runway length.	Method outlined in AC Chapter 3 applies. Existing aircraft fleet is assessed to determine whether 75% or 100% fleet mix is more applicable. Review of fleet shows that the 100% of fleet mix is applicable, therefore Figure 3-2 should determine length.
4	Select the recommended runway length from among the various lengths generated by step #3	AC Figure 3-2 is applied to determine required runway length. Figure 3-1 is also checked for reference.
5	Apply any necessary adjustments to the obtained runway length when instructed by the applicable chapter of this AC to the runway length generated by Step #4 to obtain a final recommended runway length.	Adjust length for effective runway gradient (take-off only) and wet and slippery runways (for landings by turbojet-powered airplanes). Effective gradient adjustment requires assumption of runway end elevation based on governing Part 77 or departure surfaces.

After the recommended runway length was determined, site limitations and other considerations were applied to determine the maximum recommended length of the runway.

3. BACKGROUND AND BASIS OF ANALYSIS

3.1 Airport Classification and Role

GYY is a public use general aviation (GA) airport and is classified as a National airport under the FAA's ASSET categories for nonprimary airports. The Gary-Chicago International Airport Authority is the airport sponsor, and has an operating agreement with AFCO AvPORTS Management, LLC.

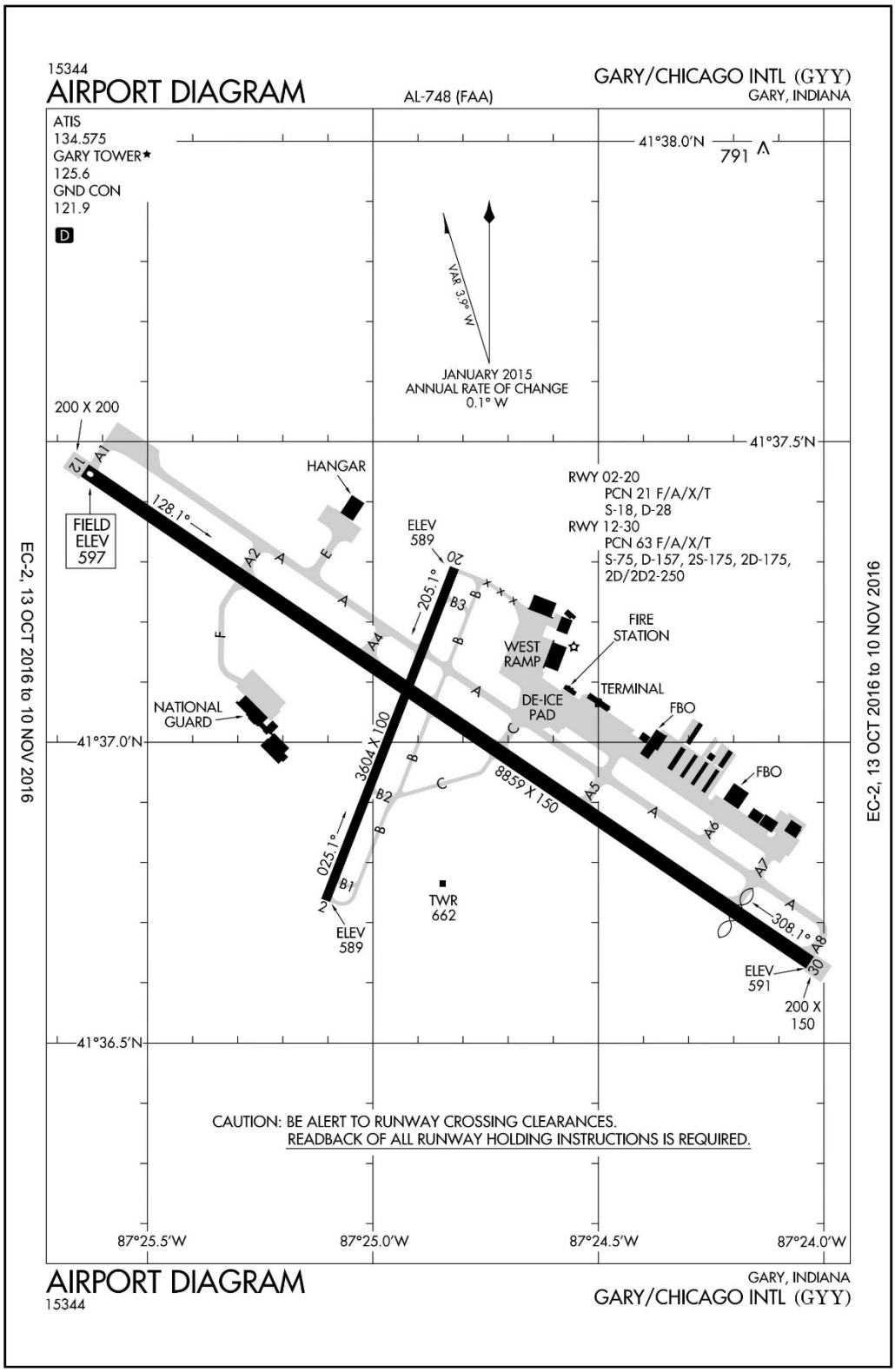
The Airport's proximity to the Chicago Metropolitan area allows it to be considered as an alternative airport for business travelers to the area. Travel time to downtown Chicago is the same or less than that from Midway (MDW) or O'Hare International (ORD).

3.2 Runway Infrastructure

There are two active runways at GYY, as shown Figure 1. Runway 12-30 has length of 8,859 feet and is the primary runway and thereby the most heavily used. It is designed for Airport Design Group (ADG) C-III and is equipped with an Instrument Landing System (ILS) on the approach end of Runway 30. A displaced threshold for aircraft landing on Runway 12 reduces landing distance available to 7,959 feet. Runway 2-20 is the cross-wind runway with length of 3,604 feet and is designated for ADG B-II. It is primarily used for light general aviation (GA) traffic due to its length and operational capabilities. However, it is also used by larger aircraft when crosswinds are not favorable for operations on the primary runway. Table 1 provides characteristics and navigational aids of each runway.

Figure 2 shows Runway 2-20 in context with its surroundings. The Grand Calumet River flows to the south of the Airport, and south of that is the Indiana Toll Road (I-90). The runway is bounded on the north by Airport Road, and beyond that, several rail lines. Taxiway B is the full length parallel serving Runway 2-20.

Figure 3-1 – Airport Diagram



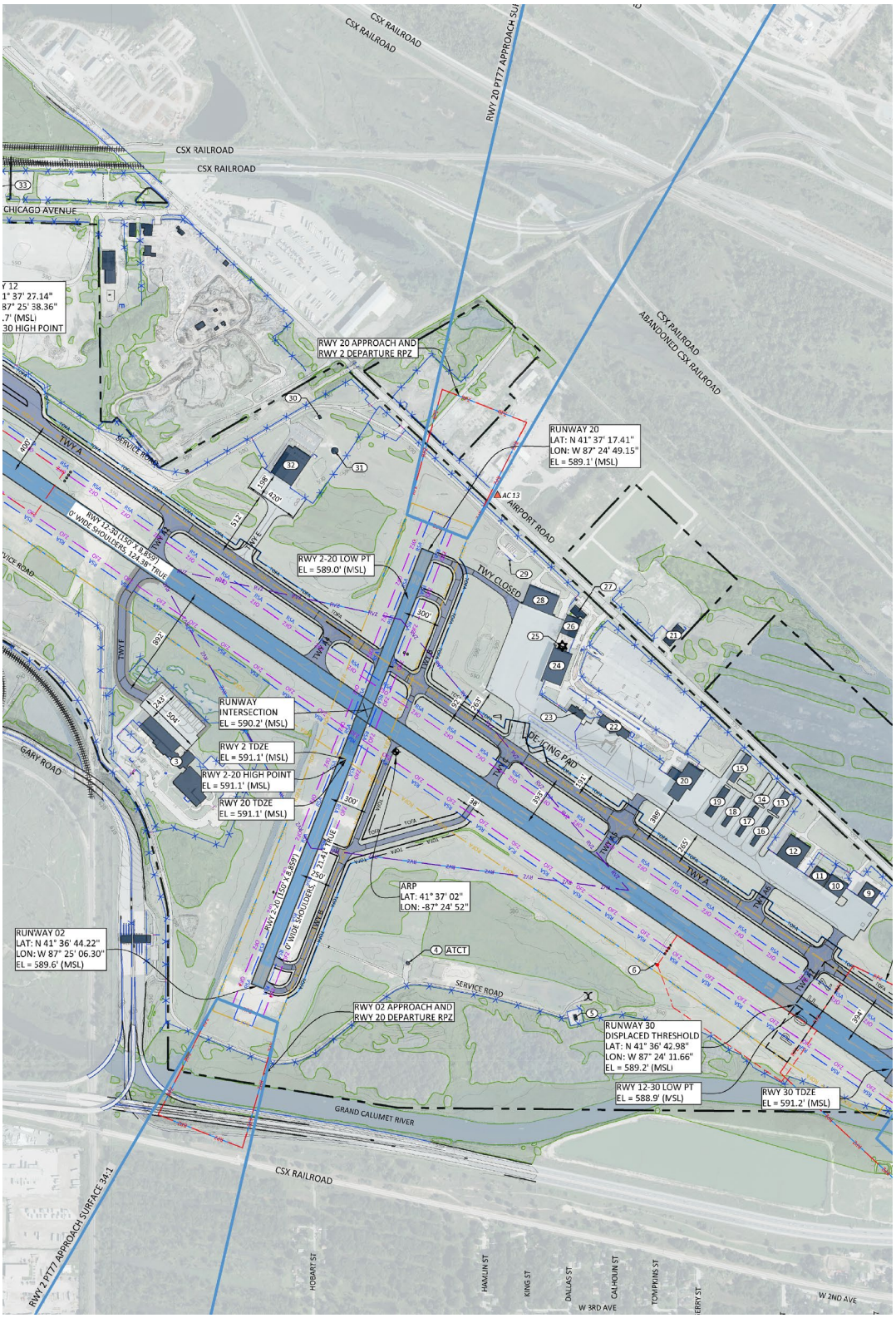
Source: FAA National Flight Data Center, October 2016

Table 3-1 – Runway Characteristics and Navaids

	Runway 2	Runway 20	Runway 12	Runway 30
Length/Width	3,604'/100'		8,859'/150'	
Displaced Threshold	N/A		900'	N/A
Pavement Strength	S-18 D-28		S-75 D-157 2D-175 2D/2D2-250	
Pavement Type	Asphalt, Concrete (Southern Portion)		Asphalt – Grooved, Concrete (Western Portion)	
Runway Reference Code	B-II		C-III	
Blast Pad	N/A		200' x 200'	
TORA	N/A		8,859'	
TODA			8,859'	
ASDA			7,959' / 8,859'	
LDA			7,959'	
Navigational Aids	GPS		LOC, GS, DME, GPS	
FAR Part 77 Approach Category	34:1	34:1	34:1	50:1/40:1
FAR Part 77 Approach Type	NPI-C	NPI-C	NPI-D	PIR
Visibility Minimums	1 Mile	1 Mile	½ Mile	3/4 Mile
TERPS Departure Surface/OCS	20:1	20:1	40:1	40:1
Runway Lighting	MIRL, REIL		HIRL-CL, REIL	HIRL-CL
Approach Lighting/VISAIDS	PAPI-2L		PAPI-4L	PAPI-4L, MALSR
Pavement Marking	Non-Precision		Precision	

