

Airport Master Plan Update

Design Criteria and Facility Requirements
Lakeland Linder International Airport

June 4 2019
Working Paper 4

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4. Design Criteria and Facility Requirements

4.1. Introduction

This chapter presents design criteria that will be used for airport-specific planning and serve as the basis of the demand/capacity and facility requirements analysis for Lakeland Linder International Airport (LAL). All design standards presented in this section have been established by the Federal Aviation Administration (FAA) and industry best practices for developing airport facilities to meet existing and forecast levels of activity.

This chapter compares the projected aviation demand to the existing capacity of the facilities at LAL. This comparison is then used to determine future facility requirements over the 20-year planning period. The facility improvements are directly related to the forecasted aviation activity and will allow LAL and the surrounding community to be adequately prepared to accommodate the potential demand over the 20-year-planning period. This chapter examines how anticipated activity levels translate into LAL's ability to serve forecasted traffic, focusing on the following distinct elements:

- Demand and Capacity Calculations
- Airside Facility Requirements
- Landside Facility Requirements
- Support Facility Requirements

Any shortcomings in the ability to serve the forecasted demand, or meet FAA design standards are identified, and recommendations are made regarding physical improvements that may be needed to mitigate recognized deficiencies.

4.2. Design Criteria

Airport design standards, as established by the Federal Aviation Administration (FAA), were employed in this Master Plan for developing airport facilities capable of meeting existing and forecast levels of aviation activity.

4.2.1. Critical Aircraft and Design Standards

An initial step in identifying an airport's design requirements is the establishment the Airport's existing and future Critical Aircraft. The critical aircraft is the most demanding aircraft type, or grouping of aircraft with similar characteristics, that make regular use of the airport. The FAA Defines Regular use in Advisory Circular (AC) 150/5000-17, Critical Aircraft and Regular Use Determination, as an aircraft type or of grouping with 500 annual operations. An operation is considered to be a take-off or landing, with touch-and-go operations excluded from regular use calculations. An airports critical aircraft affects key aspects of design, such as the sizing of runways, taxiways/lanes, and the location of aircraft parking areas, hangar facilities, and protected airspace surfaces. Airport improvements are planned and developed per the established design criteria applicable to the critical aircraft.

Referenced in Chapter 3 of this report, the critical design aircraft has been established based on justification of substantial use and future use of LAL. **Table 4-1** depicts the existing and future selected critical aircraft for each runway at the Airport.

Table 4-1 Critical Aircraft

Runway	Existing Critical Aircraft	Future Critical Aircraft
9/27	Boeing 737-700	Boeing 767-300F
5/23	Boeing 737-700	Boeing 767-300F
8/26	Cessna 172	Cessna 172

4.2.2. Runway Design Code (RDC)

The Runway Design Code (RDC) signifies standards to which the runway is to be built and maintained. Aircraft Approach Category (AAC), Airplane Design Group (ADG), and approach visibility minimums are combined to form the RDC of a specific runway. The AAC is the first portion of the RDC and relates to the aircraft approach speed, as depicted in **Table 4-2**. The ADG is the second component of the RDC and its represented by a Roman numerical as depicted in **Table 4-3**. The ADG relates to the aircraft wingspan or tail height of the critical aircraft. The final component of the RDC relates to the visibility minimums for the instrument approaches into each runway as depicted in **Table 4-4**. The runway design code (RDC) of each runway at LAL and its respective critical aircraft is depicted in **Table 4-5**.

Table 4-2 Aircraft Approach Category

Aircraft Approach Category	Approach Speed
A	Approach speed less than 91 knots
B	Approach speed 91 knots or more but less than 121 knots
C	Approach speed 121 knots or more but less than 141 knots
D	Approach speed 141 knots or more but less than 166 knots
E	Approach speed 166 knots or more

Source: FAA AC 150/5300-13A, Airport Design

Table 4-3 Airplane Design Group

Group #	Tail Height (ft [m])	Wingspan (ft [m])
I	< 20' (< 6 m)	< 49' (< 15 m)
II	20' - < 30' (6 m - < 9 m)	49' - < 79' (15 m - < 24 m)
III	30' - < 45' (9 m - < 13.5 m)	79' - < 118' (24 m - < 36 m)
IV	45' - < 60' (13.5 m - < 18.5 m)	118' - < 171' (36 m - < 52 m)
V	60' - < 66' (18.5 m - < 20 m)	171' - < 214' (52 m - < 65 m)
VI	66' - < 80' (20 m - < 24.5 m)	214' - < 262' (65 m - < 80 m)

Source: FAA AC 150/5300-13A, Prepared by Atkins 2017

Table 4-4 Visibility Minimums

RVR (ft.)	Flight Visibility Category (statute mile)
VIS	Visual Approach
4000	Lower than 1 mile but not lower than ¾ mile (APV ≥ ¾ but < 1 mile)
2400	Lower than ¾ mile but not lower than ½ mile (CAT-I PA)
1600	Lower than ½ mile but not lower than ¼ mile (CAT-II PA)
1200	Lower than ¼ mile (CAT-III PA)

Source: FAA AC 150/5300-13A, Prepared by Atkins 2017

Table 4-5 Critical Aircraft

Runway	Existing Critical Aircraft	Existing RDC	Future Critical Aircraft	Future RDC
9/27	Boeing 737-700	C-III	Boeing 767-300F	C-IV
5/23	Boeing 737-700	C-III	Boeing 767-300F	C-IV
8/26	Cessna 172	A-I	Cessna 172	A-I

4.2.3. Airport Reference Code (ARC)

Per FAA AC 150/5300-13A, the ARC is a system used to relate airport design criteria to the planner or designer and is based on an airport’s highest RDC, minus the visibility component. Airport improvements can be planned and developed per the established ARC for an entire airport. The existing ARC for LAL is C-III. The future ARC for LAL is D-IV.

4.3. Airside Facility Requirements

FAA standards are utilized in this analysis for developing airport facilities capable of meeting both existing and forecasted levels of aviation activity. FAA AC 150/5300-13A, *Airport Design*, uses coding systems to relate airport design criteria to the established critical aircraft at the airport. This criteria will further dictate the future need for expanded airfield infrastructure and operational parameters to best plan and meet the forecasted future operations.

4.3.1. Runway Requirements

The following sections examine the runways’ general characteristics with respect to conformance to FAA design and safety requirements.

4.3.1.1. Runway Width

Runway width standards are established in FAA AC 150/5300-13A and are based on RDC criteria. **Table 4-6** outlines the FAA runway width standards, and the existing runway facilities at LAL. Currently, Runways 9/27, 5/23, and 8/26 meet their existing respective FAA requirements.

Table 4-6 Runway Width

Runway	ARC (Existing and Future)	FAA Requirement Width (Ft.) (Existing and Future)	Existing Width (Ft.) (Existing and Future)
9/27	C-III / D-IV	150	150
5/23	C-III / C-IV	150	150
8/26	A-I	60	60

Source: FAA AC 150/5300-13A, Prepared by Atkins 2018

4.3.1.2. Runway Length Analysis

In accordance with FAA Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design*, an analysis was conducted to determine the runway length requirements for the existing and future critical aircraft operating at LAL. FAA AC 150/5325-4B uses a five-step procedure to determine recommended runway lengths for a selected list of critical design aircraft. The five steps are summarized below.

1. Identify the list of critical design airplanes that will make regular use of the proposed runway for an established planning period of at least five years. For federally funded projects, the definition of the term “*substantial use*” quantifies the term “*regular use*”.
2. Identify the airplanes that will require the longest runway lengths at MTOW. This will be used to determine the method for establishing the recommended runway length. When the MTOW of listed airplanes is over 60,000 lbs., the recommended runway length is determined per individual airplanes and their respective airplane planning manuals.
3. Use Table 1-1 in AC 150/5325-4B (**Table 4-7** in this document) and the airplanes identified in step #2 to determine the method that will be used for establishing the recommended runway length. MTOW is used because of the significant role played by airplane operating weights in determining runway lengths.
4. Select the recommended runway length from among the various runway lengths generated by step #3 per the process identified in chapters 2, 3, or 4 of the AC, as applicable.
5. Apply any necessary adjustment to the obtained runway length, when instructed by the applicable chapter of the AC, to the runway length generated by step #4 to obtain a final recommended runway length. Adjustments to the length may be necessary for runways with non-zero effective gradients, excessive temperatures, wind conditions, airport elevation, etc.

