4 Demand/Capacity and Facility Requirements

To ensure Blue Grass Airport (LEX or Airport) can support the projected increase in aviation activity, evaluations were conducted to verify that the recommendations of this Master Plan (Study) adequately accommodate existing and anticipated activity levels. This chapter aims to identify the Airport's facility development needs over the 20-year planning horizon. Using the preferred aviation activity forecast presented in **Chapter 3**, the Airport's facility needs were determined, forming the basis of the development concepts discussed in the remainder of the Master Plan document.

The Airport's demand, capacity, design standards, and overall facility requirements were evaluated using guidance contained in several Federal Aviation Association (FAA) publications, including:

- Advisory Circular (AC) 150/5300-13B, *Airport Design*
- AC 150/5060-5, *Airport Capacity and Delay*
- AC 150/5325-4B, *Runway Length Requirements for Airport Design*
- AC 150/5210-15A, *Aircraft Rescue and Firefighting (ARFF) Station Building Design*
- Order 5090.5, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS) & Airports Capital Improvement Plan (ACIP)*
- Order 5100.38D, Change 1, *Airport Improvement Program Handbook*

The following elements of the Airport were addressed in this assessment:

- Airside requirements
  - Airport capacity and delay
  - Runway requirements and design standards
  - Runway Protection Zone (RPZ) requirements
  - Runway length requirements
- Taxiway requirements
  - Taxiway Design Group (TDG) determination and taxiway design standards
- Airfield lighting systems requirements
- Navigational and landing aid requirements
- Apron requirements
- Terminal area analysis and facility requirements
- Support facility requirements
  - General aviation (hangars and apron)
  - Helipads
  - Cargo facility
  - Airport Traffic Control Tower (ATCT)
  - Aircraft fueling facility
  - Aircraft Rescue and Firefighting Facility (ARFF) and public safety facility
  - Airport maintenance and equipment storage requirements
  - Federal Inspection Services (FIS) facility

4.1 Planning Factors

Before the Airport's facility requirements could be determined, it was necessary to establish the Planning Activity Levels (PALs) based on the preferred forecasts, the design aircraft family, and the appropriate airport, runway, and taxiway classifications associated with FAA design standards. The parameters are discussed in the following subsections.

Aviation activity is traditionally susceptible to fluctuations in economic conditions and industry trends. As such, identifying recommended facility improvements based solely on specific years can be a challenge.

4.1.1 Planning Activity Levels (PALs)

Aviation activity is traditionally susceptible to fluctuations in economic conditions and industry trends. As such, identifying recommended facility improvements based solely on specific years can be a challenge. The timeline associated with the preferred forecast is representative of the anticipated timing of demand (in five-year increments – 2026, 2031, 2036, and 2041). The actual timing of demand can vary; therefore, PALs, rather than calendar years, were established.

PALs represent the activity levels expected to trigger the need for additional capacity or other development at the Airport.

The PALs represent the activity levels expected to trigger the need for additional capacity or other development at the Airport, thus identifying significant demand thresholds for implementing recommended facility improvements and providing the Lexington-Fayette Urban County Airport Board (LFUCAB) with the flexibility to advance or slow the rate of development in response to actualized demand. In other words, if the preferred forecast proves conservative (i.e., the high growth forecast scenario is realized because of successful airport marketing and route development initiatives, etc.), some recommended improvements may be advanced in the schedule. In contrast, if demand occurs slower than predicted in the preferred forecast, the improvements should be deferred accordingly. As actual activity levels approach a PAL and trigger the need for a facility improvement, sufficient lead time for planning, design, and construction must also be given to ensure that the facilities are available for the impending demand.

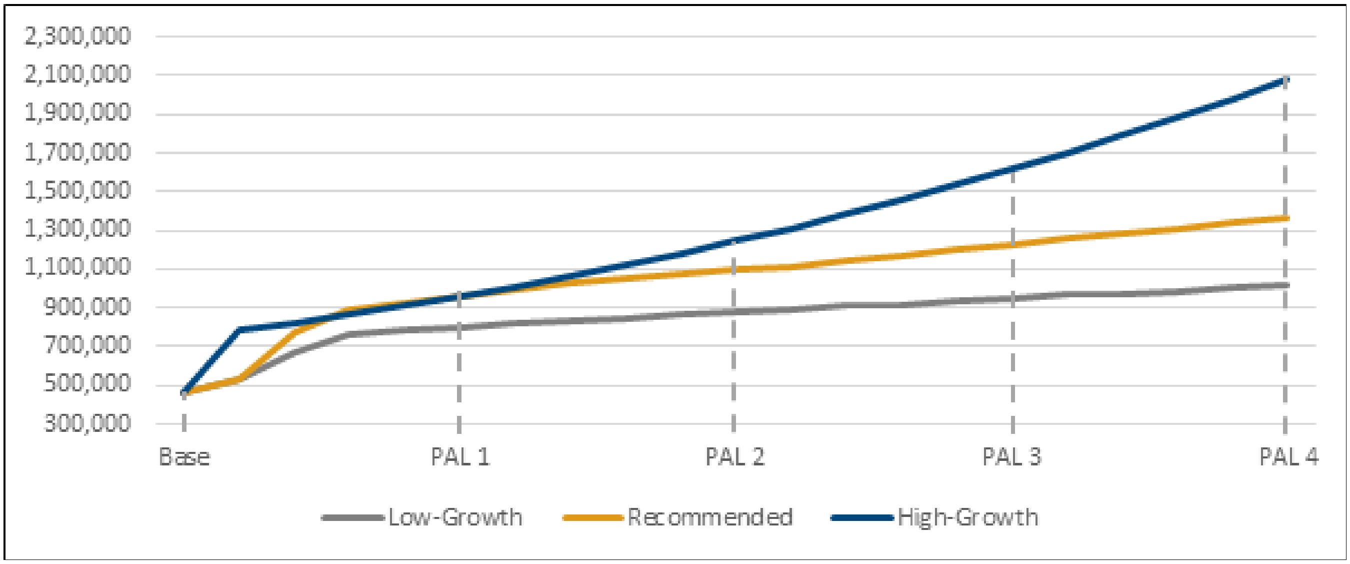
Table 4-1 identifies the Base Year and PALs used for this Study, corresponding with the preferred aviation activity forecast for the Base Year of 2021 and the planning horizon years 2026, 2031, 2036, and 2041. **Figure 4-1** presents a graphical representation of the PALs for passenger enplanements and depicts the relative time range in which each PAL could be reached if one of these other forecast scenarios is actualized. For example, facilities capable of accommodating PAL 1 demands (i.e., ±962,000 annual enplanements) could be needed as early as 2026 if the recommended-growth forecast scenario is experienced or as late as 2036 if the low-growth scenario is realized.

Table 4-1
Planning Activity Levels (PALs)

Passenger Activity						
Enplanements		**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Annual		464,169	961,994	1,093,451	1,225,263	1,366,059
Peak Month		54,915	113,812	129,364	144,959	161,616
Peak Month-Average Day (PMAD)		1,771	3,671	4,173	4,676	5,213
Peak Hour		319	661	751	842	939
Operations						
Category	**Activity**	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Commercial Aviation	Annual	17,288	21,608	24,080	25,741	27,168
	Peak Month	1,794	2,242	2,499	2,671	2,819
	PMAD	58	72	81	86	91
	Peak Hour	8	10	11	12	13
Cargo	Annual	127	254	254	254	254
General Aviation	Annual	56,887	58,611	60,679	62,403	64,127
Military Aviation	Annual	1,863	1,863	1,863	1,863	1,863
Total Operations	**Annual**	**76,165**	**82,336**	**86,876**	**90,261**	**93,412**
	Peak Month	**7,859**	**8,496**	**8,964**	**9,313**	**9,639**
	PMAD	**254**	**274**	**289**	**300**	**311**
	Peak Hour	**20**	**22**	**23**	**24**	**25**
	Average Hour (Non-Peak)	**9**	**10**	**10**	**11**	**11**
Based Aircraft						
Aircraft Type		**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Single-Engine		117	119	122	124	127
Multi-Engine		11	11	12	12	12
Helicopter		9	9	10	10	10
Jet		28	31	32	35	37
Total Based Aircraft		**165**	**170**	**176**	**181**	**186**

Source: Blue Grass Airport, FAA Operations Network (OPSNET), FAA Traffic Flow Management System Counts (TFMSC), FAA Airport Data and Information Portal (Form 5010), Bureau of Transportation Statistics (BTS) T-100 data, US DOT T-100 data, Ailevon Pacific Aviation Consulting analysis, CHA, 2024.

Figure 4-1
Enplanement Planning Activity Levels (PALs)



Source: FAA 2021 TAF, Ailevon Pacific Aviation Consulting analysis, Bureau of Transportation Statistics (BTS) T-100 data, CHA, 2024.

4.1.2 Aircraft Classification

The FAA has established aircraft classification systems that group aircraft types based on their performance and geometric characteristics. These classification systems were used to determine the appropriate airport design standards for specific runways, taxiways, taxilanes, aprons, or other facilities at the Airport, as described in FAA AC 150/5300-13B, *Airport Design*.

As discussed in **Chapter 3**, the standard aircraft classifications are the Aircraft Approach Category (AAC), Airplane Design Group (ADG), and Taxiway Design Group (TDG). **Table 4-2** presents the applicability of these classification systems to the FAA airport design standards for individual airport components (such as runways, taxiways, or aprons).

Table 4-2
Applicability of Aircraft Classifications

Aircraft Classification	Related Design Components
Aircraft Approach Category (AAC)	Runway Safety Area (RSA), Runway Object Free Area (ROFA), Runway Protection Zone (RPZ), runway width, runway-to-taxiway separation, runway-to-fixed object
Airplane Design Group (ADG)	Runway, taxiway, and apron Object Free Areas (OFAs), parking configuration, taxiway-to-taxiway separation, runway-to-taxiway separation
Taxiway Design Group (TDG)	Taxiway width, radius, fillet design, apron area, parking layout

Source: FAA AC 150/5300-13B, CHA, 2024.

4.1.3 Design Aircraft Family

The "critical aircraft" or "design aircraft family" represents the most demanding aircraft, or grouping of aircraft, with similar characteristics (relative to AAC, ADG, TDG) that are currently using or are anticipated to use an airport on a regular basis.

The design aircraft family was identified for LEX after a review of the FAA's Traffic Flow Management System Counts (TFMSC) data, T-100 data, airport-reported data, and forecast fleet mix assumptions (as described in **Chapter 3**). This grouping represents the typical commercial aircraft anticipated to operate at LEX over the planning horizon. These aircraft generally have higher AAC, ADG, and TDG classifications than the other regularly scheduled commercial aircraft. Determining the critical aircraft is important when planning airfield and landside facilities as they may require specific facility design accommodations within their designated areas of operation.

Table 4-3
Airport Operations Forecast by AAC and ADG – All Users

AAC & ADG		Base	PAL 1	PAL 2	PAL 3	PAL 4
Subtotal by AAC	A	17,103	17,618	18,235	18,750	19,265
	B	32,309	33,256	34,375	35,307	36,240
	C	25,111	29,645	32,371	34,246	35,891
	D	1,643	1,817	1,896	1,957	2,016
Subtotal by ADG	I	28,308	29,139	30,129	30,954	31,779
	II	38,217	38,963	38,321	39,689	40,985
	III	9,580	14,163	18,353	19,545	20,573
	IV	60	71	73	73	75

Source: FAA Traffic Flow Management System Counts (TFMSC), Bureau of Transportation Statistics (BTS) T-100 data, GARAA, CHA, 2024.

4.1.4 Runway Classification

The FAA classifies runways by their Runway Design Code (RDC) based on their existing and planned operational capabilities. Approximate classification restrictions are listed in **Table 4-4**. The RDC is used for planning and design only and is not intended to prohibit aircraft that may be able to operate safely at the airport.

RDC is an airport designation representing the AAC and ADG of the aircraft that the airfield is intended to accommodate on a frequent basis of at least 500 annual operations, as well as the runway's visibility component, expressed as Runway Visual Range (RVR). The visibility component is found on the Airport's instrument approach chart, with the visibility component being representative of the runway's published visibility.

Table 4-4
Airport Design: FAA's Aircraft Category Classifications

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

Group	Tail Height (and/or)	Wingspan
I	<20'	<49'
II	20' - <30'	49' - <79'
III	30' - <45'	79' - <118'
IV	45' - <60'	118' - <171'
V	60' - <66'	171 '- <214'
VI	66' - <80'	214' - <262'

Source: FAA AC 150/5300-13B, CHA, 2024.

To determine the Airport's current critical aircraft, FAA TFMSC data was evaluated to identify trends by AAC category and ADG grouping. A summary of operations by AAC and ADG is depicted in **Table 4-5.**

Table 4-5
Airport Operations Forecast by AAC and ADG – All Users

AAC & ADG		Base	PAL 1	PAL 2	PAL 3	PAL 4
Subtotal by AAC	A	17,103	17,618	18,235	18,750	19,265
	B	32,309	33,256	34,375	35,307	36,240
	C	25,111	29,645	32,371	34,246	35,891
	D	1,643	1,817	1,896	1,957	2,016
Subtotal by ADG	I	28,308	29,139	30,129	30,954	31,779
	II	38,217	38,963	38,321	39,689	40,985
	III	9,580	14,163	18,353	19,545	20,573
	IV	60	71	73	73	75

Source: FAA Traffic Flow Management System Counts (TFMSC), Bureau of Transportation Statistics (BTS) T-100 data, GARAA, CHA, 2024.

These classifications, described below, combined with the aircraft classifications previously defined, were utilized to determine the appropriate FAA standards (as per AC 150/5300-13B) for airfield facilities.

Runway 4-22

The Airport's 2013 Airport Layout Plan (ALP) categorized Runway 4-22 as a C/D-III runway, with the McDonnell MD-80 Series (C/D-III, TDG 3/4) as the current critical aircraft at that time and the Boeing 737-700W/800W (C/D-III) as the future critical aircraft.

Based on current runway usage, Runway 4-22 is categorized as D-III, with a B737-800 being an example aircraft currently operating at LEX.

Runway 9-27

The previous 2013 ALP categorized Runway 9-27 as a B-II runway, with a King Air 350 (B-II, TDG 2A) as the current critical aircraft at that time. The ALP further indicated the runway transitioning to a C-II runway in the future, with a Citation 560 (B-II, TDGE 2A) as the projected critical aircraft.

Based on current runway usage and the previous ALP, Runway 9-27 is currently categorized as a B-II runway, with a King Air 350 representing an aircraft in the critical aircraft family. Once Runway 9-27 is extended, it is possible that a new fixed-base operator (FBO) could begin service or that the FBO may choose to relocate jet activity to the west side of the airfield. This activity could result in Runway 9-27 transitioning to a C-II runway, with a Challenger 300 representing the runway's future critical aircraft.

4.2 Airfield Capacity Requirements

Airfield capacity refers to the maximum number of aircraft operations (takeoffs or landings) an airfield can accommodate in a specified amount of time. Assessments of the Airport's current and future capacity were performed using common methods described in FAA AC 150/5060-5, *Airport Capacity and Delay*.

4.2.1 FAA AC 150/5060-5, *Airport Capacity and Delay*

FAA AC 150/5060-5, *Airport Capacity and Delay*, explains how to compute airfield capacity for the purposes of airport planning and design. This evaluation helps to identify any capacity-related improvements or expansions that may be needed to support flight activity levels. The estimated capacity of the airfield at LEX can be expressed in the following two measurements:

- Hourly capacity – The maximum number of aircraft operations an airfield can safely accommodate under continuous demand in a one-hour period. This expression accounts for Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) conditions and is used to identify any peak-period constraints on a given day.
- Annual Service Volume (ASV) – The maximum number of aircraft operations an airfield can accommodate in a one-year period without excessive delay. This calculation is typically used in long-range planning and referenced for capacity-related improvements.

The tables and figures from AC 150/5060-5 that were utilized in the following evaluations can be found in **Appendix G.**

Capacity Calculation Factors

Several key factors and assumptions specific to LEX were defined to calculate these two measurements of capacity and delay. Consistent with the guidance provided in AC 150/5060-5, these included:

- Aircraft fleet mix index – Ratio of the various classes of aircraft serving the Airport
- Runway-use configuration – Number and orientation of the Airport's active runways

- Percentage of aircraft arrivals – Ratio of landing operations to total operations
- 'Touch-and-Go (T&G)' factor – Ratio of landings with an immediate takeoff to total operations
- Location of exit taxiways – Number of taxiways available to an aircraft within a given distance from the arrival end of a runway
- Meteorological conditions – Percentages of times an airfield experiences VFR, IFR, and Poor Visibility Conditions (PVC) conditions

<u>Aircraft Fleet Mix Index</u>

The Airport's aircraft fleet mix index was determined by the size of typical aircraft and the frequency of their operations. To identify the aircraft mix index, AC 150/5060-5, *Airport Capacity and Delay,* has established four categories in classifying an aircraft by its Maximum Takeoff Weight (MTOW), as depicted in **Table 4-6**.

Table 4-6
Aircraft Capacity Classifications

Aircraft Class	MTOW (lbs.)	Number of Engines	Wake Turbulence
A	<12,500	Single	Small (S)
B		Multi	
C	12,500 – 300,000	Multi	Large (L)
D	>300,000	Multi	Heavy (H)

Source: FAA AC 150/5060-5, CHA, 2024.

The aircraft mix index is calculated using the formula *% (C + 3D),* with the letters corresponding with the aircraft class. This product falls into one of the FAA-established mix index ranges, which are used in the capacity calculations and listed below:

• 0 to 20 • 21 to 50 • 51 to 80 • 81 to 120 • 121 to 180

The Airport's current facilities can accommodate all four aircraft classes. The following operations percentages for aircraft categories C and D were gathered from a review of operations that occurred in the Base Year (2021):

- Class C = 32.97 percent of the Airport's operations
- Class D = 2.16 percent of the Airport's operations

As such, the Base Year mix index is 39.44 [32.97 + 3(2.16) = 39.44], which falls between the 21 and 50 mix index range. Note, the numbers listed herein are rounded; however, the mix index calculation was completed using actual operations data (not rounded).

The projected operation percentages by aircraft class, which are depicted in **Table 4-7**, were utilized to project the future aircraft fleet mix index for each PAL. **Table 4-8** presents each planning period's projected Aircraft Mix Index, which is anticipated to fall between the 21 and 50 mix index range throughout the forecast horizon.

Table 4-7
Projected Operations by Aircraft Class (%)

Aircraft Class	Projected % of Operations by Aircraft Class			
	PAL 1	PAL 2	PAL 3	PAL 4
C	36.01%	37.26%	37.94%	38.42%
D	2.18%	2.18%	2.17%	2.16%

Source: FAA Traffic Flow Management System Counts (TFMSC), Bureau of Transportation Statistics (BTS) T-100 data, GARAA, CHA, 2024.

Table 4-8
Projected Aircraft Mix Index by PAL

Year	Aircraft Mix Index
Base	39.45
PAL 1	42.55
PAL 2	43.81
PAL 3	44.45
PAL 4	44.90

Source: CHA, 2024.

<u>Runway-Use Configuration</u>

The principal determinants of an airfield's layout or configuration are the number and orientation of runways. The efficiency and functionality of the runway system, in conjunction with the taxiways and aprons during the various levels of aviation activity, directly affects an airport's operational capacity.

If an airfield layout consists of more than one runway, the runways are termed as either "independent" or "dependent" of each other. An independent runway is one that is not operationally affected by another runway during normal operations (e.g., parallel runways with sufficient separation). A dependent runway is one that is configured in such a way that aircraft must wait for operations to complete on another runway before resuming (e.g., intersecting runways). Due to such wait times, airfields with dependent runway systems are inherently limited compared to independent runways.

The runways at LEX are configured in an 'open-V' concept, meaning that the runways do not intersect; however, two runway ends are close enough that they require aircraft operations to be dependent on one another; therefore, simultaneous operations are not possible.

Based on the runway-use diagrams contained in AC 150/5060-5 *(Figure 3-2),* Runway-Use Diagram No. 75 was chosen to best represent the runway-use configuration at LEX.

<u>Percentage of Aircraft Arrivals</u>

The percentage of arrivals is the ratio of landing operations to total operations at an airport during a specified period and is generally assumed to be equal to the percentage of departing operations; therefore, a factor of 50 percent was used for the capacity calculations for the Airport.

Percentage of Touch-and-Go (T&G) Operations

Because a T&G is representative of two operations (e.g., a landing and takeoff performed consecutively during local flight training operations), an airfield with a higher percentage of T&G operations typically has a greater airfield capacity than one with a higher percentage of air carrier operations.

T&G percentages can vary widely depending on airport characteristics, but airports such as LEX serve as hubs for GA activities, including training flights, recreational flying, and business aviation, which contribute to T&G operations. A safe assumption for the T&G percentage at LEX is 10 percent of the Airport's total aircraft operations. With the assumption that the share of T&G operations will not experience significant growth over the planning horizon, a percentage range of one to 10 percent was used in the VFR capacity calculations. Based on the relevant FAA VFR figure [AC 150/5060-5 *(Figure 3-2)]*, this percentage equated to a T&G factor of 1.02. For IFR capacity calculations, the standard T&G factor of 1.00 was utilized [AC 150/5060-5 (*Figure 3-45*)].

Location of Exit Taxiways

The location and number of exit taxiways affect the capacity of an airport's runway system because they directly relate to an aircraft's runway occupancy time. Runway capacities are highest when complemented with full-length parallel taxiways, ample runway entrance and exit taxiways, and no active runway crossings. These components reduce the amount of time an aircraft remains on the runway. FAA AC 150/5060-5 identifies the criteria for determining taxiway exit factors based on the mix index and the distance the taxiway exits are from the runway threshold and other taxiway connections. As the Airport's existing mix index range was calculated to be between 21 and 50 over the planning period, only exit taxiways between 3,000 and 5,500 feet from the threshold and spaced at least 750 feet apart contribute to the taxiway exit factors. By combining the mix index, percent of aircraft arrivals, and the number of exit taxiways within the specified range, a taxiway exit factor was calculated (0.92 during VFR and 0.98 during IFR).

Meteorological Conditions

Meteorological conditions at and around an airport also significantly impact an airfield's capacity. Runway use percentages are a result of prevailing winds, which determine which runway an aircraft should use for takeoff and landing operations.

Three measures of cloud ceiling and visibility are recognized by the FAA and were used to calculate capacity. These included:

- Visual Flight Rules (VFR) – Cloud ceiling is greater than 1,000 feet above ground level (AGL), and visibility is at least three statute miles
- Instrument Flight Rules (IFR) – Cloud ceiling is at least 500 feet AGL, but less than 1,000 feet AGL and/or the visibility is at least one statute mile but less than three statute miles
- Poor Visibility Conditions (PVC) – Cloud ceiling is less than 500 feet AGL, and/or the visibility is less than one statute mile

Data was acquired from the National Oceanic and Atmospheric Administration (NOAA)—National Centers for Environmental Information (NCEI) to calculate conditions experienced at LEX, with the most recent data being for 2023. On average, LEX experiences VFR conditions approximately 89.4 percent of the time, IFR conditions 4.0 percent of the time, and PVC conditions 6.6 percent of the time. These are approximate percentages derived from the historical data from the Airport's Weather Observation System (AWOS).

Summary of Capacity Calculation Factors

Table 4-9 summarizes the parameters calculated for the Airport, which were used to define the Airport's hourly capacity (in VFR and IFR conditions) and ASV.

Table 4-9
Calculated Capacity Parameters

	Base	PAL 1	PAL 2	PAL 3	PAL 4
Aircraft Fleet Mix Index	39.45	42.55	43.80	44.45	44.90
Runway-Use Configuration	Open V Configuration (Diagram No. 75)				
Percentage of Arrivals	50%				
T&G Factors (VFR/IFR)	1.02/1.00	1.02/1.00	1.02/1.00	1.02/1.00	1.02/1.00
Taxiway Exit Factors (VFR/IFR)	0.92/0.98	0.92/0.98	0.92/0.98	0.92/0.98	0.92/0.98
Meteorological Conditions (VFR/IFR)	89.4%/4.0%				

Source: FAA AC 150/5060-5, National Oceanic and Atmospheric Administration (NOAA)—National Centers for Environmental Information (NCEI), CHA, 2024.

Current Airfield Capacity

Hourly Capacity

An airport's hourly capacity measures the maximum number of aircraft operations (VFR and IFR) that it can support in an hour based on its runway configuration. Using graphs provided in AC 150/5060-5, VFR and IFR hourly capacity bases were established by applying the given VFR and IFR operational capacities for the runway use configuration, the aircraft mix index, and the percentage of aircraft arrivals. Once the hourly capacity bases (C*) were identified, they were multiplied by the T&G factors (T) and taxiway exit factors (E) to determine the hourly capacities. This equation is expressed as:

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

C = Hourly Capacity Base*
T = Touch-and-Go Factor
E = Taxiway Exit Factor

Table 4-10 presents the calculated hourly capacities for the Base Year and for PALs 1 through 4. Note that as the aircraft fleet mix index increases (see **Table 4-8**), hourly capacities decrease.

Table 4-10
Calculated Hourly Capacity

Factors	Base		PAL 1		PAL 2		PAL 3		PAL 4	
	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR
Hourly Capacity Base (C*)	94.7	56.7	91.8	56.6	90.8	56.6	90.5	56.6	90.0	56.5
Touch-and-Go Factor (T)	1.02	1.00	1.02	1.00	1.02	1.00	1.02	1.00	1.02	1.00
Taxiway Exit Factor (E)	0.92	0.98	0.92	0.98	0.92	0.98	0.92	0.98	0.92	0.98
Calculated Hourly Capacity	**88.87**	**55.57**	**86.15**	**55.47**	**85.21**	**55.47**	**84.93**	**55.47**	**84.46**	**55.37**

FAA AC 150/5060-5 [VFR (Figure 3-4), IFR (Figure 3-45)]
Source: FAA AC 150/5060-5, CHA, 2024.

Annual Service Volume

ASV is an expression of the total number of aircraft operations an airfield can support per year. The formula for estimating an airport's ASV is based on the ratio of annual operations to average daily operations during the peak month, multiplied by the ratio of average daily operations to average peak hour operations during the peak month. The product of those values is then multiplied by the weighted hourly capacity to determine the ASV.

Weighted hourly capacity accounts for the varying operating conditions at the airport, which are applied to the previously calculated hourly capacity. The formula for weighted hourly capacity is expressed as:

$$C_w = \frac{(C_{n1} \times W_{n1} \times P_{n1}) + (C_{n2} \times W_{n2} \times P_{n2})}{((W_{n1} \times P_{n1}) + (W_{n2} \times P_{n2}))}$$

Cw = Airfield weighted hourly capacity
$_n$ = Number of runway-use configurations
C = Hourly Capacity of each configuration (Base Year: VFR/IFR = 88.87/83.57)
W = FAA ASV weighting factor, based on mix index & percentage and hourly capacity [VFR/IFR = 1.0/1.0 (See Appendix G)]
P = Percent of time the Airport operates in each configuration (VFR/IFR = 89.4%/4.0%)

Applying the Base Year LEX data to this equation yielded the following:

$$C_w = \frac{(88.87 \times 1.0 \times 89.4\%) + (55.57 \times 1.0 \times 4.0\%)}{((1.0 \times 89.4\%) + (1.0 \times 4.0\%))}$$

$$\mathbf{C_w = 87.42}$$

Based on the aforementioned formula, the airfield's weighted hourly capacity is approximately 87 operations per hour. This methodology was carried out for each PAL, as shown in **Table 4-11**.

Table 4-11
Calculated Weighted Hourly Capacity

Factors		Base		PAL 1		PAL 2		PAL 3		PAL 4	
		VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR
Calculated Hourly Capacity	C	88.87	55.57	86.15	55.47	85.21	55.47	84.93	55.47	84.46	55.37
Weight	W	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent	P	89.4	4.0	89.4	4.0	89.4	4.0	89.4	4.0	89.4	4.0
Weighted Capacity	C_w	**87.42**		**84.82**		**83.92**		**83.65**		**83.20**	

Source: FAA AC 150/5060-5, CHA, 2024.

The ASV formula accounts for a variety of conditions that occur at an airport, including low- and high-volume activity periods, and is expressed as

$$ASV = C_w \times D \times H$$

C_w = Weighted Hourly Capacity
D = Daily Demand Ratio (ratio of annual operations to average daily operations during peak month)
H = Hourly Demand Ratio (ratio of average daily operations to average peak hour operations during peak month)

Based on the ASV metric calculated using *Chapter 3 of AC 150/5060-5*, only certain criteria apply when determining the demand ratios. It is important to recognize that ASV demand ratios were solely based on average daily demand during the peak month and average hourly demand during the peak month as they relate to operations; thus, they were not based on the Airport's peak daily or peak hourly activity and do not correspond with the peak activity levels presented in **Chapter 3**. Data derived via FAA TFMSC and Distributed OPSNET was used when determining the month with the most operations, the average daily operations during the peak month, and the average hourly operations during the peak month.

Table 4-12 identifies the daily and hourly demand ratios throughout the planning period.

Table 4-12
Demand Ratios

Factor	Base	PAL 1	PAL 2	PAL 3	PAL 4
Annual Operations	76,165	82,336	86,876	90,261	93,412
Av. Daily Operations (in Peak Month)	254	274	289	300	311
Av. Peak Hour Ops. (in Peak Month)	20	22	23	24	24
Daily Demand Ratio (D)	**299.86**	**300.50**	**300.61**	**300.87**	**300.36**
Hourly Demand Ratio (H)	**12.70**	**12.45**	**12.57**	**12.50**	**12.96**

Source: FAA AC 150/5060-5, FAA Operations Network (OPSNET), FAA Traffic Flow Management System Counts (TFMSC), Blue Grass Airport (LEX), CHA, 2024.

ASV was calculated for the Base Year and for each of the four PALs. The Base Year ASV equation is as follows:

ASV = 87.42 x 299.86 x 12.70*

ASV = 332,935

The numbers presented in this formula have been rounded; however, the results of the formula are based on actual, unrounded numbers. Again, it is important to reiterate that average daily demand and average hourly demand are independent of the activity demand forecasts presented in **Chapter 3.*

If an airport's annual aircraft operations exceed its ASV, the airport is likely to incur significant delays; however, an airport can experience delays even before its ASV capacity is reached. Activity levels that may trigger capacity planning and development are discussed in FAA Order 5090.5, *Formulation of the National Plan of Integrated Airport Systems (NPIAS) and the Airports Capital Improvement Plan (ACIP)*, which indicates (via *Table 4-4* of Order 5090.5) that 60 percent ASV is the trigger for planning a new runway or extended runway to increase hourly capacity and the trigger for development is being within five years of the ASV reaching 80 percent. This allows an airport to make necessary improvements and avoid delays before they are anticipated to occur.

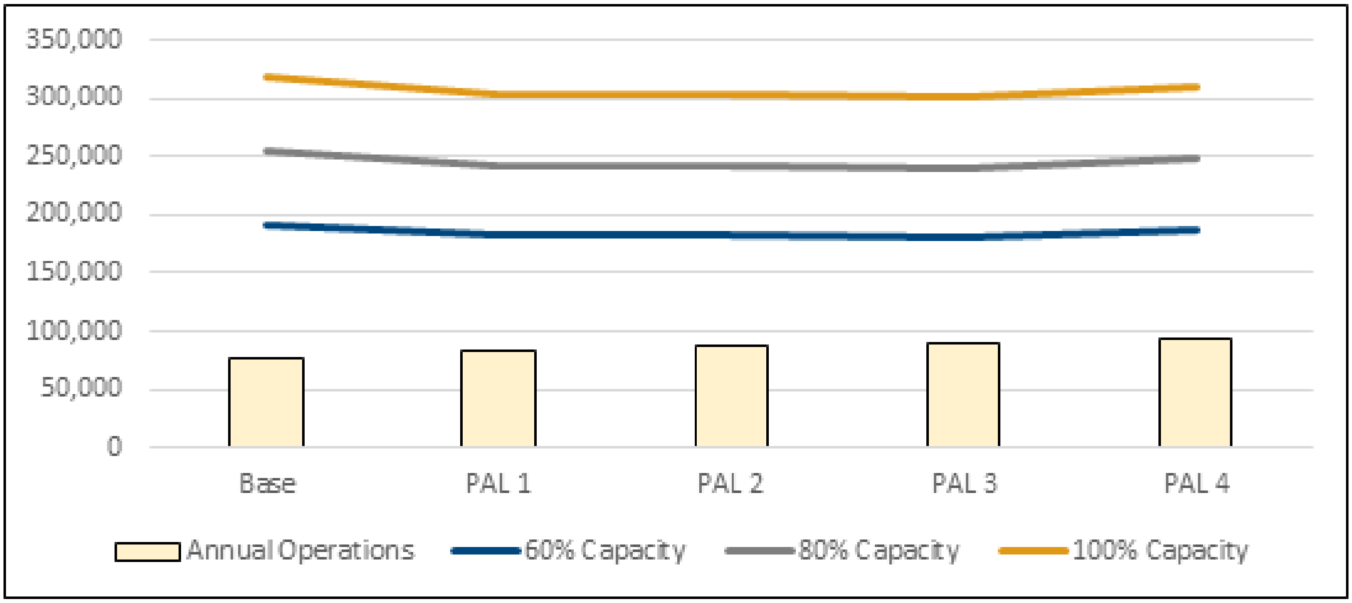
As shown in **Table 4-13**, the Airport's Base Year operations were calculated to be at approximately 22.9 percent of capacity (ASV). **Table 4-13** presents a comparison of the Airport's demands and projected ASVs in its Base Year and each PAL, and the Airport's projected annual operations compared to the 60, 80, and 100 percent capacity levels are depicted in **Figure 4-2**. There are no identified airfield capacity issues throughout the planning period.

Table 4-13
Annual Service Volume

Factor	Base Year	PAL 1	PAL 2	PAL 3	PAL 4
Annual Operations	76,165	82,336	86,876	90,261	93,412
Annual Service Volume	332,935	317,431	316,980	314,596	323,815
Capacity Level	**22.9%**	**25.9%**	**27.4%**	**28.7%**	**28.8%**

ASV was based on average peaks during the busiest month rather than peak activity levels.
Source: FAA AC 150/5060-5, CHA, 2024.

Figure 4-2
Projected Demand



Source: CHA, 2024.

Airfield Capacity Conclusion Using FAA AC 150-5060-5

Based on the airfield capacity calculations, which are based on the Airport's current airfield configuration, the Airport operates at approximately 23 percent of its capacity in the Base Year and is projected to reach approximately 29 percent capacity by PAL 4. As such, the Airport is not anticipated to experience airfield capacity issues within the planning horizon.

Note, an additional simplified overview was performed to observe how airfield capacity would be impacted if operating under a single runway configuration, should all GA operations be relocated to Runway 9-27 and Runway 4-22 serving only commercial activity levels. Using FAA AC 150-5060-5 *(Chapter 2, Figure 2-1)*, Runway-Use Diagram No. 1 was referenced. As shown in **Table 4-14**, with a mix index of 21 to 50, the single runway would have an hourly capacity of 74 operations during VFR conditions and 57 operations during IFR conditions. Furthermore, the runway would be able to accommodate up to 195,000 operations annually, thus only reaching approximately 47.9 percent capacity by PAL 4. This further supports that LEX is not anticipated to experience airfield capacity issues within the planning horizon.

Table 4-14
Hourly Capacity & Annual Service Volume (Single Runway)

Mix Index	Hourly Capacity (Operations/Hour)		Annual Service Volume (Operations/Year)
	VFR	IFR	
0 to 20	98	59	230,000
21 to 50	74	57	195,000
51 to 80	63	56	205,000
81 to 120	55	53	210,000
121 to 130	51	50	240,000

Source: FAA AC 150/5060-5, CHA, 2024.

For the purposes of this Study, the results modeled herein were used during an in-depth analysis of runway development alternatives, as well as their impact on airfield capacity, which is provided in subsequent chapters.

4.3 Runway Requirements

4.3.1 Airfield Configuration & Wind Coverage

According to FAA AC 150-5300-13B, an airport's desirable crosswind coverage is 95 percent of the time based on the total number of weather observations during the recording period of at least 10 consecutive years. The Airport's general airfield configuration, including the number of runways and their location/orientation, is expected to meet anticipated air traffic demands and maximize wind coverage and operational utility for all types of aircraft.

4.3.2 Runway Designations

Due to the changes in the earth's magnetic declination over time, the compass heading of a runway and its associated runway end number designations can change. Current magnetic declination information was derived from NOAA.[6] The current headings and declinations of the runway ends at LEX are as follows:

- Runway 4
  - Current headings: 046° magnetic (rounds and truncates to 05), 042° true
  - Declination: 5° 51′ 16″ W, changing by 0° 2′ 55″ W per year, Uncertainty ± 0° 22′
- Runway 22
  - Current headings: 226° magnetic (rounds and truncates to 23), 222° true
  - Declination: 5° 52′ 3″ W, changing by 0° 2′ 54″ W per year, Uncertainty ± 0° 22′
- Runway 9
  - Current headings: 087° magnetic (rounds and truncates to 09), 083° true
  - Declination: 5° 51′ 13″ W, changing by 0° 2′ 55″ W per year, Uncertainty ± 0° 22′

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[6] National Oceanic and Atmospheric Administration (NOAA)—National Centers for Environmental Information (NCEI) "Magnetic Field Calculators." 08 April 2024. https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml#igrfwmm

- Runway 27
  - Current headings: 267° magnetic (rounds and truncates to 27), 263° true
  - Declination: 5° 51′ 48″ W, changing by 0° 2′ 554›› W per year, Uncertainty ± 0° 22′

Currently, no changes in the runway designations of Runway 4-22 or Runway 9-27 are needed; however, since magnetic declination changes slowly over time, the runway numbers may need to be reevaluated by PAL 4, at which time the magnetic declination may have changed more significantly.

4.3.3 Runway Design Standards

During this master planning effort, FAA design and safety standards related to the airfield facilities were identified so that the Airport may review and work to achieve compliance where needed. The design standards evaluated include airfield geometry, dimensions, separation distances, protection zones, clearance requirements, etc., which vary according to design aircraft. The Airport's key FAA design and safety standards, as defined in FAA AC 150/5300-13B, are described in the following paragraphs.