Source: Federal Aviation Administration, National Flight Data Center, GYY Airport Data
Prepared By: Jacobsen|Daniels, October 2016

Figure 3-2 – Runway 2-20 Exiting Geometry and Environs

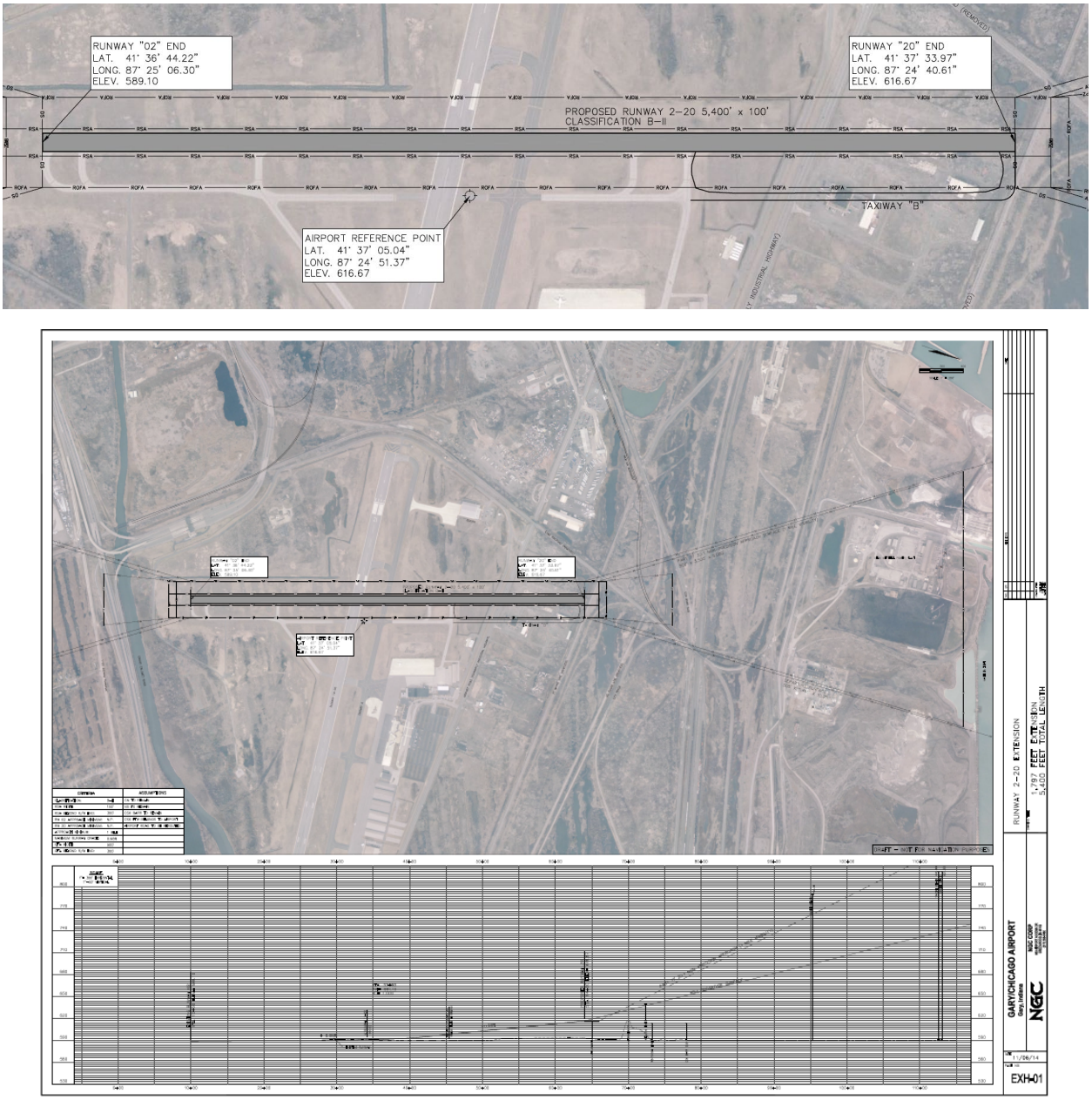


Source: GYY Existing Airport Layout Plan Drawing (Draft 10-20-2018), Jacobsen|Daniels;
Prepared by: Jacobsen|Daniels, October, 2018

3.3 Runway Extension Plan on File

In November 2014, the Gary Chicago International Airport placed a plan on file with the FAA to extend Runway 2-20 by 1,800 feet to the north. The plan assumed that the 20:1 Part 77 surface would be the controlling surface for obstruction clearance with a threshold siting surface of 40:1. That resulted in a runway end elevation of 616.67 feet, or approximately 15 feet above ground level.

Figure 3-3 – Existing Runway 2-20 Extension Plan on File



Source: NGC Corp., November 2014; Prepared by: Jacobsen|Daniels, January 2019

3.4 Aircraft Fleet

3.4.1 Based Fleet and Frequent Transient Aircraft

Through a survey of tenants conducted in December 2018, Airport staff prepared a list of based and frequent transient aircraft, which is shown in Appendix A. A summary of the numbers of aircraft by Aircraft Approach Category and Design Group is provided in Table 3.

Table 3-2 – Summary of Number of Based and Frequent Transient Aircraft

	Aircraft Approach Category and Design Group		
	B-II or below	C-I and up	Total
Based Aircraft	66	8	74
Frequent Transients	28	8	36
Total	94	16	110

Source: GCIAA tenant survey, December 2018; Prepared by: Jacobsen|Daniels, January 2019

3.4.2 Aircraft Requiring the Longest Runway Lengths

The B-II and smaller aircraft that are expected to make regular use of the runway include aircraft with a maximum take-off weight of between 12,500 and 60,000 lbs. The methodology specified in Advisory Circular 150/5325-4B is to plan using a family grouping of airplanes having similar performance characteristics and operating weights. This family includes only the turbojet-powered fleet and is divided into two groups: airplanes that comprise 75% of the light aircraft in use in throughout the industry, and those that comprise 100% of the fleet. These aircraft are shown in the AC Tables 3-1 and 3-2, respectively. The based aircraft and frequent transient aircraft at GYY which correspond with those listed in the AC Tables 3-1 and 3-2 are shown in Table 3-3. There are ten based and frequent transient aircraft from the list of 100% industry fleet, seven of which are B-II aircraft, expected to use Runway 2-20. Because GYY's operations include based and transient aircraft from the 100% of fleet list, the 100% of fleet tables were used to determine runway length, in accordance with the AC. The calculation from the 75% of fleet is shown in Appendix B, for reference.

Table 3-3 – Based and Frequent Transients at GYY in the 75% and 100% of Fleet

Airplanes That Make Up 75% of Fleet								
Aircraft Manufacturer	Model	AAC - ADG	Aircraft at GYY			Estimated Operations at GYY		
			Based	Trans.	Total	Based	Trans.	Total
Aerospatiale	Sn-600 Corvette	B-I						
Bae	125-700	C-II						
	400A	B-I						
Beech Jet	Premier I	B-I						
	2000 Starship							
Bombardier	Challenger 300	C-II		3	3		7	7
Cessna	500 Citation/501 Citation Sp	B-I	3		3	3		3
	Citation I/II/III	C-II		1	1	17		17
	525 A Citation II (CJ-2)	B-I	1		1	NP		NP
	550 Citation Bravo	B-II	1		1	31		31
	550 Citation II	B-II						
	551 Citation II/Special	B-II						
	552 Citation	B-II						
	560 Citation Encore	B-II		1	1		6	6
	560/560 XL Citation Excel	B-II	2		2			
	560 Citation V Ultra	B-II		2	2	0	17	17
	650 Citation VII	B-II						
	680 Citation Sovereign	B-II	2		2	100		100
Dassault	Falcon 10	B-I						
	Falcon 20	B-II						
	Falcon 50/50 EX	B-II	2	0	2	NP		NP
	Falcon 900/900B	B-II						
Israel Aircraft Industries	Jet Commander 1121	C-I		1	1		5	5
	Westwind 1123/1124	C-I		1	1		6	6
Learjet	20 Series	C-I						
	31/31A/31A ER	C-I						
	35/35A/36/36A	C-I						
	40/45	C-I						
Mitsubishi	Mu-300 Diamond	B-I						
Raytheon	390 Premier	B-I						
Raytheon	400/400 XP	B-I	1		1	NP		NP
Hawker	600	C-I						

Airplanes That Make Up 75% of Fleet								
Sabreliner	40/60 75A 80 T-39	B-I C-I C-II						
Totals			12	9	21	151	41	192
Airplanes That Make Up Between 75% and 100% of Fleet								
Aircraft Manufacturer	Model	AAC - ADG	Aircraft at GYY			Estimated GYY Operations		
			Based	Trans.	Total	Based	Trans.	Total
Bae	Corporate 800/1000	B-II/B-I						
Bombardier	600 Challenger	C-II	1		1	70		70
	601/601-3A/3ER Challenger	C-II	1		1			
	604 Challenger	C-II						
	BD-100 Continental	B-II						
Cessna	S550 Citation S/II	B-II						
	650 Citation III/IV	C-II						
	750 Citation X	B-II		2	2		17	17
Dassault	Falcon 900C/900EX	B-II		1	1		7	7
	Falcon 2000/2000EX	B-II		1	1		16	16
Israel Aircraft Industries	Astra 1125	C-II						
	Galaxy 1126	C-II						
Learjet	45 XR	C-I						
	55/55B/55C	C-I						
	60	C-I	1		1	36		36
Raytheon/ Hawker	Horizon	B-II						
	800/800 XP	B-II	2	1	3	27	70	97
	1000	B-I						
Sabreliner	65/75	B-I						
Totals			5	5	10	133	110	243

Source: FAA Advisory Circular 150/5325-4B, Table 3-1 and Table 3-2; Prepared by: Jacobsen|Daniels; January 2019

3.5 Wind and Required Use of Runway 2-20

The wind coverage percentages under all weather conditions for each of the four crosswind component speeds (10.5, 13, 16, & 20 knots) that are considered critical by the FAA, are shown in Table 6.

Table 3-4 – Runway Wind Coverage (All Weather)

Wind Speed (Knots)	Runway 2-20	Runway 12-30	Combined
10.5	89.70%	88.16%	97.22%
13	94.47%	93.81%	99.07%
16	98.24%	98.31%	99.70%
20	99.50%	99.56%	99.93%

Source: NOAA National Climatic Data Center, January 1, 2006 to January 1, 2015
Prepared By: Jacobsen|Daniels, October 2016

Use of Runway 2-20 is required when wind coverage precludes the safe use of Runway 12-30. Table 3-5 presents the percentage of time that Runway 12-30 is not available under all weather and IMC weather, during which Runway 2-20 would be required. A 13-knot crosswind is the maximum crosswind wind speed for B-II aircraft as specified in AC/150/5300-13A, Table 3-1. Therefore, the percentage of time that Runway 2-20 is required due to wind is between 6.19% and 7.14%.