Table 4-7 Airplane Weight Categorization for Runway Length Requirements

Airplane Weight Category		Design Approach	Location of Design Guidelines	
Maximum Certificated Takeoff Weight (MTOW)				
12,500 pounds (5,670 kg) or less	Approach Speeds less than 30 knots	Family grouping of small airplanes	Chapter 2; Paragraph 203	
	Approach Speeds of at least 30 knots but less than 50 knots	Family grouping of small airplanes	Chapter 2; Paragraph 204	
	Approach Speeds of 50 knots or more	With Less than 10 Passengers	Family grouping of small airplanes	Chapter 2; Paragraph 205 Figure 2-1
		With 10 or more passengers	Family grouping of small airplanes	Chapter 2; Paragraph 205 Figure 2-2
Over 12,500 pounds (5, 670 kg) but less than 60,000 pounds (27,200 kg)		Family grouping of large airplanes	Chapter 3; Figures 3-1 or 3-2 1 and Tables 3-1 or 3-2	
60,000 pounds (27,200 kg) or more or Regional Jets 2		Individual large airplane	Chapter 4; Airplane Manufacturer Websites (Appendix 1)	
Note 1: When the design airplane's APM show a longer runway length than what is shown in Figure 3-2, use the airplane manufacturer's APM. However, users of an APM are to adhere to the design guidelines found in Chapter 4.				
Note 2: All regional jets regardless of their MTOW are assigned to the 60,000 pounds (27,200 kg) or more weight category.				

Source: FAA AC 150/5325-4B Runway Length Requirements for Airport Design

4.3.1.2.1. Runway Length: Takeoff Distance

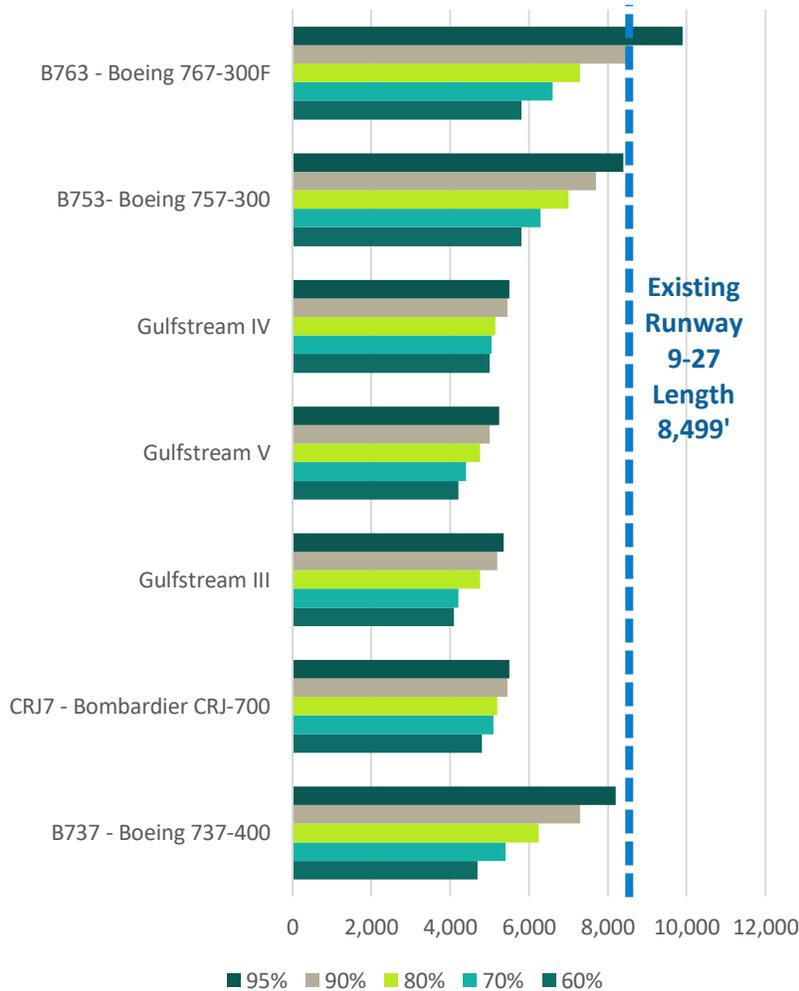
Runway length requirements are based on a variety of factors, the most notable of which is the takeoff distance of the critical aircraft operating on the runway. The departure requirements are often the most critical for measuring runway length required since departing aircraft have a full fuel load thus increasing the amount of runway required. Average high temperatures and the elevation of the runway are other factors that affect runway length requirements. The low elevation of LAL makes the elevation factor less important. Considering LAL's location in Florida, the region can reach higher temperatures during the summer months that will be taken into consideration during this analysis and will play a larger role. FAA AC 150/5325-4B, *Runway Length Requirements of Airport Design*, provides guidance that suggests recommending runway lengths based on a family grouping of aircraft. Due to the critical aircraft having a maximum takeoff weight (MTOW) of over 60,000 pounds, it is advised that the aircraft's airport planning manual (APM) is analyzed to determine the takeoff length needed, then resulting in the recommended runway length.

4.3.1.2.2. Takeoff Distance Requirements

In accordance with AC 150/5325-4B, the existing fleet mix was analyzed in detail to verify the type of runway length analysis required. Based on the forecast analysis that was completed for LAL, the critical aircraft and other additional aircraft that are to be considered for this analysis fall within the 60,000 pounds or more category for MTOW. Per AC 150/5325-4B, it is recommended that determining the runway length required of aircraft over 60,000 pounds in MTOW is to directly reference the specific manufacturer provided aircraft planning manual. These aircraft planning manuals provide information on a specific aircraft model such as performance, dimensions, weight, design standards, etc.

Figure 4-1 depicts the results of an analysis of the critical fleet mix at various take-off load factors on a standard day (59°F) at LAL. In standard day temperatures the existing runway length of Runway 9-27 is insufficient to operate the B767-300F at useful load factors higher than 90 percent.

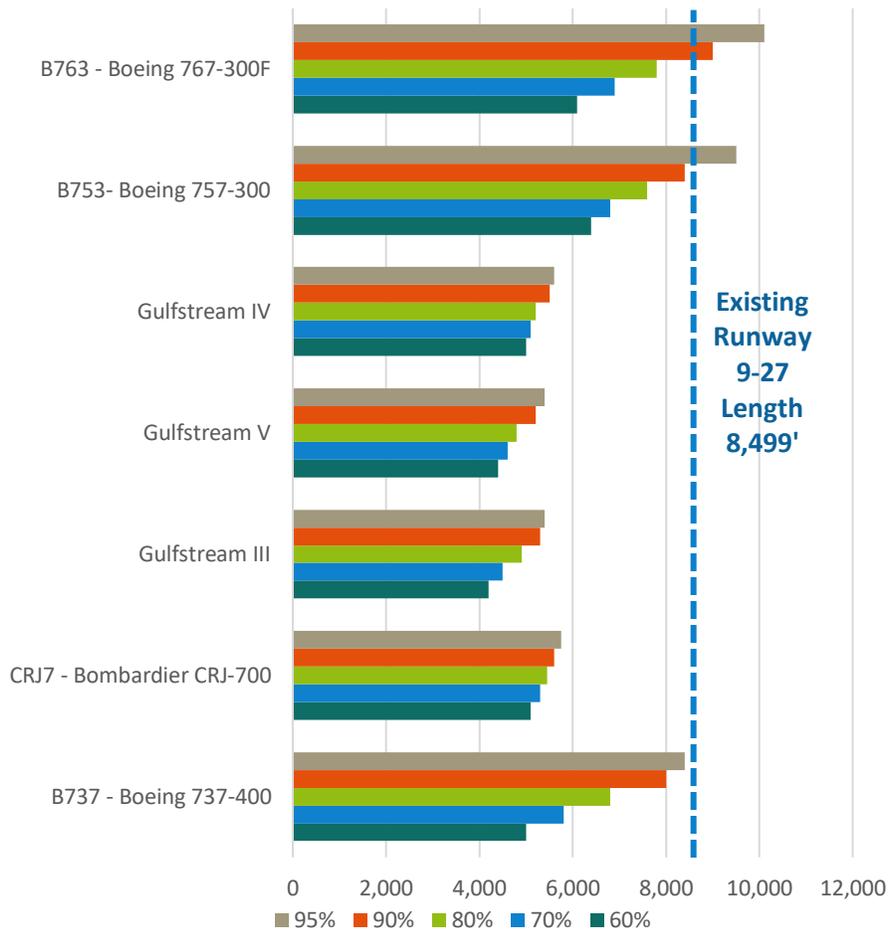
Figure 4-1 Critical Fleet Mix - Standard Day 59° Take-Off Distances



Source: TFMSC data January 2017-December 2017, Atkins Analysis 2018

The mean daily maximum temperature of the hottest month at LAL is 94.2°F. Lakeland maintains a warm tropical climate typically 9 months out of the year. These high temperatures reduce aircraft performance, causing an increase in aircraft take-off distance required. The runway length evaluation must also consider the average elevated temperatures present at LAL, with conditions as cool as standard day rarely occurring. **Figure 4-2** depicts the fleet mix performance at various useful loads at a temperature of 85°F. In this scenario the future aircraft, the Boeing 767-300F is unable to operate with 80 percent useful load at Lakeland on the existing runway length of 8,499'. To allow cargo operations of the Boeing 767-300F to operate at LAL with operationally effective load factors, the airport will need to have one runway of 10,000 feet.