Runway Design Code (RDC) is a three-component code relating to AAC, ADG, and approach visibility minima, and it is used to establish FAA design characteristics for a particular runway. The critical aircraft with regular use defines the AAC and ADG components of an RDC, and each runway's lowest visibility minima published on an instrument approach chart determines the visibility component. As reported in **Chapter 2**, Runways 4-22 and 9-27 are assigned RDC D-III-1800 and B-II-4000, respectively. As such, FAA design standards for D-III and B-II runways were used as a basis for the analyses.

Runway Width

Runway width requirements are based on each runway's RDC. The FAA standard D-III runway width is 100 feet unless the critical aircraft it serves has a maximum certificated takeoff weight greater than 150,000 pounds, which requires a 150-foot width. As stated in **3.14.1** of **Chapter 3**, the Boeing 737-800 represents the Airport's D-III ADG and critical aircraft group. Given that the 737-800's Maxiumum Takeoff Weight (MTOW) is 174,200 pounds, Runway 4-22's required width is 150 feet. A B-II runway (such as Runway 9-27) width is required to be 75 or 100 feet, depending on approach visibility minima. The Airport's runways currently meet their required widths. However, Runway 9-27 would need to be widened from 75 to 100 feet if lower than 0.75-mile instrument approach visibility minima is provided. Runway 9-27's current visibility minimum is one mile.

Runway Shoulders

Shoulders are areas adjacent to the defined edge of pavement for runways, taxiways, or aprons, and according to FAA AC 150/5300-13B, they are designed to:

- Transition between the pavement and the adjacent surface
- Support aircraft and emergency vehicles deviating from the full-strength pavement
- Facilitate drainage
- Provide blast protection

Shoulders provide resistance to blast erosion and accommodate the passage of maintenance and emergency equipment, as well as the occasional passage of an aircraft veering from a runway. Although paved shoulders are only required for runways accommodating aircraft designated ADG-VI and higher, they are recommended for runways accommodating ADG-III aircraft. None of the Airport's runways, taxiways, or aircraft parking aprons are enhanced by paved shoulders, even though Runway 4-22 is a Group III runway. The FAA's standard D-III runway shoulder width is 20 feet unless the critical aircraft it serves has a maximum certificated takeoff weight greater than 150,000 pounds, which requires 25-foot-wide runway shoulders. Given that Runway 4-22's critical aircraft is the Boeing 737-800, which has a MTOW of 174,200 pounds, per AC 150/5300-13B, it is recommended, but not required, that 25-foot-wide paved shoulders be added to both sides of Runway 4-22. While paved shoulders are not part of the recommended runway alternatives, the airport may consider adding them during the Runway 4-22 reconstruction. The design aircraft of D-III (Boeing 737-8/9) is not expected to increase during the Study period. As such, no upgrade to the required paved shoulders is necessary. Should the Airport decide to add paved shoulders, this will be determined during the project formulation and preliminary design. Should the Airport increase in ADG from III to IV during this period, paved runway shoulders would then be a required improvement.

Runway Safety Areas (RSA)

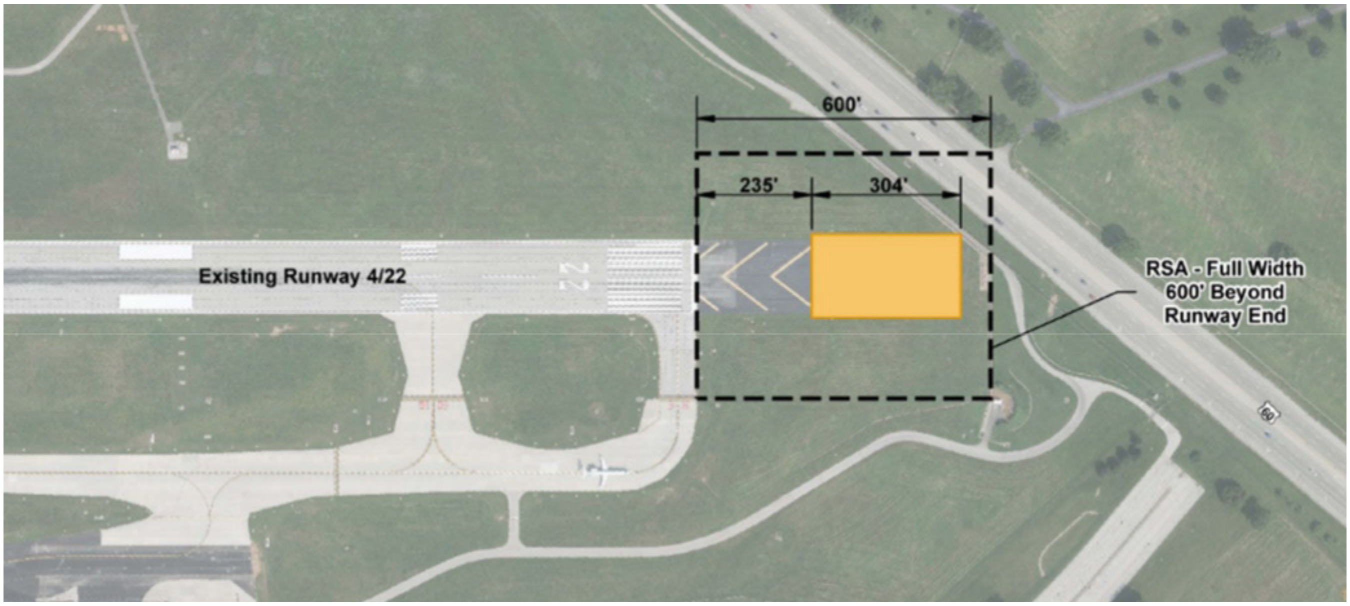
A Runway Safety Area (RSA) is a rectangular area bordering a runway that is intended to reduce the risk of damage to an aircraft in the event of an undershoot, overrun, or excursion from its associated runway. RSAs are required to be cleared and graded such that they are void of potentially hazardous ruts, depressions, or other surface variations.

A Runway Safety Area (RSA) is a rectangular area bordering a runway that is intended to reduce the risk of damage to an aircraft in the event of an undershoot, overrun, or excursion from its associated runway.

A D-III RSA is required to be 500 feet wide, must extend 1,000 feet beyond the runway end and must extend 600 feet prior to its landing threshold. A B-II RSA is required to be 150 feet wide, must extend 300 feet beyond the runway end and must extend 300 feet prior to its landing threshold unless the runway's visibility minima is less than .75 mile, which requires each of those dimensions to double. The longitudinal grade from the end of the runway should be between zero and negative three (-3.0) percent for the first 200 feet. Beyond the first 200 feet, the maximum allowable positive longitudinal grade is such that no part of the RSA penetrates any applicable approach surface, and the maximum negative grade is five percent. Transverse ('Side Slope') AAC B and D grades are required to be 1.5 to 5.0 percent and 1.5 to 3.0 percent, respectively, away from the runway shoulder edge and extended runway centerline.

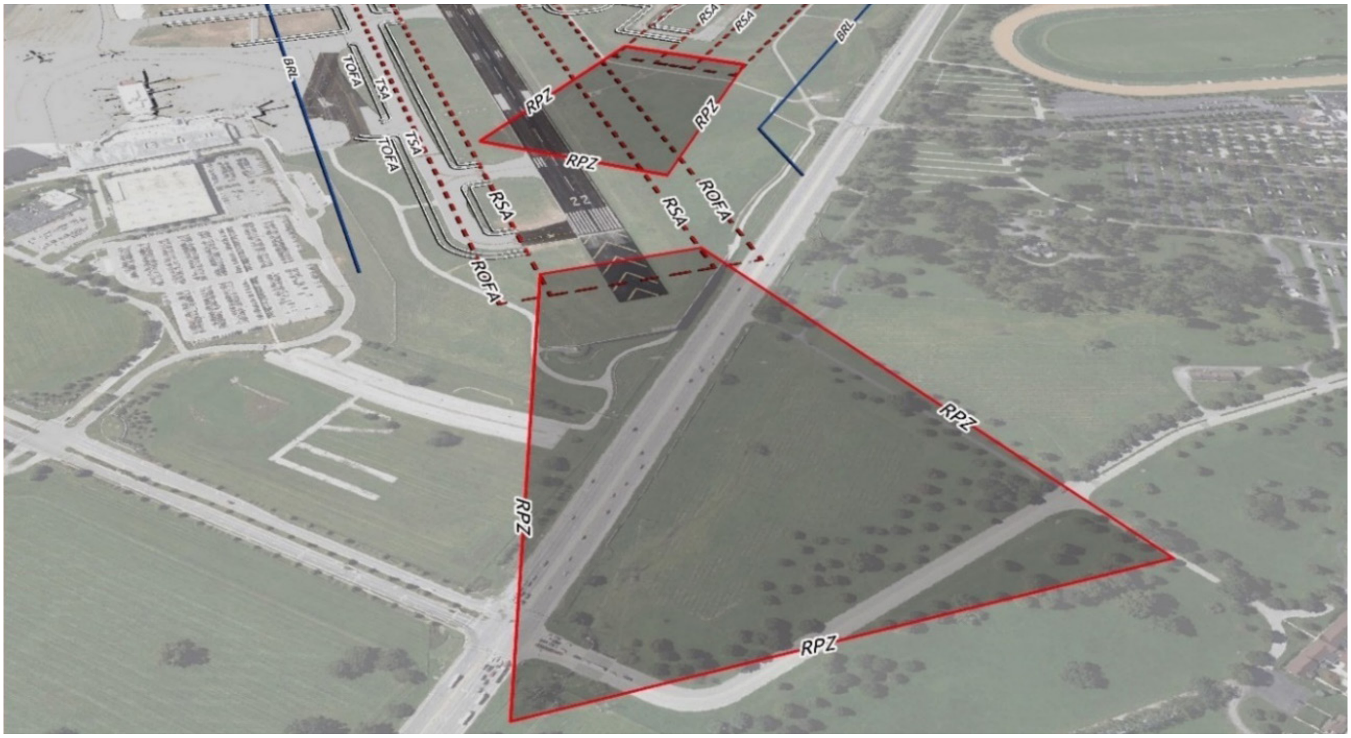
Runway 9-27's RSAs are compliant with FAA design standards. However, Runway 4-22's RSAs do not meet current FAA design standards. Extensive study and coordination between the FAA and LFUCAB have been conducted to put in place measures, and, most recently, a RSA Determination (RSAD) Study for the Runway 22 approach end to identify a coordinated determination to ensure Runway 22's operational safety. The RSAD resulted in a plan to enhance safety by constructing a 304-foot long by 170-foot wide rectangular Engineered Materials Arresting System (EMAS), understanding that the RSA could not meet current FAA standards. As depicted on **Figure 4-3**, the Runway 22 overall RSA dimensions of 320 feet by 500 feet will be achieved as an improvement to the existing RSA but will not meet the standard 600 feet. This will include the removal of existing declared distances once completed. **Figure 4-4** depicts the new Runway 22 RSA standards resulting from the FAA-approved RSAD.

Figure 4-3
Runway 22 RSA Determination Accepted Alternative



Source: FAA, Runway Safety Area Determination, 2022.

Figure 4-4
New Runway 22 RSA Standards



Source: CHA, 2024.

Runway Obstacle Free Zone (ROFZ)

A Runway Obstacle Free Zone (ROFZ) is a volume of airspace centered above a runway that is required to be clear of all objects except for frangible navigational aids fixed by function. ROFZs provide clearance protection for aircraft landing or taking off. The ROFZ is the airspace above a surface whose elevation at any point extends 200 feet beyond each end of the runway, and its width is based on visibility minimums and aircraft size. ROFZs for Runways 4-22 and 9-27 are required to be 400 feet wide. The Airport's ROFZ lengths and widths are 200 feet and 400 feet, respectively, thus meeting FAA standards.

Runway Blast Pads

Like runway shoulders, blast pads are intended to provide erosion protection at the runway ends. FAA design criteria dictate that a blast pad with dimensions at least 200 feet wide and long be placed symmetrically at the ends of an ADG-III runway, such as Runway 4-22, that has a critical aircraft with an MTOW greater than 150,000 pounds, such as the B737-800. The approach ends of Runways 4 and 22 are currently equipped with blast pads that are 200 by 600 feet and 150 by 415 feet, respectively. As such, the first 200 linear feet of Runway 22's approach end blast pad should be widened by 25 feet on both edges to meet the standard 200 by 200 feet dimensions. Blast pads are not required for a B-II runway; hence, Runway 9-27 is not equipped with one on either of its ends; however, should Runway 9-27 be converted to a D-III runway in the future, blast pads at least 200 feet long and wide would be essential and will be included in any such alternatives.

Building Restriction Line (BRL)

Though not a specific FAA design standard, the Building Restriction Line (BRL) is a reference line established by an airport that delineates suitable locations for buildings and structures within an airport's Air Operations Area (AOA). The BRL is typically established with consideration to OFAs and RPZs, as well as airspace protection, by identifying areas of allowable building heights, such as 35 feet above ground level. It should be noted that site-specific terrain considerations (i.e., grade/elevation changes) may allow buildings to be higher above ground than indicated by a generalized BRL. Height restrictions are typically based on CFR Part 77 standards and will be evaluated in later chapters for each site development plan.

Runway Gradients

Transverse Runway Gradients

Transverse gradient standards are intended to ensure that a runway provides positive lateral drainage from runway pavement surfaces. A runway's general standard transverse grade configuration is a center crown with equal, constant downward grades on either side. The transverse runway gradient design standards vary based on the AAC for a specific runway. FAA standard transverse grade slopes for category B and D runways, such as Runways 9-27 and 4-22, respectively, are within 1.0 to 2.0 percent and 1.0 to 1.5 percent from the center crown.

Runway 9-27's transverse slope is inconsistent from the center crown of the runway. It varies greatly from relatively flat to nearly plus or minus three (+/- 3) percent across the runway. Runway 4-22's transverse gradient is generally lower than the FAA's 1.0 to 1.5 percent standard. These nonstandard conditions should be resolved or improved in conjunction with each runway's next rehabilitation or reconstruction project.

Longitudinal Runway Gradients

Longitudinal runway gradient standards vary based on the AAC for a specific runway. Category B runways, such as 9-27, are allowed a maximum longitudinal and grade change percentage of plus or minus two (+/- 2.0) percent. Their vertical curve lengths must be a minimum of 300 feet for each 1.0 percent change, although a vertical curve is not necessary when the grade change is less than 0.4 percent. Category D runways, such as 4-22, are allowed a maximum longitudinal curve and grade change percentage of plus or minus one and a half (+/- 1.5) percent. However, longitudinal grades exceeding +/- 0.8 percent are not acceptable in such a runway's first or last 2,500 feet.

Runway 9-27's longitudinal gradient does not exceed the allowable +/- 2 percent grade change, does not contain any vertical curves with grade changes more than 0.4 percent, nor exceed 300 feet. Runway 4-22's grades are within their 1.5 percent grade change limit, although within the first 2,500 feet on the Runway 4 end, the gradient exceeds the 0.8 percent slope change allowed, containing slopes of approximately 1.2 percent. This results in a nonstandard condition, which creates a line-of-sight issue and a runway gradient issue. The Airport currently has a Modification of Standards (MOS) agreement with the FAA. This MOS will be renewed as part of this Master Plan effort; however, potential strategies to mitigate the nonstandard issue will be evaluated as part of the Study effort.

Runway to Runway Offsets

The minimum separation from one runway to another runway has different requirements based on varying configurations. Runways 4-22 and 9-27 are considered converging non-intersecting runways. The minimum separation of such must allow an aircraft to hold without encroaching upon the RSA of the other runway. The Airport's aircraft holding positions are not located within another runway's RSA, therefore its runways are adequately separated. Future runway alternatives should continue to achieve the required separation.

Runway and Parallel Taxiway Centerline Separation

Runway and parallel taxiway centerline separation is another significant FAA operational safety design standard. Runway 4-22 is required to be separated from its full 'parallel' Taxiway A by 400 feet. Taxiway A has varying separations from Runway 4-22, such as:

- Approximately 400 feet between exit taxiways A1 and A2; approximately 362 linear feet meet the FAA's standard separation criteria.
- Approximately 309 feet between exit taxiways A2 and A5; approximately 3,762 linear feet do not meet the FAA's standard separation criteria.
- Approximately 400 feet between exit taxiways A5 and A7; approximately 2,877 linear feet meet the FAA's standard separation criteria.

Given the above, just over half of parallel Taxiway A does not meet the FAA's standard separation distance from Runway 4-22. Runway 4-22 is also serviced by a partial-full parallel Taxiway 'B.' The two maintain a centerline separation of approximately 309 feet, which does not meet the FAA's standard separation criteria of 400 feet for design aircraft. As such, operational limitations are put in place to gain operational safety of the airfield.

Runway 9-27 is required to be separated from its parallel Taxiway F by 240 feet, whereas the actual separation is 300 feet (the required standard if lower than 0.75-mile visibility minima were ever provided). As such, the FAA's standard centerline separation is met between Taxiway F and Runway 9-27. However, if Runway 9-27 was to be upgraded to service the Airport's critical C-III aircraft family, the centerline separation would be substandard. Alternatives to correct these non-standard conditions will be presented in subsequent **Chapter 5**.

Runway Protection Zones (RPZs)

RPZs are trapezoidal areas located 200 feet beyond a runway's departure end of the runway or 200 feet prior to its landing threshold and centered on the extended runway centerline. An RPZ is primarily a land use control meant to enhance the protection of people and property near an airport through airport control. Such control includes clearing the RPZ areas of incompatible objects and activities.

RPZ Dimensions

Runways have two types of RPZs (approach and departure), which have varying dimensions based on the design aircraft's AAC and ADG, as well as the runway's visibility minima. Runway 4-22 is designated as a D-III runway. Runway 4 has a visibility minimum of 0.50 miles, and Runway 22 has a visibility minimum of 0.75 miles. Runway 9-27 is designated as B-II runway. Runway 9 has a visibility minimum of one (1) mile, and Runway 27 has a visibility minimum of 1.25 miles.

Dimensional requirements for each of the Airport's approach and departure RPZs are summarized in **Table 4-15** and are depicted in **Figure 4-5**. Each of the Airport's RPZs meets the prescribed dimensional requirements. However, incompatible land uses were delineated in most.

Table 4-15
Runway Protection Zone (RPZ) Summary

Runway	Runway 4	Runway 22	Runway 9	Runway 27
AAC and ADG	D-III	D-III	B-II	B-II
Visibility Minima	0.50 mile	0.75 mile	1 mile	1.25 miles
	Approach RPZ			
Length	2,500	1,700	1,000	1,000
Inner Width	1,000	1,000	500	500
Outer Width	1,750	1,510	700	700
	Departure RPZ			
Length	1,700	1,700	1,000	1,000
Inner Width	500	500	500	500
Outer Width	1,010	1,010	700	700

Source: FAA AC 150/5300-13B, CHA, 2024.

Incompatible Land Uses

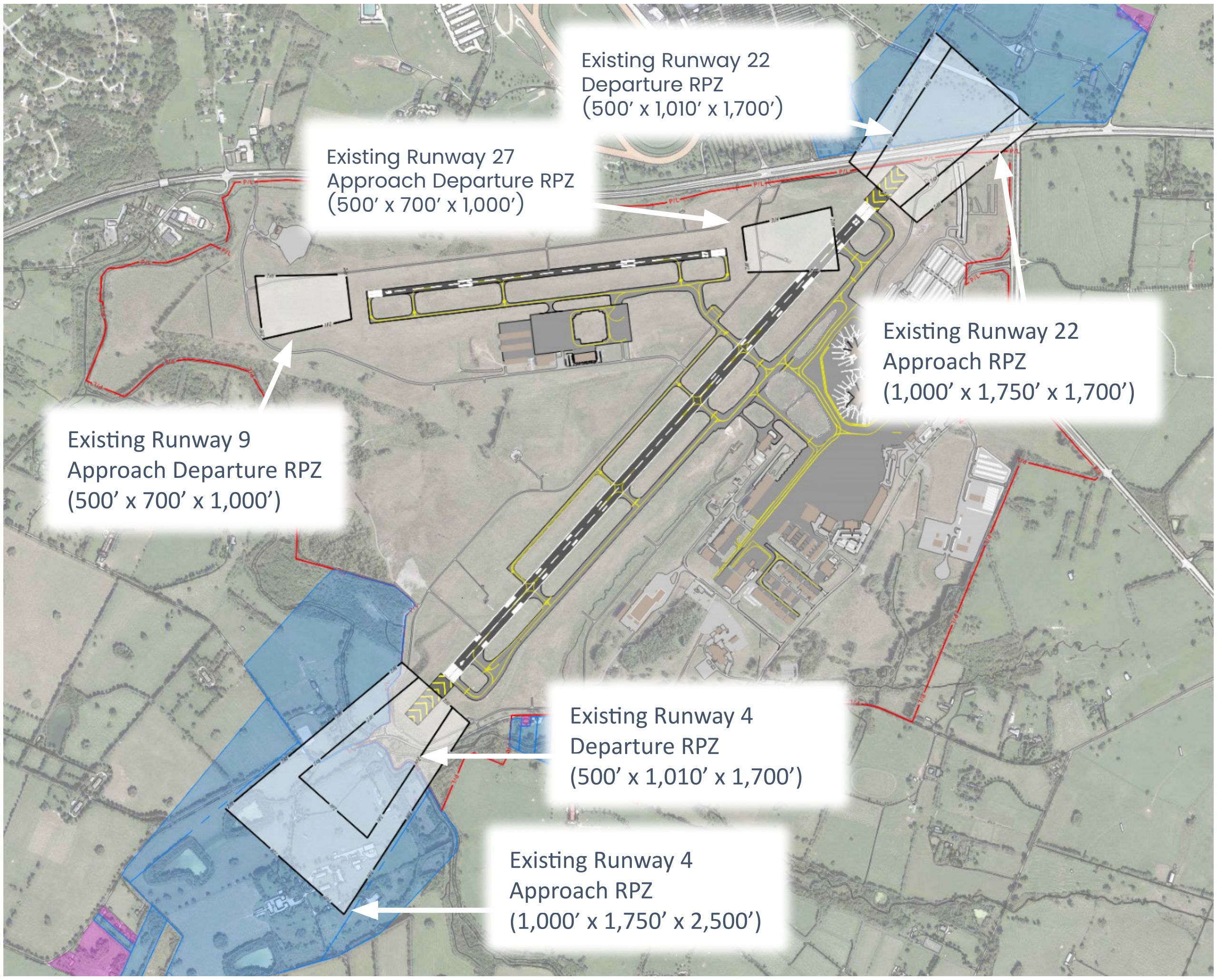
Incompatible land uses can consist of physical obstructions, visual distractions, or wildlife attractants, which can threaten the safety of aircraft operations. According to AC 150/5190-4B, compatible land uses consist of 'those that can coexist with a nearby airport without constraining the safe and efficient operation of the airport, or exposing people living and/or working nearby to significant environmental impacts.' The primary characteristics typically considered when determining land use compatibility include the following:

- Noise
- Airspace
- Visual/atmospheric interference
- Wildlife
- Protection of people and property
- Development density

Each of the previously defined RPZs was evaluated at a high level for incompatible land uses, emphasizing airspace and protection of people and property.

Several incompatible land uses were found to be in the Runway 4 approach and Runway 22 departure RPZs as they contain portions of the Airport's perimeter roadway, Parkers Mill Road/Kentucky Route 1968, a private roadway, and a residential/commercial use property which includes vehicular parking and horse stables. Additionally, the Runway 22 approach and Runway 4 departure RPZs include portions of Versailles Road and Keeneland Boulevard. The Runway 22 approach RPZ also includes the Airport's public overflow parking lot. Conversely, no incompatible land uses were identified within the Runway 9 approach RPZ or Runway 27 departure RPZ. It is important to note that the portions of Runway 4 and Runway 22 RPZs located beyond the airport property boundary are controlled through avigation (i.e., air) easements. These areas are depicted in blue in **Figure 4-5.**

Figure 4-5
Existing Approach and Departure RPZs



Source: CHA, 2024.

4.3.4 Runway Length Requirements

Runway 4-22

To ensure the Airport can continue supporting existing and anticipated commercial service and charter aircraft operational demands, a detailed runway length analysis was performed based on FAA guidance provided in 150/5325-4B*, Runway Length Requirements for Airport Desig*n, as well as performance characteristics documented in specific manufacturer's aircraft planning manuals (APMs). Inadequate runway length can hinder the operational capability of an airport, such as limiting the aircraft types that can operate at the Airport and reducing destinations that it can serve. Inadequate runway lengths can restrict an aircraft's allowable takeoff weight, thereby reducing the amount of fuel, passengers, or cargo that could otherwise be carried. The runway length analysis detailed in this section specifically pertains to the Airport's primary runway, Runway 4-22. (See ***Runway 9-27*** section for the runway lengths analysis for such).

Commercial Service Aircraft Characteristics

Per the guidance provided in AC 150/5325-4B, the following factors were assessed in the Airport's commercial service aircraft required runway length analyses:

- Model and Engine Type – Refers to the aircraft version and engine type. The Airport's most common and demanding aircraft were analyzed.
- Payload – Represents an aircraft's carrying capacity, including passengers, baggage, and cargo; both 90 and 100 percent payloads were analyzed for planning purposes.
- Estimated Takeoff Weight – The estimated weight at takeoff, including the payload and fuel (also known as useful weight) required to reach the intended destination (with required reserves). This weight varies by aircraft, payload, and destination.
- Estimated Landing Weight – The estimated weight of an aircraft at landing. The maximum landing weight (MLW) was analyzed to determine worst-case runway landing requirements.

Airport Characteristics

- Temperature – An airport's atmospheric temperature. Warmer air requires longer runway lengths due to decreased air density, which provides less lift for an aircraft. The hottest month's mean maximum (or 'average high') temperature is analyzed for runway length requirement calculations.
- Elevation – An airport's elevation above mean sea level (AMSL). As elevation increases, air density decreases, resulting in longer takeoff and landing distances.
- Effective Runway Gradient – Maximum longitudinal grade of a runway centerline expressed as a percentage slope. Takeoff distances will be longer when performed on an inclined surface. As such, for every foot of elevation difference between a runway's high and low point, 10 feet of additional takeoff length is applied to a flat surface calculation.
- Stage Length – The length in nautical miles (nm) between the origin and destination airports of a particular flight. Stage length determines an aircraft's fuel quantities required to reach the intended destination (including reserves), thus impacting aircraft weight and runway length requirements.

Aircraft and Destinations

Chapter 3, *Forecasts of Aviation Activity*, of this document identified the Airport's existing and future design code to be a D-III, the critical aircraft family best represented by the Boeing 737-800. That aircraft and other commercial service aircraft that conducted more than 500 operations in the Base Year (2021) were identified as important factors for analyzing the operational capability of Runway 4-22. **Table 4-16** provides the Airport's specific factors and characteristics as well as the aircraft identified for evaluation and their MTOW.

Table 4-16
Airport and Aircraft Characteristics Summary

Airport Specific Factors	Characteristics		Aircraft	MTOW (lbs.)
Primary Runway	Runway 4-22		Airbus A319-100	166,449
Runway Length (Current)	7,004 ft		Airbus A320-200	171,961
Airport Elevation	979.3 ft		Boeing 717-200	121,000
Hottest Month of the Year	July/August		Boeing 737-800	174,200
Mean Daily Maximum Temperature	87.1° Fahrenheit		CRJ-900 LR	84,500
Difference in High & Low Points of Runway	32.7 ft		CRJ-700	72,750
Effective Runway Gradient	0.47%		CRJ-550	72,750
			CRJ-400 LR	53,000
			ERJ-175 LR	85,517
			ERJ-145 LR	48,502

Source: AirNAV, National Oceanic and Atmospheric Administration (NOAA), Aircraft Planning Manuals (APMs), Blue Grass Airport, CHA, 2024.

All existing and planned non-stop destinations serviced through the Airport were analyzed for their distance in nautical miles to determine stage lengths for each identified aircraft. The furthest destinations were identified for each aircraft being evaluated and included Hartsfield-Jackson Atlanta International Airport (ATL), Dallas-Fort Worth International Airport (DFW), Detroit Metropolitan Wayne County Airport (DTW), Harry Reid International Airport (LAS), Chicago O'Hare International Airport (ORD), and Philadelphia International Airport (PHL).

Calculation Methodology

Once the stage lengths were identified for each aircraft being evaluated, each aircraft manufacturer's specific aircraft performance manual (APM) was referenced per the guidance provided in Chapter 4, Paragraph 402 of AC 150/5325-4B. The airport-specific factors previously presented in **Table 4-16** were used along with each aircraft's characteristic tables, payload/range, takeoff, and landing graphs to determine each aircraft's runway length requirement. **Table 4-17** and **Table 4-18** contain the Airport's 'Takeoff Length Requirements' at both 90 and 100 percent payloads, respectively, for each identified commercial service aircraft.

Table 4-17
Takeoff (TO) Length Requirements (90% Payload)

Aircraft Model	Payload	Destination	Stage Length (nm)	Estimated Takeoff Weight (lbs.)	Takeoff Length Req. (ft)	Landing Length Req. (ft)
Airbus A319-100	90%	LAS	1,461	150,530	5,408	4,735
Airbus A320-200		LAS	1,461	163,411	**7,086**	5,086
Boeing 717-200		ATL	265	103,971	6,462	5,098
Boeing 737-800		ATL	265	139,648	5,693	5,949
Bombardier CRJ900 LR		ATL	265	71,678	5,612	5,622
Bombardier CRJ700		ORD	281	66,303	5,143	5,230
Bombardier CRJ550		ORD	281	66,303	5,143	5,230
Canadair RJ200 ER		DFW	682	50,799	6,966	5,015
Embraer ERJ-175 LR		DFW	682	78,516	5,933	4,714
Embraer ERJ-170 LR		DFW	682	73,282	5,168	4,714
Embraer ERJ-145 LR		PHL	451	42,488	5,472	4,730

Runway takeoff lengths were calculated at 59° F – Standard Day + 27° F using a 1,000 ft Pressure Altitude (PA). Runway landing lengths were calculated using a 1,000 ft P.A.

Numbers in **RED** represent a deficiency based on existing conditions.

Source: AC 150/5325-4B, Airbus, Boeing, Bombardier and Embraer Aircraft Planning Manuals, CHA, 2024.

Table 4-18
Takeoff (TO) Length Requirements (100% Payload)

Aircraft Model	Payload	Destination	Stage Length (nm)	Estimated Takeoff Weight (lbs.)	Takeoff Length Req. (ft)	Landing Length Req. (ft)
Airbus A319-100	100%	LAS	1,461	154,376	5,913	4,735
Airbus A320-200		LAS	1,461	167,749	**7,637**	5,086
Boeing 717-200		ATL	265	107,171	6,783	5,098
Boeing 737-800		ATL	265	144,348	6,015	5,949
Bombardier CRJ900 LR		ATL	265	73,878	5,915	5,622
Bombardier CRJ700		ORD	281	68,183	5,371	5,230
Bombardier CRJ550		ORD	281	68,183	5,371	5,230
Canadair RJ200 ER		DFW	682	52,149	**7,135**	5,015
Embraer ERJ-175 LR		DFW	682	80,765	7,001	4,714
Embraer ERJ-170 LR		DFW	682	75,288	5,953	4,714
Embraer ERJ-145 LR		PHL	451	43,763	6,279	4,730

See notes under table 4-17.

Source: AC 150/5325-4B, Airbus, Boeing, Bombardier and Embraer Aircraft Planning Manuals, CHA, 2024.

Runway Length Recommendation for Commercial Service Aircraft

The results of the commercial service aircraft runway lengths analyses indicate that the Airport's existing Runway 4-22 can accommodate most of the current and future commercial service aircraft. However, as indicated on **Table 4-17** and **Table 4-18**, A320-200 aircraft departures to LAS on a hot day (86°F) are required to reduce their payload to lower than 90 percent to safely operate on Runway 4-22. Unrestricted operations would require Runway 4-22 to be extended to approximately 7,700 feet, requiring a runway extension of approximately 700 feet.

Large General Aviation Aircraft Specifics

Although not as demanding as the commercial service aircraft serving the Airport, an analysis of the 'large GA' aircraft (greater than 12,500 lbs.) was conducted. Per the guidance provided in AC 150/5325-4B, factors specific to the Airport were identified as part of the large GA aircraft runway analysis. Aircraft that frequently operate at the Airport were identified as an important factor for analyzing the operational capability of Runway 9-27. The aircraft identified for evaluation are presented in **Table 4-19**.

Table 4-19
Large GA Aircraft & MTOW

Aircraft Evaluated	MTOW (lbs.)
British Aerospace HS 125	25,000
British Aerospace Hawker 800	27,399
Bombardier Challenger 300	38,849
Bombardier Challenger 600	41,250
Bombardier LearJet 45	21,550
Bombardier LearJet 60	23,499
Cessna Excel/XLS	20,330
Gulfstream IV/G400	69,850

Source: Aircraft Planning Manuals (APMs), Blue Grass Airport, CHA, 2024.

Runway Length Analysis – Summary

After identifying the MTOW for each of the specified aircraft, *Table 1-1: Airplane Weight Categorization for Runway Length Requirements* of AC 150/5325-4B was referenced to further categorize the aircraft weights as they pertain to runway requirements. Based on the identified categorizations presented in **Figure 4-6**, the applicable tables and figures within Chapter 3 of AC 150/5325-4B were utilized when evaluating runway length requirements for the Citation Excel, Challenger 300/600, Hawker 125/800, and Lear 45/65, while the manufacturer's APM was utilized to evaluate runway length requirements for the Gulfstream G400.

Figure 4-6
Airplane Weight Categorization for Runway Length Requirements

Airplane Weight Category Maximum Certificated Takeoff Weight (MTOW)			Design Approach	Location of Design Guidelines
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 shows 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.

Aircraft with MTOW Greater than 12,500 lbs. but less than 60,000 lbs.

When evaluating the runway length at 60 and 90 percent useful loads for Citation, Challenger 300/600, Hawker 800, and Lear 45/65 aircraft, runway length requirements were identified under the assumptions of no wind, a dry runway surface, and zero effective runway gradient. These recommended lengths were then adjusted to account for effective runway gradient as it pertains to aircraft takeoff, as well as for wet and slippery runway conditions as applicable to aircraft landing. The required runway lengths at 60 and 90 percent payloads for the Challenger 300/600, Hawker 800, and Lear 45/65 aircraft are presented in **Table 4-20**.

After identifying the runway length requirements for each aircraft, it was necessary to adjust the runway lengths to account for the effective runway gradient, as well as wet and slippery runway conditions. Note, the effective runway gradient only impacts takeoff lengths, and the wet and slippery runway adjustments are only applicable to landing operations of turbojet-powered aircraft. Per AC 150/5325-4B, the effective runway gradient is 'the difference between the highest and lowest elevations of the runway centerline divided by the runway length. The Airport's runway effective gradient calculations are as follows:

Runway 4-22: [972.7' – 940.0' / 7,004' = 0.47%]

Runway 9-27: [973.7' – 950.1' / 4,000' = 0.59%]

Table 4-20
Runway Length Requirements (MTOW >12,500 lbs., but <60,000 lbs.)

Aircraft Model	Gradient Adjustments -Takeoff Only- (at 60% Useful Load)	Gradient Adjustments -Takeoff Only- (at 90% Useful Load)	Wet & Slippery Adjustments -Landing Only- (at 60% Useful Load)	Wet & Slippery Adjustments -Landing Only- (at 90% Useful Load)
Citation Excel	5,005	6,802	5,000*	7,000*
Challenger 300	5,005	6,802	5,000*	7,000*
Challenger 600	5,838	8,736	5,000*	7,000*
BAe HS 125	5,005	6,802	5,000*	7,000*
BAe Hawker 800	5,838	8,736	5,000*	7,000*
Learjet 45	5,005	6,802	5,000*	7,000*
Learjet 60	5,838	8,736	5,000*	7,000*

Source: AC 150/5325-4B, CHA, 2024.

*Per AC 150/5325-4B, the runway length for turbojet-powered airplanes obtained from the "60 percent useful load" curves are increased by 15 percent or up to 5,500 feet (1,676 meters), whichever is less, and the "90 percent useful load" curves are also increased by 15 percent or up to 7,000 feet (2,133 meters), whichever is less.

To adjust for runway gradients, runway length calculations are increased by 10 feet for each foot of elevation difference between the high and low points of the runway centerline. **Table 4-20** presented the required runway length for takeoff based on the gradient adjustments.

Aircraft with MTOW of 60,000 Pounds or More

The manufacturer's operational information supplement (OIS) was utilized to evaluate runway length requirements for the Gulfstream G400 aircraft. Per that OIS, the required takeoff and landing distances for the G400 are 6,125 feet and 4,508 feet, respectively. The G400's OIS includes takeoff planning charts for wet runways based on airport pressure altitude and the mean maximum temperature of the hottest month of the year. The required runway distance at MTOW was determined based on the Airport's elevation (approximately 1,000 feet) and the mean maximum temperature of the hottest month of the year. Based on these parameters, the adjusted required runway length for takeoff during wet conditions is 6,592 feet, as depicted in **Table 4-21**.

Table 4-21
Runway Length Requirements (MTOW >60,000 lbs.)

Aircraft	Takeoff Distance	Landing Distance (Dry Conditions)	Landing Distance (Wet Conditions)
Gulfstream G400	6,592'	3,519'	4,508'

Source: AC 150/5325-4B, Gulfstream Operational Information Supplement (O.I.S.), CHA, 2024.

Runway Length Recommendation for Large GA Aircraft

When evaluating each aircraft's runway length requirement, an emphasis was given to the aircraft making up 75 percent of the fleet (Citation Excel and Learjet 45), as well as the most demanding aircraft (Gulfstream 400). Based on the Airport's operating requirements, the minimum takeoff length requirement for large GA aircraft, given the Airport's runway gradient, is 6,592 feet. The minimum landing distance for large GA aircraft during wet and slippery conditions is 5,782 feet. Based on those requirements, the existing Runway 4-22 length meets the recommended runway length; however, crosswind Runway 9-27 does not.

Current Runway Length Justification

Runway 4-22 currently has a runway length of 7,004 feet. Based on linear interpolations, the percent useful load at which the Citation Excel, Challenger 300/600, Hawker 125/800, and Lear 45/65 can operate given the current runway length were calculated and presented in **Table 4-22**.