Table 3-5 – Percentage of Time That Runway 2-20 is Needed

Wind Speed (Knots)	All Weather	IMC Weather
10.5	11.84%	12.69%
13	6.19%	7.14%
16	1.69%	2.35%
20	0.44%	0.74%

Source: NOAA National Climatic Data Center, January 1, 2006 to January 1, 2015. Jacobsen|Daniels, May 2018.

3.6 Runway Use

3.6.1 Current Demand for Runway 2-20

Airport traffic control is provided by a contract tower, operating between the hours of 0500 and 2200. Controllers at GYY operate under visual flight rules (VFR), obtaining permissions for IFR departures and clearances from Chicago Air Route Traffic Control Center. Only basic flight information is collected. This includes daily counts of the type of operation (air carrier, air taxi, GA or military), whether itinerant IFR or VFR, or local. No data is collected on runway use, and only daily operations totals are submitted to the Airport. Therefore, runway use was determined based on wind conditions and fleet.

The Airport interviewed its tenants in December 2018 to obtain an estimate of annual operations by aircraft. Operators of 36 of the 94 based B-II and smaller aircraft reported a total of 684 annual operations, exceeding the FAA-specified 500 annual operation minimum for critical aircraft

designation. Not all operations data was reported for individual based aircraft. Therefore, to annualize data, usage factors were applied to aircraft for which no operations data was provided. Assuming that aircraft not reporting operations conduct the same number of operations per year as those aircraft reporting, then aircraft not reporting operations would represent an additional demand of 793 operations per year for a total demand of 1,477 operations per year. The results are shown in Table 3-6, and generally correlate with the FAA-approved Base Forecast.

Table 3-6 – Summary Annual Operations by B-II and Smaller Airplanes

Type	Physical Class	# of Aircraft w/Operations Reported	Reported Annual Operations	# of Aircraft w/No Operations Reported	Estimated Annual Operations by Aircraft Not Reporting	Adjusted Annual Operations
A-I	Jet	-	-	1	20	20
A-I	Piston	16	103	34	219	322
A-I	Turboprop	1	4	2	8	12
A-II	Jet	-	-	-	-	-
A-II	Turboprop	-	-	-	-	-
Total AAC A		**17**	**107**	**37**	**247**	**354**
B-I	Jet	5	168	4	134	302
B-I	Piston	1	4	5	20	24
B-I	Turboprop	-	-	-	-	-
B-II	Jet	11	379	11	379	758
B-II	Turboprop	2	26	1	13	39
Total AAC B		**19**	**577**	**21**	**546**	**1,143**
Runway 2-20 Total		**36**	**684**	**58**	**793**	**1,477**

Note: Assumes aircraft not reporting conduct same number of annual operations per aircraft as aircraft reporting operations.
Source: Airport reported 2017 operations; Prepared by: Jacobsen Daniels January 2019

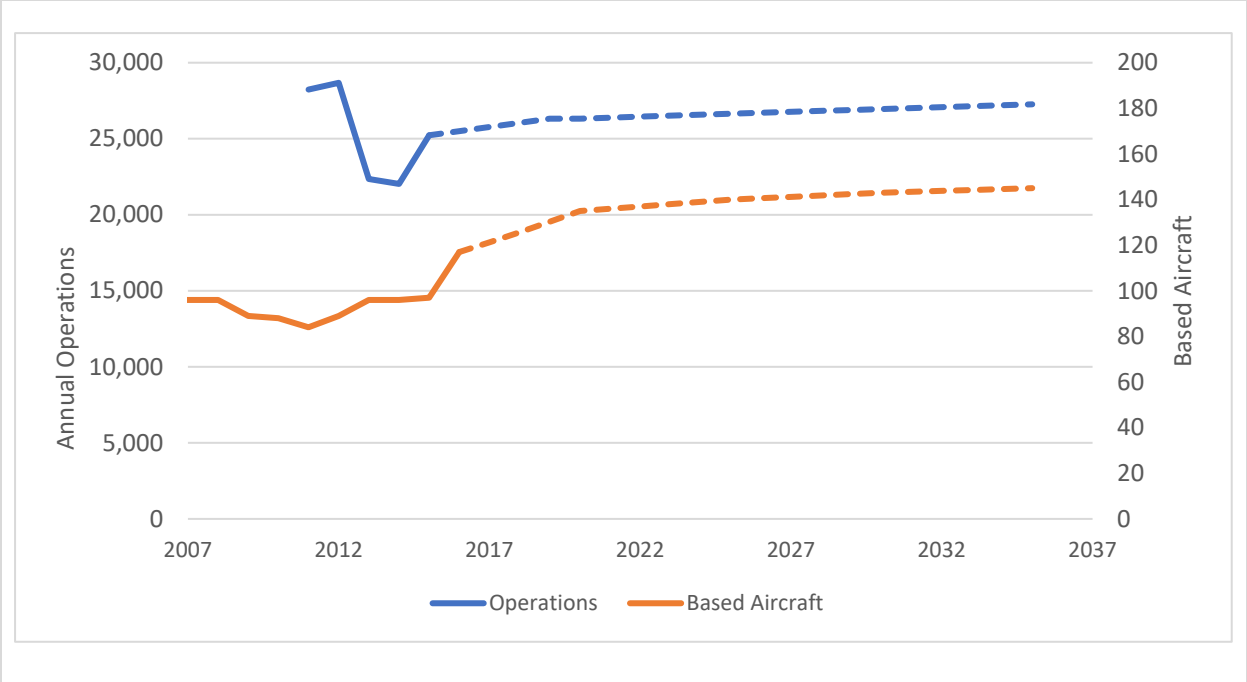
3.6.2 Forecast Future Demand for Runway 2-20

The Base Forecast developed in the Master Plan and approved by the FAA includes 0.4% to 0.7% growth in annual aircraft operations and based aircraft, respectively, as shown in Figure 3-4. This compares to the FAA's Aerospace Forecast of average annual growth of the entire GA fixed wing turbo-prop and turbo-jet aircraft[1] fleet of 0.2% and 2.0%. The FAA forecast an increase in hours flown for the turbine fleet of 2.5%

[1] FAA Aerospace Forecast 2016 – 2036.

over the same period. As shown in Table 3-7 (Table 3-10 from the approved forecast) continued and sustained demand for Runway 2-20 is expected.

Figure 3-4 -- GYY Historical and Baseline Forecast of Operations and Based Aircraft



Sources: 2006-2015: FAA TAF, issued January 2016; 2016: Gary/Chicago International Airport records; LeighFisher Master Plan Forecast 2016.

Table 3-7 – GYY Base Forecast of Operations by Aircraft Design Group

Aircraft Design Group Summary	Actual 2015 [b]	Forecast 2020	Forecast 2025	Forecast 2035	Average Annual Growth Rate 2020	Average Annual Growth Rate 2025	Average Annual Growth Rate 2035
I	10,600	10,994	11,085	11,268	0.7%	0.2%	0.2%
II	11,741	12,083	11,949	11,673	0.6	(0.2)	(0.2)
III	2,281	2,625	2,981	3,665	2.9	2.6	2.1
IV	118	129	141	164	1.8	1.8	1.5
V	45	45	45	45	-	-	-
Other [a]	444	447	447	448	0.1	0.0	0.0

(a) Includes general aviation, as well as flights that are not classified in any other category shown.

(b) Operations by aircraft type were allocated based on the FAA's Traffic Flow Management Systems data. This data is available for flights operated under Instrument Flight Rules and excludes flights operated under Visual Flight Rules.

Sources: Actual—Passenger and All-Cargo airlines: U.S. DOT, Schedule T100; GA & Other Military: Gary/Chicago International Airport records; FAA, Traffic Flow Management System (TFMS). Forecast—LeighFisher, January 2017.

3.7 Runway 2-20 Length Analysis

3.7.1 Initial Runway Length Calculation

Following the methodology outline in AC 150/5325-4B, runway length was calculated by using Figure 3-2 from the AC. In order to use the figures, some basic airport and weather characteristics are needed, which are summarized in Table 3-8.

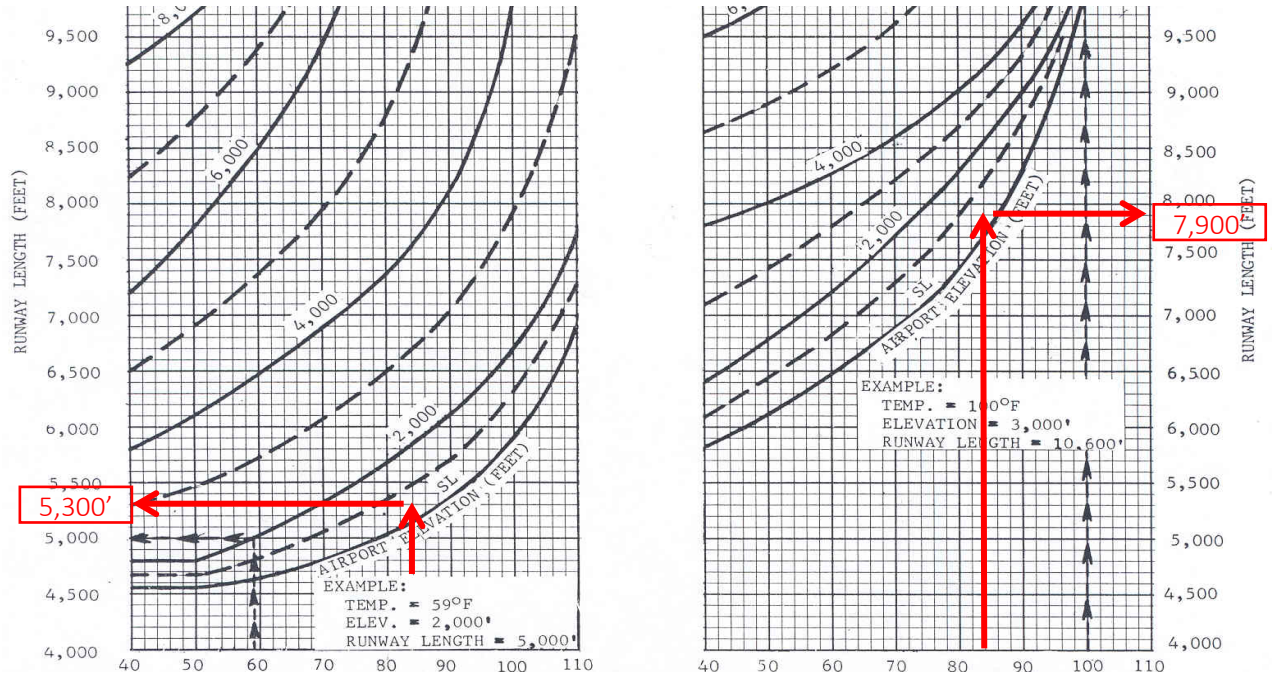
Table 3-8 – Airport and Weather Characteristics

Condition	Existing
Hottest Month	July
Mean Max. Temp (Hottest)	84° F
Airport Elevation	596 feet above MSL

Source: NOAA National Climatic Data Center, Prepared By: Jacobsen|Daniels, October 2016

With these characteristics, Figure 3-2 from the Advisory Circular was used to determine runway length. The AC figure is shown below as Figure 3-5, with red arrows added to show the calculated dimensions for GYY Runway 2-20. The unadjusted runway length is summarized in Table 3-9. For reference, the calculation is repeated with AC Figure 3-1 for 75% of the fleet in Appendix B of this document.