Figure 4-2 Critical Fleet Mix – Standard Day + 25° (85°) Take-Off Distances



Source: TFMSC data January 2017-December 2017, Atkins Analysis 2018

4.3.2. Runway Protective Surfaces

Runway protective surfaces such as the Runway Safety Area, Runway Object Free Area, and Runway Protection Zone aim to protect aircraft, people, and property in the case of an aircraft deviating from its intended course while conducting conventional runway operations. The following sections outline the existing and future criteria for the runway protective surfaces at LAL. A detailed analysis of protective surfaces utilizing updated survey data is planned as part of the upcoming Alternatives Development Chapter.

4.3.2.1. Runway Safety Area

A Runway Safety Area (RSA) is a graded surface centered on a runway that is required to be free of all objects except for those that are ‘fixed by function’ such as runway lights and certain NAVAIDS. The purpose of the RSA is to protect aircraft in the event of an under-shoot, overrun, or aircraft runoff from a runway during landing or take-off operations. The area must be able to support emergency vehicle operations and maintenance vehicles and is required to be graded to slope away from the runway at 1.5 to 5.0 percent. The width and length of an RSA depend upon a runway’s RDC and approach visibility minimums. Meeting RSA requirements is one of the FAA’s

highest priorities in maintaining safety at the nation’s airports. **Table 4-10** lists the Airport’s existing and future RSA requirements.

Table 4-8 Runway Safety Area Dimensions

Runway	RDC	RSA Width (Ft.)	Length Beyond Runway End (Ft.)
9/27	C-III	500	1,000
5/23	C-III	500	1,000
8/26	A-I	120	240

Source: FAA 150/5300-13A, *Airport Design*, Atkins Analysis 2018

A small portion of the Runway 27 end RSA is impacted by Airport Perimeter Road E. The impact is currently located on the southern portion of the RSA, where the protective surface is approximately three feet within the perimeter road. This impact is inadvisable due to safety parameters of this area. It is recommended that this identified area is mitigated to ensure the safety of operating aircraft.

4.3.2.2. Runway Object Free Area

Like the RSA, the Runway Object Free Area (ROFA) must be free of objects except those required to support air navigation and ground maneuvering operations. The function of the ROFA, also centered on the runway, is to enhance the safety of aircraft operating on the runway. It is not permissible to park an airplane within the ROFA. The width and length of the ROFA depend upon an airport’s specific RDC and approach visibility minima. The ROFA does not have specific slope requirements, but the terrain within the ROFA must be relatively smooth and grade to be at or below the edge of the RSA. The compliance of the ROFA with all relevant FAA standards is discussed in the Inventory chapter of this report. **Table 4-11** notes the ROFA dimensions for LAL.

Table 4-9 Runway Object Free Area Dimensions

Runway	RDC	ROFA Width (Ft.)	Length Beyond Runway End (Ft.)
9/27	C-III	800	1,000
5/23	C-III	800	1,000
8/26	A-I	400	240

Source: FAA 150/5300-13A, *Airport Design*, Atkins Analysis 2018

Portions of the Runway 9-27 and Runway 5-23 ROFA are currently impacted. The ROFA on both ends of Runway 5-23 is currently impacted by airport-controlled perimeter roads which go through the protective surface. The ROFA on the Runway 27 end has vegetation, such as trees, and an airport-controlled perimeter road. These impacts are inadvisable due to safety parameters of this area. It is recommended that these identified areas are mitigated to ensure the safety of operating aircraft.

4.3.2.3. Runway Protection Zones

A Runway Protection Zone (RPZ) is an area centered symmetrically on an extended runway centerline. The RPZ has a trapezoidal shape and extends prior to each runway end. The RPZ is aimed at enhancing the safety of people and property on the ground by limiting and/or restricting

the construction of certain structures within its bounds. This area should be free of land uses that create glare, smoke, or other hazards to air navigation. Additionally, the FAA requires that no vertical structures are constructed within the extents of the RPZ.

The dimensions of an RPZ depend on each runway’s RDC. With no proposed reductions in instrument approach visibility minimums, the size and dimensions of the existing RPZs at LAL are not anticipated to change throughout the planning period. **Table 4-10** illustrates the RPZ requirements for RDCs C-III and A-I.

Table 4-10 Runway Protection Zones Dimensions

Approach RPZ	RDC	Length (Ft.)	Inner Width (Ft.)	Outer Width (Ft.)
9/27	C-III	2,500 / 1,700	1,000	1,750 / 1,510
5/23	C-III	1,700	1,000 / 500	1,510 / 1,010
8/26	A-I	1,000	500	700
Departure RPZ				
9/27	C-III	1,700	500	1,010
5/23	C-III	1,700	500	1,010
8/26	A-I	1,000	500	700

Source: FAA 150/5300-13A, *Airport Design*, Atkins Analysis 2018

Portions of the Runway 23 RPZ is impacted by varying objects and features. Such impacts include Drane Field Road, and multiple buildings along Airport Perimeter Road E and Drane Field Road. The approach RPZ on Runway 5 is currently impacted by a facility constructed in 2016, located south of Doolittle Road and Doolittle Road itself. The Runway 9 RPZ is impacted by Kevin Howard Road. These are examples of non-compliant conditions within the RPZ surface, as it is recommended that activities within the protective surface must be directly controlled by the airport. While these areas are inadvisable in nature, they are an existing condition per FAA interim guidance. It is recommended that these identified areas are mitigated to ensure the safety of operating aircraft.

4.3.3. Runway Designations

A runway designation is identified by the whole number nearest to the magnetic azimuth of the runway when oriented along the runway centerline as if on approach to that runway end. This number is then rounded off to the nearest unit of ten. Magnetic azimuth is determined by adjusting the geodetic azimuth associated with a runway to compensate for magnetic declination. Magnetic declination is defined as the difference between true north and magnetic north. The value of magnetic declination varies over time and global location. Magnetic declination is a natural process and periodically requires the re-designation of runways. **Table 4-11** shows the runway’s true and magnetic bearing, along with the current magnetic declination. Currently Runway 9-27 has a need to be re-designated as Runway 10-28.

Table 4-11 Runway Magnetic Bearing

Runway	True Bearing	Magnetic Declination	Magnetic Bearing	Runway Designation Required
9	89° 52' 19"	5° 58' W	95° 50' 19"	10
27	269° 52' 19"	5° 58' W	275° 50' 19"	28
5	44° 51' 41"	5° 58' W	50° 49' 41"	5
23	224° 51' 41"	5° 58' W	230° 49' 41"	23

Source: NOAA National Center for Environmental Information, Atkins Analysis 2018

The current rate of change is 0° 6' West per year according to the National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information.

4.3.4. Runway Strength

The gross weight bearing capacity for Runway 9/27 is published in the FAA Airport 5010 as Single Wheel (S) 105,000 pounds and Dual Wheel (D) 170,000 pounds. Runway 5/23 is published as Single Wheel (S) 94,000 pounds and Dual Wheel (D) 150,000 pounds. Runway 8/26 is not posted due to the turf surface composition of the runway. Should any runway extension or rehabilitation occur within the forecast period, it is suggested to increase the weight bearing characteristics for the pavement. This would enable the Airport to service operations from larger aircraft, and to not restrict potential operations for the future.