Runway lengths can place restrictions on the allowable takeoff weight of aircraft, which then can reduce the amount of fuel, passengers, or cargo that can be carried.

Runway 9-27

To ensure that the Airport can continue supporting existing and anticipated small GA aircraft operational demands, a detailed runway length analysis was performed based on guidance set forth in AC 150/5325-4B. Inadequate runway length can limit the operational capability of an airport and reduce the types of aircraft that can be serviced by the airport's FBO. Runway lengths can place restrictions on the allowable takeoff weight of aircraft, which then can reduce the amount of fuel, passengers, or cargo that can be carried. The runway length analysis detailed in this section specifically pertains to the Airport's crosswind Runway 9-27.

Table 4-22
Percent Useful Load

Aircraft	Using Recommended Runway Length (Pre-Adjustments)	Using Runway Length Adjusted for Gradient (Takeoff)
Citation Excel	97%	93%
Challenger 300	97%	93%
Challenger 600	75%	72%
BAe HS 125	97%	93%
BAe Hawker 800	75%	72%
Learjet 45	97%	93%
Learjet 60	75%	72%

Source: CHA, 2024.

Small General Aviation Aircraft Specifics

Although a large majority of the Airport's annual operations are conducted on its primary Runway 4-22, an analysis of the 'small GA' aircraft (less than or equal to 12,500 lbs.) was conducted to ensure the airport's secondary runway meets the runway length requirements for existing GA aircraft utilizing Runway 9-27. Per the guidance provided in AC 150/5325-4B, factors specific to the Airport were identified (See **Table 4-12**) as part of the small GA aircraft runway analysis for the Airport's secondary Runway 9-27. Small GA aircraft that frequently operate at the Airport were identified as an important factor in analyzing the operational capability of Runway 9-27. The aircraft identified for evaluation and their MTOW are provided in **Table 4-22**.

Table 4-23
Small General Aviation Aircraft & MTOW

Aircraft Evaluated	MTOW (lbs.)
Diamond Star (DA40)	2,888
Cirrus SR-22	3,600
PC12 – Pilatus PC-12	10,450
C525 – Cessna Citation Jet/CJ1	10,600
BE20 – Beech 200 Super King Air	12,500

Source: AirNAV, National Oceanic and Atmospheric Administration (NOAA), Aircraft Manufacturer website, Blue Grass Airport, CHA, 2024.

<u>Runway Length Analysis – Summary</u>

After identifying the MTOW for each of the specified aircraft, AC 150/5325-4B, *Table 1-1: Airplane Weight Categorization for Runway Length Requirements*, was referenced to further categorize the aircraft weights as they pertain to runway requirements. Based on the categorizations previously presented in **Figure 4-6**, the applicable tables and figures within AC 150/5325-4B were utilized when evaluating runway length requirements for the aircraft included in **Table 4-23**.

<u>Small Airplanes with Fewer than 10 Passenger Seats</u>

When evaluating the runway length at 95 and 100 percent of the fleet for the Diamond Star, Cirrus SR-22, Pilatus PC-12, Cessna Citation Jet and the Beechcraft Super King Air 200, runway length requirements were identified under the assumptions of no wind, a dry runway surface, and zero effective runway gradient. These recommended lengths were then adjusted to account for effective runway gradient as it pertains to aircraft takeoff, as well as for wet and slippery runway conditions as applicable to aircraft landing. The required runway lengths at 95 and 100 percent of the aforementioned small airplane fleet are presented in **Table 4-24**, which includes adjustments for runway gradients and wet or slippery conditions.

Table 4-24
Runway Length Requirements (Small Airplane with less than 10 Passengers)

Aircraft Model	Gradient Adjustments -Takeoff Only- (95% Fleet)	Gradient Adjustments -Takeoff Only- (100% Fleet)	Wet & Slippery Adjustments -Landing Only- (95% Fleet)	Wet & Slippery Adjustments -Landing Only- (100% Fleet)
Diamond Star (DA40)	3,605	4,220	3,064	3,587
Cirrus SR-22	3,605	4,220	3,064	3,587
PC12 – Pilatus PC-12	3,605	4,220	3,064	3,587
Cessna Citation Jet	3,605	4,220	3,064	3,587
Beechcraft Super King Air 200	3,605	4,220	3,064	3,587

Source: AC 150/5325-4B, CHA, 2024.

Runway Length Recommendation for Small General Aviation Aircraft

Based on the Airport's operating requirements and conditions, the minimum takeoff length required for small GA aircraft is 3,605 feet for 95 percent of the existing fleet and 4,220 feet for 100 percent of the existing fleet. The minimum landing distance for small GA aircraft during wet and slippery conditions is 3,064 feet for 95 percent of the existing fleet and 3,587 feet for 100 percent of the existing fleet. A linear interpolation of that data suggests that Runway 9-27's existing length of 4,000 feet meets the required length for over 98 percent of the fleet. Given the incremental gain of providing unrestricted operations for less than two percent of the fleet, a runway extension of approximately 220 feet is not recommended. However, an ultimate, beyond the planning period, extension should be explored to protect the airspace imaginary surfaces associated with that runway if it were to be extended to serve as the Airport's temporary primary runway in the event of a Runway 4-22 closure due to maintenance or other unknown reasons.

4.3.5 Changes in Runway Design Standards Based on AAC-ADG

As was previously discussed, Runway 9-27 is anticipated to increase from a B-II to a C-II runway during the forecast horizon. This increase in the AAC would result in an increase in runway design standards and requirements. The changes in design standards when transitioning from a B-II to a C-II runway are summarized in **Table 4-25**.

Table 4-25
Changes in Runway Design Standards Based On AAC-ADG

Design Standard Being Evaluated	B-II (Not Lower than 1 Mile Visibility)	C-II (Not Lower than 1 Mile Visibility)	C-II (Lower than .75 Mile Visibility)
Runway Dimensions			
Runway Width	75 feet	100 feet	
Runway Safety Area (RSA)			
Length Beyond Departure End	300 feet	1,000 feet	
Length Prior to Threshold	300 feet	600 feet	
Width	150 feet	500 feet	
Runway Object Free Area (ROFA)			
Length Beyond Runway End	300 feet	1,000 feet	
Length Prior to Threshold	300 feet	600 feet	
Width	500 feet	800 feet	
Precision Obstacle Free Zone (POFZ)			
Length	N/A	N/A	200 feet
Width	N/A	N/A	800 feet
Blast Pads			
Width	95 feet	120 feet	

Design Standard Being Evaluated	B-II (Not Lower than 1 Mile Visibility)	C-II (Not Lower than 1 Mile Visibility)	C-II (Lower than .75 Mile Visibility)
Approach Runway Protection Zone (RPZ)			
Length	1,000 feet	1,700 feet	2,500 feet
Inner Width	500 feet	500 feet	1,000 feet
Outer Width	700 feet	1,010 feet	1,750 feet
Departure Runway Protection Zone (RPZ)			
Length	1,000 feet	1,700 feet	
Outer Width	700 feet	1,010 feet	
Runway Separation			
Holding Position	200 feet	250 feet	
Parallel Taxiway/Taxilane Centerline	240 feet	300 feet	400 feet

Source: FAA AC 150/5300-13B, CHA, 2024.

4.4 Taxiway Requirements

4.4.1 Taxiway Design Group Determination

Taxiway design standards ensure that taxiways can accommodate wing-tip clearances of aircraft with the widest wingspans, as well as wheel tracking paths of the most demanding aircraft landing configurations. Each taxiway may be designed to accommodate the critical aircraft expected to use that taxiway and may have standards different from those of other taxiways at the Airport. The applicable design standards for individual taxiways depend on the areas and facilities each taxiway supports. Taxiway design standards are based on the following separate critical aircraft groupings:

- Taxiway Design Group (TDG) is based on the main landing gear width and cockpit to main gear distance. Design standards based on TDG include width, edge safety margin, shoulder width, and fillet dimensions.
- Aircraft Design Group (ADG) is based on the wingspan and tail height of the design aircraft. Design standards based on ADG include Taxiway Safety Area (TSA), Taxiway Object Free Area (TOFA), taxiway-to-runway centerline separation, and wingtip clearance requirements.

The Airport's most demanding aircraft varies on which runway they are operating on. The large aircraft almost exclusively utilize Runway 4-22, while smaller, usually GA aircraft, also utilize Runway 9-27. Based on that important distinction, the taxiways that provide access to these two runways have different requirements. Runway 4-22's existing and future critical aircraft (Boeing 737-800) is classified as TDG 3 and ADG III aircraft. Although the most demanding aircraft is classified as TDG 3 and ADG III, some taxiways that access Runway 4-22 exceed their minimum FAA design criteria and are able to accommodate aircraft up to ADG IV and TDG 5 (the ADG and TDG, which were intended to and historically utilize those taxiways). Even though their width meets that required of TDG 5 taxiways, the large taxiways on the airfield that accommodate Runway 4-22 do not adhere to all the design standards of a TDG 5 taxiway, such as not having paved shoulders on Taxiways A or F. The most demanding aircraft currently utilizing Runway 9-27 are TDG 2b and ADG II aircraft.

4.4.2 Taxiway Design Standards

Like runways, taxiways are subject to FAA design requirements such as pavement width, edge safety margins, shoulder width, and safety and object free area dimensions. **Table 4-26** and **Table 4-27** present the FAA's taxiway design standards..

Table 4-26
FAA Taxiway Design Standards Based on ADG

Design Standard	ADG		
	II	III	IV
Protection Standards			
Taxiway Safety Area (TSA) Width	79 feet	118 feet	171 feet
Taxiway Object Free Area (TOFA) Width	124 feet	171 feet	243 feet
Wingtip Clearance	22.5 feet	26.5 feet	36 feet
Paved Taxiway Shoulders	Not Required	Recommended	Required
Separation Standards			
Taxiway Centerline to Parallel Taxiway	101.5 feet	144.5 feet	207 feet
Taxiway Centerline to Fixed or Moveable Object	62 feet	85.5 feet	121.5 feet

Source: FAA AC 150/5300-13B, CHA 2023.

Table 4-27
FAA Taxiway Design Standards Based on TDG

Design Standard	TDG			
	2B	3	4	5
Protection Standards				
Taxiway Width	35 feet	50 feet	50 feet	75 feet
Taxiway Edge Safety Margin	7.5 feet	10 feet	10 feet	14 feet
Taxiway Shoulder Width	15 feet	20 feet	20 feet	30 feet

Source: FAA AC 150/5300-13B, CHA 2023.

Taxiway Width and Shoulders

Taxiway widths and shoulders are based on an airport's TDG. The Airport's varying TDGs are currently TDG 5 for Taxiways A, C and G and TDG 2B for Taxiways B and F. The required TDG 5 and 2B taxiway widths are 75 and 35 feet, respectively. Each of the Airport's taxiways currently meets or exceeds their required width standards. Like runways, paved taxiway shoulders are recommended for taxiways as well. The recommended shoulder widths for TDG 5 and 2B are 30 and 15 feet, respectively. Taxiways A and F do not currently have paved shoulders, while they are classified in previous chapters as TDG 5, they typically do not accommodate aircraft with a larger classification than TDG 3. As such, they do not require paved shoulders.

Taxiway Safety Area (TSA) and Taxiway Object Free Area (TOFA)

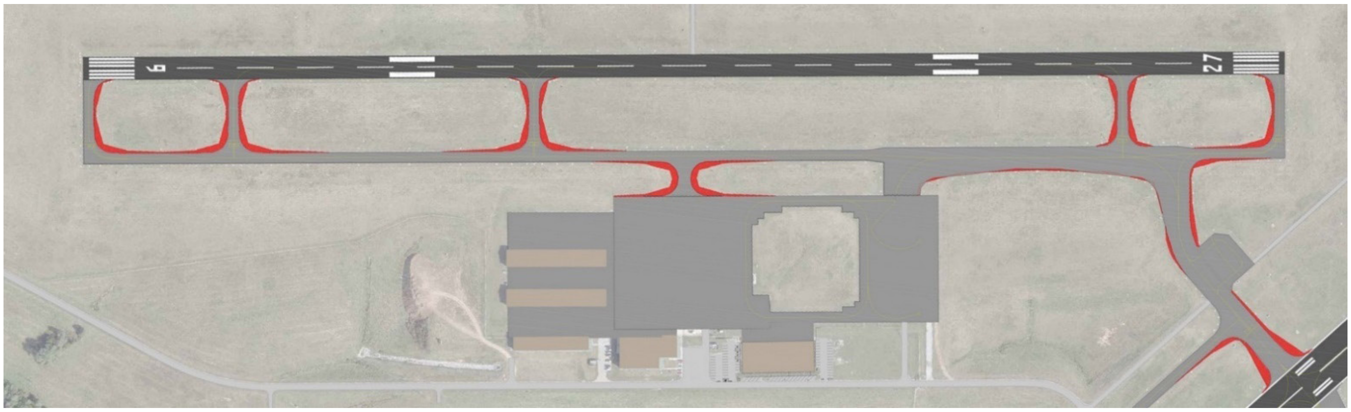
A TSA is centered around each taxiway and is required to be cleared and graded, properly drained, and capable, under dry conditions, of supporting snow removal equipment, ARFF equipment, and the occasional passage of aircraft without causing structural damage to the aircraft. Similarly, a TOFA is centered around each taxiway and is intended to prohibit vehicle service roads, parked aircraft, and above ground objects, except for those needed to be in the TOFA for air navigation or aircraft ground maneuvering purposes.

Presently, all taxiways at the Airport will either follow ADG II or ADG III requirements for TSA and TOFA dimensions. ADG II standards require the TSA to be 79 feet wide and the TOFA to be 124 feet wide, while ADG III standards require the TSA to be 118 feet wide and the TOFA 171 feet wide. There are currently no deficiencies or substandard conditions associated with the Airport's TSAs or TOFAs.

Taxiway Fillets

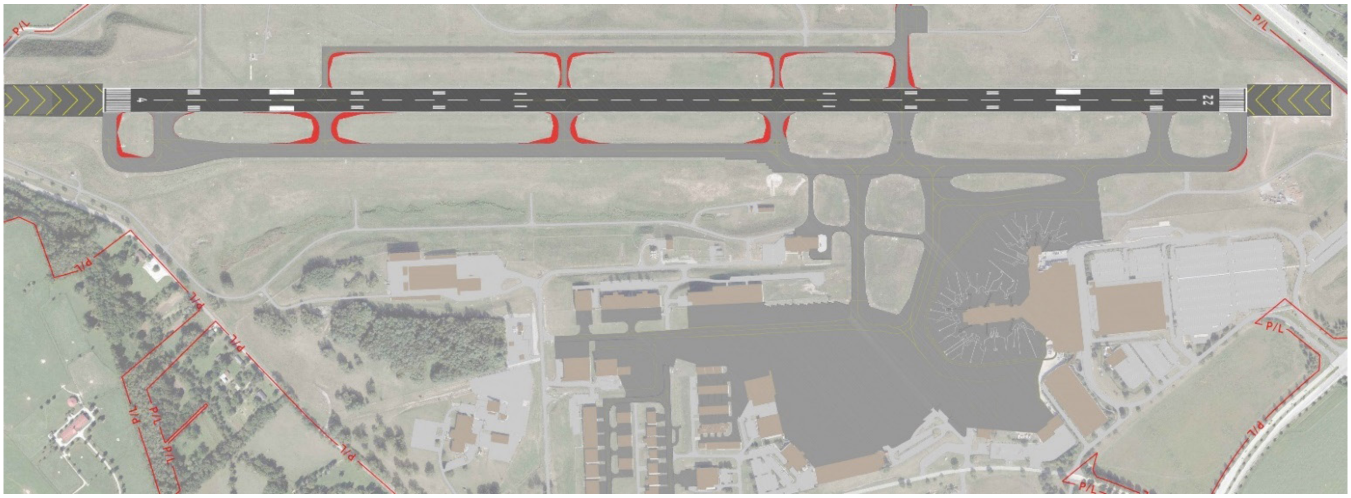
The FAA contains design standards for the geometry of the fillets, based on the angle of the turn for the intersections of taxiways, runways, and aprons. Currently, each taxiway north of Runway 4-22 fails to comply with the FAA's taxiway TDG 2B fillet design standards. Additionally, each taxiway south of Runway 4-22, including each taxiway that connects Taxiway A to the runway and Taxiway A to the commercial apron, will require changes to the fillet geometry when being rehabilitated or reconstructed. **Figure 4-7** and **Figure 4-8** depicts the additional pavement required to correct fillet geometry in accordance with FAA standards.

Figure 4-7
Additional Pavement Requirements to Meet FAA Design Standards (RWY 9-27)



Source: CHA, 2024.

Figure 4-8
Additional Pavement Requirements to Meet FAA Design Standards (RWY 4-22)



Source: CHA, 2024.

Parallel Taxiway Lengths

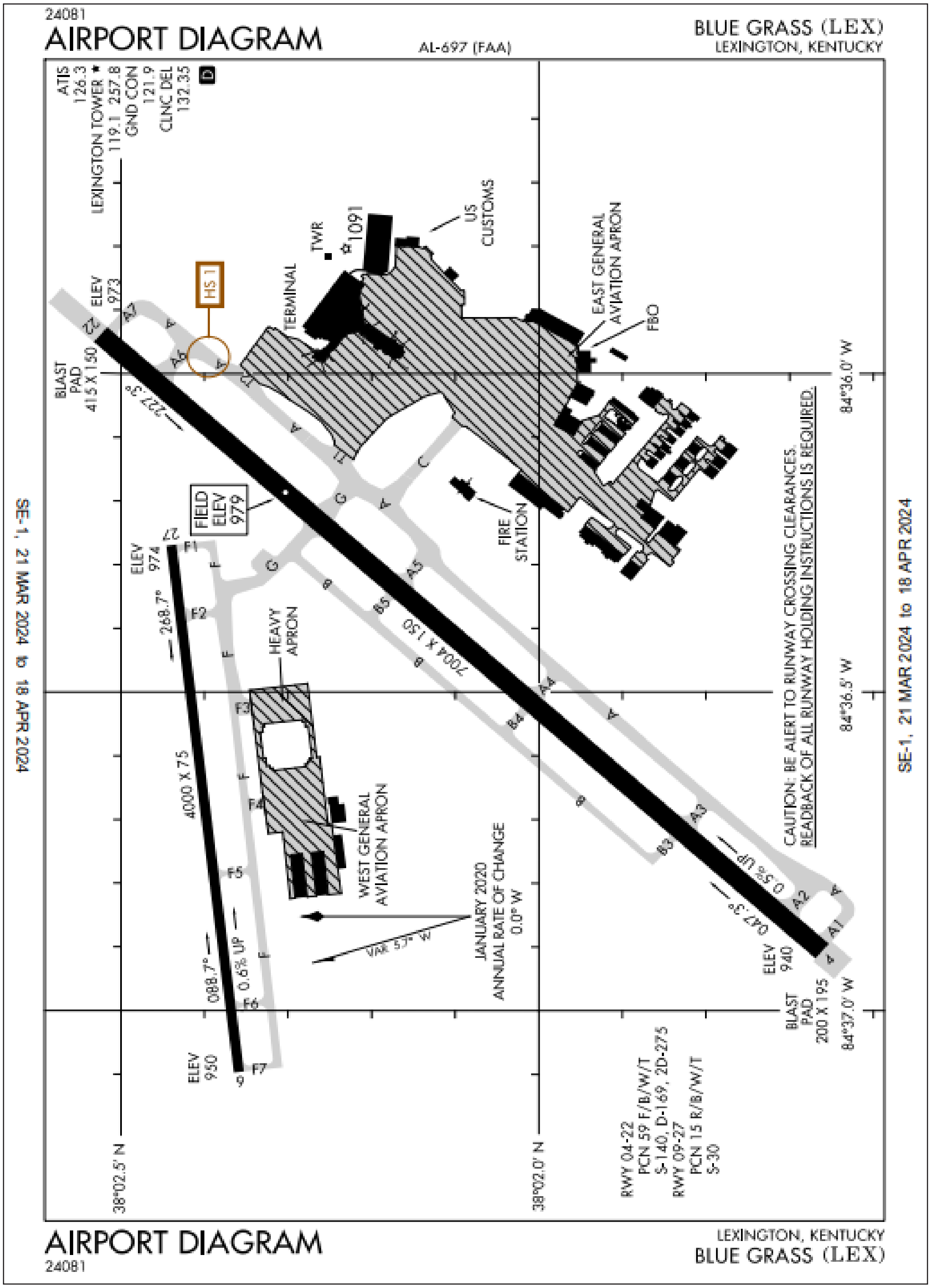
Per FAA standards, a parallel taxiway is “a continuous taxiway path located laterally to the runway it serves, providing access to one or both runway ends without entering the RSA or OFZ.” At LEX, Runway 4-22 is supported by two parallel taxiways, Taxiway A and Taxiway B. Runway 9-27 is supported by one parallel taxiway, Taxiway F. Taxiways A and F are full-length parallel taxiways, and Taxiway B is a partial-length parallel taxiway. It is recommended that Taxiway B be extended to a full-length taxiway, thus providing greater accessibility to Runway 4-22.

Hot Spots

A hot spot is defined by the FAA as a location in an airport movement area with a history of potential risk of a collision or runway incursion. Heightened attention by pilots, drivers, and controllers is necessary when maneuvering through a hot spot.

One hot spot has been identified at LEX, as shown in **Figure 4-9**, as the Runway 27 approach hold occurs prior to the Runway 22 hold line; however, this only applies when instructed by the ATCT.

Figure 4-9
Airport Diagram (Hot Spot)



Source: FAA, 2024.

4.5 Airfield Lighting Systems Requirements

Airfield lighting enhances the safety of aircraft operations during nighttime hours and low visibility conditions. Airfield lighting typically includes runway and taxiway edge and centerline lighting, Visual Glide Slope Indicator (VGSI; also known as Precision Approach Path Indicator or 'PAPI'), Runway End Identifier Lights (REILs), runway threshold lighting, runway guard lights, Touchdown Zone Lights (TDZLs), apron lighting, and airport rotating beacon.

4.5.1 Runway, Taxiway, and Apron Lighting

Runway and Taxiway Edge Lighting

Runway and taxiway edge lighting systems are classified according to their intensity (brightness); High Intensity Runway Light (HIRL), Medium Intensity Runway Light (MIRL), and Low Intensity Runway Light (LIRL). Some airports utilize a pilot-controlled system where the light intensity can be changed by pilots toggling their microphone button. Runways 4-22 and 9-27 are equipped with HIRL and MIRL, respectively.

Runway Centerline Lighting

Runway centerline lights are required for Category (CAT) II and III precision approach runways, as well as CAT I approaches, where the RVR is less than 2,400 feet. As such, Runway 4-22 is equipped with runway centerline lights.

Precision Approach Path Indicators (PAPIs)

A PAPI is a system of lights on the side of a runway threshold and provides visual descent guidance information during pilots' final approach to landing. The Airport's PAPIs are located near the approach end, on the left side of each runway. Runways 4-22 and 9-27 are equipped with a four-light PAPI (PAPI-4). Each of the Airport's PAPI systems meets FAA guidelines.

Runway End Identifier Lights (REILs)

The primary function of a REIL system is to provide rapid and positive identification of a runway's end to pilots on final approach to landing. Runways 9, 22, and 27 are each equipped with REILs.

Threshold Lights

Runway threshold lights provide a visual indicator for pilots at the beginning of the usable runway if green and the end of the usable runway if red. Each of the Airport's runways contains runway threshold lights.

Runway Guard Lights

Runway guard lights, also known as 'wigwags,' are not required but, when used, are either a pair of elevated flashing yellow lights located on each side of a taxiway or a row of in-pavement yellow lights across the entire taxiway, both in conjunction with the runway holding position marking. Their primary purpose is to enhance pilots' awareness of taxiway/runway intersections during low visibility conditions. The Airport is not currently equipped with runway guard lights.

Touchdown Zone Lights (TDZL)

TDZLs indicate the touchdown zone when landing under adverse visibility conditions. Runway 4-22 is equipped with touchdown zone and aiming point markings on each end, and Runway 9-27 is equipped with aiming point markings on each end.

Apron Lighting

In larger spaces, installing apron lights allows for clear delineation of the apron. Apron floodlight systems illuminate the Terminal Apron, GA Apron, and Air Cargo Apron. Per AC 150/5340-30J, taxiway centerline lights should be installed in apron areas with other lighting sources present to help minimize pilot confusion with any alternative lighting systems. Based on the above findings, the Airport's airfield lighting systems are currently adequate.

4.6 Navigational and Landing Aid Requirements

Pilots utilize a variety of navigational aids (NAVAIDs) and instrument procedures, including Very High Frequency (VHF) Omni Directional Range (VORs), standard terminal arrival routes (STARs), instrument approach procedures (IAPs) and NAVAIDs, approach lighting systems (ALS), airfield lighting, and rotating beacons. By providing point-to-point guidance information or position data, NAVAIDs assist pilots in locating airports, landing, and taxiing aircraft, and departing safely and efficiently from airports during nearly all meteorological conditions. **Table 4-28** summarizes the Airport's IAPs by runway and the supporting NAVAIDs.

Table 4-28
LEX's Instrument Approach Procedure Summary

Runway	Runway Markings	NAVAIDs	Lighting	Minimum Ceiling (AGL)/ Visibility	IAP Types
4	Precision	ILS, GPS	HIRL, PAPI-4, MALSR, C/L, TDZL	200 ft/0.50 mile	ILS or LOC, RNAV (GPS)
22	Precision	ILS, GPS	HIRL, PAPI-4, C/L, REIL	300 ft/0.75 mile	ILS or LOC, RNAV (GPS)
9	Non-Precision	GPS, VOR/DME	MIRL, PAPI-4, REIL	300 ft/1 mile	RNAV (GPS), VOR/DME
27	Non-Precision	GPS, VOR/DME	MIRL, PAPI-4, REIL	400 ft/1 mile	LNAV (GPS), VOR/DME

Source: FAA Airport Master Record (Form 5010), Accessed 2023.

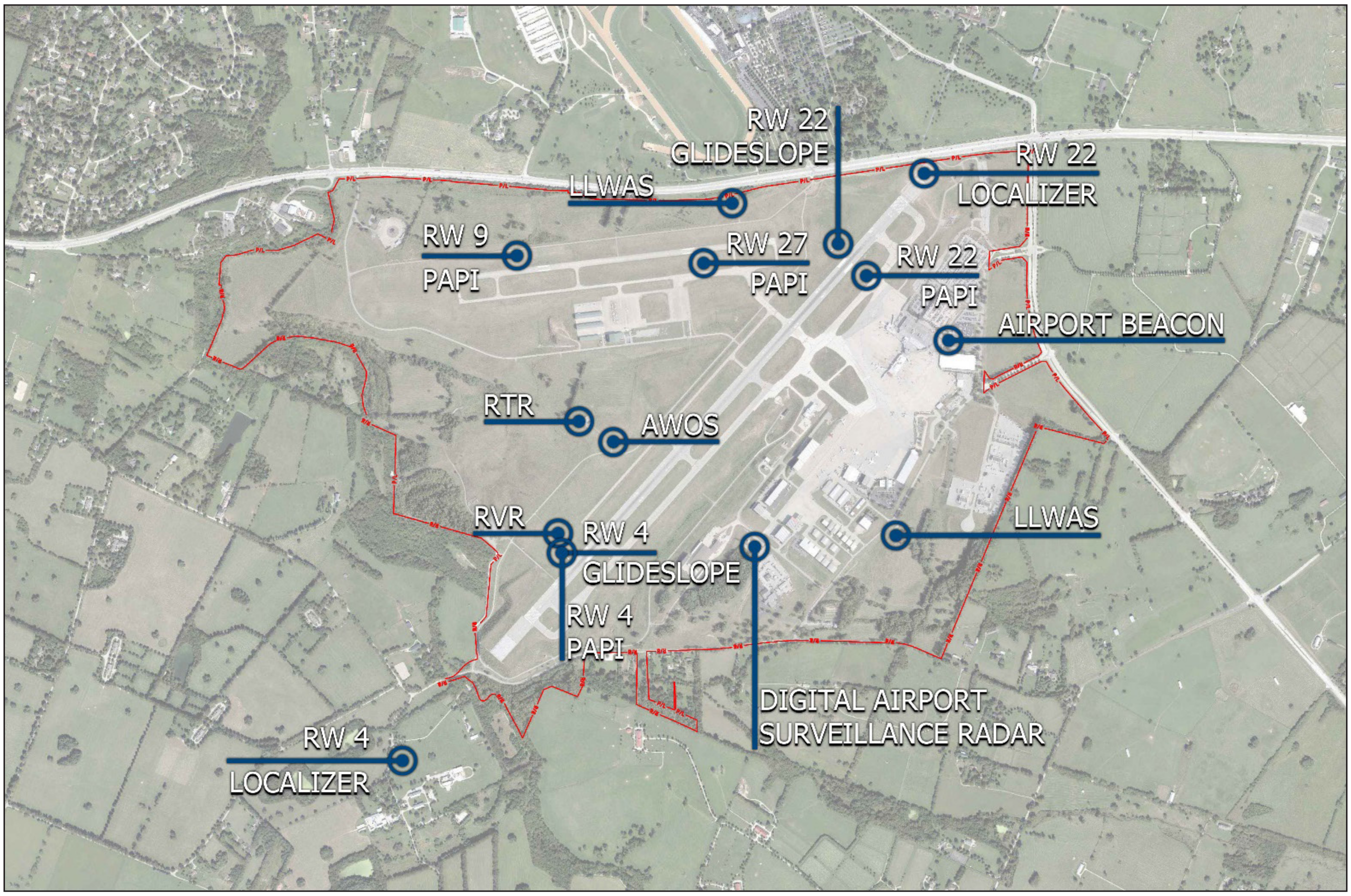
C/L – Centerline Lights
DME – Distance Measuring Equipment
GPS – Global Positioning System
HIRL – High Intensity Runway Lights
ILS – Instrument Landing System
MALSR – Medium Intensity Approach Lighting System with Runway Alignment Indicator
MIRL – Medium Intensity Runway Lighting
PAPI-4 – Four-Box Precision Approach Path Indicator
PAPI-2 – Two-Box Precision Approach Path Indicator
REIL – Runway End Identifier Lights
RNAV – Area Navigation
RNP – Required Navigational Performance
TDZL – Touchdown Zone Lights

4.6.1 VHF Omni Directional Range/Tactical Air Navigation (VORTAC)

VHF Omni-Directional Range/Tactical Air Navigation (VORTAC)

A VORTAC is a ground-based navigational system transmitting 360-degree radio signals along with distance information. These signals are used by aircraft to establish a bearing (or heading) to or between facilities. While the VORTAC signals can be used for en-route navigation, they may serve as a standalone IAP or as a component of an IAP.

Figure 4-10
On-Airport NAVAIDs



Source: CHA, 2024.

The Lexington VORTAC is located approximately seven miles southeast of LEX and provides navigational and landing guidance to the Airport. Currently, the navigational systems that utilize the Lexington VORTAC include:

- VOR-A – The VOR-A IAP is considered a "circling approach" as this approach is not assigned to a specific runway end. Aircraft executing the IAP must maintain a minimum cloud ceiling of 1,540 feet (mean sea level) and a forward visibility of at least one mile before landing.
- Instrument Landing Systems – Both the Runway 4 and Runway 22 instrument landing system IAPs utilize bearings from the Lexington VORTAC to identify waypoint intersections within their approaches as well as missed approach procedures.
- CLEGG FIVE Arrival – The CLEGG FIVE arrival route provides step-by-step guidance to aircraft arriving at LEX via IFR. The CLEGG Five arrival route utilizes three VOR/VORTAC systems to establish waypoint intersections, including the Lexington VORTAC.

As VORs and VORTACs have been outpaced by modern satellite-based technology, the FAA established a minimum operational network (MON) of VORs to reduce the number of operating systems nationwide.

Currently, the Lexington VOR is listed within the MON and is not scheduled for decommissioning. It is recommended that the Lexington VORTAC be maintained throughout the forecast period to continue providing navigational guidance to/from LEX and the greater Lexington/Fayette County region until new technology can fully replace VORTAC usage.

4.6.2 Instrument Approach Systems (ILS)

An ILS is a type of precision IAP that provides both vertical and lateral guidance to the runway. Landing visibility minimums for precision approaches are generally lower than other types of IAPs but require ground-based equipment (e.g., glideslope, localizer, approach lighting system).

Both Runway 4 and Runway 22 are equipped with an ILS and provide a minimum cloud ceiling of 200 feet above ground level. As mentioned, the ILS consists of the following components:

- Glideslope & Localizer Antenna – The glideslope antenna is located adjacent to the runway end and provides aircraft with vertical landing guidance, and the localizer antenna is located 1,000 feet from the runway end and provides horizontal landing guidance. Each antenna has a critical area that must be free of aircraft or vehicles when the official weather observation reports a ceiling of less than 800 feet or visibility of less than two miles. Although each critical area for Runway 4 and 22 is currently free of aircraft and vehicle movement, the potential future extension of Taxiway B should contain an ILS hold short bar to ensure that aircraft positioning for takeoff on Runway 4 does not remain within the Runway 4 glideslope critical area.
- Approach Lighting System – According to FAA guidance, an approach lighting system is required for IAPs providing a landing visibility minimum of less than 0.75 miles. Runway 4 is equipped with a Medium Intensity Approach Light System (MALSR). Currently, the Runway 4 ILS is the only IAP at LEX that provides a 0.5-mile minimum. Therefore, it is recommended the Runway 4 MALSR be maintained throughout the forecast period. It is unlikely the Runway 22 end can achieve a landing minimum of less than 0.75-mile visibility due to limited space and the ability to construct an ALS on this end.

4.6.3 RNAV (GPS) Approaches

An RNAV (Area Navigation) approach is a non-precision, GPS-based IAP that utilizes satellite technology to provide aircraft navigation to the runway environment. This type of approach is widely used at both commercial and GA airports as RNAV (GPS) approaches do not require ground-based navigational equipment. Generally, RNAV (GPS) approaches that are not associated with a precision runway do not provide as low of landing minimums. Each runway at LEX is equipped with an RNAV (GPS) IAP, providing both lateral and vertical landing guidance. Although the Runway 4 and Runway 22 RNAV (GPS) IAPs provide the same landing minimums as each ILS, the landing minimums for the Runway 9 and Runway 27 RNAV (GPS) IAPs are higher (see **Table 2-10)**.

Future development plans may warrant the use of Runway 9-27 as the temporary primary runway during the rehabilitation of Runway 4-22. As such, lower landing minimums are recommended for Runway 9-27 to accommodate the LEX aircraft fleet mix.

4.6.4 Runway Visual Range (RVR)

RVR equipment measures visibility values on the ground and provides the information to aircraft and air traffic control personnel. Currently, LEX has one RVR unit located adjacent to Runway 4. It is recommended that an additional RVR unit be located on the Runway 22 end to provide multidirectional visibility reporting.

4.6.5 Rotating Beacon

The Airport's rotating beacon is located on the east side of the airport near the FAA tower and between Terminal Drive and Man O' War Boulevard. It functions as the indicator for locating the Airport at night and meets current FAA standards. Various terminal alternatives may necessitate the relocation of the rotating beacon. If relocation is required, design standards contained in FAA AC 150/5345-12F should be adhered to.

4.7 Apron Requirements

4.7.1 Terminal Apron

The Terminal Apron is comprised of the facilities used for commercial aircraft gate parking, as well as airline support and servicing operations. The Terminal Apron and its facilities must be able to accommodate the current and future aircraft fleet mix of commercial aircraft. Currently, most commercial aircraft operating on the Terminal Apron consists of Group III aircraft, followed by Group II, and the occasional Group IV aircraft.

> The Terminal Apron and its facilities must be able to accommodate the current and future aircraft fleet mix of commercial aircraft.

Apron Sizing

The current apron, which covers approximately 124,000 square yards, accommodates scheduled commercial operations and diversions, remain overnight (RON) aircraft, and deicing activities.

Future Terminal Apron requirements are largely driven by terminal gate requirements, which will be evaluated in **Section 4.8, *Terminal Area Analysis and Facility Requirements***. Thus, the Terminal Apron facility requirements will be evaluated in conjunction with the terminal gate analysis.

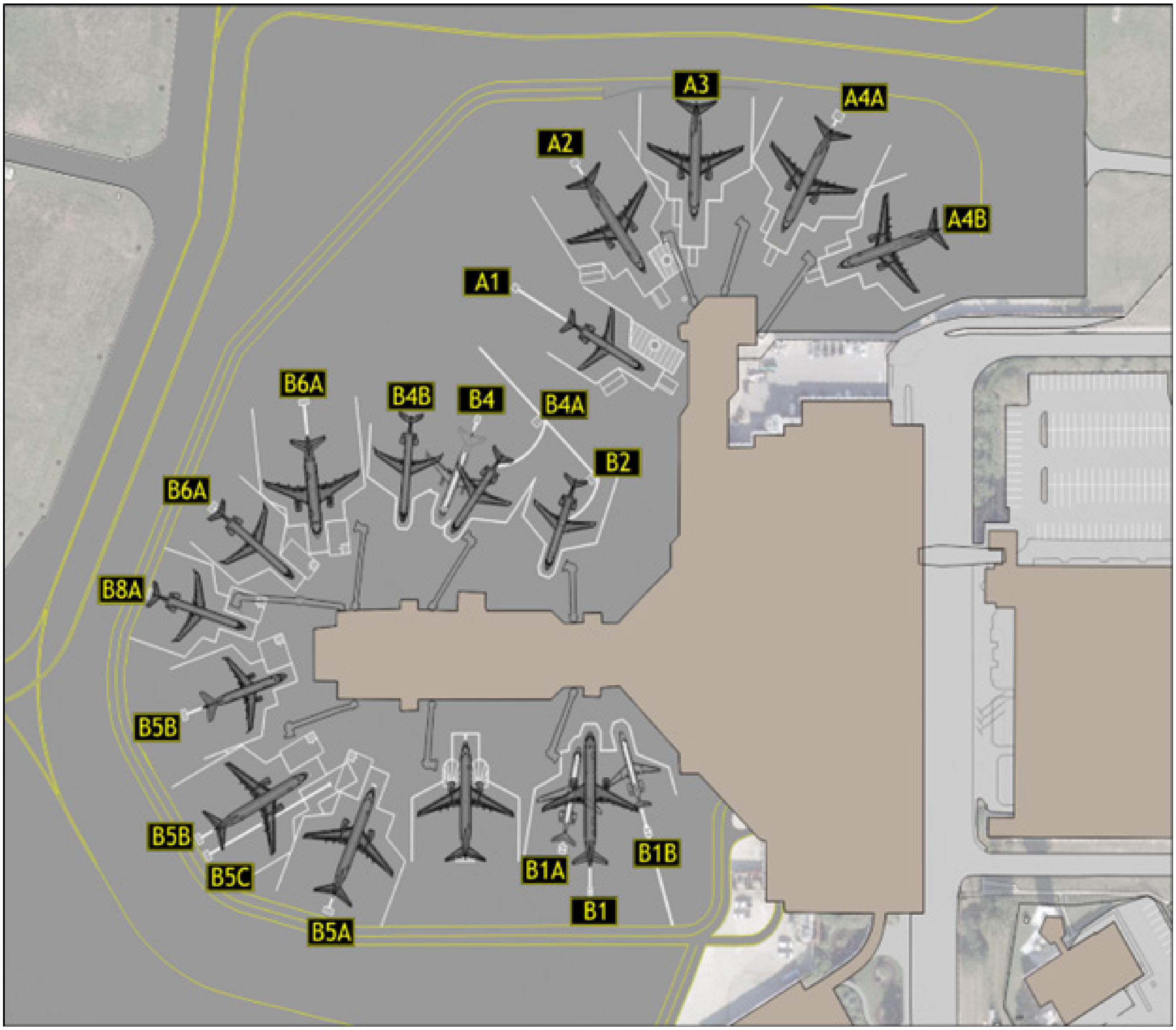
Based on the size of the Terminal Apron and the terminal building configuration, there is an adequate amount of Terminal Apron to sufficiently accommodate the existing and future demand. Should the Airport require it, there is enough apron for additional RON parking, in addition to accommodating a larger fleet of aircraft at the gates.