Figure 3-5– 100% of the Fleet at 60 or 90 Percent of Useful Load



Source: FAA Advisory Circular 150/5325-4B, Figure 3-2; Prepared by: Jacobsen|Daniels, December 2018

Table 3-9– Unadjusted Runway Length

Fleet Accommodated	60% useful load	90% useful load
100% (Table 3-2)	5,300 ft	7,900 ft

Source: FAA AC 150/5325-4B Figure 3-2; Prepared By: Jacobsen|Daniels, December 2018

3.7.2 Runway Length Adjustments

Two runway length adjustments are made to account for runway grade (adjustment to take-off length) and for wet and slippery conditions (adjustment to landing length for turbojet-powered airplanes). To calculate the runway grade adjustment, both runway end elevations must be known. Obstructions off the north end of Runway 2-20 will likely require the runway end point to be set at an elevation considerably higher than existing grade. The runway end elevation will not result in a slope which exceed FAA guidance, but will likely result in a differential height between the two ends of the runway of approximately 15 to 30 vertical feet, depending on the surfaces used for obstruction clearance and the runway length. (See Section 3.8.2) Following guidance in Section 304a of the AC, the runway length requirements should be increased by 10 feet for every 1 foot of vertical difference. For example, a 15-foot grade difference between runway ends would result in an additional 150 foot length requirement, while a 30-foot grade difference would result in an additional 300 foot length requirement.

Second, since turbojet aircraft are part of the existing and anticipated future fleet accommodated by Runway 2-20, it is necessary to add a 15% length adjustment to accommodate landings in wet or slippery conditions, up to 5,500 feet or 7,500 feet for 60% or 90% of useful load. respectively. However, if the unadjusted length with grade adjustment exceeds these thresholds, no further adjustment is needed for wet and slippery conditions.

Because adjustments to recommended length must be made after the runway end elevation (threshold elevation) is set, final runway length recommendation will be presented in Section 3-9, following the discussion on obstructions and obstruction controlling surface.

3.8 Runway Length Limiting Factors

This section explores physical constraints at the ends of Runway 2-20 that may affect the runway end elevation and required grade adjustment. These constraints will also result in limitations of the practical length to which Runway 2-20 can be extended.

3.8.1 Objects in RSA and RPZ

3.8.1.1 Runway 2 End

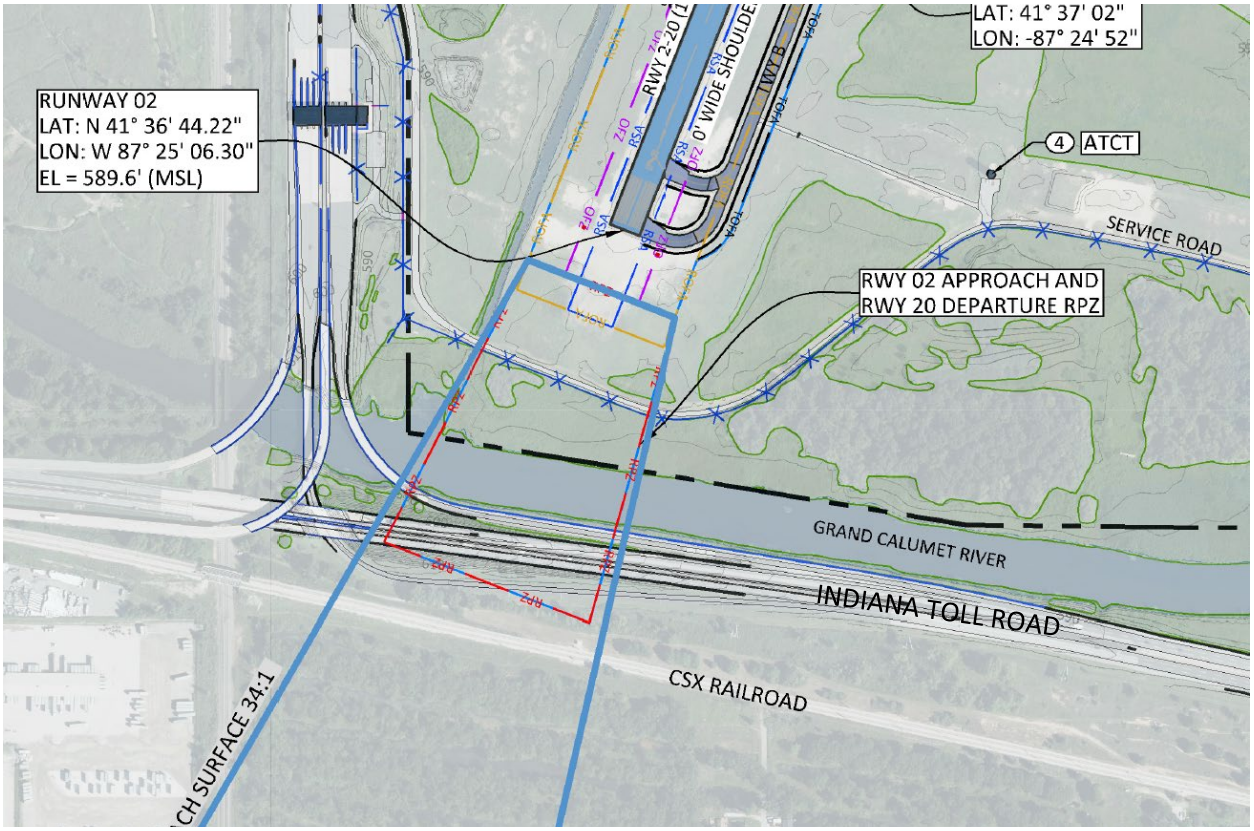
Extension of Runway 2-20 to the south is not feasible. Figure 3-6 shows the proximity of the runway, RSA and service road to the Grand Calumet River, a physical barrier to any extension to the south. Additionally, the Indiana Toll Road (I-90) runs east-west and is located just south of the river. Light poles along the toll road penetrate the 34:1 approach surface but are below the 20:1 Threshold Siting Surface (TSS). The river and toll road are also within the existing RPZ. Due to these constraints, a southerly extension was not considered.

3.8.1.2 Runway 20 End

Airport Road, which is a five-lane arterial roadway, and an active CSX Railroad line are both located to the north of existing Runway 2-20, as shown in Figure 3-7. Extension of the runway would require relocation of Airport Road. Because the CSX Railroad alignment was established as the result of the recent Runway 12-30 extension, the GCIAA has stated their intention not to relocate or modify the rail line or encroach on its 200-foot-wide right-of-way. Relocating the railroad would be impractical due to the layout of nearby rail lines and the associated costs. Therefore, the rail line will limit both the length of the Runway 2-20 extension and the relocation of Airport Road around the runway end.

The Runway Safety Area (RSA) required for a runway with a reference code B-II, extends 300 feet from the end of the pavement. The RSA must be cleared, graded and free of objects.[2] While the RSA can be kept clear by routing Airport Road under the extension, both the roadway and elevated rail line will remain in the Runway Protection Zone (RPZ). The RPZ's function is to enhance the protection of people and property on the ground, and its trapezoidal area is defined by the runway's design classification and visibility minimums. The goal, as defined in AC 150/5300-13A, is to clear the entire RPZ of all above-ground objects, and at a minimum clear the RPZ of all incompatible activities. FAA guidance[3] strongly discourages public roadways or railroads within the RPZ. Exceptions exist in situations where mitigation measures are taken.

Figure 3-6 – Runway 2 End Plan View



Source: GYY Existing Airport Layout Plan Drawing (Draft 10-20-2018), Jacobsen|Daniels;
Prepared by: Jacobsen|Daniels, October, 2018

These mitigation measures for GYY could include:

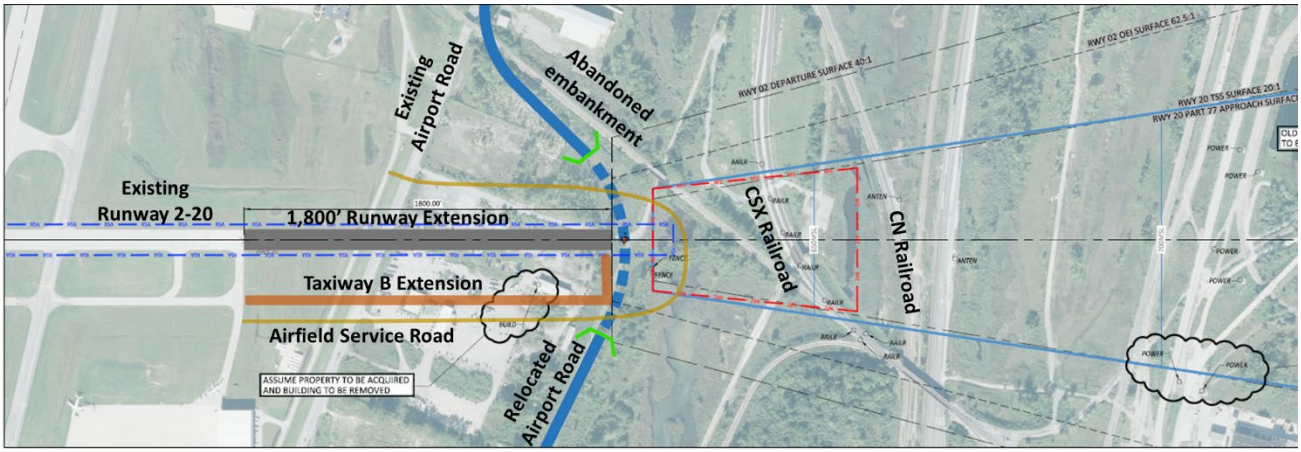
[2] The RSA must be cleared and graded; drained to preclude standing water; capable of supporting snow removal and ARFF equipment as well as the occasional passage of aircraft, and free of objects, except for those that need to be located in the RSA due to their functions. See FAA Advisory Circular 140/5300-13A, Paragraph 307.

[3] Interim Guidance on Land Uses Within a Runway Protection Zone, FAA Office of Airport Planning and Programming and Office of Airport Safety and Standards, September 27, 2012.

- Relocate Airport Road - Minimize the impact of the road through the RPZ by:
    - Routing the roadway as far away from the end of runway as possible
    - Keeping the road on the outer limits (controlled activity area) of the RPZ
    - Routing the roadway under the runway extension or RPZ.
- Raise the proposed runway end elevation - The RPZ surface is at the elevation of the runway end. By raising the runway end elevation and constructing a large portion of the runway extension on fill, relocated Airport Road could pass under the RPZ as an at-grade underpass. (Tunneling the road below existing grade would create challenges, due to the area's high ground water table and localized contamination). This would also allow the RPZ surface to be above the railroad lines, although the CSX Railroad would remain in the RPZ. This solution also allows critical surfaces to clear obstructions off of the runway end.