4.3.5. Taxiway Requirements

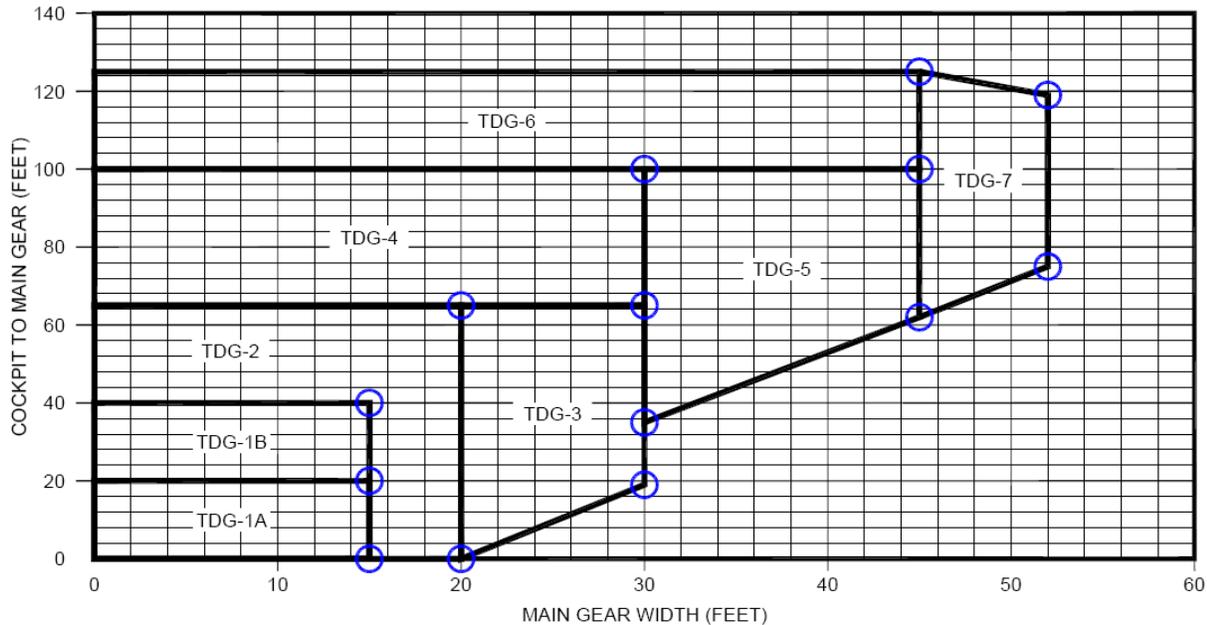
Taxiway Design Group (TDG) was introduced by the FAA with their release of AC 150/5300-13A in 2014. As depicted in **Figure 4-3**, there are eight TDGs which are determined by aircraft undercarriage (gear) dimensions such as main gear width and the distance between the cockpit and main gear. **Table 4-12** presents the Airport's anticipated critical aircraft during the planning period, along with the associated TDG dimensions.

Table 4-12 Critical Aircraft & Respective TDG

Airplane Design Group			
Aircraft Manufacture/Model	Main Gear Width (ft.)	Cockpit to Main Gear (ft.)	TDG
Boeing 767-300F	35' 9"	74' 8"	5
Cessna 172	7' 8"	4' 8"	1A

Source: Atkins Analysis, 2018

Figure 4-3 FAA AC 150/5300-13A – Taxiway Design Groups (TDGs)



Source: FAA AC 150/5300-13A Change 1, Airport Design

Taxiway systems should provide safe and efficient routes for aircraft ground movement to and from an airports runways and apron areas. The type and location of taxiways in relation to a runway system have a significant impact on airfield capacity. As traffic increases, the taxiway system can limit an airport’s overall capacity, especially if the configuration results in frequent runway crossings by taxiing aircraft or does not provide sufficient access to airport facilities.

FAA guidance found in FAA AC 150/5300-13A, recommends that a taxiway system should:

- Provide each runway with a full-length parallel taxiway
- Have as many bypasses, multiple accesses, or connector taxiways as possible to each runway end
- Provide taxiway run-up / holding bay areas for each runway end
- Have the most direct routes possible
- Have adequate curve and fillet radii
- Avoid areas where ground congestion may occur

Taxiway systems which are designed for TDG 3 aircraft has a required pavement width of 50’, where TDG 5 has a required pavement width of 75’. The existing taxiway system at LAL can accommodate the larger taxiway design group category on specific taxiways. These taxiways include Taxiway A, B, C, J, and K. It is recommended that major taxiway routes should be enhanced to accommodate the critical aircraft’s taxiway design group when taxiway rehabilitation occurs. Some taxiway fillets at taxiway/runway and taxiway/taxiway intersections do not meet the FAA design standards. Historically, the FAA permitted a few methodologies for designing and constructing taxiway fillets. However, with the most recent release of FAA 150/5300-13A Change

1, the options have been reduced to a single standard that ensures all wheels of an aircraft tracking on the taxiway centerline will maintain sufficient clearance from the taxiway edge.

4.3.5.1. Taxiway Safety Area

Like the RSA for the runway pavement, the Taxiway Safety Area (TSA) is centered on the taxiway centerline and provides a protective area around the taxiway pavement. This is to primarily provide ample room for emergency vehicle accessibility, and to minimize the severity of an aircraft run-off. The TSA is cleared and graded, and free of all objects that are not fixed by function. The width of the TSA depends on the critical aircraft's respective ADG. **Table 4-13** depicts the TSA width in respect to the critical aircraft.

Table 4-13 Taxiway Safety Area Requirements

Critical Aircraft (ADG)	TSA Width (ft.)
Existing – Boeing 737-400 (III)	118
Future - Boeing 767-300F (IV)	171

Source: FAA AC 150/5300-13A Change 1, Airport Design. Atkins Analysis 2018

4.3.5.2. Taxiway Object Free Area

Similar to the ROFA for the runway pavement, the Taxiway Object Free Area (TOFA) is centered on the taxiway centerline and provides an additional protected area beyond the TSA. The TOFA prohibits service vehicle roads, parked aircraft, and other objects that are not necessary for aircraft ground navigation. Vehicles can only operate in the TOFA if the vehicle operator gives the right of way to the oncoming aircraft. **Table 4-14** depicts the TOFA width in respect to the critical aircraft.

Table 4-14 Taxiway Object Free Area Requirements

Critical Aircraft (ADG)	TOFA Width (ft.)
Existing – Boeing 737-400 (III)	186
Future - Boeing 767-300F (IV)	259

Source: FAA AC 150/5300-13A Change 1, Airport Design. Atkins Analysis 2018

4.3.6. Inadvisable Airfield Geometry

Inadvisable airfield geometry includes but is not limited to pavement which is non-compliant with updated airfield standards, and pavement geometry prone to high-activity with multiple intersecting centerlines. Hotspots are identified when there is an increased risk of airfield incursions or there has historically been many incursions in a specific area.

Runway 9 end taxiway connector, Taxiway P1, is currently a wide expanse of pavement. The current taxiway pavement entrance is approximately 218 feet wide, which exceeds the standard for an entry taxiway. This wide expanse of pavement is inadvisable due to nonstandard sign placement and lack of visual cues in low visibility conditions. It is recommended that Taxiway P1 is mitigated through implementation of standard airfield geometry to ensure safe and efficient airfield maneuvering.

Runway 27 end taxiway connector, Taxiway C, is considered as a bypass taxiway entering the runway. Bypass taxiways are crucial at busy airports as it provides ATC the flexibility to maneuver

aircraft around other aircraft that are not yet ready for departure, ensuring a steady stream of departing aircraft. Bottlenecks result when a preceding aircraft is not ready for takeoff and blocks the access taxiway to the runway. Currently, the Taxiway C bypass is non-compliant, as the area between the bypass taxiways is currently paved. FAA AC 150/5300-13A requires that the area between the bypass taxiways contain either a painted island with appropriate marking or is not paved. It is recommended that the bypass taxiway deficiency is mitigated to ensure compliance with FAA airfield standards and improve situational awareness for pilots operating at the airport.

4.3.7. Aircraft Run Up Areas

Aircraft run up areas are crucial for efficient flow on airfields. These are used by pilots to preform pre-takeoff procedures including instrument and engine performance checks as well as to hold while waiting for clearance from ATC. They should be designed to provide a clearly marked area for pilots to park that will keep their aircraft clear of the active taxiway.

Run up areas are typically located at the runway ends directly off the taxiway and clear of any protected runway or taxiway surfaces. General design of holding bays include assured wingtip clearance of established critical aircraft and proper markings to guide pilots safely. Markings should be labeled to have a specified area where aircraft can turn within the holding bays to allow for free movement in and out of the run-up area without having to wait for preceding aircraft to move. This will allow for aircraft to easily enter and exit the run-up area without interfering with other aircraft in the same run up area. Currently, there are no designated aircraft run up areas at LAL. It is recommended that future aircraft run up areas are planned to ensure the efficient aircraft flow on the Airfield.