> Based on the size of the Terminal Apron and the terminal building configuration, there is an adequate amount of Terminal Apron to sufficiently accommodate the existing and future demand.

Current Apron Parking Layout

The Terminal Apron consists of 16 aircraft parking positions: 12 gate parking positions and four remote parking positions. The gate positions can currently accommodate up to Group III aircraft, and the remote positions can support up to Group IV aircraft. **Figure 4-11** depicts the apron parking layout, and **Table 4-29** provides a description of the aircraft accommodated by each gate.

Figure 4-11
Apron Parking Layout



Source: CHA, 2024.

Table 4-29
Aircraft Gate Designations

Aircraft	Length	Wingspan	Tail Height	A1	A2	A3	A4L	A4R	B1	B1A	B1B	B2	B4	B4A	B4B	B5A	B5B	B5C	B6A	B6B	B8A	B8B
CRJ-200	87.8	68.7	20.8	X	X	X	X	X	X			X	X	X	X	X	X		X	X	X	X
CRJ-550	106.1	76.3	24.8	X	X	X	X	X	X			X	X			X	X		X			
CRJ-700	106.6	76.3	24.8		X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X
CRJ-900	118.8	81.5	24.1		X	X	X	X	X			X	X	X	X	X	X		X	X	X	X
ERJ-135	93.4	65.8	22.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
ERJ-145	98	65.8	22.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
ERJ-170	98.1	85.3	32.3		X	X	X	X	X			X	X		X	X	X		X	X	X	X
ERJ-175EWT	106	101.7	32.4		X	X	X	X	X			X	X		X	X	X		X	X	X	X
Boeing 717	124	93.3	29.7		X	X			X			X	X		X	X	X		X	X	X	X
Boeing 737-7	116.7	117.8	41		X	X	X	X	X			X	X			X	X		X			
Boeing 737-8	129.7	117.8	40.3		X	X	X	X	X			X	X			X	X		X			
Boeing 737-9	138.3	117.8	40.8		X	X	X	X	X			X	X			X	X		X			
Boeing 737-10	143.7	117.85	40.3		X	X	X	X	X			X	X			X	X		X			
Boeing 757	178.6	134.8	44.8															X				
Airbus 220-100	127	115.1	38.7		X	X	X	X	X			X	X			X	X		X			
Airbus 220-300	127	115.1	38.7		X	X	X	X	X			X	X			X	X		X			
Airbus 319	111	117.5	39.7		X	X	X	X	X			X	X			X	X		X			
Airbus 320	123.3	117.5	39.6		X	X	X	X	X			X	X			X	X		X			
Airbus 321	146	117.5	39.7		X	X	X	X	X			X	X			X	X		X			

Source: CHA, 2024.

4.8 Terminal Area Analysis & Facility Requirements

The purpose of this section is to analyze the Level of Service (LOS) currently available in each area of the terminal facility and identify the needs for physical or other improvements that may be necessary to maintain the current LOS or higher throughout the planning period.

Abbreviations used throughout this section include, but are not limited to, the following:

ATO = Airline Ticketing Offices
BHS = Baggage Handling System
BSO = Baggage Service Office
CBIS = Checked Baggage Inspection System
CBRA = Checked Baggage Resolution Area
EQA = Equivalent Aircraft
FT = Feet/Foot
FP = Fire Protection
GSF = Gross Square Feet
HR = Hour
IT = Information Technology
LF = Linear Feet
MAP = Million Annual Passengers
No. = Number of, Number
PAX = Passenger
MEP = Mechanical, Electrical, and Plumbing
MIN = Minute
NBEG = Narrow-body Equivalent Gate
NA = Not Applicable
OSR = On-Screen Resolution
PM = Peak Month
PMAD = Peak Month, Average Day
RC = Rental Car
SARA = Service Animal Relief Areas
SF = Square Feet
SSCP = Security Screening Checkpoint
USF = Usable Square Feet
% = Percent
& = And
– = Not Provided

4.8.1 Terminal Facility Needs Summary

A summary of the needs for each of the terminal areas analyzed and evaluated is presented in **Table 4-30**. The areas (SF) are usable square footage numbers (USF) [i.e., they are not gross square footage numbers (GSF), which would include walls, structure, chases, voids, etc.].

Table 4-30
Terminal Facility Needs Summary

Area/Processor Area/Number	*Existing* [1]	PAL 1	PAL 2	PAL 3	PAL 4
Gates					
Recommended Gate Demand Summary – *No.*	*12*	12	12	**13**	**14**
Narrow-body Equivalent Gates (NBEG) – *No.*	*10*	**10.8**	**10.8**	**11.8**	**12.8**
Equivalent Aircraft Gates (EQA) – *No.*	*6*	**7.1**	**7.1**	**8.1**	**8.6**
Concourse Holdrooms					
Single NBEG Holdroom Area – *SF*	*1,957*	**3,007**	**2,911**	**2,950**	**3,023**
TOTAL HOLDROOM SPACE REQUIRED – *SF*	*15,976* [4]	**32,475**	**31,439**	**34,810**	**38,694**
Concourse A Single-Loaded Corridor Length – *LF*	*234*	**524**	**524**	**614**	**622**
Concourse A Circulation – Single-Loaded Corridor Area – *SF*	*5,598*	**10,524**	**10,524**	**12,280**	**12.44**
Concourse B Double-Loaded Corridor Length – *LF*	*352*	**510**	**510**	**557**	**604**
Concourse B Circulation – Double-Loaded Corridor Area – *SF*	*8,018*	**15,300**	**15,300**	**16,710**	**18,120**

Area/Processor Area/Number	*Existing* [1]	PAL 1	PAL 2	PAL 3	PAL 4
Airline – Check-in, ATO & Operations Processors					
Total Passenger Check-in Stations – *EA*	*25* [3]	22	24	24	25
Total Bag Drop Stations – *EA*	–	5	6	7	8
Check-in Processes (Ticketing) – *SF*	*5,000* [7]	**5,940**	**6,264**	**6,504**	**6,984**
Circulation – Check-in – *SF*	*1,222*	**2,970**	**3,182**	**3,252**	**3,492**
TOTAL PAX CHECK-IN HALL AREA – *SF*	*6,222*	**8,910**	**9,446**	**9,756**	**10,476**
Airline Ticketing Offices (ATO) – *SF*	*8,863*	4,200	4,200	4,200	4,900
Concourse Airline Operation Areas (OPS) – *SF*	*2,025*	**6,610**	**7,510**	**8,420**	**9,390**
Passenger Security Screening Checkpoint (SSCP) Processors [1]					
Security Screening Area Required (10-Minute Queue Wait Used)					
Number of Lanes Required – *No.*	*3*	**4**	**5-6**	**5-6**	**5-6**
SECURITY SCREENING AREA (SCREENING & QUEUING) – *SF*	*4,526*	**8820** [5]	**13,230** [5]	**13,230** [5]	**13,230** [5]
Circulation – Exit Lane Area – *SF*	*3,967*	2,646	**3,969**	**3,969**	**3,969**
TSA Support Area/LEO – *SF*	*755*	175	175	175	175
Meeter and Greeter (Well-wisher) Lobbies – *SF*	*2,086*	1,840	**2,093**	**2,346**	**2,622**
Baggage – CBIS, Outbound, and Inbound					
Outbound Baggage Screening (CBIS) – *SF*	*10,230* [2]	10,230	10,230	**15,170**	**15,170**
Outbound Bag Make-up (BHS) – *SF*	*14,896*	**15,600**	**15,600**	**17,900**	**19,000**
Inbound Sort Make-up and Feed – *SF*	*4,281*	3,897	3,897	3,897	**4,871**
Baggage Claim Carousels – *No.*	*2*	**3**	**3**	**3**	**4**
Inbound Baggage Claim – *SF*	*7,768*	6,128	7,704	**8,244**	**9,856**
Airline Baggage Service Offices (BSO) – *SF*	*580*	**1,000**	**1,250**	**1,250**	**1,250**
Circulation – Baggage Claim – *SF*	*5,212*	3,064	3,852	4,112	4,928
Concessions					
Pre-Security Concessions – Food and Beverage, Gift and News					
Food and Beverage – *SF*	*3,873* [8]	**952**	**1,083**	**1,213**	**1,352**
Gift and News – *SF*	*4,045*	294	335	375	418
Services – *SF*	*42*	**485**	**551**	**618**	**688**
SUBTOTAL PRE-SECURITY – *SF*	*7,960*	1,732	1,968	2,205	2,459
Post Security Concessions – Food and Beverage, Gift and News					
Food and Beverage – *SF*	*5,670*	**10,597**	**12,045**	**13,497**	**15,049**
Gift and News – *SF*	*2,913*	**4,831**	**6,153**	**6,153**	**6,860**
Services – *SF*	*42*	**156**	**198**	**198**	**221**
SUBTOTAL POST SECURITY – *SF*	*8,625*	**15,584**	**19,682**	**19,849**	**22,130**
Post Security Concessions – Food and Beverage, Gift and News					
Concession Storage – *SF*	*273*	3,463	**3,936**	**4,411**	**4,918**
Concession Circulation – *SF*	*7,427*	5,195	5,905	6,616	7,377
Rental Car Concessions					
Rental Car Retail Modules – *No.*	4	4	4	**5**	**5**

Area/Processor Area/Number	*Existing* [1]	PAL 1	PAL 2	PAL 3	PAL 4
Total Rental Car Concessionaire Areas – *SF*	*1,226*	**2,280**	**2,280**	**2,850**	**2,850**
Circulation Area – Rental Car Counters – *SF*	*368*	**684**	**684**	**855**	**855**
Airport Areas					
Airport Information Area – *SF*	*150*	150	150	150	150
Total Airport Administration – *SF*	*16,936*	**17,928**	**17,928**	**19,588**	**21,248**
Total Airport Terminal Operations Area – *SF*	*5,930*	**6,275**	**6,275**	**6,856**	**7,437**
TSA Administration Areas					
TSA Administration Area – *SF*	*2,390*	**2,510**	**2,635**	**2,767**	**2,905**
Public Restroom Facilities					
Concourse Restroom Facility Areas – Secure Airside					
Concourse A & B Restroom Area – M & W – *SF*	*2,884* [6]	2,590	2,590	**3,100**	**3,100**
Lactation Room Area – *SF*	*0*	**85**	**85**	**170**	**170**
Family Room Area – *SF*	*90*	**105**	**105**	**210**	**210**
Custodial Area – *SF*	*357*	165	165	330	330
TOTAL	*3,331*	2,945	2,945	**3,810**	**3,810**
TIX Check-in Restroom Facility Areas – Non-Secure Landside					
Check-in Restroom Area – M & W – *SF*	*1,407*	**1,270**	**1,630**	**1,905**	**2,000**
Lactation Room Area – *SF*	*0*	**85**	**85**	**85**	**85**
Family Room Area – *SF*	*80*	**105**	**105**	**105**	**105**
Custodial Area – *SF*	*612*	165	165	165	165
TOTAL	*2,099*	1,625	1,985	**2,260**	**2,355**
Baggage Claim Restroom Facility Areas – Non-Secure Landside					
Bag Claim Restroom Area – M & W – *SF*	*1,137*	**1,450**	**1,905**	**1,905**	**2,335**
Lactation Room Area – *SF*	*0*	**85**	**85**	**85**	**85**
Family Room Area – *SF*	*0*	**105**	**105**	**105**	**105**
Custodial Area – *SF*	*0*	**165**	**165**	**165**	**165**
TOTAL	*1,137*	**1,805**	**2,260**	**2,260**	**2,440**
Other Considerations					
Service Animal Relief Area (SARA) – *SF*	*204*	**225**	**225**	**225**	**225**
Total Storage Area – *SF*	*2,487*	**2,611**	**2,742**	**2,879**	**3,023**
Total MEP & IT Area – *SF*	*13,597*	**14,957**	**16,452**	**18,098**	**19,907**

[1] Denotes existing conditions in the terminal building for comparison to forecasted PAL facility needs

[2] Existing square footage represents pending CBIS Project once completed

[3] Includes self-service kiosk in ticketing counter and service agent positions at ticketing counter

[4] Area at concourse level only for 12 gates

[5] 10-minute queuing

[6] SSCP restrooms not included with concourse restrooms

[7] Kiosks and bag drops included

[8] Included kitchen area for post-security food and beverage

Those numbers depicted in italics indicate existing conditions.

Numbers in **RED** represent a deficiency in space based on existing conditions.

Source: CHA, 2024.

4.8.2 Passenger Activity Variables

The following data indicated in **Table 4-31** represents the different passenger activity variables used to evaluate and determine the processor and other function group needs throughout the planning horizons.

Table 4-31
Passenger Activity Variables

Areas	*Existing*	PAL 1	PAL 2	PAL 3	PAL 4
Load Factors – %	*71.0*	83.2	80.0	81.2	84.0
Annual Enplaned PAX – *No.*	*464,169 [9]*	961,994	1,093,451	1,225,263	1,366,059
Peak-hour Enplaned PAX [1] – *No.*	*319*	661	751	842	939
Peak-hour Origination PAX [2] – *No.*	*309*	641	728	817	911
Peak 30-minute Enplaned PAX [3] – *No.*	*160*	331	376	421	470
Peak 30-minute Originating PAX [4] – *No.*	155	321	364	408	455
Peak 20-minute Enplaned PAX [5] – *No.*	*155*	321	364	408	455
Annual Deplaned PAX – *No.*	*464,169 [9]*	961,994	1,093,451	1,225,263	1,366,059
Peak-hour Deplaned PAX – *No.*	*319*	661	751	842	939
Peak-hour Terminating PAX [6] – *No.*	*309*	641	728	817	911
Peak 30-minute Deplaned PAX [7] – *No.*	*160*	331	376	421	470
Peak 30-minute Terminating PAX [8] – *No.*	*155*	321	364	408	455

[1] Include surge factor
[2] 97% of peak-hour enplaned PAX
[3] 50% of peak-hour enplaned PAX
[4] 97% of peak 30-minute enplaned PAX
[5] Same as peak 30-minute enplaned PAX
[6] 97% of peak hour deplaned PAX
[7] 50% of peak hour deplaned PAX
[8] 97% of peak 30-minute deplaned PAX
[9] COVID Year
Source: CHA, 2024.

4.8.3 Processor Areas Evaluated

Terminal facility requirements in a Master Plan Study typically address each major processor area of the passenger terminal building. Facility utilization evaluates the building by use of accepted value systems informed by industry space standards and guidelines, as provided by the International Air Transport Association (IATA) Level of Service (LOS) standards. Level C standards were used for this Study, unless otherwise indicated. A summary of the major processor area evaluated is as follows:

- Aircraft gate demand
- Concourse holdrooms
- Concourse circulation
- Check-in, ticketing, and baggage drop lobby (ticket lobby)
- Airline ticketing offices (ATO)

- Airline operations areas at gates (concourses)
- Passenger security screening checkpoint (SSCP) and queuing
- Checked baggage inspection and security (CBIS) outbound baggage screening
- Outbound (inbound) baggage make-up
- Inbound baggage load belt feeds
- Inbound baggage claim

Additional evaluations were conducted to further determine programmatic terminal requirements to accommodate the changing passenger activity and trends at LEX. Specific terminal component demands, quantified by area square footage, were generated by applying FAA and IATA industry standards alongside other supporting guidelines. Development of the program projections encompassed included the following:

- Annual and peak hour passenger enplanement data
- Peak hour passenger deplanement data
- Annual and peak month, peak day aircraft operations data
- Fleet mix changes through the PALs
- Load factor changes through the PALS
- IATA LOS Standards

Publications by the Transportation Research Board (TRB) and IATA are also referenced and sourced. These additional publications served strictly as technical references (thus not substituting FAA policy). Referenced documents and publications included, but were not limited to:

- Airport Cooperative Research Program (ACRP) Synthesis 84, *Transportation Network Companies: Challenges and Opportunities for Airport Operators*
- ACRP, *Report 25 – Airport Passenger Terminal Planning and Design, Volume 2: Spreadsheet Models and User's Guide*
- ACRP, *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design*
- ACRP, *Report 54 – Resource Manual for In-Terminal Concessions, 2011*
- IATA, Airport Development Reference Manual (ADRM), 9th Edition
- US Department of Transportation, *Federal Aviation Administration, Systems Research & Development Service Report No. FAA-RD-75-191 – The Apron & Terminal Building Planning Manual, July 1975*
- US Customs and Border Protection, *Airport Technical Design Standard, 2016*

Non-Processor Areas Evaluated

Additional non-processor function areas were evaluated and included in this chapter, including:

- Meeter and greeter (well-wishers) lobby
- Concessions: Food and beverage, gift and news, services and rental car
- Airport administration
- Airport terminal operations

- Transportation Security Administration (TSA) office administration
- Restroom facilities
- Service animal relief areas (SARA)
- Storage requirements
- Mechanical, electrical, plumbing, and information technology systems (MEPIT)

Industry standards and guidelines were applied in the analyses with appropriate modifications to reflect LEX airline tenant needs, passenger processor functions, and passenger activities.

By comparing the programmatic spatial requirements for each PAL to the Base Year (2021, or existing conditions), the recommended terminal needs and requirements to accommodate the projected passenger activity levels were identified. The forecasted passenger demand throughout the planning period shows a steady increase. It is important to understand that the projected enplanement growth does not predetermine equal or proportional expansion across all passenger processor areas. Decisions pertaining to expanding or decreasing space considered several factors aside from enplanements, passenger behavior, and industry trends. For example, aviation industry trends show passengers are becoming more self-reliant and are using self-service functions, especially as a by-product of COVID. In addition, airlines at LEX are transitioning their fleet to include larger narrow-body aircraft.

Moreover, security, passenger screening, and checked baggage screening requirements, as administered by the federally legislated US Department of Homeland Security (DHS) or the TSA at airports, will often be perceived as growing disproportionally relative to other passenger processor areas.

For the purposes of determining the spatial needs of the terminal areas throughout the PALs, the analyses were each conducted as a "free-body analysis." Thus, area determinations did not strongly consider the existing layout, size, and configuration as a variable in determining spatial needs; however, it should be noted that the existing terminal was built before technological advancements, enhanced concessions, and security affecting passenger behavior and needs. These realities will be addressed in the development of planned alternatives for existing and future needs and improvements driven by demand.

Gate Demand Summary

The data presented in **Table 4-32** indicates the gate demands used to evaluate and determine the processor and other function groups' needs throughout the planning horizons.

Table 4-32
Preferred Gate Demand Summary

Areas	*Existing*	PAL 1	PAL 2	PAL 3	PAL 4
Gate Demand Analysis					
Gate Forecast Demand – *No.*	*12*	12	12	**13**	**14**
Narrow-body Equivalent Gates (NBEG) – *No.*	*10.2*	**10.8**	**10.8**	**11.8**	**12.8**
Equivalent Aircraft Gates (EQA) – *No.*	**6.4**	**7.1**	**7.1**	**8.1**	**8.6**

Those numbers depicted in italics indicate existing conditions.

Numbers in **RED** represent a deficiency in space based on existing conditions.

Source: CHA, 2024.

4.8.4 Level of Service (LOS)

As shown in **Table 4-33**, IATA's *Airport Development Reference Manual, 12th Edition*, provides established LOS grades, which were utilized to judge the adequacy of terminal features at LEX. For this Study, the intended LOS goal was 'C' or 'Good.' LOS C is typically used as a baseline performance criterion target for most airport terminals and is recommended by IATA as the minimum design standard as it denotes "good level of service."

Table 4-33
IATA Level of Service Grades

Level of Service (LOS) Grade		Level of Service Description
A	Excellent	Excellent level of service; condition of free flow; excellent level of comfort
B	High	High level of service; condition of stable flow; very few delays; high level of comfort
C	Good	Good level of service; condition of stable flow; acceptable good level of comfort
D	Adequate	Adequate level of service; condition of unstable flow; acceptable delays for short periods of time; adequate level of comfort
E	Inadequate	Inadequate level of service; conditions of unstable flow; unacceptable delays; inadequate level of comfort
F	System Breakdown	Unacceptable level of service; condition of cross flows; system of breakdown and unacceptable delays; unacceptable level of comfort

Source: International Air Transport Association (IATA), ADRM, 12th Edition, CHA, 2024.

4.8.5 Aircraft Gate Demand Analysis

The current terminal gate configuration has 12 contact gates. With all 12 gates assumed to be operationally equal, each gate has approximately 2.50± departures per peak month/peak average day as evaluated in a COVID year. As the Base Year for the forecast is at the tail end of a COVID recovery, this was not an acceptable beginning point to start a gate need analysis.

To get a complete picture of LEX service and functionality, it was important to benchmark with other similar airports that provide comparable carriers and flight services. In the case of low-cost carriers, such as Allegiant, industry standards reflect a target range of 3.00 - 3.75 departures per gate per day. Analysis at LEX should consider this stipulation and apply similar design criteria to maintain an acceptable LOS throughout its terminal considerations. Historically, small hub airports have lower departures per gate per average day than medium or large hub airports.

In the context of gate planning, the definition of "gate" is one aircraft parking position per one contact gate. Building on this, appropriate assumptions were established, which were benchmarked with other similar airports for departures per peak month/peak average day to conduct a gate need analysis.

Beyond low-cost carriers, the LEX gate demand analysis considered factors that specifically affect terminal usage. This included seasonal traffic surges, ultra-low-cost airfare share, gate management, and physical space available. All these factors have a profound impact on terminal analysis, as described throughout this section.

For planning purposes, it is essential to align the analysis performed with a rational set of real-world figures. Future terminal gate allotments should be determined as accurately as possible. Data given will be compared with non-hub and small-hub airports, with these levels held consistent throughout the entire analysis attached.

Gate demand of more than 3.50 daily departures was not accounted for unless otherwise indicated and explained. It must be noted that examined norms do not typically exceed this figure but maximized gate structures may allow such a number to come to fruition. This would affect the total number of gates available at LEX.

Gate utilization determines gate demand, though other variables also impact gate planning analysis, such as fleet mix and departure load factors. Gate demand is not solely a function of enplanement growth, while other variables remain stationary. For example, over the 20-year planning horizon, fleet mixes are expected to include larger planes with more seats. As passenger departures increase alongside plane size, departures may contract to achieve an equilibrium point. Considering this, planning forecast assumptions were made where applicable to develop the forecasted gate demand analysis.

A straight-line, annualized enplaned passengers per gate forecast is presented in **Table 4-34**. This table does not depict a peak month enplaned passenger per gate forecast. See **Table 4-35** for peak month enplaned passenger per gate forecast.

Table 4-34
Annual Average Enplaned Passenger per Gate Forecast Approach

Year	Annual Enplaned PAX	Annual Departures [1]	# of Gates	Annual Average Enplaned PAX per Gate	Annual Average Enplaned PAX per Departure	Annual Average Turns per Gate
Existing [2]	*464,169 [2]*	*8,644*	*12*	*38,681*	*53.7*	*720*
PAL 1	**961,994**	**10,804**	**12**	**80,166**	**89.0**	**900**
PAL 2	**1,093,451**	**12,040**	**12**	**91,121**	**90.8**	**1,003**
PAL 3	**1,225,263**	**12,871**	**13**	**94,251**	**95.2**	**990**
PAL 4	**1,366,059**	**13,584**	**14**	**97,576**	**100.6**	**970**

[1] Assumes Total Annual Commercial Operation ÷ 2 = Annual Commercial Departures. See **Table 4-1.**
[2] COVID Year
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook*, CHA, 2024.

Peak month enplaned passenger per gate forecast is depicted in **Table 4-35**.

Table 4-35
Peak Month Enplaned Passenger per Gate Forecast Approach

Year	Peak Month Enplaned PAX	Peak Month Departures [1]	# of Gates	Peak Month Average Enplaned PAX per Gate	Peak Month Average Enplaned PAX per Departure	Peak Month Average Turns per Gate
Existing [2]	*54,915* [2]	*897*	*12*	*4,576*	*61*	*75*
PAL 1	**113,812**	**1,121**	**12**	**9,484**	**102**	**93**
PAL 2	**129,364**	**1,250**	**12**	**10,780**	**103**	**104**
PAL 3	**144,959**	**1,336**	**13**	**11,151**	**109**	**103**
PAL 4	**161,616**	**1,410**	**14**	**11,544**	**115**	**101**

[1] Assumes Total Peak Month Operations ÷ 2 = Peak Month Departures. **See Table 4-1.**
[2] COVID Year
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook*, CHA, 2024.

A straight-line, annualized daily departure per gate forecast is presented in **Table 4-36**. This table does not depict a peak month, average day departures per gate forecast. Daily departures and annual departures per gate are both controlled at baseline figures.

Table 4-36
Daily Average Departures per Gate Forecast Approach

Year	Annual Enplaned PAX	Average Day Departures [1]	# of Gates	Average Day PAX per Gate	Average Daily Turn per Gate
Existing [2]	*464,169*	*29*	*12*	*106*	*2.42*
PAL 1	**961,994**	**36**	**12**	**220**	**3.00**
PAL 2	**1,093,451**	**41**	**12**	**250**	**3.41**
PAL 3	**1,225,263**	**43**	**13**	**258**	**3.30**
PAL 4	**1,366,059**	**46**	**14**	**267**	**3.29**

[1] Assumes Average Day Operations ÷ 2 = Average Day Departures. See **Table 4-1.**
[2] Covid Year
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook*, CHA, 2024.

The peak month departures per gate forecast is presented in **Table 4-37**. This table illustrates the calculated gates needed to maintain the standard departures for both peak month average turns per gate and peak month average day turns per gate.

Table 4-37
Peak Month Departures per Gate Forecast Approach

Year	Peak Month Enplaned PAX	Peak Month Departures [1]	# of Gates	Peak Month Average Turns per Gate	Peak Month, Average Day PAX per Gate	Peak Month, Average Daily Turns per Gate
Existing [2]	*54,915*	*897*	*12*	*75*	*153*	*2.5*
PAL 1	**113,812**	**1,121**	**12**	**94**	**316**	**3.13**
PAL 2	**129,364**	**1,250**	**12**	**104**	**359**	**3.47**
PAL 3	**144,959**	**1,336**	**13**	**102**	**371**	**3.40**
PAL 4	**161,616**	**1,410**	**14**	**101**	**384**	**3.36**

[1] Assumes Total Peak Month Operation ÷ 2 = Peak Month Departures. See **Table 4-1**.
[2] Covid Year
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook*, CHA, 2024.

A summary of the calculated number of gates needed across given approaches is provided in **Table 4-38**.

Table 4-38
Gate Forecast Demand

	Table	BASE	PAL 1	PAL 2	PAL 3	PAL 4
Annual Enplaned Passenger/Gate Approach	4-5	12	12	12	**13**	**14**
Peak Month Enplaned Passenger/Gate Approach	4-7	12	12	12	**13**	**14**
Daily Departures per Gate Forecast Approach	4-8	12	12	12	**13**	**14**
Peak Month, Average Day Departures/Gate Forecast Approach	4-9	12	12	12	**13**	**14**
RECOMMENDATION FOR GATES	–	–	12	12	**13**	**14**

Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: CHA, 2024.

Narrow-Body Equivalent Gates and Equivalent Aircraft Gate Analysis
As previously discussed in **Section 4.1**, the "design aircraft" or "design aircraft family" represents the most demanding aircraft or grouping of aircraft with similar characteristics (relative to AAC, ADG, TDG) that are currently using LEX. After a review of operations, the Boeing 737-800 (ADG D-III, TDG of 3) is the most current demanding passenger aircraft operating at LEX.

The current and projected design aircraft family, as presented, is used as the basis for normalizing the terminal gates at the Airport and for conducting the gate equivalencies analyses. Gate equivalency analyses were useful in determining holdroom spatial requirements, as well as determining other processor evaluations and aircraft ramp frontage requirements at the terminal concourses. The results of the analyses are summarized in **Table 4-30**.

It is important to note that the definition of the term "gate" refers only to a parking position assigned to a scheduled aircraft for enplanement and deplanement of passengers. The term is applied as a number without consideration of the size of the aircraft. To standardize the definition of gates when determining processor sizing requirements, two metrics were developed: *Narrow-body Equivalent Gates* (NBEG), specifically for sizing holdrooms and *Equivalent Aircraft* (EQA) to size other processor areas. **Table 4-39** sets forth the determination for NBEG and EQA.

Table 4-39
Gate Equivalencies

Design Group	Class and Aircraft	Existing # of Gates	NBEG		EQA	
			Maximum Wingspan (ft)	Index	Typical Seats Average	Index
BASE Gate Equivalencies						
I	Small Regional (Metro, B99, J31)	*0*	49	0.4	25	0.2
II	**Medium Regionals (C-II)**	**6**	**79**	**0.7**	**50**	**0.4**
III	**Large Regionals (C-III)**	**4**	**118**	**1.0**	**75**	**0.5**
III	**Narrow-body (C-III, D-III)**	**2**	**118**	**1.0**	**186**	**1.0**
IIIa	B757 (B757, B757 w/Winglets)	*0*	135	1.1	185	1.3
IV	Wide-body (B767)	*0*	171	1.4	280	1.9
V	Jumbo (B747, B777, A330, A340)	*0*	214	1.8	400	2.8
VI	A380 (A380, B747-8)	*0*	262	2.2	525	3.6
BASE (Existing) Totals		**12**	**NBEG**	**10.2**	**EQA**	**6.4**
PAL 1 Gate Equivalencies						
I	Small Regional (Metro, B99, J31)	0	49	0.4	25	0.2
II	**Medium Regionals (C-II)**	**4**	**79**	**0.7**	**50**	**0.4**
III	**Large Regionals (C-III)**	**5**	**118**	**1.0**	**75**	**0.5**
III	**Narrow-body (C-III, D-III)**	**3**	**118**	**1.0**	**186**	**1.0**
IIIa	B757 (B757, B757 w/Winglets)	0	135	1.1	185	1.3
IV	Wide-body (B767)	0	171	1.4	280	1.9
V	Jumbo (B747, B777, A330, A340)	0	214	1.8	400	2.8
VI	A380 (A380, B747-8)	0	262	2.2	525	3.6
PAL 1 Totals		**12**	**NBEG**	**10.8**	**EQA**	**7.1**
PAL 2 Gate Equivalencies						
I	Small Regional (Metro, B99, J31)	0	49	0.4	25	0.2
II	**Medium Regionals (C-II)**	**4**	**79**	**0.7**	**50**	**0.4**
III	**Large Regionals (C-III)**	**5**	**118**	**1.0**	**75**	**0.5**
III	**Narrow-body (C-III, D-III)**	**3**	**118**	**1.0**	**186**	**1.0**
IIIa	B757 (B757, B757 w/Winglets)	0	135	1.1	185	1.3
IV	Wide-body (B767)	0	171	1.4	280	1.9
V	Jumbo (B747, B777, A330, A340)	0	214	1.8	400	2.8

Design Group	Class and Aircraft	Existing # of Gates	NBEG		EQA	
			Maximum Wingspan (ft)	Index	Typical Seats Average	Index
VI	A380 (A380, B747-8)	0	262	2.2	525	3.6
PAL 2 Totals		**12**	**NBEG**	**10.8**	**EQA**	**7.1**
PAL 3 Gate Equivalencies						
I	Small Regional (Metro, B99, J31)	0	49	0.4	25	0.2
II	**Medium Regionals (C-II)**	**4**	**79**	**0.7**	**50**	**0.4**
III	**Large Regionals (C-III)**	**5**	**118**	**1.0**	**75**	**0.5**
III	**Narrow-body (C-III, D-III)**	**4**	**118**	**1.0**	**186**	**1.0**
IIIa	B757 (B757, B757 w/Winglets)	0	135	1.1	185	1.3
IV	Wide-body (B767)	0	171	1.4	280	1.9
V	Jumbo (B747, B777, A330, A340)	0	214	1.8	400	2.8
VI	A380 (A380, B747-8)	0	262	2.2	525	3.6
PAL 3 Totals		**13**	**NBEG**	**11.8**	**EQA**	**8.1**
PAL 4 Gate Equivalencies						
I	Small Regional (Metro, B99, J31)	0	49	0.4	25	0.2
II	**Medium Regionals (C-II)**	**4**	**79**	**0.7**	**50**	**0.4**
III	**Large Regionals (C-III)**	**6**	**118**	**1.0**	**75**	**0.5**
III	**Narrow-body (C-III, D-III)**	**4**	**118**	**1.0**	**186**	**1.0**
IIIa	B757 (B757, B757 w/Winglets)	0	135	1.1	185	1.3
IV	Wide-body (B767)	0	171	1.4	280	1.9
V	Jumbo (B747, B777, A330, A340)	0	214	1.8	400	2.8
VI	A380 (A380, B747-8)	0	262	2.2	525	3.6
PAL 4 Totals		**14**	**NBEG**	**12.8**	**EQA**	**8.6**

Those numbers depicted in italics indicate existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook,* CHA, 2024.

4.8.6 Concourse Holdrooms

When calculating holdroom square footage, all gates were equalized to meet narrow-body aircraft standards. The goal of this analysis was to determine the optimal holdroom size for LEX while taking into consideration load factors, total passenger traffic, and varying specific constraints necessary for terminal efficiency. Analysis was centered on accommodating Design Group III aircraft, as this category was determined to be the most appropriate considering long-term forecasted traffic.

The calculations made for holdroom area across the planning horizon are depicted in **Table 4-40**. Most importantly, the seat number on the design aircraft is assumed to be 186. This number represents Allegiant seats on an A320 and captures the seating capacities for a B737-800 aircraft also. In addition, evaluations were conducted based on a LOS B/C, which mandates 15 square feet for seated passengers and 10 square feet for standing passengers. In comparison, LOS A would allot 17 square feet for seated passengers and 12 square feet for standing passengers.

Table 4-40
Single NBEG Holdroom Area Evaluation

	Existing		**PAL 1**		**PAL 2**		**PAL 3**		**PAL 4**	
			Input	**Out**	**Input**	**Out**	**Input**	**Out**	**Input**	**Out**
Seats on Design Aircraft – *No.*	186		186		186		186		186	
Load Factors (%)	*71.0%*		83.2%		80.0%		81.2%		84.0%	
# of Design Passengers	**–**		**155**		**149**		**151**		**156**	
% PAX Seated	*80%*	*106*	80%	124	80%	119	80%	122	80%	125
% PAX Standing	*20%*	*26*	20%	31	20%	30	20%	29	20%	31
Seated PAX Area – *SF*	*15*	*1,590*	15	1,860	15	1,785	15	1,830	15	1,875
Standing PAX Area – *SF*	*10*	*260*	10	310	10	300	10	290	10	310
Seated & Standing Area – *SF*		**1,850**		**2,170**		**2,085**		**2,120**		**2,185**
% Increase for Amenities	*10%*	***185***	10%	**217**	10%	**209**	10%	**212**	10%	**219**
% Increase for High Utilization	*5%*	***93***	5%	**109**	5%	**104**	5%	**106**	5%	**109**
Holdroom Share Factor-(Decrease)	*-3%*	***-56***	-3%	**-65**	-3%	**-63**	-3%	**-64**	-3%	**-66**
Adj. Seated/Standing Area (SF)	**–**		**2,431**		**2,335**		**2,374**		**2,447**	
Podium Width/Position – *FT*			4		4		4		4	
Depth of Podium to Back Wall – *FT*			8		8		8		8	
Podium Queue Depth – *FT*			15		15		15		15	
Area/Podium Position – *SF*		92		92		92		92		92
Podium Positions – *No.*			2		2		2		2	
Total Podium & Queue – *SF*		184		184		184		184		184
Boarding/Exit Corridor Width – *FT*			6		6		6		6	
Depth of Holdroom – *FT*			25		25		25		25	
Boarding/Egress per Bridge – *SF*		150		150		150		150		150
Bridges/Gate – *No.*			1		1		1		1	
Boarding Corridor Area – *SF*		150		150		150		150		150
Single NBEG Holdroom Area – *SF*	***(1,957)***		**3,007**		**2,911**		**2,950**		**3,023**	

Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook,* CHA, 2024.

Table 4-41 follows, which indicates inclusive holdroom space requirements as calculated in this Study throughout the planning horizon (represented by given PALs).

Table 4-41
Inclusive Holdroom Space Requirements

Function	*Existing*	PAL 1	PAL 2	PAL 3	PAL 4
NBEG Factor – *No.*	*10.2*	10.8	10.8	11.8	12.8
Each Holdroom Area – *SF*	–	3,007	2,911	2,950	3,023
Total Holdroom Area – *SF*	***23,500***	**32,475**	**31,439**	**34,810**	**38,694**

Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: CHA, 2024.