The roadway and rail constraints result in a practical extension of approximately 1,800 feet to a total length of 5,404 feet, as shown in Figure 3-7. This 1,800-foot extension is consistent with the current runway extension plan on file with the FAA. Based on evaluation of multiple alternatives, Airport Road will be relocated north and routed under the runway extension

Figure 3-7 – Runway 2-20 Extension and Controlling Obstructions



Source: Jacobsen|Daniels from obstruction data prepared by Quantum Spatial, July 2018; Prepared by: Jacobsen|Daniels, October 2018

3.8.2 Obstruction Clearance and Controlling Surface

Obstruction surveys were completed for the Runway 2-20 as part of the Master Plan and ALP update. Figure 3-8 and Figure 3-9 show obstructions in plan and profile, respectively, for existing Runway 20. In addition to Airport Road and the CSX and CN rail lines, numerous high-voltage power lines and industrial smoke stacks are located within the areas subject to obstruction evaluation.

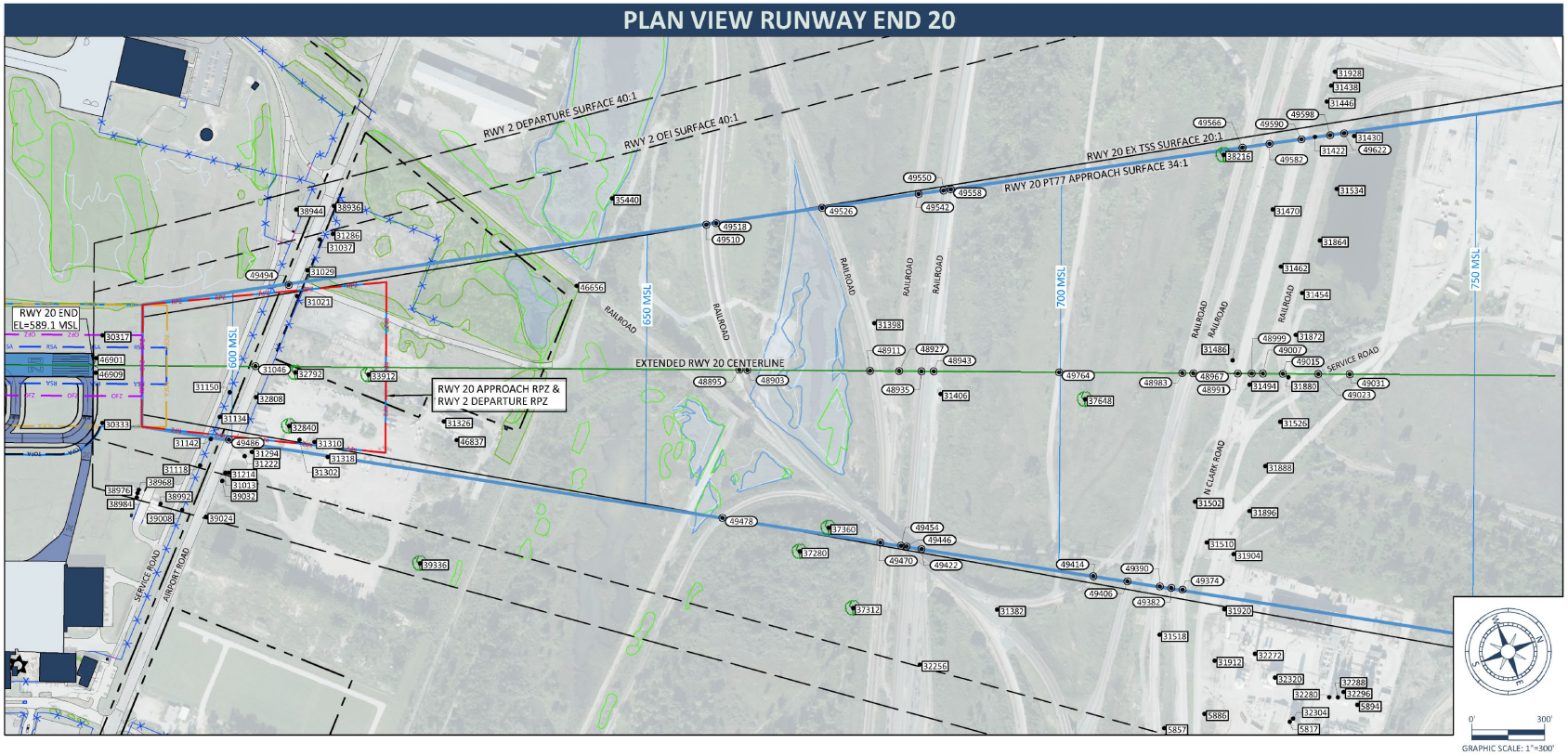
3.8.3 Controlling Surfaces

Typically, Part 77 surfaces would govern obstruction requirements, including a departure surface or one engine inoperative surface with slopes of 40:1 and 62.5:1 respectively, from the end of the runway pavement. Another potentially applicable controlling surface is the Threshold Siting Surface (TSS) 20:1 approach surface starting from the end of the runway safety area. Future runway end elevation will vary depending on which controlling surface is enforced.

Discussion with the FAA Chicago ADO and Great Lakes Region in November 2018, provided no clear guidance on which surface (20:1 Threshold Siting Surface, 34:1 Part 77 Approach Surface or 40:1 Departure Surface) should be used as the controlling surface. As illustrated in Figure 3-10 using the 20:1 would result in a runway end elevation approximately 20 feet above surrounding ground elevation with the 23' vertical clearance above the CSX rail line obstructions controlling the threshold/runway end elevation, with three obstructions penetrating the 40:1 surface (CSX rail line, an antennae, and power line) within 2,250 feet of the runway end. As illustrated in Figure 3-11, using the 40:1 would result in a runway end elevation approximately 37 feet above surrounding ground elevation with power line obstructions controlling the threshold/runway end elevation. Additional power lines could be lowered or removed to clear obstructions penetrating the 40:1 surface.

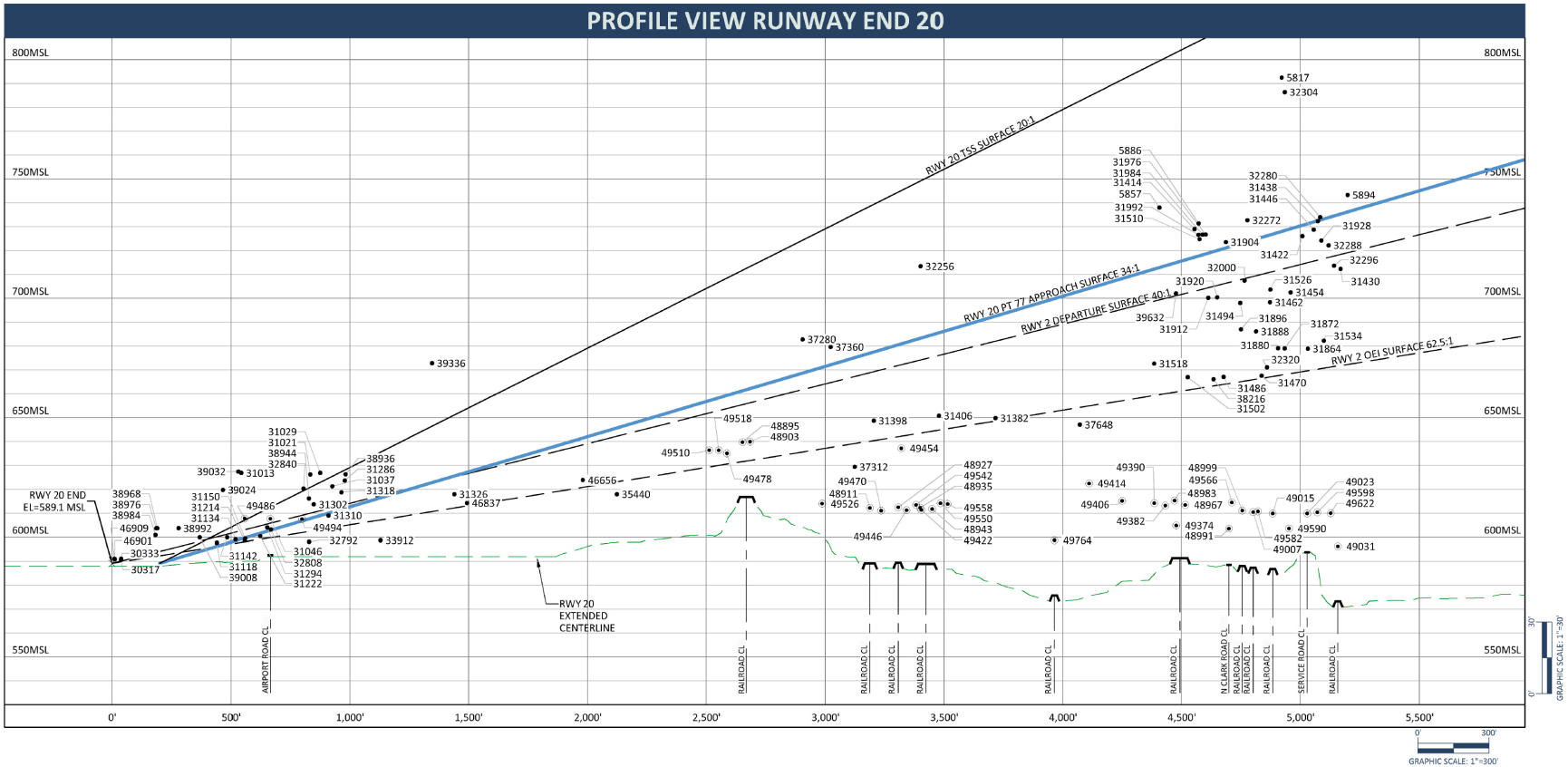
Table 3-2 of FAA Engineering Brief 99, dated September 20, 2018 provides approach and departure standards and Obstruction Controlling Surface (OCS) for runway types based on the approach type and visibility minimums. Runway 2-20 has a precision instrument approach with visibility of greater than or equal to one mile. Based on that, Runway 2-20 meets the requirements of row 4, "runways expected to accommodate instrument approaches having visibility greater than or equal to ¾ statute mile". The slope of the OCS is 20:1, and the surface begins at the elevation of and 200' from the runway threshold. General notes for the table state that "meeting the requirements of this table will protect the use of the runway in both visual and instrument meteorological conditions near the airport while ensuring maximum runway utility", and "for planning purposes, objects must remain clear of the surfaces provided in this table." Therefore, this analysis recommends use of the 20:1 surface as the obstacle clearance surface, resulting in a runway end elevation of 612' above MSL, approximately 20 feet above the surrounding ground.