Run-up areas proposed in Chapter 5, *Alternatives*, will aim to meet the following criteria:

- Markings should be placed to direct aircraft to turn perpendicular or angled to the taxiway, which will create independent standing areas, so aircraft can enter and exit at ease and avoid prop wash during run up, and ensure proper wingtip clearance.
- Pavement area should be increased to address capacity issues and ensure proper hold bay depth for the established critical aircraft.
- Identify additional locations to maximize run up area availability for each runway end.

4.3.8. Airfield Lighting

Chapter 2- *Inventory* describes the existing condition of airfield lighting equipment at LAL. Currently, each paved runway has lighting such as Runway Edge Lighting and Runway Threshold Lighting. Each runway at the Airport lacks Runway End Identification Lighting (REIL), which is required for precision approach runways. Due to this, it is recommended the runways are enhanced with this lighting system in the future. However, lighting will be analyzed in the upcoming alternatives analysis when making any proposed improvements to instrument approach minima. Finally, future improvements to or implementation of lighting equipment should feature light-emitting diode (LED) technologies where able and when practical.

4.3.9. Signage

Chapter 2- *Inventory*, describes existing conditions of airfield signage at LAL. While no specific recommendations for signage improvement are identified, airfield signage should be expanded and updated as necessary in conjunction with any airfield improvement projects.

4.3.10. Airfield Marking

Chapter 2- *Inventory*, describes the existing conditions of airfield markings at LAL. While no specific recommendations for marking improvements are identified, airfield markings should be expanded and updated as necessary in conjunction with any airfield improvement projects.

4.4. Demand and Capacity

4.4.1. Airspace Capacity

Airspace is defined as the navigable space that is used by pilots to navigate from one airport to another. Airspace capacity can become constrained when flight paths of air traffic at nearby airports, or local navigational aids (NAVAIDs), interact to add operations to the airspace that surrounds an individual airport. This creates the possibility of congestion within LAL's airspace. The need to alter flight paths of arriving and departing aircraft to avoid obstructions is also a concern.

The LAL airfield is enclosed in the Mode-C veil of Tampa International. This requires operators to have a Mode-C identifier onboard the aircraft for Class B procedures. The Class B airspace directly to the west of LAL can cause possible air navigation delays during high traffic volume at TPA. This, coupled with the several airports surrounding LAL, can cause delay in air navigation. In addition, the alert areas to the southwest of LAL can cause further delay with operators staying outside of the alert area boundaries.

4.4.2. Airside Capacity

Airside Capacity calculations represent the capacity of the airside infrastructure such as runways, taxiways, and Instrument Approach Procedures (IAPs). These values are compared to existing and future demand to determine the need for future capacity enhancing infrastructure such as additional runways or taxiway exits.

Airside capacity is a measure of the number of aircraft that can operate at an airport in a given timeframe. Capacity is most often expressed in hourly or annual measures. Hourly capacities are calculated for visual flight rules (VFR) and instrument flight rules (IFR) to identify any peak-period issues. Hourly airport capacity calculations included in the following sections do not include variables attributed to air traffic control (ATC) procedures such as procedural spacing. The differentiation between VFR and IFR hourly capacities derived from the heightened minimums required for IFR operations. While under IFR conditions, some aircraft are limited in their ability to handle said conditions and will ultimately reduce the hourly capacity. Annual Service Volume (ASV) is calculated to measure an airport's ability to meet existing and future demand levels.

The major components to be considered when determining an airport's capacity include runway orientation and configuration, runway length, and runway exit locations. Additionally, the capacity of any given airfield system is affected by operational characteristics such as fleet mix, climatology, and IAP's. Each of these components has been examined as part of the airside capacity analysis.

The FAA defines total airport capacity as a reasonable estimate of an airport's annual capacity, which accounts for the differences in runway use, aircraft mix, weather conditions, etc., which would be encountered over a year's time. The parameters, assumptions, and calculations required for this analysis are included in the following sections.

4.4.2.1. Airfield Capacity Parameters and Assumptions

The generally accepted methodology for calculating airfield capacity is found in FAA Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*. The calculations are based on the runway utilizations that produce the highest sustainable capacity consistent with existing air traffic rules, practices, and guidelines. The criteria and values used in the AC are typical of U.S. airports with similar runway configurations and are designed to enable calculation of airport capacity as accurately as possible. The parameters and assumptions identified in this section were used to calculate the Airport’s airfield capacity.

4.4.2.2. Runway Orientation, Utilization, and Wind Coverage

The Airport has three bi-directional runways, Runway 9/27 and Runway 8/26 with an east-west alignment, and Runway 5/23 with a northeast-southwest alignment. The utilization rates and orientation of these runways were evaluated to determine the Airport’s annual capacity, which is the sum of capacities determined for each runway. It is important to note that an operation is defined as either a takeoff or landing. The direction of each operation is highly influenced by wind, available instrument approaches, noise abatement procedures, airspace restrictions, and/or other operating parameters. The runway use configuration for the Airport’s capacity calculations considered runway orientations for Runway 9/27, 5/23, and 8/26 in various combinations.

Providing adequate wind coverage is an important factor in enhancing an airports capacity. Runways should be constructed to maximize the opportunity for aircraft to take-off and land heading into the wind. The FAA recommends that each airport’s primary runway has 95 percent or greater wind coverage in all-weather conditions. According to FAA AC-150/5300-13A, *Airport Design*, the 95 percent wind coverage is met for a B-II runway when the crosswind component does not exceed 13 knots. Furthermore, the wind analysis revealed that each of the three bi-directional runways exceed the 95 percent wind coverage independently for the classes of aircraft most regularly accommodated.

4.4.2.3. Aircraft Mix Index

The FAA has developed a classification system for grouping aircraft based on size, weight, and performance. **Table 4-15** illustrates the classification categories as they are presented in FAA AC 150/5060-5, *Airport Capacity and Delay*.

Table 4-15 FAA Aircraft Certifications

Aircraft Class	Max. Cert. Takeoff Weight (lb)	Number of Engines	Wake Turbulence Classification
A	12,500 or less	Single	Small (S)
B		Multi	Small (S)
C	12,500 – 300,000	Multi	Large (L)
D	Over 300,000	Multi	Heavy (H)

Source: FAA AC 150/5060-5, *Airport Capacity and Delay*.

This classification system is used to develop an aircraft mix which is the relative percentage of operations conducted by each of the four classes of aircraft (A, B, C, and D). The aircraft mix is used to calculate a mix index which is then used for airfield capacity studies. The FAA defines the mix index as a mathematical expression, representing the percent of Class C aircraft, plus three

times the percent of Class D aircraft (C+3D). The FAA has established mix index ranges for use in capacity calculations as listed below:

- 0 to 20
- 21 to 50
- 51 to 80
- 51 to 120
- 121 to 180

A review of the calendar year 2017 Traffic Flow Management System Counts (TFMSC), compiled by the FAA, indicates the airport experiences most of its traffic from aircraft falling into either A or B weight classifications outlined above. Being the FAA establishes mix index ranges for airport capacity calculations it is not necessary to compute the actual mix index value. For the purposes of this analysis it is assumed that the mix index range for LAL will be between zero and twenty throughout the planning period. This assumes that the aircraft having maximum certified takeoff weighting over 41,000 lbs. will not make up more than 30 percent of the Airport total annual operations.

4.4.2.4. Arrivals Percentage

The percent of arrivals is the ratio of arrivals to total operations. It is typically safe to assume that the total annual arrivals will equal total departures, and that average daily arrivals will equal average daily departures. Therefore, a factor of 50 percent arrivals will be used in the capacity calculations for the Airport. This percentage is based on operational understandings.

4.4.2.5. Touch-and-Go Percentage

The touch and go percentage is the ratio of landings with an immediate takeoff to total operations. This type of operation is typically associated with flight training. The number of touch and go operations normally decreases as jet operations increase, the demand for service and number of total operations approach runway approach capacity, and/or weather conditions deteriorate. It is assumed that there are no touch and go operations conducted during IFR conditions. Typically, touch-and-go operations are assumed to be between zero and 40 percent of all operations at the Airport.

Due to the number of flights schools located at the airport, and the location of the airport relative to the major metropolitan areas of Orlando and Tampa, flight training operations at LAL can be assumed to be higher than average. As discussed in section 3.6 of the forecast of aviation activity, touch-and-go operations are anticipated to be approximately 50 percent of total operations.