4.8.7 Concourse Circulation

To provide an efficient and pleasant flying experience, concourse circulation must be sized in accordance with forecasted passenger activity. More passengers, heightened air services, and an expanded fleet mix necessitate right-sizing in concourse circulation.

The LEX terminal exhibits a single-loaded concourse format (Concourse A) and a double-loaded concourse format (Concourse B). Both concourses were evaluated according to their respective configurations. For concourses without moving walkways, a corridor width of 20 feet is acceptable for single-loaded concourses and a 30-foot width for double-loaded concourses, defined as follows:

- Single-loaded Concourse – Gates on one-side of concourse only
- Double-loaded Concourse – Gates of both-sides of concourse

For concourses with moving walkways, 15 feet on both sides of the walkway is recommended to allow uncongested circulation. However, many factors can impact corridor width, including, but not limited to:

- Accessibility
- Advertising
- Drinking fountains
- Restrooms
- Concessions
- Building structure
- People mover carts
- Vending machines

Analyses conducted considered the number of NBEG aircraft and accounted for a wingtip width requirement of 118 feet, as indicated in **Table 4-39**. Calculations also added 25 feet for wingtip clearance between NBEG aircraft and determined an aircraft frontage factor of 143 feet. The methodology to determine double-loaded corridor length multiplied the frontage factor by the planning horizon number of NBEG divided by two. To determine the area for circulation, the resultant length was multiplied by 30 feet of width.

Single corridors can be determined by multiplying the indicated number of NBEG aircraft by the associated width requirements of 118 feet (refer to **Table 4-39**). An additional 25 feet of added wingtip clearance between NBEG aircraft for a NBEG aircraft frontage factor of 143 feet should be used to determine the length. The area can then be calculated by multiplying 20 feet of concourse width by the overall concourse length to determine the concourse circulation area.

- The NBEG single-loaded corridor lengths are indicated in **Tables 4-42** and **4-43**.
- The NBEG double-loaded corridor areas are indicated in **Tables 4-44** and **4-45**.

Table 4-42
Concourse A: NBEG Single-Loaded Concourse Corridor Length

Function	Existing	PAL 1	PAL 2	PAL 3	PAL 4
NBEG Factor (Table 4-11) – *No.*	*10.2*	10.8	10.8	11.8	12.8
Concourse A NBEG Factor – *No.* (0.33 X NBEG in Table 4-11) [2]	–	3.67	3.67	4.01	4.35
Concourse A Single-loaded Length [1] – LF	*234*	**524**	**524**	**614**	**622**

[1] Based on the theoretical NBEG determination, the single-loaded corridor length and areas were calculated. This does not reflect the existing conditions, except where indicated otherwise, but represents the theoretical lengths required for a single-loaded corridor by normalizing the existing gates to accommodate Aircraft Design Group III Narrow-body Aircraft

[2] Assume 1/3 of the PAX activity is on Concourse A

Those numbers depicted in italics indicate existing conditions.

Numbers in RED represent a deficiency in space based on existing conditions.

Source: CHA, 2024.

Table 4-43
Concourse A: NBEG Single-Loaded Corridor Circulation Area

Function	Existing	PAL 1 2026	PAL 2 2031	PAL 3 2036	PAL 4 2041
Concourse A Corridor Circulation Area [2] – *SF*	***5,598***	**10,524**	**10,500**	**12,280**	**12,440**

[1] Based on the theoretical NBEG determination, the double-loaded corridor length and areas were calculated. This does not reflect the existing conditions but represents the theoretical lengths required for a double-loaded corridor by normalizing the existing gates to accommodate Aircraft Design Group III – Narrow-body Aircraft

[2] Assume 1/3 of the PAX activity is on Concourse B

Those numbers depicted in italics indicate existing conditions.

Numbers in **RED** represent a deficiency in space based on existing conditions.

Source: CHA, 2024.

Table 4-44
Concourse B: NBEG Double-Loaded Concourse Corridor Length

Function	*Existing*	PAL 1 2026	PAL 2 2031	PAL 3 2036	PAL 4 2041
NBEG Factor (Table 4-11) – *No.*	*10.2*	10.8	10.8	11.8	12.8
Concourse B NBEG Factor – *No.* (0.66 X NBEG in Table 4-11) [2]	–	7.13	7.13	7.79	8.45
Concourse B Double-loaded Length [1] – *LF*	***352***	**510**	**510**	**557**	**604**

[1] Based on the theoretical NBEG determination, the double-loaded corridor length and areas were calculated. This does not reflect the existing conditions, except where indicated otherwise, but represents the theoretical lengths required for a double-loaded corridor by normalizing the existing gates to accommodate Aircraft Design Group III – Narrow-body Aircraft

[2] Assume 2/3 of the PAX activity is on Concourse B

Those numbers depicted in italics indicate existing conditions.

Numbers in **RED** represent a deficiency in space based on existing conditions.

Source: CHA, 2024.

Table 4-45
Concourse B: NBEG Double-Loaded Corridor Circulation Area

Function	Existing	PAL 1 2026	PAL 2 2031	PAL 3 2036	PAL 4 2041
Concourse B Corridor Circulation Area [2] – *SF*	***8,018***	**15,300**	**15,300**	**16,710**	**18,120**

[1] Based on the theoretical NBEG determination, the double-loaded corridor length and areas were calculated. This does not reflect the existing conditions but represents the theoretical lengths required for a double-loaded corridor by normalizing the existing gates to accommodate Aircraft Design Group III – Narrow-body Aircraft

[2] Assume 2/3 of the PAX activity is on Concourse B

Those numbers depicted in italics indicate existing conditions.

Numbers in **RED** represent a deficiency in space based on existing conditions.

Source: CHA, 2024.

4.8.8 Check-in, Ticketing, and Baggage Drop Lobby (Ticket Lobby)

Industry trends indicate that check-in procedures at airports are shifting away from the traditional agent-centric model in favor of evolving technologies that focus on customer self-service. Though self-service may become the future norm, complete transition and removal of agent-assisted approaches should not be encouraged. Instead, area demographics and socioeconomic influences should be considered when determining agent support, as both factors can greatly impact what customers expect when at LEX. Thus, an acceptable LOS should be ensured for individuals who seek either agent, or non-agent, check-in processes.

The shift to self-service lessens the square footage consumption of the check-in area inside the terminal building. Streamlined online services can allow passengers to easily access boarding passes, baggage tags, and self-bag checks, often granting passengers the opportunity to print these items in advance (if applicable) on and off airport grounds; however, demand for agent-assisted counters will not completely dissipate. As space dedicated to agent-assisted procedures reduces with time, a reasonable LOS should remain constant for those passengers still seeking certain services from an airline representative.

The same evolving future impacts ticketing halls at LEX, as well. A new, reimagined ticketing hall may rise in the wake of the changes brought by new technologies and innovation. As agent space decreases with time, LEX is presented with an opportunity to alter the current terminal to better meet the needs of future passengers. Despite this, maintenance of the traditional ticketing process (tangible agent help, printed paper passes, etc.) should be maintained in appropriate LOS stature, even if decreased in footprint.

A new, reimagined ticketing hall may rise in the wake of the changes brought by new technologies and innovation.

For this Study, future possibilities are included in terminal space analysis. Check-in processor calculations addressed and assumed certain passenger trends throughout the planning horizons, including:

- Full-service agent positions, where passengers complete their entire transaction with an airline agent
- Airline agent-assisted bag drops, where passengers drop bags after checking in online or at a kiosk
- Self-service kiosks, curbside, check-in offsite procedures, where passengers can complete transactions at home, on a web browser, or via mobile device
- Passenger self-service bag tag and bag drop, where the process is handled primarily through virtual portals and the passenger directly

LEX, as is the case with other airports of similar size, may not always adopt technology shifts as quickly as larger counterparts. This is due in part to the nature of the day-to-day flight operations but also to the availability of resources to implement technology with a realized return on investment.

Check-in functionalities found at airports are summarized below:

- Automatic Check-in – An example of automatic check-in is if a passenger holds an elite status with an airline, the airline will automatically check the passenger in for the passenger's flight 36 hours in advance, putting this passenger ahead of other passengers for boarding preferences and upgrades. In addition, many airlines have apps that automatically check in passengers without prompting.
- Baggage Drop Positions – Airline staff or agents accept bags from passengers who check in via an internet PC/mobile device or at a kiosk for a two-step process.
- Bypass (Internet Browser/PC/Mobile Device) Check-in – Passengers who do not check bags and can check in remotely prior to arriving at the terminal. They do not use terminal check-in processors.
- Curbside Check-in Processors – Typically, curbside check-in facilities are equipped with conveyor belts located at the check-in podiums for direct input of bags into the outbound baggage system. At smaller airports (or for airlines who do not wish to pay for conveyors), checked bags may be placed on carts and taken into the check-in lobby to be transferred to the ticket counter baggage conveyor.
- Full Service (Agent) Check-in – Airline staff or agents may assist passengers with boarding passes, rebooking, and with baggage check-in.
- Passenger Self-Service Baggage Tag and Baggage Drop – Without the assistance of an airline agent, passengers can complete the checked baggage processes.

- Self-Service Kiosk Check-in – Stand-alone kiosks can be located at the ticket counter, remote from the ticket counter, or throughout the terminal. Kiosks can print boarding passes and bag tags. When kiosks are located at the ticket counter, they are typically configured in pairs with a bag well, which often includes a baggage scale between the kiosks.

The LOS assumptions for passenger check-in behaviors at LEX through the planning horizon are shown in **Table 4-46** and **Table 4-47**.

Table 4-46
IATA Level of Wait Time Standard for Check-In (Minutes)

Type of Service	Short to Acceptable (min.) [1]	Acceptable to Long (min.) [1]
Full Assist Economy Check-in	0-10	10-20
Kiosk Boarding Pass	1-2	2-5
Agent Assist Bag Drop	1-5	5-10

[1] See assumptions for Table 4-21
Source: International Air Transport Association (IATA), ADRM, 12th Edition, CHA, 2024.

Table 4-47
IATA Level of Service Space Standard for Check-In (Sq Ft per PAX)

Type of Service	A	B	C	D	E	F
Few carts and few PAX with check-in baggage	18.3	15.0	12.9	11.8	9.6	<9.6
Few carts and one or two pieces of baggage per PAX	19.4	16.1	14.0	12.9	11.8	<11.8
High percentage of PAX using baggage carts	24.8	20.5	18.3	17.2	16.1	<16.1
"Heavy aircraft" flights with two or more items per PAX and a high rate of PAX using baggage carts	28.0	24.8	21.5	20.5	19.4	<19.4

Recommended row width between stanchions is 4.0 to 4.5 feet.
Source: International Air Transport Association (IATA), ADRM, 12th Edition, CHA, 2024.

For planning purposes, this Study assumed 60 percent of all originating passengers check baggage through to their destination at the actual "ticketing" lobby, with an additional 10 percent checking baggage through at the departure gate. Combined, this comes to a total of 70 percent of all passengers checking a bag with an agent. Without curbside check-in and remote baggage drop locations, it was assumed at LEX that 60 percent of the originating passengers drop baggage off in the check-in processor area. This percentage of baggage drop utilization was assumed to remain constant throughout the planning horizon.

The planning analysis conducted also weighed the impact that future technologies, as mentioned above, will have on terminal design. In addition, consideration was paid to passenger behavior (adoption of new systems), passenger demographics, and the ripple effects of increased self-service. For this Study, it was determined that age demographics factor significantly into a passenger's willingness to trust/adopt the handling of their own check-in processes. From this conclusion, it was derived that agent-assisted services should be included in the future terminal structure.

In accordance with industry trends, it is predicted that LEX passengers will gradually adopt self-service options as time progresses. This, in turn, decreases the reliance on agent-assisted modules. As reflected in the data, the percentages of passengers using self-service will lag at first and increase as options are made more accessible and visible.

Note, passengers who are checking bags to their destination are more likely to check-in at the airport as part of the baggage drop and screening process. In addition, without self-bag tagging and self-drop of baggage, each passenger checking baggage will need an interface with an agent. The assumptions for passenger check-in behaviors at LEX through the planning horizon are shown in **Table 4-48**.

The airport does not estimate that curbside services will be factored in addressing passenger check-in or checked baggage/bag drop functions. In addition, remote off-airport baggage drop locations are not foreseeable in the planning horizon. If these two functions were utilized, the demand to provide an area within the terminal for these check-in processor functions may be reduced.

Table 4-48
Enplaned Passenger Check-In Utilizations

Check-in and Checked Bag Drop		*Existing*	PAL 1	PAL 2	PAL 3	PAL 4
Passenger Check-in by Methodology						
Traditional Ticket Counter & Bag Drop Function – Agent Assist [1]		–	44%	37%	33%	31%
Terminal Kiosk Check-in Only		–	7%	9%	6%	4%
Terminal Kiosk Check-in & Bag Drop Function – Agent Assist		–	19%	20%	18%	15%
Remote/Automatic Check-in & Bag Drop Function – Agent Assist		–	12%	14%	19%	24%
Curbside Check-in Processors		–	0%	0%	0%	0%
By-Pass Remote Check-in (Browser or Mobile App)		–	18%	20%	24%	26%
Automated Check-in		–	0%	0%	0%	0%
Remote/Automatic Check-in & PAX Self-Service Bag Tag & Drop		–	0%	0%	0%	0%
Terminal Kiosk Check-in & PAX Self-Service Bag Tag & Drop		–	0%	0%	0%	0%
Total PAX Utilization		**–**	**100%**	**100%**	**100%**	**100%**
Baggage Check and Drop Locations Utilization						
Terminal Building	Location	*100%*	100%	100%	100%	100%
	PAX Utilization	*70%*	70%	70%	70%	70%
Curbside	Location	*0%*	0%	0%	0%	0%
	PAX Utilization	*0%*	0%	0%	0%	0%
Off-Airport Location	Location	*0%*	0%	0%	0%	0%
	PAX Utilization	*0%*	0%	0%	0%	0%

[1] Accounts for high PAX utilization with Allegiant and the likelihood ultra-low-cost airline carriers will provide new air services at LEX
Those numbers depicted in italics indicate existing conditions.
Source: CHA, 2024.

Assumptions

Additional assumptions included:

- Transaction time for checking in at a kiosk is 2.5 minutes.
  - Maximum desired queue time: 2.5 minutes +/-
  - Maximum average queue time: 1.5 minutes +/-
- Transaction time for agent assistance is 5 minutes.
  - Maximum desired queue time: 10 minutes +/-
  - Maximum average queue time: 6 minutes +/-
- Transaction time for checking a bag (baggage drop and self-service bag drop) is 1.7 minutes.
  - Maximum desired queue time: 10 minutes +/-
  - Maximum average queue time: 6 minutes +/-
- Ticketing check-in and bag drop counter areas assume 6 linear feet per position (including baggage scale), a 12-foot depth from the back wall to the face of the counter, and an 8-foot circulation easement from the face of the counter to the queuing line.
- The kiosk area, assuming free-standing kiosks are not integral to the counter, is 9 square feet per kiosk with 25 square feet of circulation and 50 square feet of queuing space.
- Seventy percent of passengers check baggage in the traditional ticket lobby throughout the planning horizon.

Throughout the planning period:

- Curbside positions are not a service provided through the planning horizon.
- The quantity of agent assist positions decreases incrementally.
- The quantity of baggage check and drop positions increases incrementally as passengers arrive at the terminal with checked-in status and only need to check and drop baggage in the check-in hall.
- The quantity of passenger self-service kiosks within the terminal facility decreases incrementally as passengers check in remotely and/or with mobile devices.

[Intentional Page Break]

Table 4-49
Passenger Check-In and Bag Drop Stations Required

Check-in Modes	*Existing*	PAL 1	PAL 2	PAL 3	PAL 4
Traditional Ticketing Counter & Bag Drop (Agent Assist) – *No.*	*10*	18	18	18	19
Self-Service Kiosks (Check-in, Bag Drop, & Self Bag Tag) – *No.*	*15* [1]	5	6	6	6
Baggage Drop Positions (Agent Assist) - *No.*	*0*	5	6	7	8
PAX Self-Service Bag Drops – *No.*	*0*	0	0	0	0
Totals	***25***	**28**	**29**	**31**	**33**

[1] Self-service kiosk in ticketing counters
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook,* CHA, 2024.

Table 4-50 indicates the area requirements for each type of passenger check-in mode based on the station required in **Table 4-49**.

For many areas in this section and subsequent sections, a circulation factor was applied. This circulation factor considers the overflow of terminal processors (concessions, rental car counters, check-in counters, etc.) where passengers congregate in typical circulation areas (hallways, walkways, etc.). As families or multi-person groups use the processor, others loiter or congest these areas, allowing additional necessary space to accommodate passengers. As such, a circulation factor is applied in these areas to account for these situations.

Table 4-50
Passenger Check-In Area Requirements

Size & Areas	*Existing*	PAL 1	PAL 2	PAL 3	PAL 4
Traditional TIX Counter Processor Functions – Agent Assist					
Effective Length (6 feet per TIX Position) – *LF*	*177*	108	108	108	114
PAX Queue Depth – *FT*	*7.58*	20.00	20.00	20.00	20.00
Agent Area [(12 feet *(10 feet Existing)* – Front of Counter to Wall)] – *SF*	*1,925*	1,296	1,296	1,296	1,368
Front Circulation Area (8 feet, Counter to Queue) – *SF*	*1,546*	864	864	864	912
Queuing Area – *SF*	*1,529*	2,160	2,160	2,160	2,280
Subtotal – Traditional TIX Counter	***5,000*** [4]	**4,320**	**4,320**	**4,320**	**4,560**
Kiosks – Check-in, Checked Baggage & Bag Tag Processor Functions – Self Service – Free Standing [2]					
Effective Kiosk Area (9 feet) – *EA*	*0*	45	54	54	54
Area (25-square feet each) – *SF*	*0*	125	150	150	150
Queuing Area – *SF*	*0*	250	300	300	300
Subtotal – Kiosks	**0**	**420**	**504**	**504**	**504**
Bag Drop Stations – Agent Assist [3]					
Effective Length (6 feet per DROP Position) – *LF*	*0*	30	36	42	48
Queue Depth - *FT*	*0*	20	20	20	20

Size & Areas	*Existing*	PAL 1	PAL 2	PAL 3	PAL 4
Agent Area (12 feet, Front of Counter to Wall) – *SF*	*0*	360	432	504	576
Front Circulation Area (8 feet, Counter to Queue) – *SF*	*0*	240	288	336	384
Queuing Area – *SF*	*0*	600	720	840	960
Subtotal – Bag Drop Stations – *SF*	***0***	**1,200**	**1,440**	**1,680**	**1,920**
PAX Self-Service Bag Drop Stations					
Effective Length – *LF*	*0*	–	–	–	–
Front Circulation – *FT*	*0*	–	–	–	–
Queuing – *SF*	*0*	–	–	–	–
Subtotal – PAX Self-Service Bag Drop – *SF*	0	–	–	–	–
SUBTOTAL – TIX LOBBY	***5,000***	**5,940**	**6,264**	**6,504**	**6,984**
Circulation					
Circulation Factor of 0.50 [1] – *SF*	*1,222*	**2,970**	**3,182**	**3,252**	**3,492**
TOTAL PASSENGER CHECK-IN HALL AREA – SF	***6,222***	**8,910**	**9,446**	**9,756**	**10,476**

[1] A generally acceptable circulation factor is 0.30 times the *Area* for passenger "ticket" lobby area requirements. This analysis concluded that a more practicable circulation factor is 0.50 to address any errant airline operational policies and/or procedures, non-common equipment and facilities use, and inherent inefficiencies with the existing structure common with future renovation projects.

[2] Self-service kiosk integrated in ticketing counter, where occurs, and reflected in Subtotal for Traditional TIX Counter

[3] All baggage check-in at ticketing counters and reflected in Subtotal for Traditional TIX Counter

[4] Kiosks and bag drops included

Those numbers depicted in italics indicate existing conditions.

Numbers in **RED** represent a deficiency in space based on existing conditions.

Source: CHA, 2024.

Partial or full common-use facilities would allow the ticketing lobby to adequately serve demand beyond the planning period and grant more flexibility in adjusting to changing conditions, such as adding new carriers. In addition, these improvements should balance the demand loads between airlines and achieve higher efficiency in the check-in lobby.

4.8.9 Airline Ticket Offices (ATO)

Following planning industry standards, 900 square feet of office space per air carrier was initially assumed in calculating airline ticketing office (ATO) square footage; however, this size does not account for the typical square footage that ultra-low-cost carriers (ULCCs) demand. In efforts to reduce costs and overhead, many of these airlines scale back square footage demand and passenger services available. To take this into account, ATO sizing was adjusted to 700 square feet. This provides a more realistic approach to determining the true sizing needs for airlines at LEX. Moreover, this planning study assumed that LEX would maintain six ATO spaces through all the planning horizons and add a seventh ATO in PAL 3.

Table 4-51
Airline Ticketing Offices

Function	*Existing*	PAL 1	PAL 2	PAL 3	PAL 4
No. of Airlines – *No.*	5	6	6	7	7
Airline Ticketing Offices – *SF*	***8,863 [1]***	**4,200**	**4,200**	**4,900**	**4,900**

[1] Area includes occupied ATO, unoccupied areas, and storage areas behind ticketing counters

Those numbers depicted in italics indicate existing conditions.

Source: CHA, 2024.

4.8.10 Airline Operations Area at Gates (Concourse)

Airlines require additional space outside of the gate area and holdrooms to ensure a safe and efficient passenger experience. To determine how much total space is needed, an analysis was undertaken to calculate the programmatic area required to support airline activities at LEX. Industry trends for operational space closely mirror that seen for ATO—airline cost-cutting maneuvers have led to an increased focus on downsizing footprints whenever possible. Though diminished, the need has not and will not disappear across the planning horizon. Following planning methodology, based on previous experience and benchmarking comparisons to peer airports, it was determined that a factor of 1,000 square feet for every 100 peak hour enplaned passengers was needed to maintain an acceptable LOS, as tabulated in **Table 4-52**.

Table 4-52
Airline Operation Areas at Gates (OPS)

Function	*Existing*	PAL 1	PAL 2	PAL 3	PAL 4
Peak Hour Enplaned PAX Factor – *No.*	–	661	751	842	939
Airline Operation Areas at Gates – *SF*	***2,025***	**6,610**	**7,510**	**8,420**	**9,390**

Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: CHA, 2024.

4.8.11 Passenger Security Screening Checkpoint (SSCP) and Queuing

SSCP size requirements are controlled by TSA, which provides standards and functionality requirements for all applicable airports. These areas are subject to change at any time due to relevant levels of threats, technological advancement in security screening equipment, and stated TSA requirements.

LEX operates one distinct SSCP with three SSCP queue lanes.

Checkpoint requirements define the number of TSA document checkers (TDC), the number of checkpoint lanes, and the amount of queue area required to support terminal activity. A checkpoint lane consists of a single or paired advanced imaging technology (AIT) and magnetometer, an x-ray unit with an attached divest and recompose rollers and tables, manual search stations, and benches. A supervisor station is used to monitor each checkpoint area. Demand is affected by airline flight schedules and the upstream flight check-in process.

Overall screening lane processing rates are typically measured in terms of passengers per hour per lane. At LEX, this was measured by identifying the total number of passengers who went through the AIT or magnetometer; however, multiple factors within the screening process affect overall throughput. TSA requires that each passenger clear the following screening procedures in sequence to complete the checkpoint screening process: ticketing (boarding pass and passenger identification) document check, divesture of TSA-regulated items, AIT or magnetometer scans, recompose, and, if necessary, secondary screening (carry-on baggage and passenger search, or private personal search room screening).

Checkpoint processing rates vary at each specific airport, with further impacts brought on by passenger characteristics and time of year. For accuracy in this planning process, these factors were considered when determining the processing rate to be used for calculating the number of checkpoint lanes and the size of required areas.

Divesting and recomposing activities consume the most time. With this, these functions were critical determinants of throughput in TSA checkpoints. TSA regulations for divesting personal items require the use of multiple bins per passenger; similarly, passenger recompose activity (post AIT/magnetometer scanning) requires an extended throughput of the x-ray units. Lack of adequate divest and recompose table lengths can impede materials reaching the x-ray units, resulting in decreased lane throughput. Extension and/or adding area and table lengths for divesting and recomposing has proven to yield above-average site-specific processing rates.

Checkpoint demand was analyzed against the LOS standards that address performance in terms of the time passengers wait for processing, as well as the space allotted for each waiting passenger. The IATA LOS guidelines for checkpoint (same as passport control outbound) wait times are:

- Short-to-acceptable: 0-5 minutes
- Acceptable-to-long: 5-10 minutes

IATA's standards in gauging space needed for passengers waiting in a single queue to be screened are depicted in **Table 4-53**.

Table 4-53
IATA Level of Service Standards for Security Screening Checkpoints

Factor	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F
Checkpoint (IATA Passport Control) per PAX – *SF*	15.0	12.9	**10.8**	8.6	6.5	<6.5

Source: International Air Transport Association (IATA), ADRM, 12th Edition.

These standards provide valuable guidance in determining how much space is needed for wait times and queuing, as TSA does not provide such data; however, TSA does provide minimum area allocations for each screening lane, as well as associated support square footage. These figures must be met for the complete functionality of TSA procedures.

The processing rate per lane in this analysis initially assumed 175 passengers per hour, which was normalized at a rate of 150 passengers per hour, per checkpoint lane after considering TSA PreCheck and non-passenger, employees, crew, etc.

TSA-issued Checkpoint Design Guidelines (CDG) recommend airports and local TSA authorities collaborate to establish acceptable goals for terminal-specific wait times and screening lane processing rates used for planning purposes.

Extended queue depths and areas have a dimensional effect on a pair of checkpoint lanes, as depicted in **Figure 4-12**. In addition, dimensions can be impacted by processing rates and wait time variables, which later inform queue area totals.

The basis for determining screening lane requirements was held constant at LOS C, 150 passengers per hour, per lane (0.40 MIN/PAX). This is coupled with a square feet of queue area that corresponds to wait times per lane of about 10 minutes, 8 minutes, and 4 minutes, as indicated in **Figure 4-12**.

Figure 4-12
Wait Time Calculation

Wait Time/Lane (MIN) = Total Queue Area (SF) x Screening Lane Throughput (MIN/PAX)
LOS (SF/PAX)

Therefore,

10.00 Wait Time/Lane MIN = *270* SF x 0.40 Screening Lane Throughput (MIN/PAX)
10.8 (SF/PAX)

8.00 Wait Time/Lane MIN = *220* SF x 0.40 Screening Lane Throughput (MIN/PAX)
10.8 (SF/PAX)

4.00 Wait Time/Lane MIN = *110* SF x 0.40 Screening Lane Throughput (MIN/PAX)
10.8 (SF/PAX)

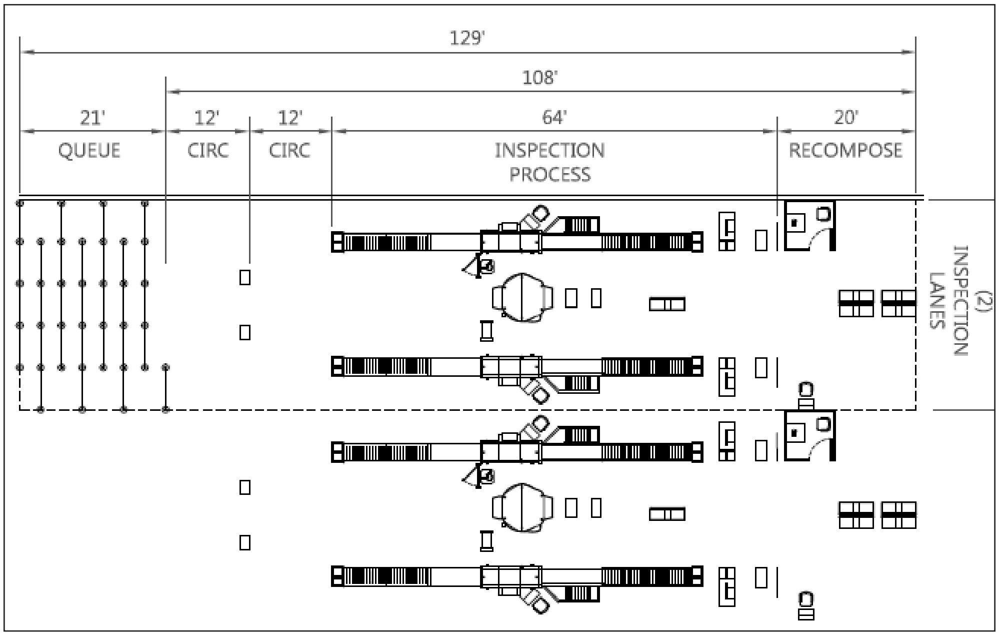
Table 4-54
Passenger Security Screening Checkpoint Lane Demand

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Peak Hour Enplaned – *No.*	*319*	661	751	842	939
Peak 30-Min. Originating PAX – *No.*	–	321	364	408	455
Additional Traffic – *No.* [1 2]	–	48	55	61	68
Total Peak 30-Min. Originating PAX – *No.*	–	369	419	469	523
Existing No. of Security Lanes – *No.*	***3***	**–**	**–**	**–**	**–**
4-Minute Queue Wait – No. of Lanes Required					
Demand [4] – *No.*	*3*	5-6	5-6	6	7-8
8-Minute Queue Wait – No. of Lanes Required					
Demand [4] – *No.*	3	4	5-6	5-6	6
10-Minute Queue Wait – No. of Lanes Required					
Demand [4] – *No.*	***3***	**4**	**5-6**	**5-6**	**5-6**

[1] 15 percent of peak 30-minute originating PAX
[2] Non-passengers, employees, crew, etc.
[4] Normalized to 0.40 minutes per passenger process rate, or 150 PAX per lane per hour
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook*, CHA, 2024.

Shifts in the LOS offered, the processor rate per lane, and accepted wait times for the queuing area will result in fluctuations in the forecasted number of screening lanes required throughout the planning horizon. To visualize the layout of a generic pair of TSA security checkpoint lanes, refer to **Figure 4-13**. This helps provide background in calculating SSCP processor areas.

Figure 4-13
Standard TSA Security Screening Checkpoint Lane



Utilizing the assumptions, the dimensional guideline for a checkpoint lane pair with AIT and magnetometer was approximately 3,870 square feet, without queueing as depicted in **Figure 4-13**, and consisted of:

- Screening lane pair consisting of the length of each screening lane, including divest tables, x-ray
- Machine, agent work area, recompose tables, AIT body scanner, magnetometer, divest bins, and recompose benches
- Private search rooms, manual carry-on baggage search tables, and screening equipment
- Circulation aisle separating the screening lane area from the boarding pass document check agent podium
- Queue stanchions
- Stanchions for ADA-accessible and family queue lanes

The total SSCP areas needed at LEX are tabulated in **Table 4-55**. For consistency across all modules in this Study, a 0.30 circulation factor was applied to the SSCP total area. This accounts for SSCP exit lanes from the secure airside concourse to the non-secured public area.

Table 4-55
Passenger Security Screening Checkpoint (SSCP) Area Requirements

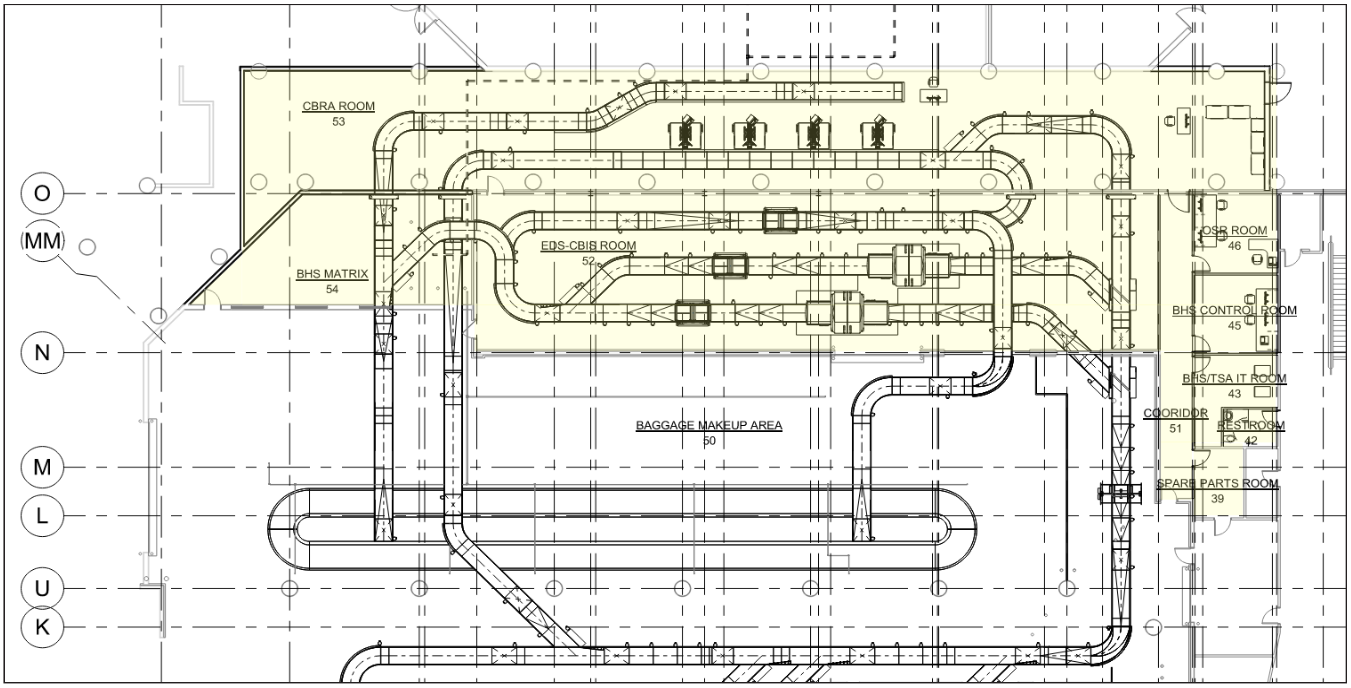
	Existing	PAL 1 [1]	PAL 2 [1]	PAL 3 [1]	PAL 4 [1]
4-Minute Queue Wait					
Total Area Required – *SF*	*3,703*	10,225 to 12,270	10,225 to 12,270	12,270	14,315 to 16,360
TSA/LEO Support Areas – *SF*	*755*	175	175	175	175
Public Circulation [2] – *SF*	*2,131*	3,068 to 3,681	3,068 to 3,681	3,681	4,295 to 4,908
8-Minute Queue Wait					
Total Area Required – *SF*	*7,187*	8,620	10,775 to 12,930	10,775 to 12,930	12,930
TSA/LEO Support Areas – *SF*	*755*	175	175	175	175
Public Circulation [2] – *SF*	*3,703*	2,586	3,233 to 3,879	3,233 to 3,879	3,879
10-Minute Queue Wait					
Total Area Required – *SF*	**3,703**	**8,820 [3]**	**11,025 to 13,230 [3]**	**11,025 to 13,230 [3]**	**11,025 to 13,230 [3]**
TSA/LEO Support Areas – *SF*	***755***	**175 [3]**	**175 [3]**	**175 [3]**	**175 [3]**
Public Circulation [2] – *SF*	***2,131***	**2,646 [3]**	**3,308 to 3,969 [3]**	**3,308 to 3,969 [3]**	**3,308 to 3,969 [3]**

[1] Number of lanes required indicated in Table 4-26, multiplied by (3,870 SF ÷ 2) + (Queueing Area by Minutes) = Area Requirements
[2] A factor of 0.30 was applied to the total SSCP area to determine the SSCP circulation and exit lane needs
[3] Indicated in Table 4-2
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: CHA, 2024.

4.8.12 CBIS Outbound Baggage Screening

All checked baggage brought into LEX must be processed through sort-controlled Checked Baggage Inspection Systems (CBIS) per federally mandated standards. Baggage at LEX is screened by one of the two TSA-operated Explosion Devices Systems (EDS) machines. The in-line processing at LEX begins behind the airline counters belt conveyors that bring luggage to the CBIS facilities area. Baggage then makes its way to the outbound baggage make-up area carousel, where it is eventually loaded into the intended aircraft.

Figure 4-14
Proposed Checked Baggage Inspection System Renovation and Remodel (Highlighted)



Source: Corgan, 2022.

Forecasted data indicates an increase in LEX passenger activity across planning horizons, which generates more demand for additional baggage screening equipment. This trend is tabulated in **Table 4-56**. Space constraints may limit the ability of the Airport to introduce more screening equipment to meet long-term demand, even with the ongoing CBIS remodel and expansion project. See **Figure 4-14**.

Table 4-56
Checked Baggage Inspection System Requirements (CBIS)

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Design Hour Baggage Load					
Peak Hour Originating PAX Checking In [1] – *No.*	*319*	661	751	842	939
PAX Checking Bags at TIX– *No.*	–	641	728	817	911
Average Bags per PAX – *No.*	–	70%	70%	70%	70%
Bags to Process in Peak Hour – *No.*	–	1.6	1.6	1.6	1.6
10-Minute Baggage Flow Rate – *No.*	–	123	140	157	175
TSA Surge Factor (Based on 10-Minute Baggage Flow Rate)	–	1.18	1.17	1.16	1.15
Equivalent Baggage Surge Rate	–	874	983	1,093	1,211
% of Bags That are Oversized & Too Big For EDS	–	3%	3%	3%	3%
Oversized Bags Requiring ETD Inspections – *No.*	–	26	29	33	36
Bags to Process Through Level 1 EDS Units – *No.*	–	847	954	1,061	1,174

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
EDS/ETD Equipment Requirements					
Level 1 EDS Screening – Process Rate (bags/hour) – *No.*	–	500	500	500	500
Level 1 EDS Units Required – No.	*2*	2	2	3	3
% of Scanned Bags Requiring Level 2 Screen **(Alarm Rate)**	–	25%	25%	25%	25%
Bags Requiring Level 2 OSR – *No.*	–	212	238	265	294
Level 2 OSR Rate (Bags/Hour per Operator) – *No.*	–	120	120	120	120
Level 2 OSR Stations Required (1 Operator/Station) – *No.*	–	2	2	3	3
% of Resolved OSR Bag reviews **(Clear Rate)**	–	80%	80%	80%	80%
Bags Needing Level 3 Screening in Peak Hour – *No.*	–	69	78	86	96
Level 3 ETD Screening – Process (Bags/Hour/Screener)	–	24	24	24	24
Level 3 ETD Units Required (2 Screeners/Unit) – *No.*	–	2	2	2	2
Baggage Screening Requirements					
Level 1 Area Per EDS Screening Unit – *SF*	–	800	800	800	800
Required EDS Units – *No.*	–	2	2	3	3
Level 2 Area per OSR Station – *SF*	–	40	40	40	40
OSR Stations Required – *No.*	*3*	2	2	3	3
Area per ETD Screening Units – *SF*	–	100	100	100	100
Required ETD Units – *No.*	4	2	2	2	2
Conveyance Equipment – *SF*	*4,735*	4,735	4,735	**7,103**	**7,103**
CBRA Room – *SF*	*700*	700	700	**1,050**	**1,050**
Oversized Baggage Screening – *SF*	*1,468*	1,468	1,468	**2,202**	**2,202**
Ancillary Support Areas – *SF*	*1,297*	1,297	1,297	**1,946**	**1,946**
Total Area Requirements for CBIS – *SF*	***10,230*[2]**	**10,230 [2]**	**10,230 [2]**	**15,170**	**15,170**

[1] 97 percent originating PAX with pre-applied surge factor

[2] Existing square footage represents pending CBIS Project once completed

Those numbers depicted in italics indicate existing conditions.