Figure 3-8 – Existing Runway 20 Obstructions – Plan View



Source: Rwy 20 Inner Approach Rwy 2 Departure, Existing Plan & Profile, Airport Layout Plan Drawing Set for GYY, Draft 10-20-2018: Prepared by: Jacobsen|Daniels, October 2018

Figure 3-9 - Existing Runway 20 Obstructions, Profile View



Source: Rwy 20 Inner Approach Rwy 2 Departure, Existing Plan & Profile, Airport Layout Plan Drawing Set for GYY, Draft 10-20-2018: Prepared by: Jacobsen|Daniels, October 2018

Figure 3-10 – Runway 2 Extension and Obstructions with 20:1 Obstacle Controlling Surface

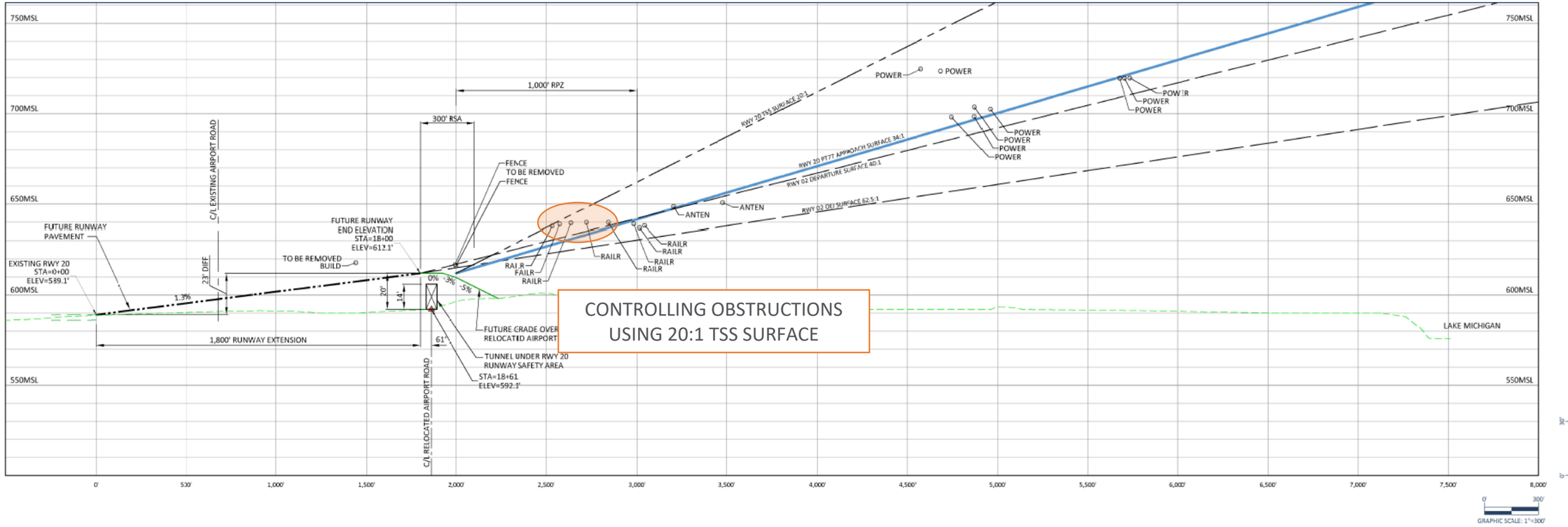
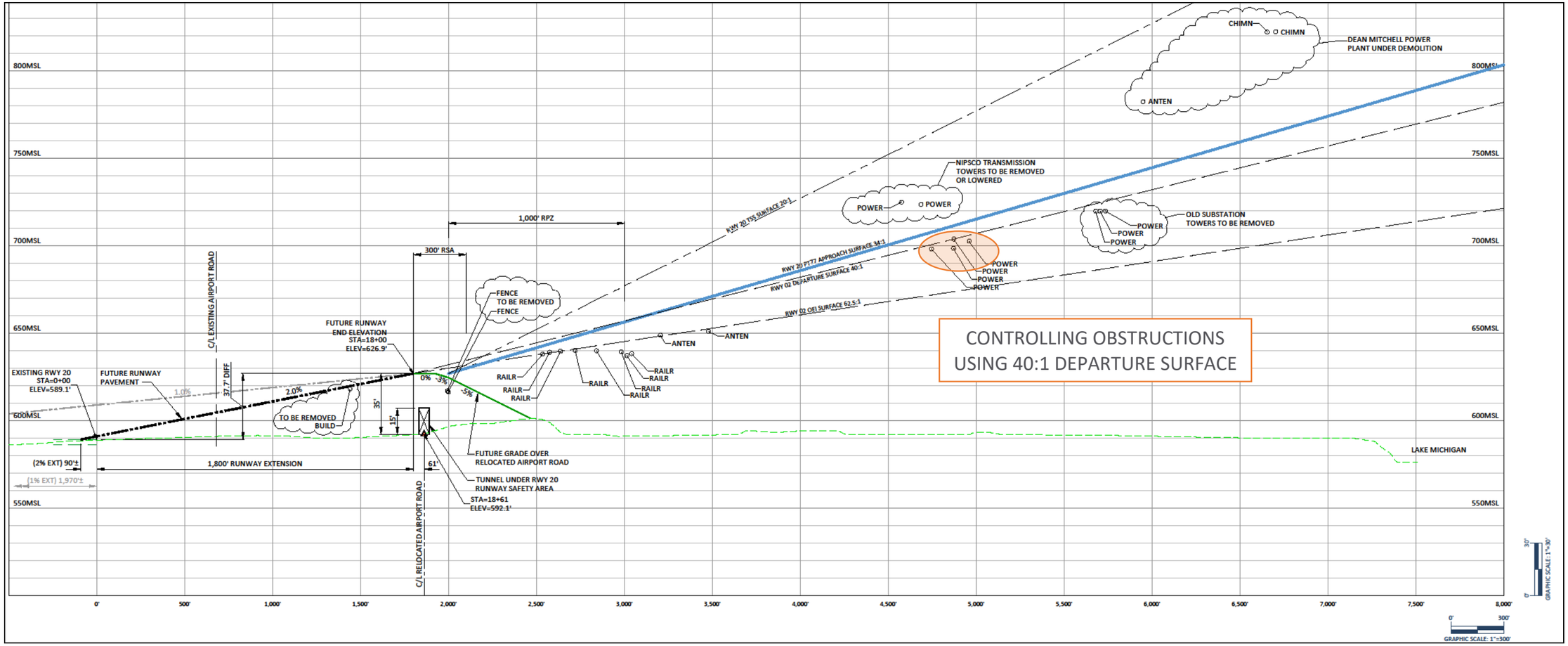


Figure 3-11 – Runway 2 Extension and Obstructions with 40:1 Obstruction Controlling Surface



Source: Jacobsen|Daniels based on obstruction survey data from Quantum Spatial, July 2018; Prepared by: Jacobsen|Daniels November 2018

3.8.4 Displaced Threshold and Declared Distances

Another way to address obstructions that cannot be mitigated (by either removal or raising the runway threshold) is to displace the landing threshold, moving the effective end point of the runway to a point where the controlling surfaces are free of obstructions. There is benefit in lowering the runway end from both collateral development and capital cost perspectives, however using declared distances reduces the available length of the runway from the physical length.

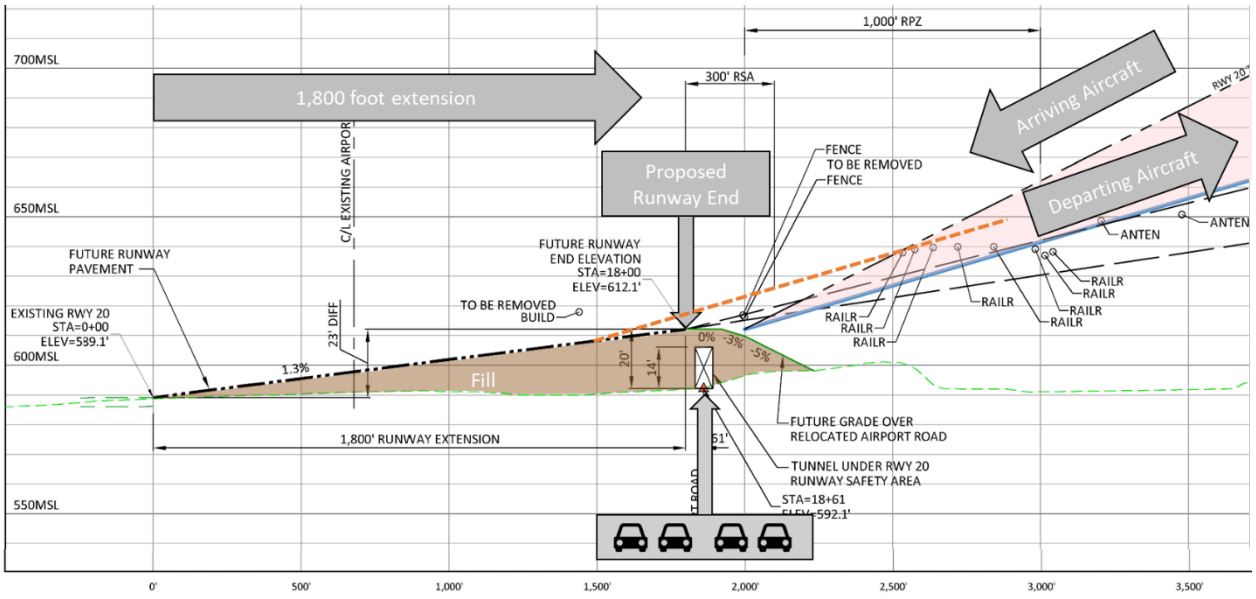
The runway alternatives analysis investigated a scenario using a runway end elevation of 612' above MSL and a 40:1 departure controlling surface from the end of the runway. In this case, the CSX rail lines would be the controlling obstructions. Table 3-10 shows the required displaced thresholds and resulting reduction in take-off distance available (TODA) and TORA. This is illustrated in Figure 3-12. If a 20:1 TSS is used, displaced distances would likely not be needed.