4.4.2.6. Taxiway Access Factors

Taxiway entrance and exit locations are an important factor in determining the capacity of an airport's runway system. Runway capacities are highest when there are full-length parallel taxiways, ample runway entrance and exit taxiways, and no active runway crossings available. FAA AC 150/5060-5, *Airport Capacity and Delay*, identifies the criteria for determining taxiway exit factors at an airport. The criteria for exit factors are generally based on the mix index and the distance the taxiway exits are from the runway threshold and other taxiway connections. Taxiway exits were evaluated for operations in both directions on all three runways. **Table 4-16** depicts the findings of the taxiway exit evaluation. All runways have accessible taxiway exits between 2,000 feet and 4,000 feet of the landing threshold. For the taxiway exits to count towards the capacity at

the airfield, the exits need to be separated by at least 750 feet in addition to being in a range from 2,000 feet to 4,000 feet from the landing thresholds.

Runway 9/27 has a full-length parallel taxiway with multiple runway/taxiway connectors. This will decrease runway occupancy times for aircraft arriving on the primary runway due to the multiple options for exit at the respective aircraft's need. The availability of multiple taxiway exits will increase the overall utilization of the runway within any given time.

Table 4-16 LAL Taxiway Exit Ranges

Runway	Number of Exits within Optimal Range (2,000 ft. to 4,000 ft.)
9	3
27	2
5	2
23	1
8	N/A
26	N/A

Source: Atkins Analysis 2018

4.4.2.7. Instrument Approach Capabilities

Instrument approach capability is qualified based upon the ability of an airport to safely accommodate aircraft operations during periods of inclement weather. Weather, in this regard, is characterized by two measures: local visibility in statute miles and the height of a substantial cloud ceiling above airport elevation. These two measurements are termed “approach minima”. **Table 4-17** depicts the existing approach visibility minimums for each runway.

Table 4-17 Instrument Approach Minimums

Runway	Approach Minimums	Ceiling Height Minimums
9	1/2 < Mile Visibility	200'
27	3/4 < Mile Visibility	200'
5	3/4 < Mile Visibility	200'
23	1 < Mile Visibility	300'
8	N/A	N/A
26	N/A	N/A

Source: FAA LAL Instrument Approach Charts

4.4.2.8. Weather Influences

Operational limitations during such times of inclement weather were accounted for in airport capacity computations. Weather data obtained from the National Climatic Data Center (NCDC) is broken up into VFR and IFR observations. The data identified that IFR conditions (ceilings greater than 200 feet or less than 1,000 feet above ground level [AGL] and/or visibility greater than ½ mile but less than three miles) occur approximately 6.28 percent of the time at the Airport.

Wind data was obtained and analyzed to accurately depict the most appropriate operational traffic flow during various wind conditions. This wind data was utilized to understand runway utilization scenarios and to better understand the most favorable operational scenarios. **Table 4-18** depicts

the airfield operating condition assumptions at LAL based on the NCDC weather VFR data. **Table 4-19** depicts the airfield operating condition assumptions at LAL based on the NCDC weather IFR data.

Table 4-18 VFR Airfield Operating Configurations

	0° - 90° Wind	91° - 180° Wind	181° - 270° Wind	271° - 360° Wind
Arrivals	Runways 9, 5, 8	Runways 9, 23, 8	Runways 27, 23, 26	Runways 27, 23, 26
Occurrence %	41.46%	13.31%	8.96%	10.86%

Source: NCDC Wind & Weather Observations, 2017, & Atkins Analysis 2018

Table 4-19 IFR Airfield Operating Configurations

	0° - 90° Wind	91° - 180° Wind	181° - 270° Wind	271° - 360° Wind
Arrivals	Runways 9, 5	Runways 9, 23	Runways 27, 23	Runways 27, 23
Occurrence %	3.47%	1.55%	1.66%	1.74%

Source: NCDC Wind & Weather Observations, 2017, & Atkins Analysis 2018

The wind ranges were calculated based on the most effective basis to compare the collected NCDC data to the existing airfield layout.

4.4.3. Airfield Capacity Calculations

The airfield capacity calculations in this section were performed using the parameters and assumptions discussed in the previous sections. These calculations also utilize data from the aviation demand forecast, as presented within Chapter 3, for portions of the capacity calculations. The following sections outline the hourly capacities in VFR and IFR conditions, as well as the Airport’s calculated ASV.

4.4.3.1. Hourly Capacity Calculations

The hourly capacity of the runway facilities is determined by analyzing the appropriate VFR and IFR figures in AC 150/5060, *Airport Capacity and Delay*. The equation used to obtain the hourly capacity was taken from the FAA AC 150/5060-5, and is presented below.

$$\text{Hourly Capacity} = (C^*) \times (T) \times (E)$$

Hourly Capacity Base (C*)

Hourly Capacity Base (C*) is calculated for both VFR conditions and IFR conditions utilizing FAA provided diagrams provided in AC 150/5060. By first computing a combination of mix index, and arrivals percentage, the hourly capacity is determined. At LAL the following hourly capacity bases were utilized:

- VFR – Operating Runway 9, 5, & 8, (C*) = 75
- IFR – Operating Runway 9, & 5, (C*) = 54
- VFR – Operating Runway 27, 23, & 26, (C*) = 75
- IFR – Operating Runway 27, & 23 (C*) = 54

Touch & Go Factor (T)

The Touch and Go Factor (T) is an expression of touch and go activity and its effect on capacity. The value is derived using tables within AC 150/5060. Due to the weather constraints under IFR conditions, the factor for (T) is constant during said conditions. This is primarily due to the training aspect of touch and go operations. The factors in calculating (T) include the percent of operations which are touch and go, and the mix index.

- In VFR scenarios operating Runway 9, 5, & 8 at LAL, (T) = 1.40
- In VFR scenarios operating Runway 27, 23, & 26, at LAL, (T) = 1.40
- For IFR scenarios (T) is always assumed to be **1.00**

Exit Factor (E)

Exit Factor (E) is an expression of the availability of taxiway exits within an appropriate range for the mix of aircraft operating at the airport, derived by selecting the appropriate tables provided within AC 150/5060. The primary factors in calculating (E) are the mix index, the number of exits which are within appropriate exit range for arriving aircraft, and the percent arrivals (50%). The appropriate exit range for arriving aircraft, based on the calculated mix index, is within 2,000' to 4,000' from the arriving runway threshold as identified in **Table 4-16**. For the exit to count, there must be a minimum separation of 750' between runway exits. To calculate capacity at LAL for various scenarios the following exit factors (E) were utilized:

- Operating Runway 9, & 5 (E) = .94
- Operating Runway 27, & 23 (E) = .92

Hourly VFR Capacity

Hourly VFR capacities at LAL were calculated to be 99.

Hourly IFR Capacity

Hourly IFR capacities used similar assumptions to those used in the VFR hourly capacity calculations. However, maintaining greater separation between aircraft is generally required during IFR operations, which results in the hourly capacity base variable of the equation to be lower. In addition, certifications and authorizations are needed to operate in IFR conditions which reduces the overall hourly capacity further. These adjustments taken into consideration, the overall hourly capacity during IFR operations is 54.

Annual Service Volume

An airport's ASV is the maximum number of annual operations that can occur at the airport before an assumed maximum operational delay value is encountered. ASV is calculated based on the existing runway configuration, aircraft mix, and the parameters and assumptions identified herein, and incorporates the hourly VFR and IFR capacities calculated previously. Utilizing this information and the guidance provided in FAA AC 150/5060-5, *Airport Capacity and Delay*, the Airport's existing conditions ASV was calculated using the following equation:

- Weighted Hourly Capacity (Cw) x Annual/Daily Demand (H) = **ASV**

The weighted hourly capacity (Cw) is an expression of hourly capacity which takes into account the percentage of time each runway use configuration is used for both VFR and IFR conditions.

- $Cw \times D \times H = ASV \rightarrow 232,029$

Additionally, according to the FAA, the following guidelines should be used to determine necessary steps as demand reaches designated levels.

- **60 percent of ASV** – The threshold at which planning for capacity improvements should begin.
- **80 percent of ASV** – The threshold at which planning for improvements should be complete and construction should begin.
- **100 percent of ASV** – The airport has reached the total number of annual operations it can accommodate, and capacity-enhancing improvements should be made to avoid extensive delays.