Numbers in **RED** represent a deficiency in space based on existing conditions.

Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook*, CHA, 2024.

4.8.13 Meeter and Greeter (Well-Wishers) Lobby

Meeter and greeter areas at LEX are dedicated spaces for passenger congregation, primarily for the purpose of well-wishers, friends, and family of departing and arriving passengers. To examine further, well-wishers congregate outside of the SSCP to see passengers off, whereas meeters and greeters are generally found in the bag claim area to meet arriving passengers. This is an important distinction, and the terminal needs to provide adequate space for both groups of people. This analysis assumed a generic factor of 10 percent for the peak hour terminating passengers, along with a 1.25 surge factor to account for the meeters and greeters. The result was then multiplied by 23 square feet, per the IATA LOS standard, to determine the overall meeter and greeter area requirements. Figures resulting from analysis are shown in **Table 4-57**.

Table 4-57
Meeter and Greeter (Well-Wishers) Area Requirements

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Terminating PAX Factor [1] – *No.*	–	802	910	1,022	1,139
10-percent of Peak-Terminating PAX Factor	–	80	91	102	114
Meeter and Greeter (Well-wisher) Area – *SF*	***2,086***	**1,840**	**2,093**	**2,346**	**2,622**

[1] 97% of peak hour deplanement with pre-applied surge factor applied to Peak -Terminating PAX x 1.25 for additional surge factor
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 25, Airport Passenger Terminal Planning and Design*, CHA, 2024.

4.8.14 Outbound Baggage Make-Up

It is assumed that baggage make-up processor areas contain baggage make-up rooms, a baggage sortation device or system, and baggage carts/tug circulation and staging areas. The analysis performed is for enclosed baggage make-up areas only and is shown in **Table 4-58.**

Table 4-58
Outbound Baggage Make-up

	Existing	PAL 1 2026	PAL 2 2031	PAL 3 2036	PAL 4 2041
Required Bag Make-Up Area Space [1] – *SF*	***14,896***	**15,600**	**15,600**	**17,900**	**19,000**

Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 25, Airport Passenger Terminal Planning and Design*, CHA, 2024.

4.8.15 Inbound Baggage Load Belt Feeds

Inbound baggage areas provide deplaning passengers with a space dedicated to retrieving their luggage inside the terminal building. The inbound baggage load belt feed connects to the baggage claim devices inside the baggage claim hall. LEX currently operates two baggage claim carousels located near the rental car counters.

With passenger traffic forecasted to increase across planning horizons, the analysis performed sought to examine the space needed for inbound baggage claim areas. Calculations can be accessed in **Table 4-59** below.

Table 4-59
Inbound Load-belt Feed Systems

No. Required Area Requirements	*Existing*	PAL 1	PAL 2	PAL 3	PAL 4
Load-Belt Feeds – *No.*	*2*	**4**	**4**	**4**	**5**
Total Load-Belt Feeds System Area – *SF*	***4,281***	**3,897**	**3,897**	**3,897**	**4,871**

Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: CHA, 2024.

4.8.16 Inbound Baggage Claim

The encompassing analyses below addressed both the baggage claim spatial needs for the passenger areas as well as the capacity and requirements for the baggage claim device.

The methodology for determining claim device capacities and requirements was based on a peak 20-minute deplaning arrivals analysis. For this planning Study, peak 20-minute defaults to peak 30-minute deplaning demand, or 47 percent of peak hour deplaning passengers. Moreover, these are the utilized assumptions throughout the baggage claim processor area analyses:

- Percent of passengers checking bags: *60 percent (50 percent ticketing lobby (TIX), 10 percent at the gate)*
- Average number of bags per passenger checking bags: *1.6*
- Average traveling party size: *1.3*
- Percent additional passengers at claim: *30 percent*
- Claim frontage per person: *1.5 linear feet*
- Area per person in active retrieval area: *18 square feet (LOS C)*

As shown below, **Table 4-60** provides the sizes and capacities of the existing carousels and was used as the basis for capacity needs throughout the planning horizons. The analyses to meet the capacity needs and, ultimately, the number/size of carousel units for arrival flight schedules and fleet mix were based on satisfying the requirements for practical baggage storage on the carousel.

Table 4-60
Baggage Carousel Claim Frontage and Baggage Display Capacities

Existing T-shape Flatbed Device (Approx. Device Size)	***Existing Frontage Linear Feet – LF [1]***	***Theoretical Baggage Display on Carousel – No. [1]***	***Practical Baggage Display on Carousel – No. [1]***
Bag Claim Device Size (50' x 36') [2] *Device Area = 688 SF Large Regional*	*108*	*(177)*	*(117)*
Oval Sloping Bed Device (Approx. Device Size)	**Frontage Linear Feet – LF [1]**	**Theoretical Baggage Display on Carousel – No.[1]**	**Practical Baggage Display on Carousel – No.[1]**
Bag Claim Carousel Size (68' x 18') Device Area = 1,054 SF Narrow-Body	154	308 Bags	205 Bags
Bag Claim Carousel Size (52' x 20') Device Area = 954 SF Large Regional	121	242 Bags	162 Bags

[1] US Department of Transportation, FAA *The Apron & Terminal Building Planning Manual*, Report No. FAA-RD-75-191 – Mechanized Claim Devises, Figure 4-18
[2] Assumed size of existing bag claim devices at LEX
Source: CHA, 2024.

For planning purposes and added accuracy, calculations were also conducted to estimate the number of bags that may need to be stored or retrieved from each individual carousel. Data generated was made in agreement with fleet mix and load factors.

The determined number of baggage claim carousels required throughout the planning horizon (PALs) are depicted in **Table 4-61**. The existing T-shaped Baggage Claim flatbed devices are undersized for narrow-body flights. For purposes of this evaluation, the analysis assumed all new carousels should meet the demand of 68 feet by 18 feet narrow-body claim carousels, at a minimum, and compared to the existing flatbed baggage claim devices at LEX. The evaluation predisposes that all arriving narrow-body flights shall not be limited by which carousel can be used because of carousel size constraints and/or capacities. In addition, practical baggage display capacities on carousels were utilized to determine the number of additional baggage claim carousels required. The theoretical baggage display capacity lower limits were used, where not excessive, to determine a practicable number of baggage claim devices to address display requirements.

Table 4-61
Claim Device Baggage Display Capacity Analyses

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Narrow-body Seats – *No.*	*186 [1]*	186 [1]	186 [1]	186 [1]	186 [1]
% Load Factor	*71.0*	83.2	80.0	81.2	84.0
Assume all NBEG Flights/Device/20-min – *No.*	*2 [3]*	3 [3]	3 [3]	3 [3]	4 [3]
NBEG Flight No. 1 Arriving PAX/Flight – *No.*	*132*	155	149	151	156
NBEG Flight No. 2 Arriving PAX/Flight – *No.*	*132*	155	149	151	156
NBEG Flight No. 3 Arriving PAX/Flight – *No.*	–	155	149	151	156
NBEG Flight No. 4 Arriving PAX/Flight – *No.*	–	–	–	–	156
Average No. Bags per PAX – *No.*	*1.6*	1.6	1.6	1.6	1.6
NBEG Flight No. 1 Bags to Retrieve – *No.*	*211*	248	238	242	250
NBEG Flight No. 2 Bags to Retrieve – *No.*	*211*	248	238	242	250
NBEG Flight No. 3 Bags to Retrieve – *No.*	–	248	238	242	250
NBEG Flight No. 4 Bags to Retrieve – *No.*	–	–	–	–	250
Existing Bag Claim Devices [2] – *No.*	*2*	*2*	*2*	2	2
Existing Claim No. 1 Practical Bag Display Capacity/Device – *No.*	117	117	117	117	117
Existing Claim No. 2 Practical Bag Display Capacity/Device – *No.*	117	117	117	117	117
Total Practical Baggage Display Surplus/**(Deficit)** – *No.*	**136**	**510**	**480**	**492**	**516**
Total Narrow-body Baggage Claim Devices Required (New) [4] ***No.***	**2**	**3 [4]**	**3 [4]**	**3 [4]**	**4 [4]**

[1] Assumes Allegiant A320 Narrow-body with 186 seats and captures seating capacities for B737-800 aircraft

[2] Existing flatbed baggage claim device

[3] See Table 4-1

[4] Utilizes theoretical display capacities beyond practical display capacities for narrow-body aircraft in determining a total number of baggage claim devices required

Those numbers depicted in italics indicate existing conditions.

Numbers in **RED** represent a deficiency in space based on existing conditions.

Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook,* CHA, 2024.

Table 4-62
Terminating PAX Baggage Claim Space Requirements

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Peak Hour Deplaned PAX	*319*	661	751	842	939
Peak 20-min. Terminating PAX – *No.*	–	321	364	408	455
% PAX Bags Check at TIX and Gate – *No.*	–	80.0	80.0	80.0	80.0
Total PAX Checking Bags – *No.*	–	256	291	327	364
Average Travel Party Size – No.	–	1.3	1.3	1.3	1.3
Number of Parties – *No.*	–	197	224	251	280
Additional Persons at Bag Claim	–	30%	30%	30%	30%
Total Persons at Carousel – *No.*	–	215	244	274	305
Claim Frontage Required – 1.5 *LF/PAX*	–	323	366	411	453
Claim Frontage Provided (Table 4-31) – *LF*	*360*	308	462	462	616
Area/Person in Active Retrieval – *SF*	–	18	18	18	18
Total Area for Active Retrieval – *SF*	*6,802*	3,870	4,392	4,932	5,490
Total Carousel Device Area – *SF*	*688*	**2,108**	**3,162**	**3,162**	**4,216**
Oversize Baggage Claim – *SF*	*278*	150	150	150	150
Subtotal	***7,768***	**6,128**	**7,704**	**8,244**	**9,856**
Circulation [1] (0.50 x Factor)	*5,212*	3,064	3,852	4,122	4,928
Total Bag Claim Processor Area – *SF*	***12,980***	**9,192**	11,556	12,366	14,784

[1] Generally acceptable circulation factor is 0.30 times the Subtotal for baggage claim area requirements. This analysis concluded that a more practicable circulation factor is 0.50 to address any errant airline operational policies and/or procedures, non-common equipment and facilities use, and inherent inefficiencies with the existing structure common with future renovation projects.

Those numbers depicted in italics indicate existing conditions.

Numbers in **RED** represent a deficiency in space based on existing conditions.

Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook*, CHA, 2024.

Airline Baggage Service Offices (BSO)

Airline BSOs in a terminal building are typically located adjacent to the baggage claim devices. A BSO module is approximately 250 square feet and consists of a public service area and a secure baggage storage room. **Table 4-63** summarizes the area needed for airline BSOs with the anticipated number of airline carriers in the LEX market.

Table 4-63
Airline Baggage Service Offices

No. Required Area Requirements	*Existing*	PAL 1	PAL 2	PAL 3	PAL 4
Airlines BSO – *No.*	2	4	5	5	6
Average BSO Area – *SF*	*290*	250	250	250	250
Total BSO – *SF*	***580***	**1,000**	**1,250**	**1,250**	**1,250**

Those numbers depicted in italics indicate existing conditions.

Numbers in **RED** represent a deficiency in space based on existing conditions.

Source: CHA, 2024.

4.8.17 Concessions: Food and Beverage, Gift and News, Services, and Rental Car

For this planning analysis, concession areas refer to specific concession types, mainly food and beverage, gift and news, and various services (advertising, information desks, banking, health counters, ATM, foreign currency exchange, etc.). This planning study at LEX addressed airside, landside, and storage requirements for acceptable LOS concessions. The analysis was done in accordance with ACRP, *Report 54, Resource Manual for In-Terminal Concessions 2011,* the standard source for evaluating concession requirements.

Concession requirements were calculated with the formula given in **Figure 4-15**.

Figure 4-15
Total Concession Calculation

$$\text{Total Concession Area (SF)} = \frac{\text{Enplaned PAX}}{1{,}000} \times 18\ \text{SF}$$

When evaluating concessionaire square footage at an O&D terminal, it was important to consider the need to divide spaces between pre-and-post security areas. For LEX, a 10 percent factor was applied to total pre-security space, while 90 percent was dedicated to post-security. Categorical concessionary percentage splits were not specific to LEX; rather, they represent the industry standard for terminals. Guidelines allocated 68 percent of post-security concessionaire space to food and beverage, 31 percent to gifts and news, and one percent to services. For pre-security analysis, a split of 55, 17, and 28 percent, respectively, was utilized.

It is recommended that LEX complete a specific concession plan to account for any terminal modifications, as this will allow for greater local-specific detail.

Storage requirements for concessions at LEX are also displayed in **Table 4-64**. This figure was calculated by applying a factor of 1.2 to the total concession space. A factor of 0.30 was also applied to account for circulation. Each data point is a product of appropriate standards and industry trends.

[Intentional Page Break]

Table 4-64
Concession Areas

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Pre-Security Concessions (10% of total)					
Food and Beverage – *SF*	*3,873*	952	1,083	1,213	1,352
Gifts and News – *SF*	*4,045*	294	335	375	418
Services [1] – *SF*	*42*	485	551	618	688
Subtotal – *SF*	***7,960***	**1,732**	**1,968**	**2,205**	**2,459**
Post-Security Concessions (90% of total)					
Food and Beverage – *SF*	*5,670*	10,597	12,045	13,497	15,049
Gifts and News – *SF*	*2,913*	4,831	5,491	6,153	6,860
Services [1] – *SF*	*42*	156	177	198	221
Subtotal – *SF*	***8,625***	**15,584**	**17,714**	**19,849**	**22,130**
Total Concessions Area – *SF*	**15,041**	**17,316**	**19,682**	**22,055**	**24,589**
Concessions Storage [2] – *SF*	273	**3,463**	**3,936**	**4,411**	**4,918**
Circulation [3] – *SF*	7,427	5,195	5,905	6,616	7,377

[1] Includes ATM/foreign currency exchange/mailbox drop and business center as a service concession
[2] A factor of 0.20 was applied to the total concession area to determine the concession storage needs
[3] A factor of 0.30 was applied to the total concession area to determine the public concession circulation needs

Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.

The analysis of concessions does not include the Airport's conference centers or rental car/transportation functions; however, a separate analysis is conducted for rental car/ground transportation processor areas.

Source: CHA, 2024.

Rental Car Concessionaires

Seven rental car companies are currently in operation at LEX: Alamo, Avis, Budget, Dollar, Enterprise, Hertz and National. Each company shares a counter space with one another, except for Enterprise. There are currently four rental car counter modules at LEX. The rental car companies are grouped as follows:

- Alamo – National
- Avis – Budget
- Enterprise
- Hertz – Dollar

Outside of counters, rental car companies also generally require office space, parking facilities, and maintenance capacities.

From a planning perspective, the number of rental car concessionaires on-site is usually pre-determined as part of a Request-for-Proposal renewal process for rental car concessions, with a mutual understanding between the airport operator and the rental car companies. For the purposes of this study, based on a benchmark of the existing building and total rental car companies (counters), a comparison of peer airports, and experience with similar airport leases and management of rental car operations, in the absence of criteria to determine metrics for planning, this analysis assumed an average square footage for each public rental car concession.

It is recommended that an additional rental car counter module be added beginning in PAL 3 for a total of five rental car counters. **Table 4-65** also includes a calculation for circulation needs, which was found by applying a 0.30 factor to the total concession areas.

Table 4-65
Rental Car Concessions Areas

	Base Existing	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
RC Concessionaires – *No.*	*7*	7	7	**8**	**8**
Average RC Mod Size – *SF*	*307*	570	570	570	570
No. of RC Modules – *No.*	*4*	4	4	**5**	**5**
Total RC Concessions Area [1] – *SF*	***1,226***	**2,280**	**2,280**	**2,850**	**2,850**
Circulation [1] – *SF*	*368*	**684**	**684**	**855**	**855**

[1] A factor of 0.30 was applied to the total rental car concession area to determine the public circulation needs.
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: CHA, 2024.

Airport Information

Existing ground transportation services information kiosks and/or counters comprise an area of 150 square feet each at LEX. The current space is located within the baggage claim area, meets the present demand, and is expected to adequately support projected demand.

Table 4-66
Airport Information

Area Requirements	***Existing***	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Airport Information – SF	***150***	**150**	**150**	**150**	**150**

Those numbers depicted in italics indicate existing conditions.
Source: CHA, 2024.

[Intentional Page Break]

4.8.18 Airport Administration

Additional areas evaluated included airport administrative offices, conference centers, restrooms, breakrooms, kitchens, airport operations, police, badging, etc. It should be noted that functional areas (i.e., airfield resources, airport police, security, security badging offices, maintenance, mail, receiving, etc.) are evaluated in separate capacities. Administration space needs are driven by future staffing levels necessary to maintain an adequate LOS. The analysis for determining *Airport Administration* areas was conducted using the following formulation:

Figure 4-16
Airport Administration Calculation Methodology

FA = PAL NBEG No. x NBEG Factor (SF):

- FA = Future Airport Administration program requirements, in square feet
- BYA = Base Airport Administration area in square feet = 16,936 SF
- NBEG Factor (SF), for PAL 1 = BYA ÷ BASE NBEG No. = 16,936 SF ÷ 10.2 = 931 SF

Source: Quantitative analysis for increase of area requirements based on forecasted NBEG, CHA, 2024.

Table 4-67 represents the results of calculations with figures representing projections throughout the planning horizon.

Table 4-67
Airport Administration Requirements

NBEG Area Requirements	*Base Existing*	PAL 1 2026	PAL 2 2031	PAL 3 2036	PAL 4 2041
NBEG – *No.*	*10.2*	10.8	10.8	11.8	12.8
NBEG Factor – *SF*	*1,660*	1,660	1,660	1,660	1,660
Total Airport Administration [1] – *SF*	***16,936***	**17,928**	**17,928**	**19,588**	**21,248**

[1] Includes circulation area specific to function group
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: CHA, 2024.

[Intentional Page Break]

4.8.19 Airport Terminal Operations

Airport terminal operation space requirements are reliant on passenger and facility growth functions. The analysis considered future staffing levels and what staffing levels/facilities are necessary to support operational needs across the planning horizon. The analysis for determining *Airport Terminal Operations* areas utlized the following formulation:

Figure 4-17
Airport Terminal Operations Calculation Methodology

FA = PAL NBEG No. x NBEG Factor (SF):

- FA = Future Airport Terminal Operations program requirements, in square feet
- BYA = Base (Existing) Airport Operations area, in square feet = 5,930 SF
- NBEG Factor (SF) for PAL 1 = BYA ÷ BASE NBEG No. = 5,930 SF ÷ 10.2 = 581 SF

Source: CHA 2023, Quantitative analysis for increase of area requirements based on forecasted NBEG

The calculation results in **Figure 4-17** are presented in **Table 4-68** with figures representing projections throughout the planning horizon.

Table 4-68
Airport Terminal Operations Requirements

NBEG Area Requirements	*Base Existing*	PAL 1	PAL 2	PAL 3	PAL 4
NBEG – *No.*	*10.2*	10.8	10.8	11.8	12.8
NBEG Factor – *SF*	*581*	581	581	581	581
Total Airport Operation [1] – *SF*	***5,930***	**6,275**	**6,275**	**6,856**	**7,437**

[1] Includes circulation area specific to functional group
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: CHA, 2024.

[Intentional Page Break]

4.8.20 TSA Office Administration

Table 4-69 exhibits the total TSA office administration space needed at LEX across planning horizons. This area includes space necessary for administration, circulation, and staff operations (staff break room, kitchen, staff storage area). Note that this space does not include CBIS and SSCP processor areas. A five percent growth factor was assumed (based on enplaned passenger projections) to be satisfactory to account for future fluctuations in activity.

Table 4-69
TSA Administration Area

Area Requirements	*Base Existing*	PAL 1	PAL 2	PAL 3	PAL 4
Total TSA Administration – *SF*	***2,390***	**2,510**	**2,635**	**2,767**	**2,905**

This is in line with the TSA standards.
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: CHA, 2024.

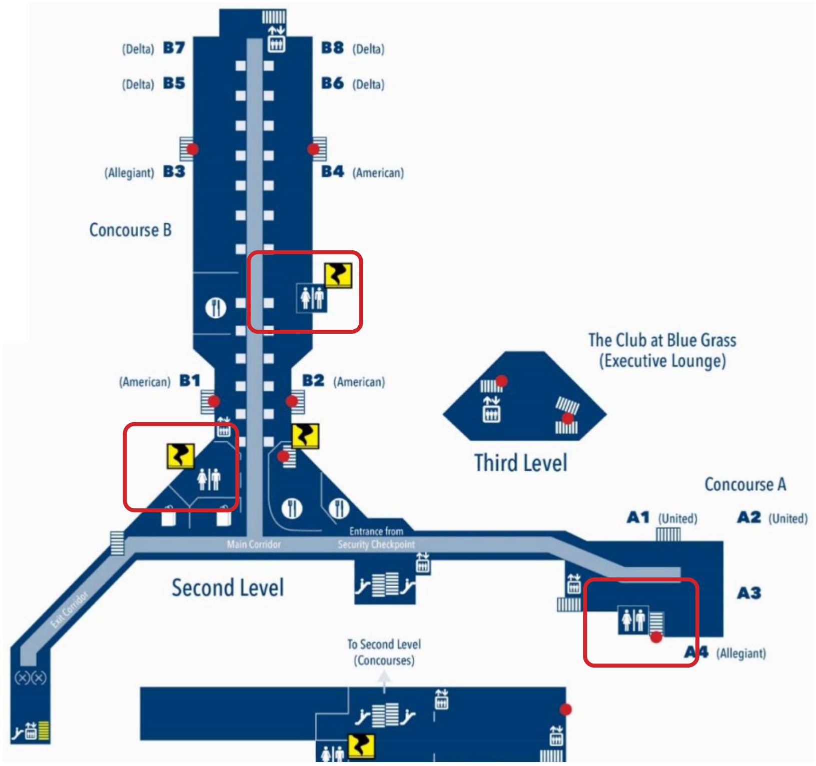
4.8.21 Restroom Facilities

Restrooms are a pivotal piece of terminal infrastructure that accounts for passenger safety and comfort. These facilities are located throughout the terminal building, with this analysis dividing their location between non-secure (landside) and secure (airside) settings. Non-public (private) restrooms were not included in this analysis. The non-secure analysis treated terminal space as one continuous room, providing a streamlined approach to calculating total restroom square footage across its landside entirety. Calculating secure restroom square footage was done alongside the following assumptions:

- Assumption – The Airport has two distinct concourse areas connected by a corridor. Concourse B and Concourse A with eight and four gates, respectively. See **Figure 4-18**. For the purposes of this analysis, the gates will be considered contiguous when determining restroom facilities. After the needs are determined, it may be that the concourse restroom requirements need to be divided proportionally into two modules to address the restroom facilities on both concourses.
- The fixture counts and area requirements in square feet are established using the methodology in the ACRP *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design.*

[Intentional Page Break]

Figure 4-18
Existing Concourse A and Existing Concourse B



Source: CHA 2024.

Special attention should be paid to locating the restrooms in the ideal location for optimal design. Space redundancy should be a high consideration for locating restrooms, as should alternative locations for when maintenance/renovations are scheduled at specific facilities, providing the Airport with resiliency during construction periods (e.g., there should be a reasonable alternative for any one restroom that may be closed for maintenance/renovation). A high LOS, unimpeded by necessary restroom work, should be the end goal. Restrooms also need to account for additional offerings not always mandated by building codes. Per the Friendly Airports for Mothers (FAM) Act of 2018, Airports are required to provide lactation spaces and baby changing tables. The requirements went into effect in 2021 for medium and large hub airports, and by 2022 for small hub airports. In the case of this analysis, the Study included lactation rooms, changing rooms, and family rooms. Though not available at every airport, industry and social trends have shown a greater emphasis on providing such facilities.

The analysis calculated the square footage requirements to support the optimal restroom layout based on the number of fixtures required for each module. The areas calculated included a diaper changing station and the doorless privacy entryway from the concourse circulation. Each restroom module includes a lactation room, family room, and a custodial and service sink room, which were calculated separately at an industry-standard square foot area.

External Quality Assessment (EQA) provided the foundation of analysis for restroom facility needs with EQA data found in **Table 4-31**. For this analysis, a restroom module is defined as having separate men's and women's facilities, a mother's room (family room), and a custodial area with a service sink.

Secure Airside Terminal Restroom Facilities – Concourse Analysis

The first step of the analysis was to determine the number of restroom modules necessary to service a concourse. **Figure 4-19** highlights the methodology used when determining the number of modules.

Figure 4-19
Restroom Demand

$$\text{No. of Restroom Modules} = \frac{EQA}{8}$$

The total number of restroom modules required at LEX for each concourse throughout the planning horizon is shown in **Table 4-70**. Concourse layout was an important variable in calculating the number of modules needed, as there are spacing differences between modules in a double-loaded concourse when compared to those found in a single-loaded concourse. The results of the analysis are depicted in **Table 4-70**.

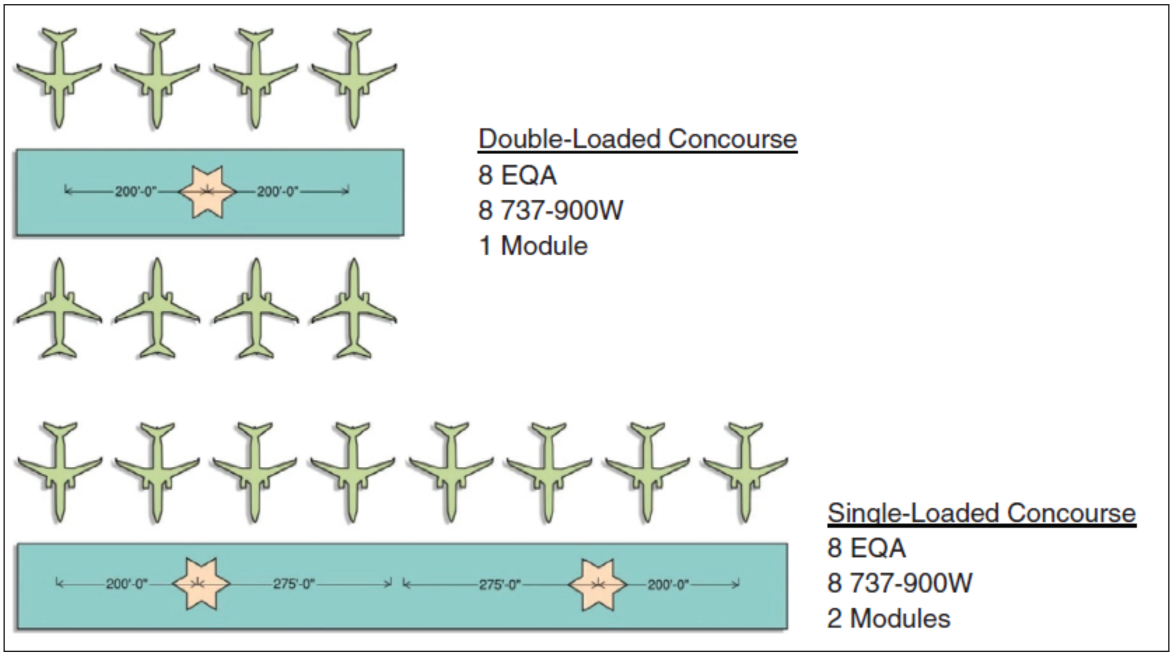
Table 4-70
Number of Restroom Modules (Mods) Required at Concourse

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
EQA [1]	6.4	7.1	7.1	8.1	8.6
No. of Modules – Theoretical [2]	*0.80*	0.89	0.89	1.01	1.08
No. of Modules – Required [3]	***1.00***	**1.00**	**1.00**	**2.00**	**2.00**

[1] The EQA values is the PAL EQA value from Table 4-3.
[2] Represents calculated theoretical value for the number of modules required
[3] The theoretical value is rounded up to the next whole number.
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design*, CHA, 2024.

For added clarity, **Figure 4-20** displays the spacing differences of modules for single and double-loaded concourses. The figure represents the spacing of restroom modules in each concourse scenario for eight EQA. The frequency and spacing of restroom modules were consistent with the formula in **Figure 4-19**, which determined the number of restroom modules required based on a factor of eight EQA.

Figure 4-20
Single-Loaded vs. Double-Loaded Concourse Exhibit



From the data in **Table 4-31** and the load factors for each PAL, the peak passenger capacity (Design Passengers) was calculated using the formula shown in **Figure 4-21**. The results of the analysis are presented in **Table 4-71**.

Figure 4-21
Design Passengers Restroom Calculation

Design Passengers = EQA x 186 Seats x Load Factor

186 seats = 1.0 EQA

Table 4-71
Concourses: Design Passengers

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Load Factor – *No.*	*71%*	83.2%	80.0%	81.2%	84.0%
Equivalent Aircraft Gates (EQA) – *No.*	*6.4*	7.1	7.1	8.1	8.6
Design Passenger (PAX) – *No.*	***845 [1]***	**1,098 [1]**	**1,057 [1]**	**1,223 [1]**	**1,344 [1]**

[1] Assumes EQA seats is 186 is typical of an Allegiant A320 aircraft
Those numbers depicted in italics indicate existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design*, CHA, 2024.

The next step in the analysis was determining the peak 20-minute passenger demand for restroom facilities using the formula in **Figure 4-22**. Results can be found in **Table 4-72**.

Figure 4-22
Concourse Restroom Demand (20-min Peak)

Peak 20-Minute Passenger Demand = Design Passenger x Peak 20-Minute %

For concourse with only origin and destination (O & D) assume the Peak 20-Minute % = 50%

Table 4-72
Concourse: Peak 20-Minute Restroom Demand

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Concourse Peak 20 Min. Demand – *No.*	*423*	549	529	612	672

Those numbers depicted in italics indicate existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design,* CHA, 2024.

The Design Factor calculated using the formula in **Figure 4-23** was the variable that allowed the finding of the fixtures required. These factors are tabulated in **Table 4-73**.

Figure 4-23
Concourse Restroom Design Factor (20-min Peak)

Design Factor = Peak 20-Minute Passenger Demand x % Using Restroom *(utilization)*

The general utilization rate planning standard = 50% to 60%. For this analysis, 60% is used.

Table 4-73
Concourse: Peak 20-Minute Design Factors

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Concourse Peak 20 Min. Design Factors – *No.*	*254*	330	317	367	403

Those numbers depicted in italics indicate existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design,* CHA, 2024.

The formulas represented in **Figure 4-24** and **Figure 4-25** were used to determine the total number of men's and women's fixtures with a fixture defined as a toilet or urinal. These fixture requirements are tabulated in **Table 4-74**.

Figure 4-24
Men's Fixtures Calculation

Men's Fixtures = Design Factor x Male % ÷ 13

The passenger gender mix ratio is assumed to be a 50%/50% ratio.

Figure 4-25
Women's Fixtures Calculation

Women's Fixtures = Men's Fixtures x Female Increase Factor

The passenger gender mix ratio is assumed to be a 50%/50% ratio. The Female Increase Factor = 1.25

Table 4-74
Concourse: Total Required Fixtures for all Modules

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Men's [1]	*18*	13	13	15	16
Women's [1]	*16*	**17**	**17**	**19**	**20**

[1] Does not include restroom module in post-SSCP area on the main level
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Fixture count rounded up to the nearest whole fixture.
Source: Airport Cooperative Research Program (ACRP) *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design,* CHA, 2024.

The fixtures required for each module were then calculated with the formula in **Figure 4-26** and tabulated in **Table 4-75**.

Figure 4-26
Restroom Fixture Calculation

Fixtures Required for Each Module = Required Fixtures ÷ No. Modules Required

Table 4-75
Concourse: Fixtures Required per Module

	Existing	PAL 1 [1]	PAL 2 [1]	PAL 3 [1]	PAL 4 [1]
Men's (Fixture No. per Module)	–	13	13	8	8
Women's (Fixture No. per Module)	–	17	17	10	10

[1] Number of restroom modules required is shown in Table 4-42
Those numbers depicted in italics indicate existing conditions.
Fixture count rounded up to the nearest whole fixture.
Source: Airport Cooperative Research Program (ACRP) *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design,* CHA, 2024.

The formulas used for calculating Concourse men's and women's restroom area is shown in **Figure 4-27** and **Figure 4-28**, respectively, and the areas are tabulated in **Table 4-76** and **Table 4-77**, respectively.

Figure 4-27
Men's Restroom Area Calculation

Men's Room Area = Required Fixtures x 85 SF per Fixture Required

Figure 4-28
Women's Restroom Area Fixture Calculations

Women's Room Area = Required Fixtures x 95 SF per Fixture Required

Table 4-76
Concourse: Single Module Area Requirements

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Men's – *SF*	–	975	975	600	600
Women's – *SF*	–	1,615	1,615	950	950
Lactation Room [1] – *SF*	–	85	85	85	85
Family Room – *SF*	–	105	105	105	105
Custodial – *SF*	–	165	165	165	165
Concourse Single Module Total – SF	**–**	**2,945**	**2,945**	**1,905**	**1,905**

[1] One Lactation Room shared with one Men's/Women's modules
Those numbers depicted in italics indicate existing conditions.
Source: CHA, 2024.

Table 4-77
Concourse: Total Restroom Area Requirements

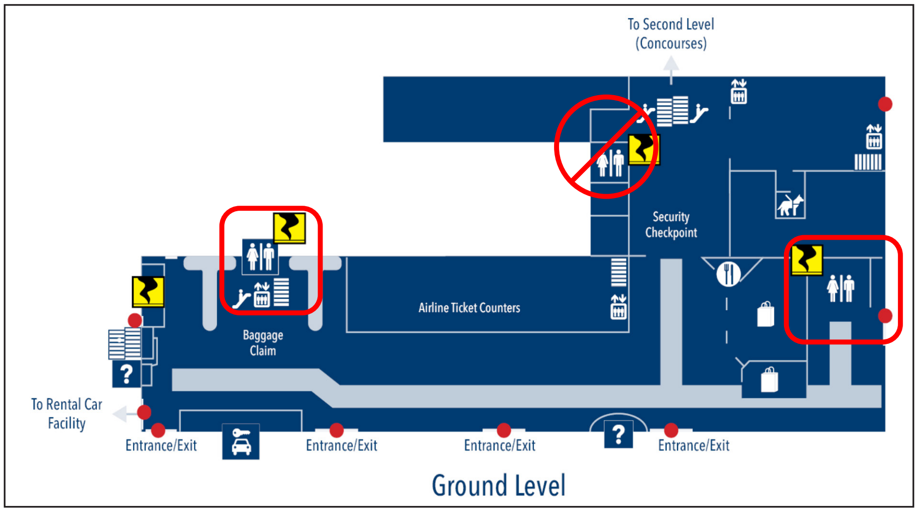
Existing		PAL 1		PAL 2		PAL 3		PAL 4	
Modules	*Total Area*	No. of Modules	Total Area	No. of Modules	Total Area	No. of Modules	Total Area	No. of Modules	Total Area
3.00	*3,331*	1.00	2,945	1.00	2,945	2.00	3,810	2.00	3,810

Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: CHA, 2024.

Non-Secure Landside Terminal Restroom Facilities – Baggage Claim and Ticketing Pre-Security
Non-secure, also referred to as landside, restrooms are commonly found adjacent to heavily trafficked areas, such as the baggage claim area, the check-in lobby, and the concessions area. These facilities provide easily accessible restrooms to passengers and visitors and are an overall important feature of good customer service.

See **Figure 4-29** for locations of non-service restroom locations as part of the baggage claim and ticketing restroom evaluations. Please note that the restroom next to the post-SSCP area was not included in this evaluation.

Figure 4-29
Existing Ticketing Restroom and Existing Baggage Claim Restrooms



Source: CHA 2024.

To determine how many of these facilities are needed at LEX, calculations were performed primarily based on the total peak-hour O&D passenger demand (PHP) and the visitors associated with those passengers. An industry standard visitor ratio was used, with demand increasing by a factor of 20 percent for well-wishers (WW) and 30 percent for meeters and greeters (M&G). For added clarity, well-wishers are visitors associated with departing passengers, whereas meeters and greeters are visitors associated with arriving passengers.

The analysis performed assumed evaluation methodologies scenarios associated with a multi-level terminal building. To begin, the landside Design Passenger Demand was determined for each of the functional areas in which restrooms are typically provided.

<u>Check-in Restroom Facilities Determinations</u>

The Check-in Design Demand was calculated with the formula in **Figure 4-30**. The design demands are shown in **Table 4-78**.

Figure 4-30
Check-In Fixtures Calculation

Check-in Design Demand = Enplaning Peak-Hour Passengers x Well-Wisher Ratio

Well-Wisher Ratio = 1.20

Table 4-78
Non-Secure Landside: Check-In Restroom Design Demand

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Peak-hour Enplaning PAX – *No.*	*319*	661	751	842	939
Check-in Design Demand – *No.*	***383***	**793**	**901**	**1,010**	**1,127**

Those numbers depicted in italics indicate existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design,* CHA, 2023.

Figure 4-31 and **Figure 4-32** determined the quantity of fixtures needed for men's and women's restroom facilities, respectively. Moreover, **Table 4-74** shows the number of fixtures required for both gender-specific facilities.