Table 3-10 – Declared Distances for an 1,800-foot Extension with 40:1 OCS

Critical Dimension Type	Distance (feet)
Extension length	1,800
Improved Runway Length	5,404
Take-off Run Available – TORA *(reduction from physical-length)*	4,868 *(536)*
Take-off Distance Available – TODA *(reduction from physical-length)*	5,104 *(300)*
ASDA (Accelerate Stop Distance Available)	5,404
LDA (Landing Distance Available)	5,404

Prepared by Jacobsen|Daniels, January 2019

Figure 3-12 – Runway 2-20 Extension with Declared Distances

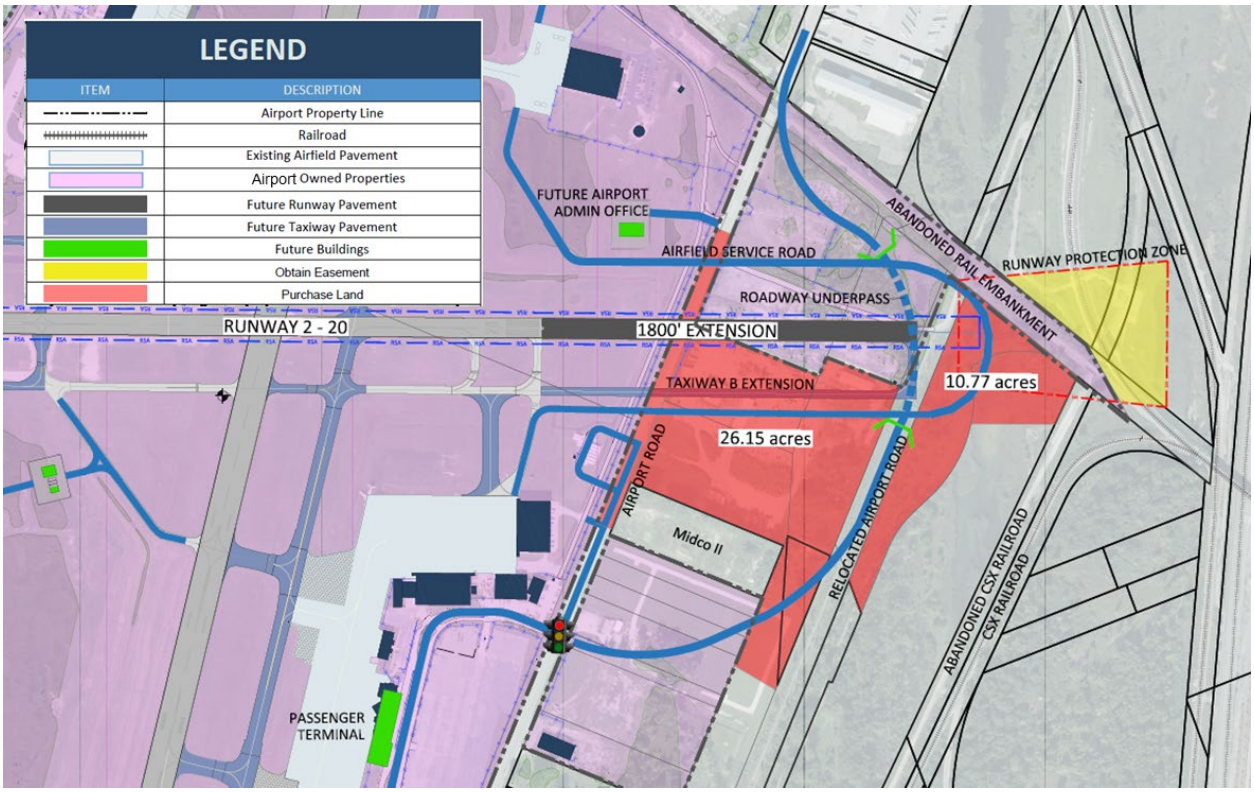


Source: Jacobsen|Daniels; Prepared by: Jacobsen|Daniels, October 2018

3.9 Land Acquisition

Extension of the runway will require GCIAA to acquire additional land to accommodate the runway, parallel taxiway, Airport Road realignment, a service road and all associated embankment and grading. Figure 3-13 shows the parcels identified for acquisition. Where the majority of a parcel or the structure on a parcel would be needed, it is assumed that the entire parcel would be required. If a usable parcel would remain, then only a portion of the parcel is assumed to be acquired. Also, the City of Gary owns the abandoned rail right-of-way to which Airport Road would be aligned, so no acquisition is assumed for that parcel. A portion of the current alignment of Airport Road is shown as an acquisition tract since the right-of-way would need to be deeded to the Airport. Given these assumptions, a total of 37 acres would be needed.

Figure 3-13 – Potential Land Acquisition for Runway 2-20 Extension



4. SUMMARY OF ANALYSIS

Key elements of the analysis (following the steps in AC 5325-4B) and findings are:

1) Critical Aircraft for Runway 02/20:
    a. Based on the current and forecast future fleet mix, the existing classification of Runway 2-20 as a B-II runway is appropriate.
    b. Estimated annual operations of B-II and below aircraft is 1,457. Wind conditions preclude the use of the primary runway 12-30, approximately 6.2% of the time for B-II and below aircraft. This is expected to grow slightly according to the FAA-approved Base Forecast.
2) Airplanes requiring the longest runway length: The current and forecast future based and operations fleet mix includes a high proportion of aircraft between 12,500 and 60,000 lbs. Therefore, this analysis follows the methodology presented in Chapter 3 of FAA Advisory Circular 150/5325-4B.
3) Method to be used for establishing recommended runway length: Advisory Circular Table 1-3 addresses runway length for a crosswind runway. GYY is a GA airport with non-scheduled runway service and therefore the runway length for crosswind runway equals 100% of the recommended runway length determined for the lower crosswind capable airplanes[4] using the primary runway.
4) Selecting recommended runway length:
    a. Comparing the specific aircraft comprising the based and frequent transient fleet mix to Tables 3-1 and 3-2 from the Advisory Circular, a significant proportion of operations are conducted by aircraft listed in the 100% of fleet. Therefore, according to the guidance, Figure 3-2 should be used to determine the runway length.
    b. Figure 3-2 is used with a result of 5,300 feet and 7,900 feet for 60% and 90% useful load, respectively.
5) Adjustments:
    a. Adjusting for grade will add 200 feet, based on an obstacle clearance surface of the CSX rail line. (See discussion in Sections 3.7.2 and 3.8.) No additional adjustments are needed for wet and slippery conditions since that adjustment is only needed up to 5,500 feet or 7,500 feet for 60% or 90% useful load, respectively. Therefore, the recommended length of Runway 2-20 is at 5,500 feet or 8,100 feet to accommodate 100% of the fleet at 60% or 90% useful load, respectively.

[4] Lower crosswind capable aircraft are those that require a crosswind of 13 knots or less for safe operation.

Physical constraints prohibit extending the runway to its recommended length. These constraints include the Grand Calumet River and Indiana Toll Road (I-90) on the south end and on the north end, a public roadway and railroad. Although physical constraints limit the extension length to approximately 1,800 feet, that would allow the runway to serve nearly 100% of the fleet at 60% useful load. With an extension, the runway would better accommodate a wide variety of ongoing general aviation activity at the Airport for B-II aircraft.

Final recommended lengths with adjustments are shown in Table 4-1 and compared to possible extension length considering the physical constraints. The possible extension length nearly satisfies 100% of the fleet at 60% useful load.

Table 4-1 – Adjusted Runway Length Requirements

Criteria	Recommended Length (feet)	
	60% useful load	90% useful load
Fleet Accommodated: 100% (Table 3-2)	5,300	7,900
Adjustment for grade	200	200
Adjustment for wet conditions	Up to 5,500	Up to 7,500
Total recommended length	5,500	8,100
Length allowable due to physical constraints	5,404	5,404

Source: FAA AC 150/5325-4B Figures 3-1 and 3-2; Prepared By: Jacobsen|Daniels, December 2018

The master plan alternatives section will consider all physical and financial constraints and will recommend a plan to meet the recommended runway length. Given the known constraints, it may be necessary to extend the runway in phases. However, in order to preserve the ability to meet the full runway length requirements it is recommended to show the full extension and associated land acquisition on the ALP.

FAA review and concurrence is required on the runway length justification and selection of the obstruction controlling surface. This report was prepared for submittal to the FAA for that purpose.

Appendix A – Existing Aircraft Fleet at GYY

Tables A-1 and A-2 present the results of a tenant survey performed by Airport staff to identify the based and frequent transient aircraft, respectively. Operators were asked to provide the number of annual operations, however not all operations data was submitted to the Airport staff. NP indicates that operations data was not provided for that aircraft.

Table A-1 – Based Aircraft and Reported Annual Operations

Aircraft Type	AAC	ADG	Annual Ops
Beechcraft Bonanza	A	I	NP
Beechcraft Bonanza	A	I	NP
Beechcraft Bonanza	A	I	NP
Beechcraft Bonanza	A	I	NP
Beechcraft Bonanza	A	I	NP
Bonanza	A	I	NP
Cessna 172M	A	I	NP
Cessna 172N	A	I	NP
Cessna 177	A	I	NP
Cessna 177	A	I	NP
Cessna 177 RG	A	I	NP
Cessna 182	A	I	NP
Cessna 182	A	I	NP
Cessna 182	A	I	NP
Cessna 182Q	A	I	NP
Cessna 210N	A	I	NP
Cessna Skyline 182	A	I	NP
Cessna TTX	A	I	NP
Cirrus Vision Jet SF50	A	I	NP
C-U206C	A	I	NP
Diamond DA-20	A	I	9
Hawker G36	A	I	NP
Mooney M20	A	I	NP
Mooney M20E	A	I	NP
Mooney M20E	A	I	NP
Mooney M20J	A	I	NP
Mooney M20J	A	I	NP
Mooney M20K	A	I	NP
PA-32-300	A	I	NP

Aircraft Type	AAC	ADG	Annual Ops
TBM700	A	I	NP
TBM700	A	I	NP
TBM700	A	I	NP
Baron	B	I	4
95-B55 (T42A)	B	I	NP
Baron	B	I	NP
Beechcraft Baron	B	I	NP
Beechcraft Baron	B	I	NP
C510	B	I	NP
Cessna 414	B	I	NP
Cessna 510	B	I	NP
Cessna 525	B	I	NP
Cessna Mustang	B	I	75
Hawker 400A	B	I	NP
Hawker 700	B	I	70
BD-100-1A10	B	II	NP
C-425	B	II	NP
C-525B	B	II	NP
C-560XL	B	II	NP
C-560XL	B	II	NP
Cessna 441	B	II	NP
Cessna 560	B	II	NP
Cessna 680	B	II	NP
Cessna Cit. Sovereign C680	B	II	100
Cessna CJ3	B	II	100
Citation Bravo	B	II	31
Falcon 2000EX	B	II	NP
Falcon 50	B	II	NP
Falcon 50	B	II	NP

Aircraft Type	AAC	ADG	Annual Ops
PA-46-310P	A	I	NP
Piper Cherokee	A	I	NP
Piper Cherokee	A	I	NP
Piper Malibu	A	I	NP
Piper Saratoga	A	I	NP
SR22T	A	I	NP
Challenger 650	C	II	465
Challenger 650	C	II	465
Challenger 650	C	II	465
CL600	C	II	NP
Hawker800XP	C	II	NP
G-200	D	II	NP
G-200	D	II	NP
GIV-X	D	II	NP
Gulfstream G-IV	D	II	65
Gulfstream IV	D	II	11
Gulfstream IV	D	II	13
BBJ 737-700/800	D	III	314
BBJ 737-700/800	D	III	314
BBJ 737-700/800	D	III	314
8GCBC	-	-	NP

Aircraft Type	AAC	ADG	Annual Ops
Hawker 800	B	II	27
Hawker 900	B	II	NP
Falcon 7X	B	III	100
Lear Jet 60XR	C	I	36
Challenger 601	C	II	70
Challenger 650	C	II	465
Bell LongRanger B206 Helicopter)	-	-	200
Cessna 336	-	-	NP
Eurocopter	-	-	NP
Eurocopter France	-	-	NP
Piper Twin Comanche PA30	-	-	NP
Sikorsky UHL-60 Helicopter	-	-	NP
Sikorsky UHL-60 Helicopter	-	-	NP
Sikorsky UHL-60 Helicopter	-	-	NP
Sikorsky UHL-60 Helicopter	-	-	NP
Sikorsky UHL-60 Helicopter	-	-	NP
Sikorsky UHL-60 Helicopter	-	-	NP
Sikorsky UHL-60 Helicopter	-	-	NP
Sikorsky UHL-60 Helicopter	-	-	NP
Tecnom P2008	-	-	NP