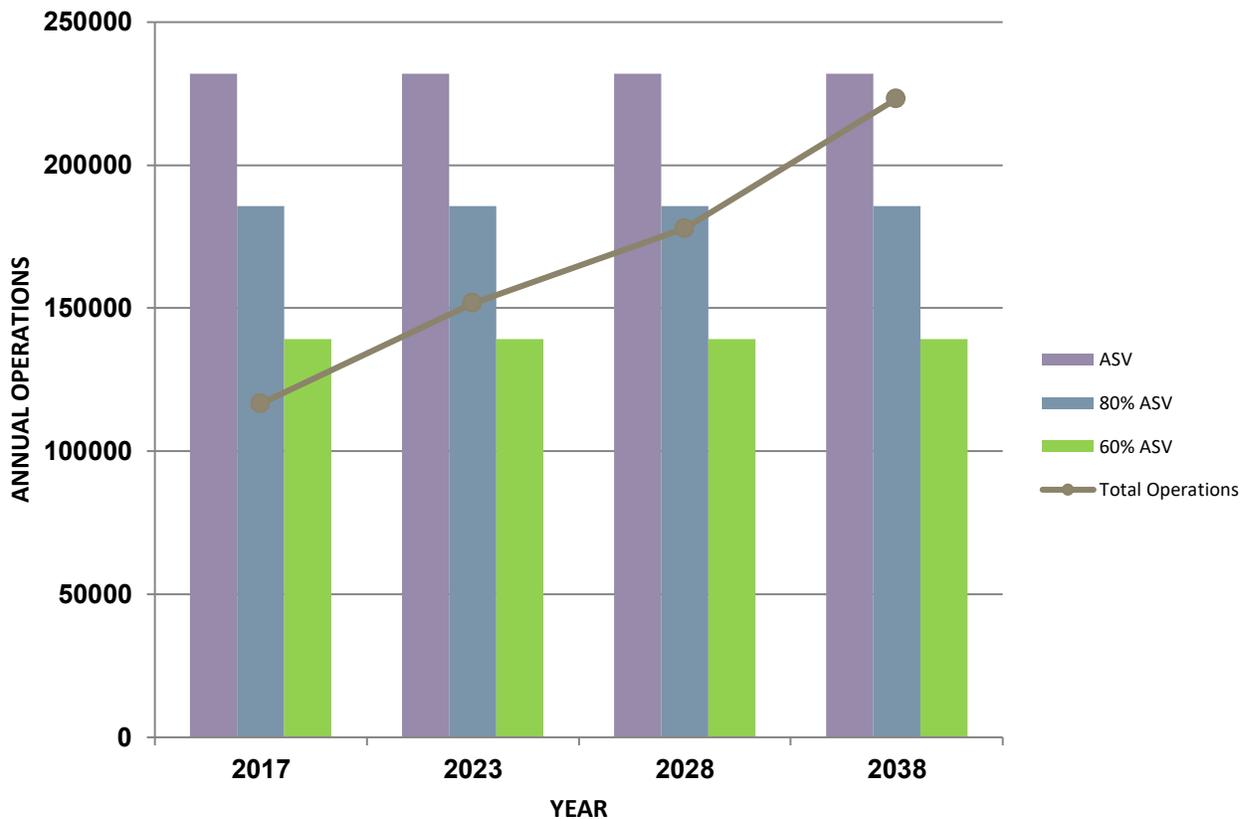
The current aviation demand in number of aircraft operations for the base year 2017 at LAL, as presented in Chapter 3, *Aviation Demand Forecast*, is 116,653. **Table 4-20** illustrates the preferred aviation demand forecast for LAL and its relation to LAL’s current ASV, **Figure 4-4** Graphically depicts this relationship.

Table 4-20 Annual Service Volume vs. Annual Demand

Year	Annual Operations	Annual Service Volume	Percent of Annual Service Volume
2017	116,653	232,029	50.28%
2023	151,700	232,029	65.38%
2028	177,900	232,029	76.67%
2038	223,200	232,029	96.19%

Source: FAA AC 150/5060-5, Airport Capacity and Delay, ESA analysis 2018, and Atkins analysis, 2018

Figure 4-4 Annual Service Volume vs. Annual Demand



Based on the calculated relationship between the Airport’s existing ASV and forecast of aviation demand, the Airport will surpass the 60% ASV threshold before 2023, the 80% ASV threshold before 2028, and closely approaching the 100% ASV post 2038. As described above, the planning for capacity enhancing projects should commence when the 60% ASV threshold is surpassed. To ensure this can be accomplished, capacity enhancing development will be identified in subsequent chapters of this report.

4.5. Landside Facility Requirements

The planning of landside facilities is based on both airside and landside capacity. The requirements for terminal and support area facilities has been determined for the 20-year planning period. The principal operating elements covered under these analyses for general aviation requirements include:

- Aircraft Hangars
- Aircraft Parking Apron
- Fueling Facilities
- Terminal/Airport Administration Building
- Support Facilities
- Perimeter/Security Fencing and Access Gates
- Utilities

- Vehicle Access and Parking
- Land Use

4.5.1. Aircraft Storage Hangars

Hangar requirements for a GA facility are a function of the number of based aircraft, the type of aircraft to be accommodated, owner preferences, and area climate. Furthermore, it is common when calculating the hangar size needs of a facility to use an average size requirement for the various types of aircraft; meaning that each type of aircraft will require a different amount of space (usually measured in square-feet) within a specific type of storage facility, e.g. T-hangar, single-aircraft box hangar, or large multi-aircraft conventional hangar. Table 4-21 illustrates aircraft storage assumptions currently at LAL.

Table 4-21 Aircraft Storage Assumptions

Aircraft Storage Type	% of Based Aircraft Fleet Using Storage
SE Piston	
T-Hangar	45%
Parking Apron	45%
Conventional/Box Hangar	10%
ME Piston	
Conventional/Box Hangar	70%
T-Hangar	0%
Parking Apron	30%
Jet	
Conventional Hangar (Large)	100%
Rotorcraft	
Conventional/Box Hangar	80%
Apron	20%

Acronyms: Square Feet (Sq. Ft.), Single-Engine (SE), Multi-Engine (ME)
Source: Atkins Analysis 2018

4.5.1.1. T-Hangars

Future t-hangar requirements will be representative of the type and sophistication of future based aircraft and the preferences of aircraft owners. Existing t-hangar facilities at LAL cater specifically to small single-engine aircraft. Currently 85 single-engine aircraft are stored in the t-hangar facilities. It is reasonable to anticipate that the t-hangar storage requirement will increase compared to the existing utilization rate, as there is currently a limited amount of t-hangar capacity at the Airport. T-Hangars provide an efficient method for aircraft storage and should be capitalized to provide additional airport revenue. ~~Table 4-23 depicts the aircraft storage assumptions throughout the planning period.~~ These assumptions were selected after review of the Airport Cooperative Research Program (ACRP) Report 113, *Guidebook on General Aviation Facility Planning*. This guidebook has provided researched and effective guidance to help the creation of flexible and cost-effective general aviation plans. A 20% planning buffer was applied to the T-Hangar calculations to account for possible fluctuations in future operations. It will be assumed that in the future, 45 percent of single-engine based aircraft will be stored in t-hangars. Utilizing that

assumption, and comparing it to the aviation demand forecast, **Table 4-22** provides a summary of the surplus and deficiency of t-hangar units at the Airport over the planning period.

Table 4-22 T-Hangar Requirements

	Base Year	Forecast		
	2017	2023	2028	2038
Single-Engine Aircraft Requiring T-Hangar/T-Shed Storage	88	97	104	120
Current Capacity	85	85	85	85
Surplus/Deficiency	3	12	19	35

Source: Atkins Analysis 2018

There is currently a deficiency at the Airport, due to the limited number of t-hangars available and the t-hangar wait list that currently exists. The wait list has approximately 35 committed operators. These results will be further analyzed during the alternatives section of this report.

4.5.1.2. Conventional Hangars

Those single engine aircraft not forecasted to be based on the apron or in a T-Hangar unit are assumed to be based in a conventional hangar. Furthermore, the storage assumptions for multi-engine, Jet, and Rotor aircraft are depicted in **Table 4-23**. For planning purposes, the spatial requirements for each aircraft type is depicted in **Table 4-24**.

Table 4-23 Average Aircraft Space Requirements (Conventional/Box Hangars)

Aircraft Storage Type	Space Required (Sq. Ft.)
Conventional/Box Hangar	
SE Piston	1,800
ME Piston	3,200
Jet	5,200
Rotorcraft	3,200

Includes 20% planning buffer
 Acronyms: Square Feet (Sq. Ft.), Single-Engine (SE), Multi-Engine (ME)
 Source: Atkins Analysis 2018

The average space requirements for the various aircraft in the Airport's based aircraft fleet mix was applied to the based aircraft forecasts to estimate hangar area requirements for each hangar type. **Table 4-23** includes the assumptions made regarding the type of storage needed for each type of based aircraft at the Airport. The existing based aircraft data provided by airport management, along with the current aircraft storage conditions, combined with the forecasted fleet mix, **Table 4-26** depicts the calculated demand requirements for hangar space throughout the planning periods. A 20% planning buffer was applied to the conventional hangar calculations to account for possible fluctuations in future operations.