Figure 4-31
Check-In Male Fixtures Calculation

Check-in Total Male Fixtures = Design Demand ÷ Ratio

Ratio = 1 fixture per 70 enplaning PHP for first 400 enplaning PHP + 1 fixture per 200 enplaning PHP in excess of 400 enplaning PHP

Figure 4-32
Check-In Female Fixtures Calculation

Check-in Total Female Fixtures = Total Male Fixtures x Female Increase Factor

Female Increase Factor = 1.25

Table 4-79
Non-Secure Landside: Check-In Men's and Women's Fixture Requirements

	Existing		PAL 1		PAL 2		PAL 3		PAL 4	
	M	*W*	M	W	M	W	M	W	M	W
Check-in [1]	*13*	*8*	6	8	8	**10**	9	**12**	9	**12**

[1] Number of fixtures in the Check-in area only. Does not include restroom module in post-SSCP area on the main level
Abbreviations: M = Men's & W = Women's
Notes: Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Fixture count rounded up to the nearest whole fixture.
Source: Airport Cooperative Research Program (ACRP) *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design,* CHA, 2024.

Baggage Claim Facilities Determinations

The terminal Design Demand was calculated with the formula in **Figure 4-33** and the Design Demands are indicated in **Table 4-80**.

Figure 4-33
Baggage Claim Demand

Baggage Claim Design Demand = Deplaning Peak-Hour Passengers x M & G Ratio

Meeter & Greeter Ratio = 1.30

Table 4-80
Non-Secure Landside: Baggage Claim Restroom Design Demand (PALs)

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Deplaning Peak-Hour PAX – No.	*319*	621	751	842	939
Baggage Claim Design Demand	***415***	**859**	**976**	**1,095**	**1,221**

Those numbers depicted in italics indicate existing conditions.
Source: Airport Cooperative Research Program (ACRP) *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design,* CHA, 2024.

The quantity of fixtures could be determined from the Design Demand for men's and women's restroom facilities, as indicated in **Figure 4-34** and **Figure 4-35,** respectively, and the fixture requirements are depicted in **Table 4-81**.

Figure 4-34
Baggage Claim Male Fixtures Calculation

Baggage Claim Total Male Fixtures = Design Demand ÷ Ratio

Ratio = 1 fixture per 70 deplaning PHP for first 400 deplaning PHP + 1 fixture per 200 deplaning PHP in excess of 400 deplaning PHP

Figure 4-35
Baggage Claim Female Fixtures Calculation

Baggage Claim Total Female Fixtures = Total Male Fixtures x Female Increase Factor

Female Increase Factor = 1.25

Table 4-81
Non-Secure Landside: Baggage Claim Men's/Women's Fixture Requirements

No.	*Existing*		PAL 1		PAL 2		PAL 3		PAL 4	
	M	*W*	M	W	M	W	M	W	M	W
Baggage Claim [1]	***8***	***7***	**7**	**9**	**9**	**12**	**9**	**12**	**10**	**13**

[1] Number of fixtures in the Baggage Claim level and area only
Abbreviations: M = Men's & W = Women's
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Fixture counts rounded up to the nearest whole fixture.
Source: Airport Cooperative Research Program (ACRP) *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design,* CHA, 2024.

The methodology for calculating required toilet fixtures was determined using analytics for a multi-level terminal. The methodology addressed toilet fixture requirements for only the check-in lobby and baggage claim area. For multi-level terminals, restrooms should be in proximity to the major passenger processing functions such as check-in, baggage claim, security screening, meeter and greeter areas, and major landside concession nodes.

The following analysis considered the physical configuration, locations of the functional areas, and passenger flow for the Airport's terminal.

Table 4-82 tabulates total fixture requirements and allows analysis to compare the existing number of fixtures to those required in future planning levels.

Table 4-82
Non-Secure Landside: Total Fixtures Required – Check-In & Baggage

No.	*Existing*		PAL 1		PAL 2		PAL 3		PAL 4	
	M	***W***	**M**	**W**	**M**	**W**	**M**	**W**	M	W
Check-in	*13*	*8*	6	8	8	10	9	12	9	12
Baggage Claim	*8*	*7*	7	9	9	12	9	12	10	13
Totals	***21***	***15***	**13**	**17**	**17**	**22**	**18**	**24**	**19**	**25**

Abbreviations: M = Men's & W = Women's
Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Fixture counts rounded up to the nearest whole fixture
Source: Airport Cooperative Research Program (ACRP) *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design,* CHA, 2024.

For planning purposes, it is recommended that each processor area (check-in lobby and baggage claim area) have one restroom module each, as that is the industry norm. **Table 4-83** exhibits total fixture requirements for each processor area, with each module including essential components necessary for modern restrooms. As mentioned, these include a diaper changing station, a doorless privacy entryway from the public circulation area, a lactation room, a family room, and a custodial/service sink room—with the latter three given as a standard size.

The methodology used for calculating landside men's and women's restroom areas is shown in **Figure 4-25** and **Figure 4-26**, respectfully, and the requirements are shown in **Table 4-83**.

Figure 4-36
Men's Restroom Area Calculation

Men's Restroom Area = Required Fixtures x 85 SF per Fixture Required

Figure 4-37
Women's Restroom Area Calculation

Women's Restroom Area = Required Fixtures x 95 SF per Fixture Required

Table 4-83
Non-Secure Airside: Single Restroom Module Area Requirements for Check-In and Bag Claim

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Check-in Men's – *SF*	*742*	510	680	**765**	**765**
Check-in Women's – *SF*	*665*	**760**	**950**	**1,140**	**1,235**
Lactation Room – *SF*	*0*	**85**	**85**	**85**	**85**
Family Room – *SF*	*80*	**105**	**105**	**105**	**105**

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Custodial – *SF*	*612*	165	165	165	165
Check-in Module Total – *SF*	***2,099***	1,625	1,985	**2,260**	**2,355**
Baggage Claim Men's – *SF*	*574*	595	**765**	**765**	**850**
Baggage Claim Women's – *SF*	*563*	**855**	**1,140**	**1,140**	**1,235**
Lactation Room – *SF*	*0*	**85**	**85**	**85**	**85**
Family Room – *SF*	*0*	**105**	**105**	**105**	**105**
Custodial – *SF*	*0*	**165**	**165**	**165**	**165**
Baggage Claim Module Total – *SF*	***1,137***	**1,805**	**2,260**	**2,260**	**2,440**

Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: CHA, 2024.

During the design phase, if it is determined that more modules are best suited to meet the stated requirements, then the total areas in **Table 4-83** for men's and women's can be divided by the number of modules provided to determine the square footage for each module. It is recommended that any added module at LEX have a lactation room, family room, and custodial area included in its gross square footage estimate.

Fixture counts were established using the methodology in the ACRP *Report 130 – Guidebook for Airport Terminal Restroom Planning and Design*. It is suggested that any future design should incorporate the most stringent fixture counts mandated by state or local building codes.

4.8.22 Other Considerations

Service Animal Relief Areas

Per Title 49 Code of Federal Regulations (CFR) Part 27.71 (h), *Service Animal Relief Areas*, "each airport with 10,000 or more annual enplanements shall provide wheelchair-accessible SARAs for service animals that accompany passengers departing, connecting, or arriving at airports." Furthermore, per AC 150/5360-14A (Appendix A), *Guidelines for Service Animal Relief Area*, "at least one SARA must be located in each public sterile area of each terminal." Each SARA is planned for 225 square feet and is preferably located near a restroom module after security. Current and future square footage is found in **Table 4-84.**

Table 4-84
Service Animal Relief Areas

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Relief Area – *SF*	***204***	**225**	**225**	**225**	**225**

Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: CHA, 2024.

Storage Requirements

Storage space is found throughout the terminal and used for various functions. The areas evaluated under this section assumed a five percent growth rate from one PAL to the next, with square footage across planning horizons displayed in **Table 4-85**.

Table 4-85
Storage Requirements

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
Storage Area – *SF*	*2,487*	2,611	2,742	2,879	3,023

Those numbers depicted in italics indicate existing conditions
Numbers in **RED** represent a deficiency in space based on existing conditions
Source: CHA, 2024.

4.8.23 Mechanical, Electrical, Plumbing, and Information Technology (IT) Systems (MEPIT)

Mechanical, electrical, plumbing, and information technology (IT) systems (MEPIT) ensure that a terminal building remains physically operational. These areas are calculated on a needs progression factor of 1.10 based on the existing conditions and applied to the overall usable square footage/net square footage requirements for each PAL. **Table 4-86** summarizes calculations performed.

Table 4-86
Mechanical, Electrical, Plumbing, and Information Technology Requirements

	Existing	PAL 1	PAL 2	PAL 3	PAL 4
MEPIT Area – *SF*	*13,597*	14,957	16,452	18,098	19,907

Those numbers depicted in italics indicate existing conditions.
Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: CHA, 2024.

4.9 Support Facility Requirements

Support facilities provide vital functions related to the overall operation of the Airport and include facilities related to GA operations, cargo operations, ATCT, aircraft fueling, ARFF and Public Safety, Airport maintenance and equipment storage, and FIS.

4.9.1 General Aviation Requirements

Aircraft storage hangar requirements are generally a function of the number and type of based aircraft, owner preferences, hangar rental costs, and area climate. The support facility requirements examine existing airport facilities and structures that accommodate the movement and storage of aircraft, and provide facilities to support pilots, passengers, and airport employees. Due to various weather conditions, hangars are a valuable commodity in the central Kentucky region, where rain, high wind, frost, and the occasional occurrence of snowstorms can cause damage to parked aircraft, which can be disruptive to aircraft operations. Additionally, during the warmer months, heat and sun exposure can damage avionics and fade paint. Thunderstorms and hailstorms can also occur, with the potential to cause considerable amounts of damage. All these factors make hangars desirable.

Due to various weather conditions, hangars are a valuable commodity in the central Kentucky region, where rain, high wind, frost, and the occasional occurrence of snowstorms can cause damage to parked aircraft.

General Aviation Hangar Facilities

GA hangar facilities can be found at the East and WestLEX GA Campuses, with Signature Flight Support, the Airport's fixed-base operator (FBO), managing the hangars at the East GA Campus and LFUCAB managing the hangars at the WestLEX GA Campus.

Existing Hangar Storage Space

The Airport's locally based operators comprise most of the hangar space utilization. The hangar storage areas, which are leased to various aircraft owners, consist of different types of hangars that vary in size, from approximately 4,000 square feet to over 40,000 square feet. **Table 4-87** depicts each type of storage hangar at the Airport, its approximate size, and the year it was constructed.

Full hangar capacities and increasing itinerant traffic can put an operational strain on GA facilities. During discussions with tenants that occupy hangar space at the Airport, several expressed that hangar space needs to increase significantly during the planning period and beyond. Many also expressed a desire and willingness to have their hanger space more consolidated in proximity to each other and that they would be open to relocating operations to their current or new GA hangars at the WestLEX GA Campus to be near Runway 9-27.

[Intentional Page Break]

Table 4-87
Aircraft Hangar Units

GA Area/ Location	Building	Building Number	Year Built	Approximate Hangar Area (Sq Ft)
East GA Campus	Aviation Museum	Hangar 13	1988	42,000
	Thoroughbred Hangar	Hangar 15	1982	16,000
	Signature/Thoroughbred	Hangar 16	1970	44,000
	4345 Hangar Drive (3 units)	Hangar 18	1977	6,550 (Total)
	4337 Hangar Drive (8 T-hangars)	Hangar 19	1977	9,150 (Total)
	4325 Hangar Drive (8 T-hangars)	Hangar 20	1977	9,150 (Total)
	4317 Hangar Drive (5 T-hangars)	Hangar 21	1968	9,550 (Total)
	4311 Hangar Drive (5 Units)	Hangar 22	1968	10,000
	4300 Hangar Drive (DGY Hangar)	Hangar 23	1998	16,314
	4203 Airport Road	Hangar 26	1995	3,500
	4205 Airport Road	Hangar 27	1995	3,850
	4209 Airport Road	Hangar 28	1995	2,500
	4217 Airport Road	Hangar 29	1995	3,600
	4225 Airport Road	Hangar 30	1995	4,050
	4233 Airport Road	Hangar 31	1995	4,300
	4245 Airport Road	Hangar 33	2006	5,600
	4249 Airport Road	Hangar 34	2006	5,600
	4253 Airport Road	Hangar 35	2006	5,600
	4261 Airport Road	Hangar 36	2008	6,400
	4263 Airport Road	Hangar 37	2007	6,400
	4265 Airport Road	Hangar 38	2006	8,100
	4160 Aviator Road	Hangar 41	2006	21,000
	4170 Aviator Road	Hangar 42	2007	13,000
	4148 Aviator Road	Hangar 44	2003	15,000
	4144 Aviator Rd – Signature Hangar	Hangar 45	1983	15,000
	4132 Aviator Road	Hangar 46	2010	46,500
WestLEX GA Campus	4480 Gumbert Road	Hangar 106	2015	20,000
	4476 Gumbert Road	Hangar 107	2015	20.,000
	4472 Gumbert Road	Hangar 108	2015	20,000
	4464 Gumbert Road	Hangar 109	2018	15,000
TOTAL				**365,714**

The Aviation Museum was excluded from the total existing hangar storage.
Source: Blue Grass Airport, CHA, 2024.

Projected Hangar Storage Space

During the forecast period, the Airport is projected to experience an increase in based aircraft, consisting predominately of jet and single-engine aircraft (see **Table 4-88**).

Table 4-88
Recommended General Aviation Based Aircraft Forecast (By Aircraft Type)

Year	Single-Engine	Multi-Engine	Turboprop	Jet	Helicopter	Recommended GA Based Aircraft
Base Year (2021)	117	11	6	22	9	165
PAL 1	119	11	7	24	9	170
PAL 2	122	12	7	25	10	176
PAL 3	124	12	8	27	10	181
PAL 4	127	12	8	29	10	186

Source: FAA 2021 TAF, Blue Grass Airport, CHA, 2024.

To develop a projection of required hangar space, assumptions were made based on average square feet of space required to store each type of aircraft and the forecasted fleet mix of based GA aircraft in the planning period. **Table 4-89** provides an overview of anticipated hangar space requirements based on the following:

- Single-engine piston = 1,100 square feet per aircraft
- Multi-engine piston = 3,000 square feet per aircraft
- Turboprop = 3,600 square feet per aircraft
- Jet = 7,200 square feet per aircraft
- Helicopter = 2,500 square feet per aircraft

Based on the airport's current waiting list, it can be presumed that all hangars are currently in use and at capacity.

Table 4-89
Based Aircraft Hangar Space (SF) Requirements

Aircraft Type	Base Year	PAL 1	PAL 2	PAL 3	PAL 4
Current & Projected Based Aircraft					
Single	117	119	122	124	127
Multi	11	11	12	12	12
Turboprop	6	7	7	8	8
Jet Aircraft	22	24	25	27	29
Helicopter	9	9	10	10	10
Total	**165**	**170**	**176**	**181**	**186**
Additional Based Aircraft To Be Accommodated Each Planning Period					
Single	–	2	3	2	3
Multi	–	0	1	0	0
Turboprop	–	1	0	1	0
Jet Aircraft	–	2	1	2	2
Helicopter	–	0	1	0	0
Total	**-**	**5**	**6**	**5**	**5**

Additional Hangar Storage Required (SF)					
Single	–	2,200	3,300	2,200	3,300
Multi	–	0	3,000	0	0
Turboprop	–	3,600	0	3,600	0
Jet Aircraft	–	14,400	7,200	14,400	14,400
Helicopter	–	0	2,500	0	0
Total	**–**	**20,200**	**16,000**	**20,200**	**17,700**
TOTAL					
Total Additional Hangar Space Through PAL 4		74,100			

Basic square foot requirements were assumed for each aircraft type.
Source: FAA 2021 TAF, Blue Grass Airport, CHA, 2024.

Based on the projections, the Airport is expected to need approximately 74,100 SF of additional hangar space by PAL 4 (11,000 SF for single-engine aircraft, 3,000 SF for multi-engine aircraft; 7,200 SF for turboprop aircraft, 50,400 SF for jet aircraft, and 2,500 SF for helicopters). Single-engine aircraft could be accommodated within 10 T-hangars at 1,100 SF each, while the one additional multi-engine aircraft could be accommodated within a 3,000 SF T-hangar. Box hangars could be constructed to accommodate turboprop, jet aircraft, and the additional projected helicopter.

These projections align with desires expressed by various tenants during the tenant interview process. In addition to more hangar space, many tenants conveyed interest in having a more consolidated approach to the hangar space, where each tenant's hangars would be in closer proximity to each other or the tenant's specific business.

While the East GA Apron houses most of the Airport's hangars, the WestLEX GA Apron provides the most direct access to Runway 9-27, which is utilized more by GA operators than Runway 4-22. While there is space for additional hangars on both East and WestLEX GA Aprons, an expansion to the WestLEX GA hangar space may be preferred due to its proximity to Runway 9-27. Locations for future hangar development will be further examined in the Alternatives Chapter.

General Aviation Apron and Tie-Down Spaces

As discussed in **Chapter 3**, GA itinerant operations accounted for approximately 77.8 percent of total GA operations at LEX in the Base Year. Many of these operations utilize itinerant parking aprons, tiedown areas, and corporate hangar space in both the East and WestLEX GA areas. Itinerant aprons are typically utilized for transient aircraft, only visiting, or remaining at the airport for a short period of time (i.e., a few hours to overnight).

The East GA Apron is comprised of approximately 83,000 square yards (SY) of apron area that GA operators can utilize. Approximately 14,000 SY is solely used for aircraft movement purposes, reducing the total available East GA Apron area to approximately 68,500 SY. Of this pavement, approximately 11,500 SY is used for based aircraft parking purposes, leaving 57,000 SY of pavement for use by itinerant aircraft operators or transient aircraft. Currently, there are approximately 15 apron tie-downs on the Signature apron; however, according to the tenant, only one tie-down is currently under a lease contract, with 14 tie-downs available. Signature does not anticipate the number of lease contracts for tie-downs increasing in the foreseeable future, even with additional apron space; however, Signature has advised that additional apron space is needed, especially during seasonal peaks. Aside from the three designated parking areas on the apron, three additional unmarked parking areas are utilized during seasonal peaks/significant local events. It is important to note that the FBO must share this apron space with Thoroughbred Aviation and the Aviation Museum of Kentucky.

The WestLEX GA Apron is approximately 65,000 SY. Approximately 37,000 SY is solely used for aircraft movement purposes, reducing the total available GA apron parking area to approximately 28,000 SY. Of this pavement, approximately 23,000 SY are used for the purposes of itinerant aircraft operations or transient aircraft. The WestLEX GA Apron contains 19 apron tie-downs; however, according to WestLEX staff, only 15 tie-downs are currently under a lease contract, leaving four available tie-downs for itinerant aircraft. Unlike Signature, WestLEX anticipates that the number of lease contracts for tie-downs will increase. According to management at WestLEX, 11 marked parking positions are expected to be cored and anchored by summer 2023 at the latest. With the additional tie-down location, the management at WestLEX plans to convert the four tie-down positions currently available for itinerant traffic into lease tie-down spaces for local tenants. Given that the WestLEX GA Campus has a limited, fixed number of tie-down points, these aircraft parking spaces are typically reserved for local aircraft with contract leases for those locations. Itinerant aircraft on the WestLEX Apron are usually parked on one of the 11 painted parking spots between the nested tie-downs (nearest the T-hangars) and the self-serve tank. Apart from large twin or large turbine aircraft, itinerant aircraft that remain overnight (RON) are moved into a hangar or tied down in an available tie-down parking spot.

Due to the decommissioning of existing itinerant tie-down locations along with the projected influx in demand, it may be necessary to plan for additional tie-down positions in the future. Under the assumption that the four tie-down positions on the WestLEX GA Apron will be reserved for local use and all tie-down locations that are currently under lease at LEX will remain under lease throughout the planning horizon, LEX has 14 tie-down spaces, capable of serving small piston aircraft (Group I), available for itinerant aircraft parking at the East GA Apron. Note, these tie-down locations at LEX are designed to accommodate Group I aircraft and cannot support turboprop or larger jet aircraft without occupying multiple positions. See **Table 4-90**.

Table 4-90
Apron and Tie-Down Space

Year	Tie-Down Spaces Available				Tie-Down Apron Availability (SY)			
	Group I	Group II	Group III	Total	Group I	Group II	Group III	Total
Base Year	14	0	0	14	5,040	0	0	5,040

WestLex plans to convert the four available tie-down locations from itinerant to local aircraft parking; therefore, these positions were assumed as not available for itinerant aircraft parking.
Source: Signature Flight Support, Blue Grass Airport, CHA, 2024.

When evaluating the extent of projected itinerant activity, activity for the busiest day was assumed to be 10 percent more than the peak-month average day (PMAD) itinerant activity. This assumption is based on AC 150/1300-13b, Appendix E2.5. Furthermore, arrivals were assumed at 50 percent of the itinerant operations, with approximately 80 percent of itinerant arrivals parking at tie-down spaces. See **Table 4-91**.

Table 4-91
Projected Itinerant General Aviation Aircraft Activity

Year	Total Itinerant Ops	Peak Month	PMAD	Busiest Day (Assume 10% >PMAD)	Itinerant Arrivals on Busiest Day (Assume 50%)	Itinerant Aircraft on Ground (Assume 80%)
Base	44,276	4,591	148	163	82	66
PAL 1	45,618	4,730	153	168	84	67
PAL 2	47,227	4,897	158	174	87	70
PAL 3	48,569	5,036	162	178	89	71
PAL 4	49,911	5,175	167	184	92	74

Source: Blue Grass Airport, FAA Operations Network (OPSNET), FAA Traffic Flow Management System Counts (TFMSC), FAA Airport Data and Information Portal (Form 5010), Bureau of Transportation Statistics (BTS) T-100 data, US DOT T-100 data, Signature Flight Support, Ailevon Pacific Aviation Consulting analysis, CHA, 2024.

To estimate the aircraft mix, it was assumed that itinerant aircraft would retain the fleet mix from the Base Year, which consisted of approximately 47.8 percent Group I, 49.9 percent Group II, and 2.3 percent Group III aircraft.

After projecting the number of aircraft anticipated to need accommodations, it was necessary to project the demand for apron space. Using apron space requirements set forth in FAA AC 150/5300-13, assuming no taxilane, projected Group I aircraft normally require 360 SY each for parking, while Group II aircraft would each require 490 SY of apron space. To accommodate projected Group III aircraft on the ground, approximately 19,600 SY of apron space would be required for each aircraft based on the average configuration of Group III aircraft frequenting LEX. The demand is summarized in **Table 4-92**.

Table 4-92
Itinerant Aircraft Parking (Demand)

Year	Tie-Down Spaces Required				Tie-Down Apron Space Requirements (SY)			
	Group I	Group II	Group III	Total	Group I	Group II	Group III	Total
Existing	32	33	1	66	11,520	16,170	19,600	47,290
PAL 1	32	33	2	67	11,520	16,170	39,200	66,890
PAL 2	33	35	2	70	11,880	17,150	39,200	68,230
PAL 3	34	35	2	71	12,240	17,150	39,200	68,590
PAL 4	35	37	2	74	12,600	18,130	39,200	69,930

Source: Blue Grass Airport, FAA AC 150/5300-13, FAA Operations Network (OPSNET), FAA Traffic Flow Management System Counts (TFMSC), FAA Airport Data and Information Portal (Form 5010), Bureau of Transportation Statistics (BTS) T-100 data, US DOT T-100 data, Ailevon Pacific Aviation Consulting analysis, CHA, 2024.

For the purpose of this Study, the planned apron area is assumed to be 10 percent higher than demand, as shown in **Table 4-93**. This assumption is based on AC 150/1300-13b, Appendix E2.5.

Table 4-93
Itinerant Aircraft Parking (Demand – Planned Apron Space)

Year	Group I (SY)	Group II (SY)	Group III (SY)	Total (SY)
Existing	12,672	17,787	21,560	52,019
PAL 1	12,672	17,787	43,120	73,579
PAL 2	13,068	18,865	43,120	75,053
PAL 3	13,464	18,865	43,120	75,449
PAL 4	13,860	19,943	43,120	76,923

Source: Blue Grass Airport, FAA AC 150/5300-13, FAA Operations Network (OPSNET), FAA Traffic Flow Management System Counts (TFMSC), FAA Airport Data and Information Portal (Form 5010), Bureau of Transportation Statistics (BTS) T-100 data, US DOT T-100 data, Ailevon Pacific Aviation Consulting analysis, CHA, 2024.

As previously discussed, the East GA Apron has 14 available tie-down locations. After comparing the available tie-down locations to demand and after evaluating the planned apron space requirements/demand, it is projected that the current tie-down apron spaces cannot support anticipated itinerant activity. The projected aircraft parking requirements are summarized in **Table 4-94**.

Table 4-94
Itinerant Aircraft Parking (Requirements)

Year	Tie-Down Spaces Required [Surplus/(Deficit)]				Tie-Down Apron Space Requirements (SY) [Surplus/(Deficit)]			
	Group I	Group II	Group III	Total	Group I	Group II	Group III	Total
Base	(18)	(33)	(1)	(52)	(7,632)	(17,787)	(21,560)	(46,979)
PAL 1	(18)	(33)	(2)	(53)	(7,632)	(17,787)	(43,120)	(68,539)
PAL 2	(19)	(35)	(2)	(56)	(8,028)	(18,865)	(43,120)	(70,013)
PAL 3	(20)	(35)	(2)	(57)	(8,424)	(18,865)	(43,120)	(70,409)
PAL 4	(21)	(37)	(2)	(60)	(8,820)	(19,943)	(43,120)	(71,883)

Source: Blue Grass Airport, FAA AC 150/5300-13, FAA Operations Network (OPSNET), FAA Traffic Flow Management System Counts (TFMSC), FAA Airport Data and Information Portal (Form 5010), Bureau of Transportation Statistics (BTS) T-100 data, US DOT T-100 data, Ailevon Pacific Aviation Consulting analysis, CHA, 2024.

As previously discussed, the East GA Apron currently has approximately 57,000 SY of apron space that can be used for itinerant aircraft, while the WestLEX GA Apron has approximately 23,000 SY of apron space. It was expressed by Signature that they wish to reserve the 57,000 SY for future corporate activity, thus resulting in only the 23,000 SY in the WestLEX GA area being available for future itinerant aircraft. As shown in **Table 4-94**, it is recommended that the Airport provide up to an additional 48,883 SY (PAL 4 demand of 71,883 SY – existing 23,000 SY) of apron space for itinerant aircraft parking.

In addition, approximately 7,300 SY of existing apron space that is currently used for itinerant aircraft in the East GA area will be leased out to a private tenant, tentatively in PAL 1. Thus, it is further recommended that an additional 7,300 SY be provided elsewhere in the short term.

In summary, a total of 56,183 SY of apron space (48,883 SY + 7,300 SY) is recommended by PAL 4 for future itinerant aircraft use. Locations for additional GA apron parking will be further evaluated in the Alternatives Chapter.

4.9.2 Helipad Facility Requirements

Chapter 3 projected helicopter activity to modestly increase by 10 percent by the end of the planning period. The Airport does not currently provide a designated helipad for helicopter operations. As such, they are required to hover taxi to or from the runways before or after their takeoff or landing operations, respectively. That greatly diminishes the Airport's operational flexibility for helicopter users, which is typically provided by their vertical takeoff and landing (VTOL) capabilities. The Airport's projected helicopter activity during this Study's planning period does not warrant the addition of a helipad.

4.9.3 Cargo Facility Requirements

While the Airport does not have scheduled air cargo services, cargo operators have conducted annual operations ranging between 127 and 456 over the last 10 years (2011 through 2021), or an average of 254 annual operations. An air freight facility is located east of the terminal and is capable of supporting air cargo activity; however, the facility is being used for non-cargo-related activities, including those related to US Customs and Border Protection. The cargo operations forecast presented in **Chapter 3** assumed that LEX will continue to receive the average number of cargo operations throughout the planning period. As such, cargo facility improvements or additions are not anticipated to be required through PAL 4.

The cargo operations forecast presented assumed that LEX will continue to receive the average number of cargo operations throughout the planning period.

The two largest air cargo carriers in the United States—UPS and FedEx—have major hubs of operation approximately 54 and 315 nautical miles from the Airport, respectively. Additionally, Amazon Air opened its 'superhub' in September 2021 at an airport approximately 60 nautical miles from LEX. If LEX were to receive scheduled service in the future, smaller regional air cargo carriers, known as 'feeders,' would be the most likely to utilize the Airport. As such, if a cargo operator expresses future interest in establishing a presence at the Airport, potential alternative areas capable of supporting such activity should be identified.

4.9.4 ATCT Facility Requirements

Per FAA Order 5100.38D, Change 1, *Airport Improvement Program Handbook,* buildings have a useful life of 40 years. The ATCT, located east of the terminal building, opened in 1972 and thus surpasses its expected useful life. It is recommended that the Airport consider programming for the design and construction of a new ATCT. Additional sites for a new ATCT will be evaluated in **Chapter 5** and **Appendix H**.

4.9.5 Fueling Facility Requirements

An independent evaluation of the Airport Fuel Facilities was conducted under separate cover. Please refer to **Appendix A** for a full fuel farm evaluation, including age, replacement, and sizing.

4.9.6 Airport Rescue and Firefighting (ARFF) and Public Safety Facility Requirements

ARFF and Public Safety Facilities

<u>ARFF Functions</u>

The Airport currently has one ARFF station, which also houses public safety (police functions and services), located northeast of the airfield and east of the terminal building. The new ARFF station opened in 2020 and was constructed in accordance with building design requirements found in the FAA AC 150/5210-15A, *Aircraft Rescue and Firefighting (ARFF) Station Building Design*.

The ARFF station is approximately 23,200 SF and contains four vehicle bays. The facility can effectively house the vehicles required to operate under the current ARFF Index (Index C), which LEX is anticipated to retain throughout the planning horizon.

As previously discussed, the useful life of a building is 40 years; therefore, the ARFF station is not expected to surpass its useful life during the planning horizon. Should the ARFF facility need more space within the planning horizon, it may be necessary to revisit the FAA guidance for ARFF requirements. The building and site are designed to accommodate one additional pull-through truck bay.

In addition to the ARFF station, the Airport maintains an ARFF training facility located on the northwest side of the airfield, east of Gumbert Road. This area contains an ARFF Training Center, which was constructed in 1997. The Airport is currently under contract for a rehabilitation and expansion of the ARFF Training Facility, including the building and the training simulators themselves. However, as previously mentioned, per the FAA AIP Handbook, buildings have a useful life of approximately 40 years; therefore, it is recommended that the Airport plan for possible rehabilitation of the remaining ARFF Training Center by PAL 3. It is recommended that the Airport monitor the integrity of these simulators during the forecast horizon to determine when replacement may be necessary.

ARFF personnel have expressed interest in having a dedicated area on the west side of the airfield (west of Runway 22), which could further support ARFF training (i.e., FEMA) and police training activities.

Public Safety Functions

Public safety activity is also housed within the ARFF station. The facility contains a training room, which is cost-efficient for the Airport as public safety officers do not have to go off-site for training, thus saving on travel expenses. In the case of an emergency, the training room can also be repurposed as an Emergency Operations Center (EOC). This facility is anticipated to continue to meet the Airport's needs throughout the planning horizon.

ARFF Equipment

While the ARFF station is expected to adequately accommodate projected activity levels, it may be necessary to replace ARFF vehicles, which have a useful life of approximately 15 years (per the FAA AIP Handbook). The current ARFF vehicle fleet and conditions are depicted in **Table 4-95**. As shown, several vehicles are in fair to poor condition. If ARFF vehicles are taken out of commission, it is important that the Airport replace vehicles as needed to ensure the required ARFF Index C equipment is maintained. The Airport is only required to maintain two to three ARFF vehicles, depending on the vehicles' configurations.

Table 4-95
ARFF Vehicle Fleet Inventory

Year	Make	Model	Condition	Carrying Capacity
1993	Oshkosh	Striker 1500	Fair	1,500-gallon water tank 210-gallon foam tank 450 lbs. of dry chemical 460 lbs. of Halotron 1
1994	International	Command/ Rescue	Good	–

Year	Make	Model	Condition	Carrying Capacity
1999	Oshkosh	Striker 3000	Fair	3,000-gallon water tank 420-gallon foam tank 500 lbs. of dry chemical 460 lbs. of Halotron 1
2006	Oshkosh	Striker 3000	Good	3,000-gallon water tank 420-gallon foam tank 500 lbs. of dry chemical 460 lbs. of Halotron 1
2018	Oshkosh	Striker 1500	Excellent	1,500-gallon water tank 210-gallon foam tank 450 lbs. of dry chemical 460 lbs. of Halotron 1

Source: Blue Grass Airport, 2022/2023.

4.10 Potential Advanced Air Mobility Requirements

Unmanned Aerial Vehicle (UAV) and Urban Air Mobility (UAM) Basics

In recent years, many advancements have been made in the next generation of airborne transportation. These advancements have been focused on both manned and unmanned aircraft, electric-powered aircraft, traditional winged aircraft, and aircraft with vertical takeoff and landing capabilities. With the support of NASA, the FAA, and aviation stakeholders, this industry has been termed Urban Air Mobility (UAM) for the potential to expand transportation networks in metropolitan areas. LEX serves the Commonwealth of Kentucky and the Lexington-Fayette, KY Metropolitan Statistical Area (MSA); therefore, it is important to look ahead at how the potential for UAM activity could impact the Airport and basic facility requirements and alternatives to accommodate demand.

In April 2023, the FAA released the *UAM Concept of Operations (ConOps), Version 2.0*. The publication describes "the envisioned operational environment that supports the expected growth of flight operations in and around urban areas." The advancement of UAM is anticipated to eventually aid in supporting passenger and cargo operations in hard-to-reach, congested, or underserved areas. Per the FAA, UAM advancement will take place in a series of increasing levels of autonomy and operational tempo.

The initial phases of implementing UAM will utilize existing helicopter routes, helipads, aircraft aprons, rules and regulations, and ATC services. As demand for UAM activity increases, the demand on infrastructure and procedures will increase and be impacted. Over time, the FAA will establish and define UAM Corridors from specific aerodromes[7] based on performance requirements. This will also trigger changes to and enforcement of new UAM regulations. As the state of operations matures and becomes more advanced, and as frequency increases throughout the UAM sector, the previously formed UAM Corridors may form a new network, thus optimizing paths between aerodromes. The number of aerodromes or vertiports would also increase as demand increases. One primary difference between the stages of activity is that once operations have increased to be considered 'mature,' the UAM vehicles may be piloted remotely or autonomously rather than having an onboard pilot in control.

[7] Per the FAA, an aerodrome is "a location from which UAM flight operations depart or arrive."

Figure 4-38
Sample UAM Aircraft

As the previously discussed advancements are made, the FAA will continue to define, maintain, and make publicly available the standards and regulations regarding the UAM system; therefore, it is important that LEX review and apply the standards to ensure the accommodation of this newly emerging technology. Advancements to current infrastructure at LEX could include, but are not limited to:

- Installing charging stations in the FBO and other GA areas for the aircraft's electric motors and batteries
- Designated operations areas, including locations for electric Vertical Takeoff and Landing (eVTOL) aircraft in the terminal area, with defined takeoff and landing routes
- Construction of one or more vertiports, apron parking, and hangars to accommodate the new aircraft

Alternate locations for these activities will be further evaluated in **Chapter 5**.

If the Airport introduces a vertiport on site, dual consideration should be made to accommodate helicopter aircraft at that site. One of the primary differences between a vertiport and a heliport is electrification. Helicopters utilize traditional fossil fuels, whereas the emerging UAM aircraft fleet is largely electric and may require its own substation. As such, future vertiports should be strategically placed to integrate with local power grids.

4.11 Surface Transportation and Parking

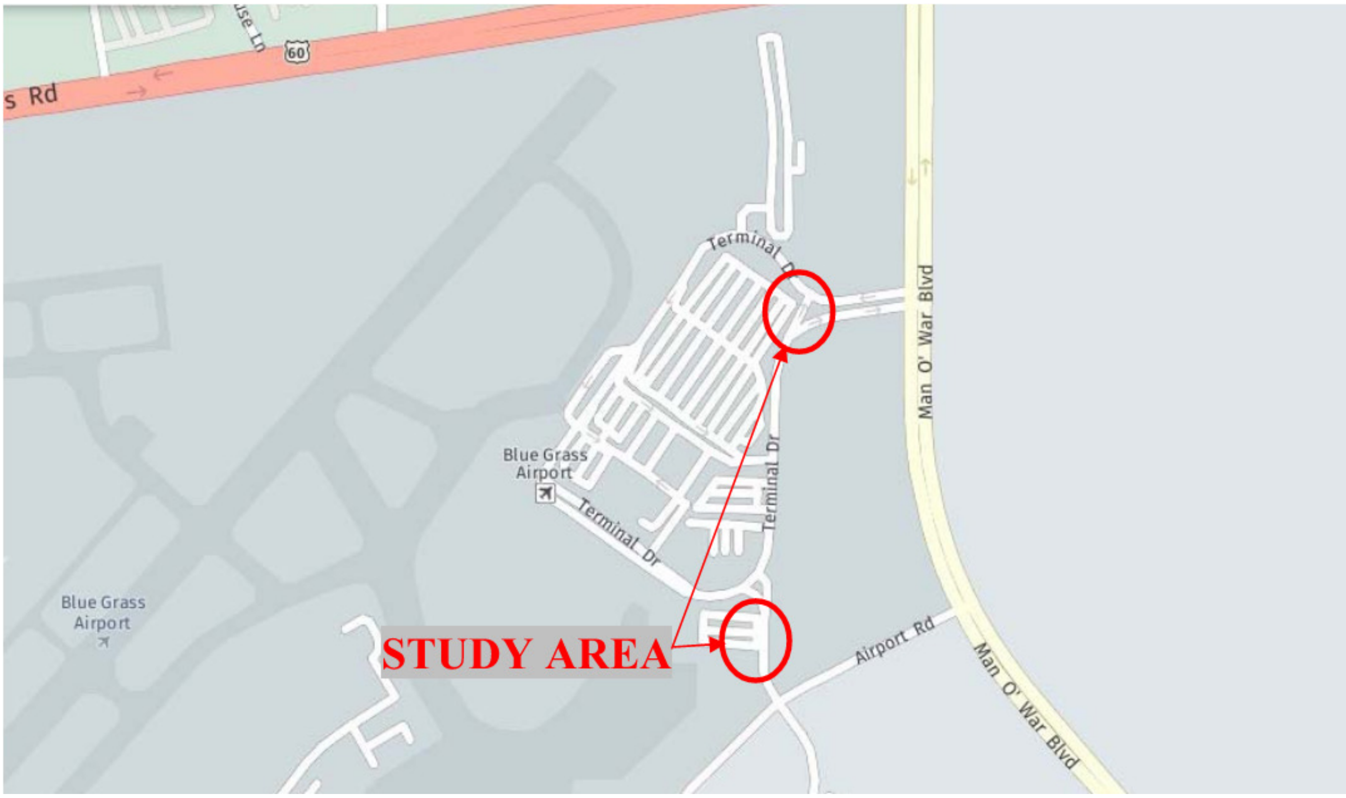
The types of roadways that typically serve the purpose of providing access to/from and within an airport most commonly are as follows:

- Access Roadways – These roadways link the local/regional roadway network with the airport terminal. Access roadways provide a free flow of traffic and typically have a limited number of decision points.
- Curbside Roadways – These roadways are one-way thoroughfares located immediately in front of the terminal building for the loading and unloading of passengers and baggage. For an airport with a similar size to LEX, the curbside roadways typically consist of one inner lane, an adjacent maneuvering lane, and one or more through or bypass lanes.