Source: GCIAA tenant survey, December 2018; Prepared by: Jacobsen|Daniels

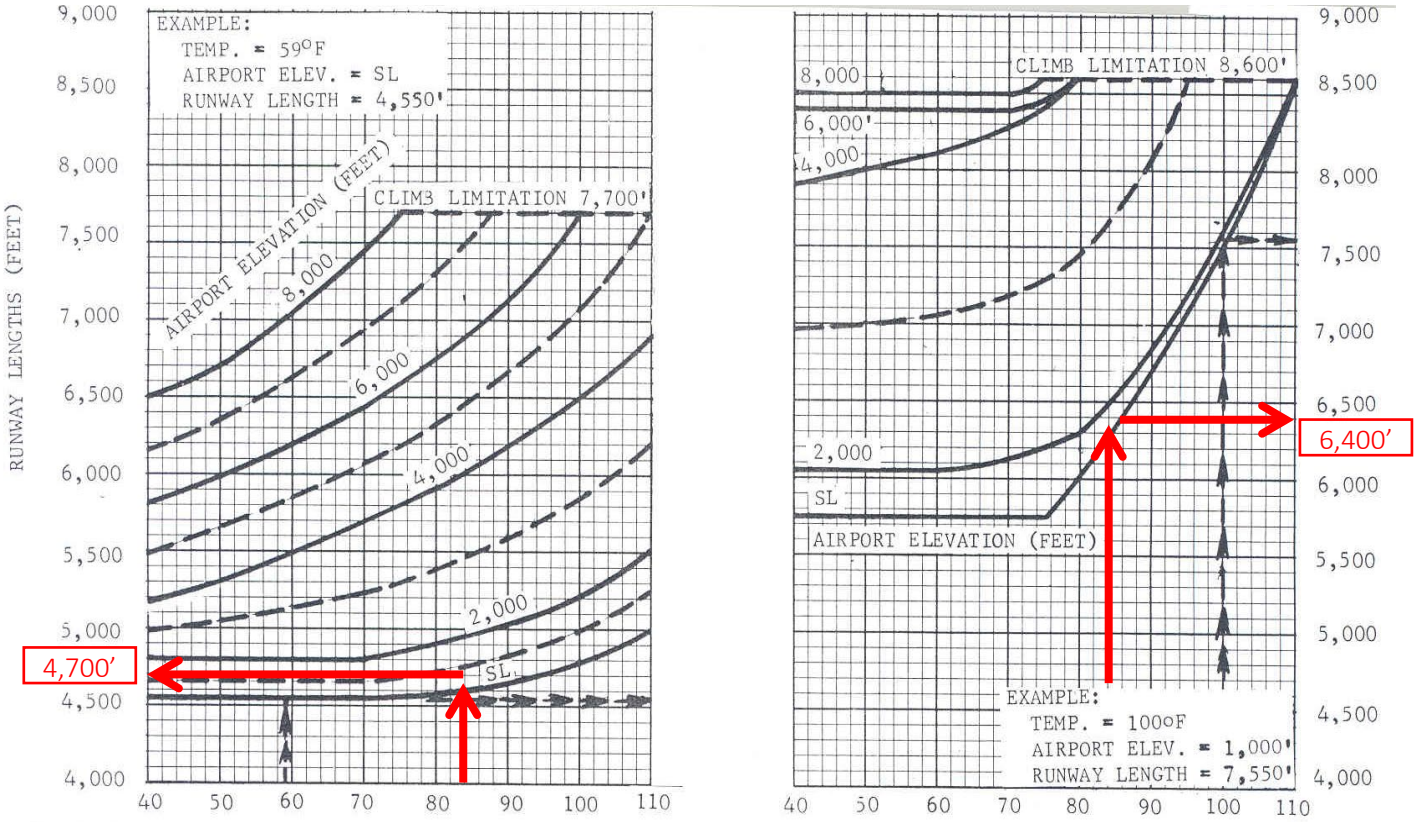
Table A-2 – Frequent Transient Aircraft

Aircraft Type	AAC	ADG	Annual Ops	Aircraft Type	AAC	ADG	Annual Ops
Cessna C-172	A	I	9	Dassault Falcon 2000EX	B	II	16
Cessna C-172	A	I	10	Dassault Falcon 900	B	II	5
Cessna C-172	A	I	3	Dassault Falcon 900EX	B	II	7
Cessna C-172	A	I	17	Hawker 800	B	II	70
Cessna C-172	A	I	3	Dassault Falcon 7X	B	III	7
Cessna C-172	A	I	5	Global 5000	B	III	NP
Cessna C-172	A	I	1	Bombardier Challenger 300	C	II	4
Cessna C-172	A	I	1	Bombardier Challenger 300	C	II	2
Cessna C-172	A	I	22	Bombardier Challenger 300	C	II	1
Piper PA46 Meridian	A	I	4	Bombardier Challenger 350	C	II	3
Piper Saratoga	A	I	6	Bombardier Challenger 350	C	II	5
Piper Seminole	A	I	6	Cessna Citation III	C	II	17
Piper Seminole	A	I	4	Gulfstream G100	C	II	5
Piper Seminole	A	I	4	Gulfstream G280	C	II	10
Piper Seminole	A	I	1	Gulfstream G-IV	D	II	13
Piper Seminole	A	I	2	Eurcopter BK117	-	-	6
Beechcraft Beech Jet 400	B	I	7	Euroceopter BK117	-	-	1
Cessna Citation M2	B	I	9	Eurocopter AS350	-	-	6
Raytheon Hawker 700	B	I	7	Eurocopter BK117	-	-	5
Beechcraft King Air 350	B	II	8	Eurocopter EC145	-	-	2
Beechcraft King Air 350	B	II	18	Eurocopter EC145	-	-	2
Cessna Citation V	B	II	6	Eurocoptor AS350	-	-	3
Cessna Citation X	B	II	10	Westwind	-	-	6
Cessna Citation X	B	II	7				

Source: GCIAA tenant survey, December 2018; Prepared by: Jacobsen|Daniels

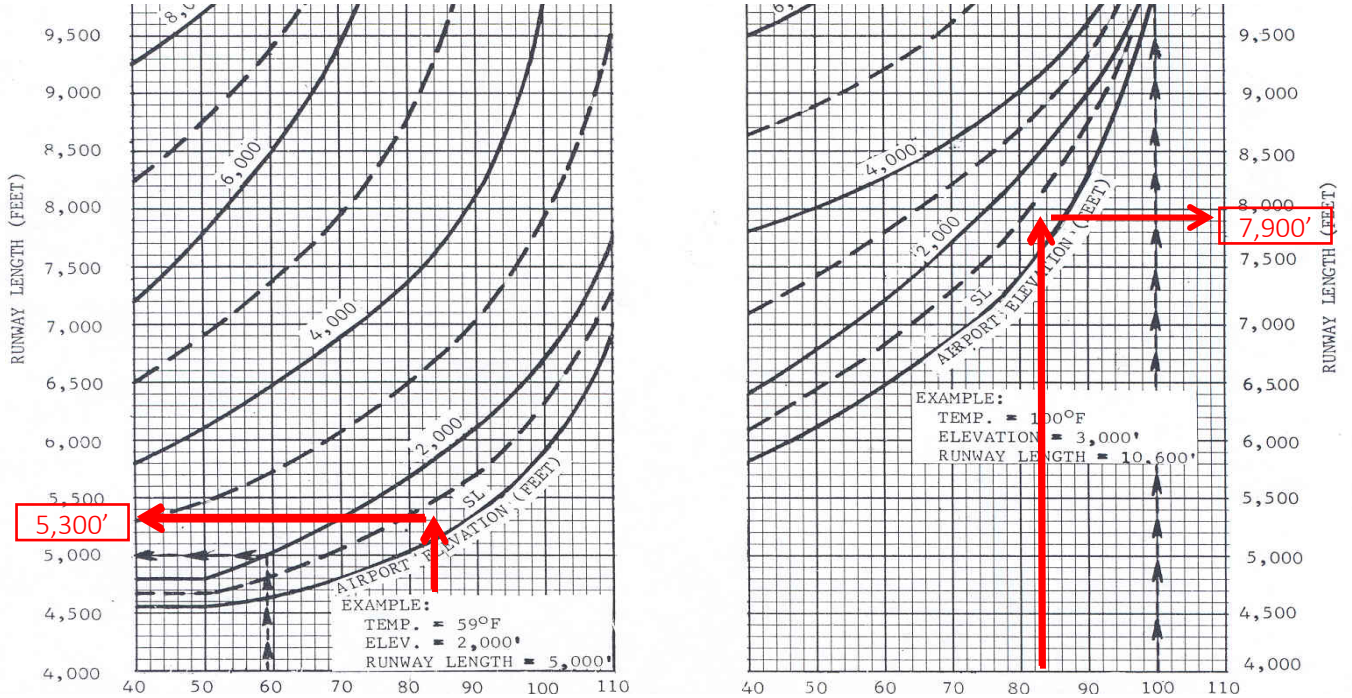
Appendix B – Runway Length Calculations

Figure B-1 – 75% of the Fleet at 60 or 90 Percent of Useful Load



Source: FAA Advisory Circular 150/5325-4B, Figure 3-1; Prepared by: Jacobsen|Daniels

Figure B-2 – 100% of the Fleet at 60 or 90 Percent of Useful Load



Source: FAA Advisory Circular 150/5325-4B, Figure 3-2; Prepared by: Jacobsen|Daniels

Table B-1 – Unadjusted Runway Length

Fleet Accommodated	60% useful load	90% useful load
75% (Table 3-1)	4,700 ft	6,400 ft
100% (Table 3-2)	**5,300 ft**	**7,900 ft**

Source: FAA AC 150/5325-4B Figures 3-1 and 3-2; Prepared By: Jacobsen|Daniels, December 2018

Table B-2 – Summary of Recommended Runway Length and Adjustments for 100% of Fleet

Criteria	Recommended Length (feet)	
	60% useful load	90% useful load
Fleet Accommodated: 100% (Table 3-2)	5,300	7,900
Adjustment for grade	200	200
Adjustment for wet conditions	Up to 5,500	Up to 7,500

Total recommended length	5,500	8,100
Length allowable due to physical constraints	5,404	5,404

Source: FAA AC 150/5325-4B Figures 3-1 and 3-2; Prepared By: Jacobsen|Daniels, December 2018

Table B-3 – Summary of Recommended Runway Length and Adjustments for Up to 75% of Fleet

Criteria	Recommended Length (feet)	
	60% useful load	90% useful load
Fleet Accommodated: 100% (Table 3-2)	4,700	6,400
Adjustment for grade	200	200
Adjustment for wet conditions	Up to 5,500	Up to 7,500
Total recommended length	5,405	7,360
Length allowable due to physical constraints	5,404	5,404

Source: FAA AC 150/5325-4B Figures 3-1 and 3-2; Prepared By: Jacobsen|Daniels, December 2018