Table 4-24 Conventional Hangar Requirements

	Base Year	Forecast		
	2017	2023	2028	2038
Based Single-Engine Aircraft Requiring Hangar Space	19	21	23	27
Based Multi-Engine Requiring Hangar Space	18	21	24	32
Based Jet Requiring Hangar Space	16	21	26	41
Based Helicopter Requiring Hangar Space	10	13	16	23
Total Aircraft Hangar Space Required (sq. ft.)	208,680	256,513	305,453	436,128
Total Existing Hangar Space (sq. ft.)	125,821	125,821	125,821	125,821
Surplus / Deficiency (sq. ft.)	82,859	130,692	179,632	310,307

Includes 20% planning buffer
Acronyms: Square Feet (Sq. Ft.)
Source: Atkins Analysis 2018

4.5.2. General Aviation Aprons

General aviation aprons are areas that provide for the tie-down and storage of aircraft, as well as provide access to airside facilities and fuel facilities. FAA AC 150/5300-13A, *Airport Design*, provides guidelines for sizing aircraft aprons based on the number of aircraft anticipated to be utilizing the airport on a busy day. Operations can be classified in two categories: local and itinerant. Apron spaces at LAL was analyzed across each category of operations in accordance with FAA guidance, and the results are presented in the following sections.

4.5.2.1. Aircraft Parking Apron

The Airport is comprised of multiple aircraft parking areas. To identify the required parking needed for based aircraft not stored in a hangar, as well as transient aircraft requiring temporary parking, a demand analysis for the parking will be conducted. Transient aircraft are those that are visiting the airport on a temporary basis and do not remain for an extended period. Areas designated for the parking of transient (visiting) aircraft are usually identified as “itinerant aprons”. There are currently multiple apron areas for based aircraft. The layout of said aprons are arranged to be accessible to the conventional hangars at LAL and are typically located directly in front of said hangars.

Due to the Airport’s flight training operations, it has been assumed that a total of 45 percent of the based single-engine aircraft, 30 percent of multi-engine aircraft, and 20 percent of rotorcraft will be stored on apron pavements. Most of the single-engine and multi-engine aircraft being stored on aprons are owned and operated by the flight schools. Itinerant apron space is intended for relatively short-term parking periods, usually less than 24 hours. For this study, it is assumed the average itinerant aircraft occupies the apron for five hours. Utilizing the peaking characteristics established in the *Forecast* chapter of this report, recognizing that itinerant operations represented 50 percent of total airport operations, applying the FAA’s recommendation of 360 square yards per itinerant aircraft, **Table 4-25** identifies the Airport’s combined apron requirements over the planning period. A 20% planning buffer was applied to the apron calculations to account for possible fluctuations in future operations.

Table 4-25 Apron Requirements

	Forecast			
	2017	2023	2028	2038
Based Aircraft Apron Requirements				
Single Engine Aircraft Requiring Apron Parking	84	93	102	122
Multi Engine Aircraft Requiring Apron Parking	8	9	10	14
Rotorcraft Requiring Apron Parking	3	3	4	6
Total Based Aircraft Apron Required (sq. yards)¹	35,155	39,525	43,608	53,188
Itinerant Aircraft Apron Requirements				
Average Day Peak Hour Operations	48	72	85	106
Average Day Peak Hour Itinerant Operations	24	36	43	53
Transient Aircraft Positions Required (5-hour avg. stay)	120	180	213	265
Total Transient Apron Required (sq. yards)¹	51,840	77,760	91,800	114,480
Total Apron Requirements				
Total Apron Required (sq. yards) ¹	86,995	117,285	135,408	167,668
Existing Aircraft Apron (sq. yards)	62,929	62,929	62,929	62,929
Surplus/Deficiency (sq. yards)	24,066	54,356	72,479	104,739

Includes 20% planning buffer
Source: Atkins Analysis 2018

4.5.3. Security and Perimeter Fencing

The primary function of airport fencing is to restrict the inadvertent entry to the airport by unauthorized individuals or wildlife. Most GA airports at a minimum possess some type of perimeter fencing around the airfield. LAL currently has fencing and access control measures in place that provides a layer of security and safety for its users and tenants. Overall, the eight-foot high fencing is in good condition. However, portions of the fencing on the west side of airport property have deteriorated. It is critical that deficient fencing is rehabilitated immediately due to safety concerns and the requirements of the airports Part 139 certificate. As new development at the airport occurs, security and perimeter fencing will need to be expanded and or modified proportionally to maintain a secure perimeter.

4.5.4. GA Terminal

The existing GA terminal is described in Chapter 2, *Inventory*. Chapter 5 of ACRP Report 113, *Guidebook on General Aviation Facility Planning*, provides general guidance as to the sizing of GA terminals. The primary consideration is that the facility can support the number of pilots, passengers, and visitors which could reasonably be expected during peak hour operations. GA facility sizing can range from 100 to 150 square feet per person. For planning purposes, the ACRP suggests using a factor of 2.5 people per-peak hour operation (pilots and passengers). Additionally, combining the square-footage of the terminal building and the FBO facility produced total “terminal” space available at the Airport today. The logic being that the majority of GA itinerant users are likely to use the FBOs rather than the Terminal; thus, the FBO shared public space in fact adds to the overall “terminal”

space at the Airport, even though the space is located in physically different locations. The requirements for the GA building space are presented in **Table 4-28**.

Table 4-26 GA Terminal Requirements

	Base Year	Forecast		
	2017	2023	2028	2038
Peak Hour Operations	48	72	85	106
Required General Terminal Building Space (sq ft.)	12000	18000	21250	26500
Current Capacity Terminal Building (sq ft.)	27260	27260	27260	27260
Current Capacity Fixed Based Operator (sq ft.)	4265	4265	4265	4265
Surplus/Deficiency (sq ft.)	19525	13525	10275	5025

Source: Atkins Analysis 2018

The terminal facilities currently have a surplus in square footage based on the determined peak hour operations. This is due to the terminal building being designed and constructed for commercial service operations. The addition of commercial service operations to the airport greatly increases the terminal square footage needed to accommodate all incoming passengers, departing passengers, flight crews, additional employees, and accounting for people dropping off or picking up passengers.

4.5.5. Automobile Parking and Access

Clearly defined parking areas near an airport’s terminal building and other landside facilities are essential elements for GA airports. LAL has numerous vehicle parking areas available, both to the public and for its based aircraft users and tenants. Public parking areas have a current surplus in the amount of spaces available. The number of automobile parking spaces required is generally calculated as a function of peak hour users as well as tenant and employee demand. Parking requirements are shown in **Table 4-29**.

Table 4-27 Automobile Parking Requirements

	Forecast			
	2017	2023	2028	2038
GA Peak Hour Airport Users	48	72	85	106
Employees	20	20	20	20
Simultaneous Parking Area Users	68	92	105	126
Parking Area Required (sq. yards)	2,380	3,220	3,675	4,410
Existing (sq. yards)	14,945	14,945	14,945	14,945
Surplus / Deficiency (sq. yards)	12,565	11,725	11,270	10,535

Source: Atkins Analysis 2018

Based on the existing public parking spaces currently available at LAL, there is no current need for additional marked automobile parking areas. This is due to the terminal parking area having capacity for scheduled commercial service and is built out for this primary reason.

4.5.6. Fuel Storage

Fuel flowage is measured in U.S. gallons and is divided into two categories; Jet A for jet aircraft and 100LL (Avgas) for non-jet aircraft. Fuel flowage data has been provided depicting gallons sold month by month from 1993 to 2017. The fuel flowage demand was determined by segregating airport operations into jet and non-jet operations and applying trend in gallons of flowage per operation. The peak month forecast was taken into consideration to best plan for most demanding operation periods.

Based on existing capacity and based on the fuel demand analysis, it is seen that future additions to fuel storage at LAL is needed to supply the growing operational levels. Additionally, to be operationally efficient, it is recommended that fuel storage facilities are near major airside and landside development. This will reduce the number of runway crossings needed and overall capacity will increase. Locations and sizes for additional fuel storage units will be analyzed in the alternatives section of this report.

4.5.7. Airport Equipment Storage Building

The existing airport equipment storage building is currently outdated and at capacity. An additional storage building is needed to safely protect equipment when not in use and to allow for increased storage space. A well-built operations storage building is needed to ensure the longevity and safety of airport equipment. Locations for a new airport equipment storage building will be analyzed in the alternatives section of this report.

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