- Circulation Roadways – These roadways provide a variety of paths for the movement of vehicles between the terminal, vehicle parking, rental car facilities, and other on-airport facilities.
- Service Roads – These roadways link the airport access roadways with on-airport public facilities, employee parking areas, and other support facilities.

For the purposes of this Study, the traffic analysis focused on the operations of the curbside roadways, circulation roadways, and parking roadways. The traffic data used as a part of this analysis was taken at the locations shown in **Figure 4-39** below. Traffic movement data and analysis output reports can be found in **Appendix I** to this report.

Figure 4-39
Landside Access Study Areas



Source: Palmer Engineering, 2023.

As shown in the Figure, part of this analysis evaluated the existing and projected conditions of Terminal Drive, including the entrances and exits at Terminal Drive and Man O' War Boulevard intersection, as well as Air Freight Drive and Terminal Drive intersections.

This study included traffic counts at the intersections studied. Peak hour and peak month average day volumes were identified and compared to passenger throughput at those times. The results of this analysis then projected these vehicular levels through the planning period to determine existing and future access road and terminal curbside congestion.

Additionally, as part of this study, a manual evaluation was completed to determine the dwell time at the pick-up and drop-off areas of the terminal curb to determine the average duration of time that a car is parking in these zones, potentially impacting curbside congestion. This study of the terminal curb was to comprehensively identify potential congestion as it relates to passengers waiting at the curb and compare those results to curbside volume to determine a correlation between dwell times and LOS. Full dwell time analyses are provided in the associated appendix.

4.11.1 Level of Service (LOS)

Like the terminal evaluation, LOS is also employed as an industry-accepted standard by the Federal Highway Administration and State Department of Transportation offices for use in evaluating roadways and access. Dependent on the roadway facility, the determination of the performance measure for the facility considers factors such as traffic volumes, capacity, roadway geometrics, driver characteristics, and various other factors. LOS analysis was completed to determine the traffic operations along the terminal curbsides and within the circulation roadway. The following sections briefly describe the methodologies used for each roadway facility.

Terminal Curbside Roadway and Curb Front Level of Service

Traffic analysis was completed to determine the LOS on Terminal Drive (i.e., arrival terminal curbside roadway) and Air Freight Drive (i.e., departure terminal curbside roadway). The analysis for each of these curbsides was completed using the Quick Analysis Tool for Airport Roadways (QATAR). This macro-simulation model was developed alongside and implements the equations and methodologies set forth in ACRP *Report 40*, *Airport Curbside and Terminal Area Roadway Operations*. This modeling program considers various traffic operational factors including lane configuration, parking characteristics, vehicle dwell time, traffic volumes, and other various inputs. QATAR produces performance measures, such as volume-to-capacity ratio and curbside utilization ratio, that are used to evaluate the traffic operations at the curbside and roadway.

The LOS designation for the curbside and curbside roadway are determined based on the performance measures output by QATAR. **Table 4-96** summarizes the LOS grades for curbside and curbside roadways based on the appropriate performance measure for each facility. The LOS criteria used for the terminal curbside analysis are based on the 2010 ACRP *Report 40*, *Airport Curbside and Terminal Area Roadway Operations*, published by the TRB.

Table 4-96
Level of Service for Curbside

Facility Type	Curbside	Curbside Roadway
Grade Designation	**Curbside Utilization (%)**	**Roadway Volume to Capacity Ratio (v/c)**
A	≤90%	≤0.25
B	90-110%	0.25-0.40
C	110-130%	0.40-0.60
D	130-170%	0.60-0.80
E	170-200%	0.80-1.00
F	>200%	>1.00

Source: Airport Cooperative Research Program (ACRP) *Report 40, Airport Curbside and Terminal Area Roadway Operations.*

For roadway studies, traffic movements that operate at LOS A through D are considered acceptable under most design guidelines; however, according to the TRB's ACRP *Report 40*, *Airport Curbside and Terminal Roadway Operations*, LOS C is typically considered to be the minimum acceptable LOS on airport roadways because of a lack of alternate travel paths and the significant negative consequences resulting from travel delays (i.e., passengers missing their flights, parking at the curbside for extended periods, etc.). For that reason, traffic movements that operate at LOS D, E, or F are deficient for curbside facilities.

As discussed previously, multiple factors influence a curb front LOS, including the mode of transportation used by passengers arriving and departing the airport, the design hour volume, dwell time by mode, and the curb front geometrics. The evaluation performed on each curbside considered the typical mode split at LEX. **Table 4-97** identifies the percentage split and dwell time for each transportation mode currently in use at the airport. The dwell times shown in this table and used for analysis are based on the ACRP *Report 25*, *Airport Passenger Terminal Planning and Design*.

Multiple factors influence a curb front, including the mode of transportation used by passengers arriving and departing the airport, the design hour volume, dwell time by mode, and the curb front geometrics.

In addition to these input parameters, information related to the number of passengers who utilize the various parking facilities at the airport was used. Based on industry-standard planning metrics (ACRP *Report 25*) and peer airport comparisons, it is estimated that approximately 41 percent of passengers will park at the airport, indicating that approximately 59 percent of passengers will arrive by one of the identified modes of transportation and utilize the curb front. The results of the curbside utilization influence the roadway capacity. As seen in **Figure 4-40**, taken from ACRP *Report 40*, the roadway capacity decreases significantly as curbside utilization increases past 100 percent.

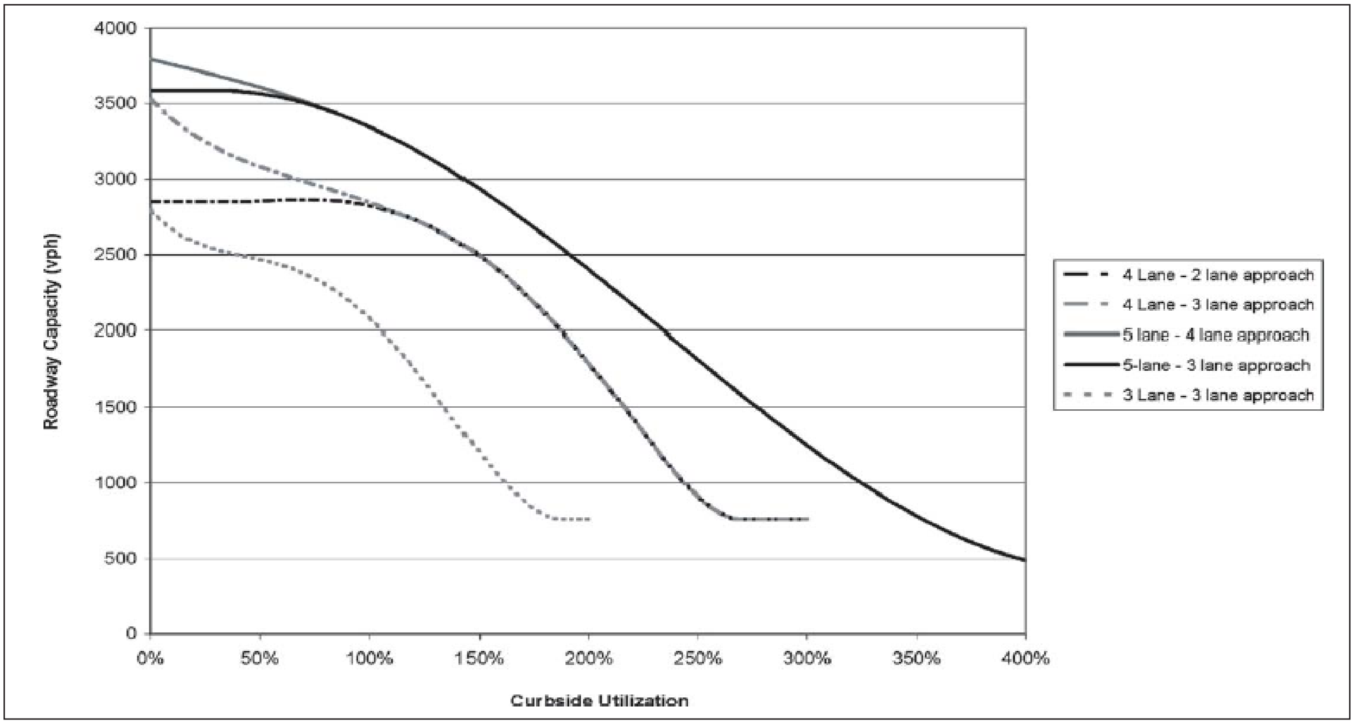
It is important to note that the average dwell time for private autos, the highest percentage of users, is between 2 and 4 minutes.

Table 4-97
Curb Front Mode of Transportation

Mode	Percentage	Dwell Time (Minutes)
Private Auto	56.18%	2–4
Rental Car Shuttle	0.00%	2–5
Taxis	22.47%	1–3
Limousines	11.24%	1–3
Hotel Shuttles	3.37%	2–4
Airport Shuttles	0.00%	2–4
Buses	3.37%	2–4
Other	3.37%	Varies

Source: Airport Cooperative Research Program (ACRP) *Report 25, Airport Passenger Terminal Planning and Design.*

Figure 4-40
Roadway Capacity versus Curbside Utilization



Source: Airport Cooperative Research Program (ACRP) *Report 40, Airport Curbside and Terminal Area Roadway Operations.*

4.11.2 Terminal Curbside

Dwell Time

The initial study of the traffic counts and terminal curb evaluation included a manual review of dwell times on the terminal curb. This factor, when evaluating the conditions and future demand of the curbside, is critical to determine if private vehicles with extended stays on the curbside potentially impact the total capacity of the terminal curb.

As shown in **Figure 4-41** below, a sample dwell time analysis was recorded for the Study, with approximately 30 vehicles being selected at random each day as data points for consideration. Based on the data collected, the minimum dwell was approximately 18 seconds, with the maximum dwell exceeding 60 minutes. The total evaluation resulted in an average dwell time of 9 minutes and 35 seconds. This is significantly higher than the industry average of 2-4 minutes previously discussed, potentially identifying a LOS issue, which will be addressed in the next chapter.

As mentioned previously, it's important to understand the discrepancy between the industry average dwell time and the average actual dwell time at the Airport. The impacts of high dwell times and the locations of the longer duration stay vehicles on the curbside are exacerbated based on where the vehicle is stopped. Should the vehicle stop earlier in the departure curb, the entrance to the curbside will become congested sooner, quickly decreasing the LOS to the remaining terminal curbside.

Figure 4-41
Dwell Times

TABLE 3. BLUEGRASS AIRPORT DWELL TIMES

Sample #	Date	Arrival Time	Entrance (A or B)	Dwell
1	29-Dec	0:07	A	1min 16sec
2	29-Dec	7:39:52	A	22min 37sec
3	29-Dec	8:19:56	A	4min
4	29-Dec	8:54:19	A	19min 40sec
5	29-Dec	10:15:32	A	29sec
6	29-Dec	11:00:27	A	6min 50sec
7	29-Dec	12:09:01	A	3min 35sec
8	29-Dec	13:14:30	A	4min 36sec
9	29-Dec	15:34:56	A	9min 46sec
10	29-Dec	16:58:43	A	23min 28sec
11	29-Dec	18:55:05	A	21min 11sec
12	29-Dec	19:25:50	A	2min 20sec
13	29-Dec	20:49:50	A	32min 20sec
14	29-Dec	21:53:05	A	1min 42sec
15	29-Dec	22:54:10	A	1min 22sec
16	29-Dec	0:54	B	1min 8sec
17	29-Dec	4:30:52	B	2min 16sec
18	29-Dec	5:06:35	B	1min 51sec
19	29-Dec	6:20:18	B	7min 38sec
20	29-Dec	7:46:45	B	1min 24sec
21	29-Dec	8:57:20	B	3min 11sec
22	29-Dec	10:26:58	B	2min 12sec
23	29-Dec	11:45:26	B	31sec
24	29-Dec	13:01:28	B	5min 28sec
25	29-Dec	15:06:30	B	1min 34sec
26	29-Dec	16:03:22	B	49sec
27	29-Dec	17:02:30	B	15min 30sec
28	29-Dec	18:16:36	B	1min 42sec
29	29-Dec	19:23:28	B	2min 12sec
30	29-Dec	21:11:16	B	12min 10sec
31	30-Dec	0:01	A	3min 46sec
32	30-Dec	4:30	A	3min 55sec
33	30-Dec	7:16:18	A	57sec
34	30-Dec	8:51:02	A	1min 26sec
35	30-Dec	10:17:06	A	13min 18sec
36	30-Dec	11:45:32	A	26min 20sec
37	30-Dec	13:08:24	A	14min 2sec
38	30-Dec	14:44:56	A	2min 40sec
39	30-Dec	16:01:16	A	6min 12sec
40	30-Dec	17:18:40	A	5min 18sec
41	30-Dec	18:45:32	A	8min 30sec
42	30-Dec	20:06:28	A	9min 44sec
43	30-Dec	21:22:12	A	30sec
44	30-Dec	22:02:42	A	21min 20sec
45	30-Dec	23:01:52	A	1min 38sec

Sample #	Date	Arrival Time	Entrance (A or B)	Dwell
138	2-Jan	4:17:10	B	2min 40sec
139	2-Jan	5:24:20	B	1min 58sec
140	2-Jan	6:42:12	B	41min 28sec
141	2-Jan	8:03:40	B	10min 16sec
142	2-Jan	9:09:36	B	4min 16sec
143	2-Jan	10:02:02	B	1min 38sec
144	2-Jan	11:33:44	B	5min
145	2-Jan	12:47:02	B	1min 26sec
146	2-Jan	14:30:38	B	2min
147	2-Jan	16:10:16	B	7min 8sec
148	2-Jan	17:02:22	B	5min 22sec
149	2-Jan	18:02:44	B	1min 14sec
150	2-Jan	19:03:10	B	50sec
151	2-Jan	20:01:28	B	1min 32sec
152	4-Jan	0:12:38	A	20min 58sec
153	4-Jan	4:00:22	A	33min 36sec
154	4-Jan	6:45:16	A	47min 54sec
155	4-Jan	8:22:56	A	13min 56sec
156	4-Jan	9:48:18	A	2min 36sec
157	4-Jan	11:19:56	A	58min 40sec
158	4-Jan	12:51:00	A	12min
159	4-Jan	14:10:36	A	2min 50sec
160	4-Jan	15:53:42	A	13min 8sec
161	4-Jan	17:14:36	A	3min 2sec
162	4-Jan	18:16:04	A	26min 10sec
163	4-Jan	19:07:54	A	36min 4sec
164	4-Jan	20:12:44	A	7min 48sec
165	4-Jan	21:26:54	A	8min 38sec
166	4-Jan	23:07:58	A	7min 36sec
167	4-Jan	0:36:24	B	9min 40sec
168	4-Jan	4:25:34	B	1min 58sec
169	4-Jan	6:04:28	B	4min 46sec
170	4-Jan	7:35:48	B	7min 4sec
171	4-Jan	9:22:16	B	1min 42sec
172	4-Jan	10:44:44	B	1min 40sec
173	4-Jan	12:01:56	B	26min 2sec
174	4-Jan	13:24:26	B	24min 58sec
175	4-Jan	15:08:24	B	3min 10sec
176	4-Jan	16:23:52	B	2min 6sec
177	4-Jan	17:47:30	B	56sec
178	4-Jan	19:18:26	B	13min 24sec
179	4-Jan	20:53:14	B	1min 38sec
180	4-Jan	21:34:38	B	1min 50sec
181	4-Jan	23:30:30	B	10min 28sec
Average Dwell Time (min)				9.58

Source: Palmer Engineering, 2023.

Terminal Curbside

The terminal curb front can be a complex operating environment as it combines pedestrians, private vehicles, taxis, limos, ride-share, and commercial vehicles (buses and shuttles), while commonly having strict security requirements necessary to ensure a safe and efficient operating environment for all users.

Small-hub airports typically aim for LOS C at new and existing curbside roadways. Curbside roadways work most efficiently if the lanes are divided to serve different vehicle types (e.g., passenger vehicles separated from commercial).

Due to the nature of airport curbside facilities, the capacity is greatly reduced compared to typical roadway facilities with the same number of lanes due to the prevalence of parking maneuvers. More often, at commercial service airports, there is a need to provide additional curbside lanes to have enough capacity to handle peak volumes even if a through lane is blocked due to double/triple parking and maneuvering.

LEX is a small-hub airport that has ground-level roadways leading to the terminal building with departures and arrivals on one level. The LOS results for the terminal curb will be described in this section.

Departures and Arrival Curb

As shown in the dwell times, there is a wide range of dwell time values, and frontages should not be designed for high dwell times. As such, frequency distribution was utilized to provide assumptions and inputs to the terminal curb evaluation. This resulted in evaluating the curb front with two different dwell time scenarios, 5-minute and 7.5-minute average dwell times. The results of the frequency analysis are shown in the associated **Appendix I**.

For the purposes of this study, the results of both scenarios (5 to 7.5-minute dwell time) are shown below. Each scenario will be shown (5-minute dwell first) in all cases throughout the forecast period.

The terminal curbside roadway provides a total of two lanes, along with three pedestrian crosswalks used to access a sidewalk to the adjacent parking garage. The innermost portion of the inner lane (closest to the terminal building) functions as a parking area for vehicles that stop to drop off passengers at the curb. The length of this curbside measures approximately 526 feet and has markings designating it as an unloading zone only; however, it is assumed that when vehicles are pulled up along the curb, through vehicles can still utilize this lane without impeding the vehicles dropping off passengers, effectively functioning as two throughput lanes with restricted maneuverability in the inner lane. The outermost lane is used strictly for through traffic. The resulting LOS given by QATAR for the existing conditions, the PAL where LOS exceeds LOS C and PAL 4 conditions is shown in **Figure 4-42**, **Figure 4-43**, and **Figure 4-44**.

In its current condition, the terminal curbside and roadway frequently get congested during peak times. As noted below, there are concerns about vehicle dwell time impacts. It should also be noted that the capacity of the inner lane is reduced due to its use as parking and a through lane because of dwell time averages. This situation cannot be modeled in QATAR but will influence the roadway LOS. This discrepancy will be considered in all scenarios.

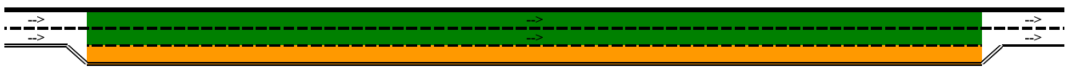
Figure 4-42 depicts the existing conditions of the terminal curbside. As presented, the throughput lanes are LOS A, with a reduction in LOS in the loading lane, presumably because of excess dwell times. As shown, from 7.5 to 5-minute dwell times, there is a full LOS change because of reduced dwell.

Figure 4-43 depicts the conditions of the terminal curbside at PAL 1. As presented, the throughput lanes are now getting more congested with LOS B and LOS C, respectively.

Figure 4-44 depicts the conditions of the terminal curbside at PAL 2. As presented, the throughput lanes are now beyond LOS C and are failing based on projected demand.

Figure 4-42
Base Conditions Terminal Curbside (5-min and 7.5-min)

Airport	Blue Grass Airport
Roadway location	Terminal 1
Scenario	Existing
Level / type of roadway	Mixed
Total lanes / approach lanes	3 / 2
Number of curbside zones	1



Zone ID	Zone 1
Name/description	Existing
Curb length (feet)	526
Zone type	active
Roadway volume (vph)	288
Roadway capacity (vph)	1,483
Roadway V/C ratio	0.194
Roadway LOS	A

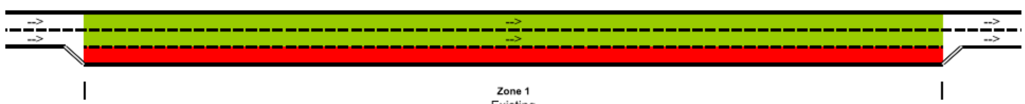
Level-of-service (LOS) key:

A
B
C
D
E
F

Results: Level-of-Service by Zone

Model run by: Sandeep Das on 11/17/2023

Airport	Blue Grass Airport
Roadway location	Terminal 1
Scenario	Existing
Level / type of roadway	Mixed
Total lanes / approach lanes	3 / 2
Number of curbside zones	1

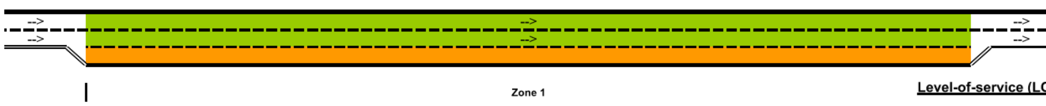


Zone ID	Zone 1
Name/description	Existing
Curb length (feet)	526
Zone type	active
Roadway volume (vph)	288
Roadway capacity (vph)	805
Roadway V/C ratio	0.358
Roadway LOS	B

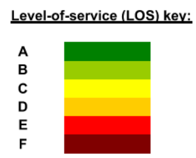
Source: Quick Analysis Tool for Airport Roadways (QATAR), CHA, 2024.

Figure 4-43
Terminal Curbside PAL 1 (5-min and 7.5-min)

Airport	Blue Grass Airport
Roadway location	Terminal 1
Scenario	Planning Activity Level 1
Level / type of roadway	Mixed
Total lanes / approach lanes	3 / 2
Number of curbside zones	1

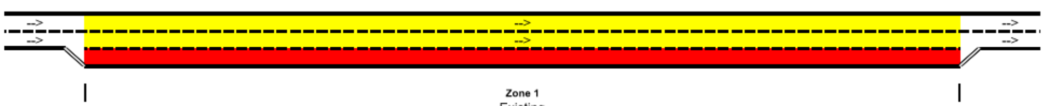


Zone ID	Zone 1
Name/description	
Curb length (feet)	526
Zone type	active
Roadway volume (vph)	338
Roadway capacity (vph)	1,104
Roadway V/C ratio	0.306
Roadway LOS	B



Results: Level-of-Service by Zone
Model run by: Sandeep Das on 11/17/2023

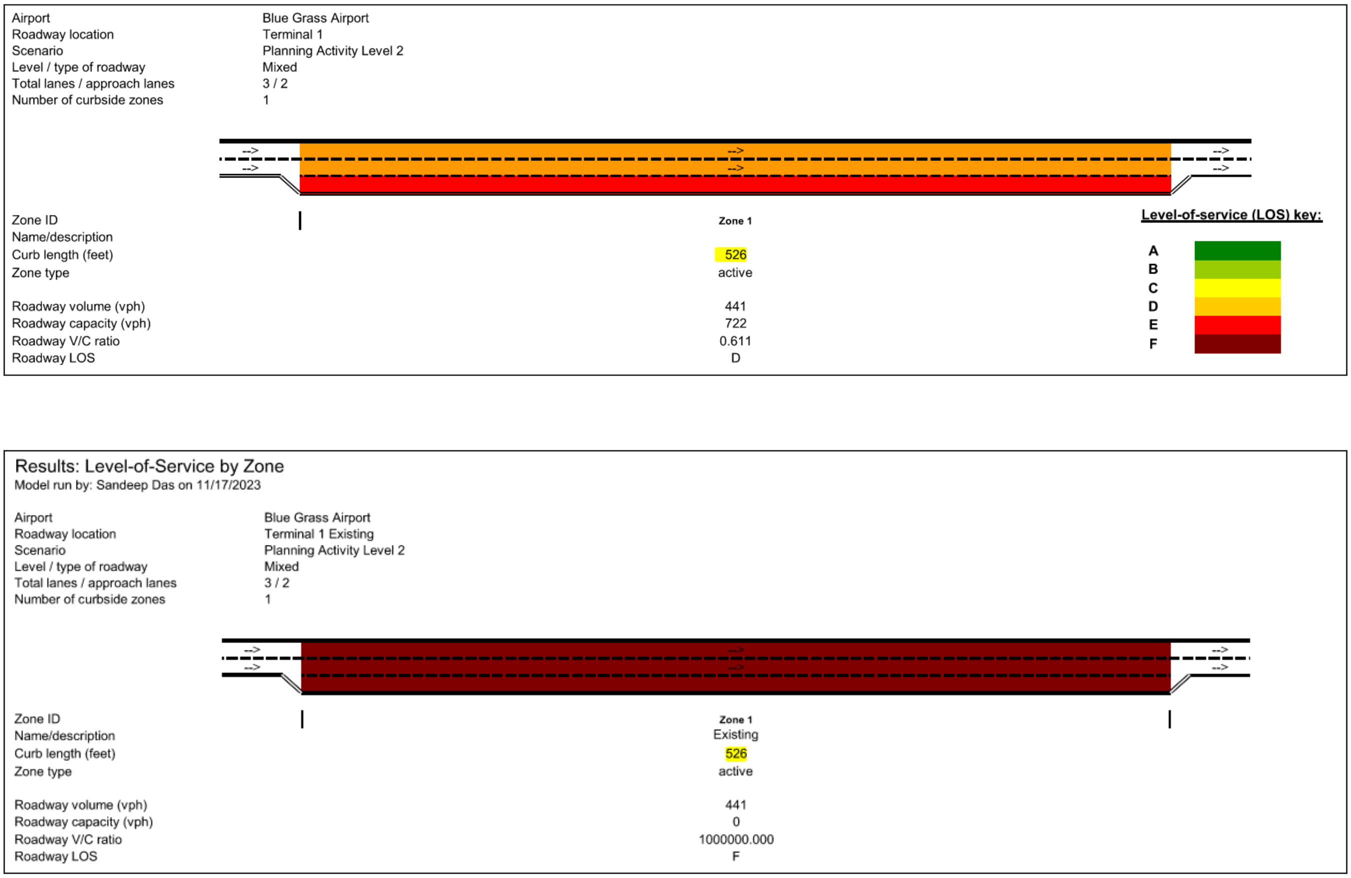
Airport	Blue Grass Airport
Roadway location	Terminal 1 Existing
Scenario	Planning Activity Level 1
Level / type of roadway	Mixed
Total lanes / approach lanes	3 / 2
Number of curbside zones	1



Zone ID	Zone 1
Name/description	Existing
Curb length (feet)	526
Zone type	active
Roadway volume (vph)	338
Roadway capacity (vph)	722
Roadway V/C ratio	0.468
Roadway LOS	C

Source: Quick Analysis Tool for Airport Roadways (QATAR), CHA, 2024.

Figure 4-44
Terminal Curbside PAL 2 (5-min and 7.5-min)



Source: Quick Analysis Tool for Airport Roadways (QATAR), CHA, 2024.

Terminal Curbside Summary

As shown in the analysis above, improving the terminal roadway by PAL 2 would be considered necessary to avoid decreasing the LOS to the passenger to the point of failure on the terminal curbside. Options to mitigate the projected curbside congestion will be evaluated in **Chapter 5**. However, dwell time reductions would significantly impact the LOS of the terminal curb. As such, it is a highly stressed recommendation to implement a program or process to monitor the terminal curb and reduce dwell times to increase the capacity of the curbside.

4.11.3 Public Parking Requirements

This section summarizes the analysis of the current public parking space supply and projections for parking demand at LEX based on historical data (e.g., daily parking reports and transactional summaries), which was provided by the Airport's parking vendor, Republic Parking System. The analysis reviewed and identified current patterns in parking demand at LEX during peak and non-peak periods. These trends and patterns were used to generate an estimate of potential future parking based on the enplanements forecast and a transportation analysis.

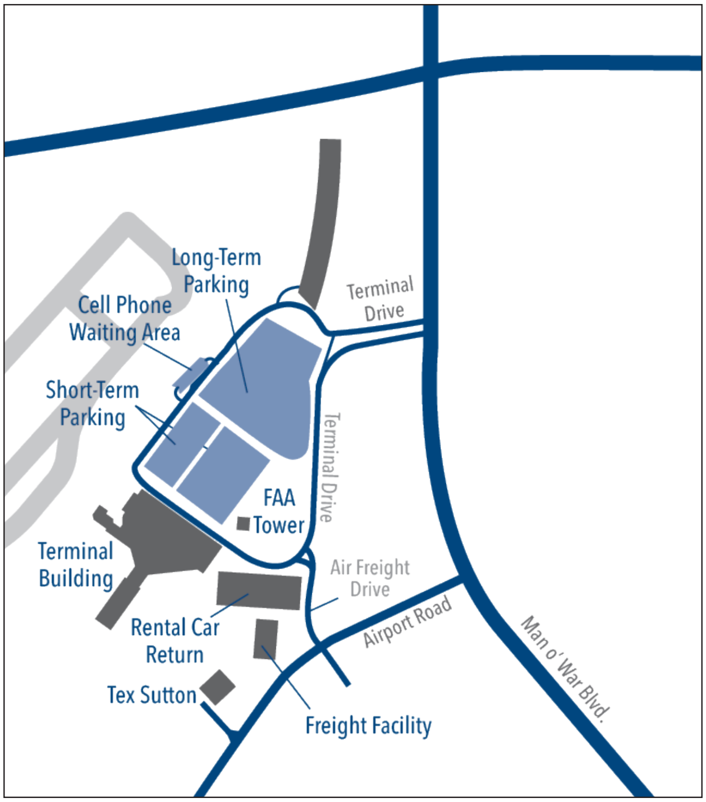
The number of required automobile parking spaces at an airport is directly related to annual enplaned passenger traffic levels. The following is an analysis of the public, employee, and rental car parking space requirements throughout the planning period. Vehicle access to these parking facilities was also evaluated. The full analysis is provided in **Appendix J**.

Parking Supply

The most current parking spaces at the time of this Study are summarized in **Table 4-98**, which included short-term parking (consisting of two short-term parking lots and the three levels of the parking garage), the long-term parking lot, and the overflow lot. After reviewing the daily reports during this specific period, the overflow lot was unused. However, during peak periods (summer, spring break, fall break), the overflow lot sees significant use. Many times, the public parking lots, parking garage, and overflow lot will reach capacity, and passengers will park in the grass areas adjacent to the lots. These periods are very specific and occur during periods where there is an overlap of ULCC (Allegiant) flights when departures arrive prior to arrivals exiting the lots. These peak periods and lot locations are included in the occupancy and adequacy analysis.

Although the parking lots are owned by the Airport, parking operations are handled by Republic Parking System. Parking facilities at LEX consist of one parking garage, three surface parking lots, and two support lots (overflow parking). See **Table 4-98** for a further breakdown of parking spaces per parking lot. **Figure 4-45** depicts the location of each parking facility.

Figure 4-45
On-Airport Parking



Source: CHA 2024.

<u>Effective Full</u>

Typically, users of a parking system or facility that does not provide an individual space parking guidance system (PGS) will begin to become frustrated from searching for a vacant space well before a facility or system is full. Depending on the size of the system or facility, this will typically occur when the system or facility reaches between 80 and 90 percent full. This is referred to as an "effective full" condition, or the point at which users may become frustrated and depart a facility under the perception that there are no vacant spaces. For the purposes of this Study, an effective full percentage of 85 percent was assumed. The full and effective full capacities for each parking location are presented in **Table 4-98**.

Table 4-98
Public Parking Spaces (Supply)

Parking Location	Parking Supply	Effective Full (85%)
Short-Term Parking	1,246	1,059
Long-Term Parking	987	839
Overflow Parking	326	277
Total	**2,559**	2,175

Source: WGI, CHA, 2024.

Parking Demand

Public parking demand is the number of spaces required during peak parking periods. Public parking demand at an airport is a direct function of airline passenger activity. A measurement tool to determine the adequacy of the existing parking capacity and future parking demand is by determining the parking demand ratio relative to passenger enplanements and applying those to existing spatial capacity. The public parking demand ratio is calculated by comparing annual enplanements with the peak demand to determine the number of parking spaces required per 1,000 annual enplanements.

Data Review & Methodology

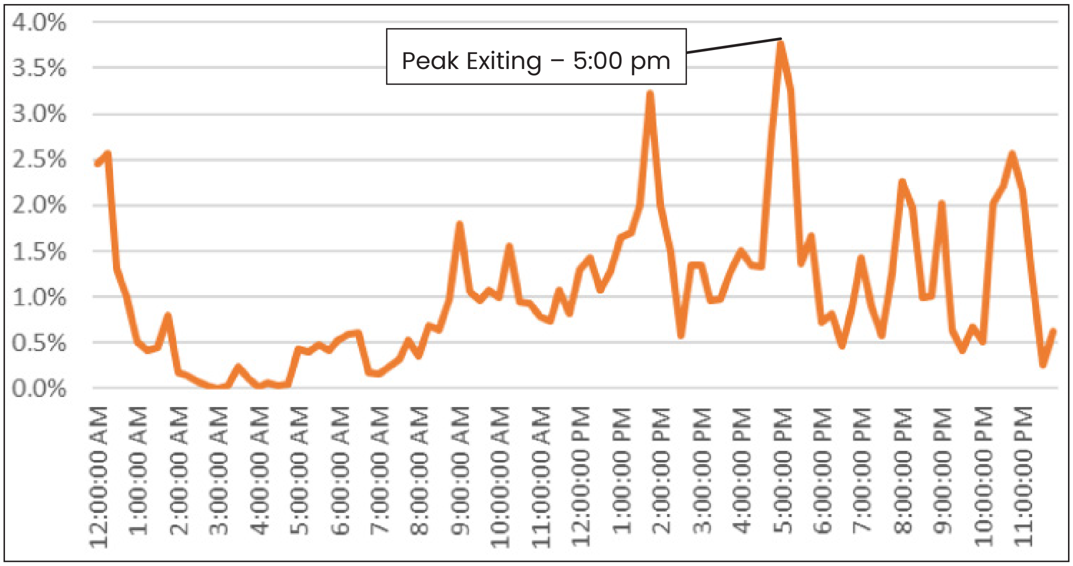
The following data was analyzed and incorporated into this analysis during the preparation of this Study:

- 2018 Daily Reports (two months)
- 2019 Daily Reports (eight months)
- 2020 Daily Reports (eight months)
- 2021 Daily Reports (10 months)
- 2021 Nightly Car Counts (four months)
- 2022 Daily Reports (12 months)
- 2022 Nightly Car Counts (four months)
- 2023 Daily Reports (January – April)
- 2023 Nightly Car Counts (four months)
- Exit lane transaction logs (June 2023)

Peak Hours and Volumes of Parkers – Exiting & Entering

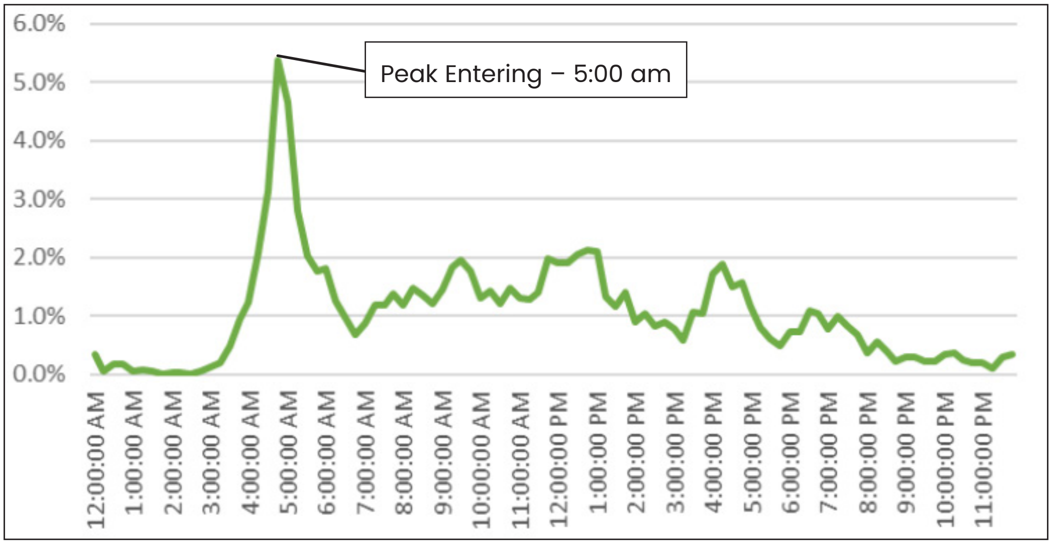
Note, the referenced daily reports did not detail transactional data by hour of the day. Rather, these reports summarized the total transactions that occurred each day. Transactional detail logs were provided for the exit lanes, dating from June 1 through 10 (2023), which gave context for the lane throughput analysis. The analysis of the transactional data was completed to identify peak hours and volumes of parkers entering and/or exiting traffic for the parking areas by time of day, day of the week, and month of the year. Based on the average of entering and exiting transactions, the percentage of daily transactions for each 15-minute period for each day of the week was used to establish entry and exit patterns based on the time of day. These time-of-day patterns were then applied to the historical daily reports provided by the Airport to review hour by hour historical parking occupancies. The nightly car counts were considered in establishing the day-to-day parking occupancies. The average peak exiting time was 5:00 pm, while the average peak entering time occurred at 5:00 am.

Figure 4-46
Time of Day - Peak Exiting



Source: WGI, 2023.

Figure 4-47
Time of Day - Peak Entering



Source: WGI, 2023.

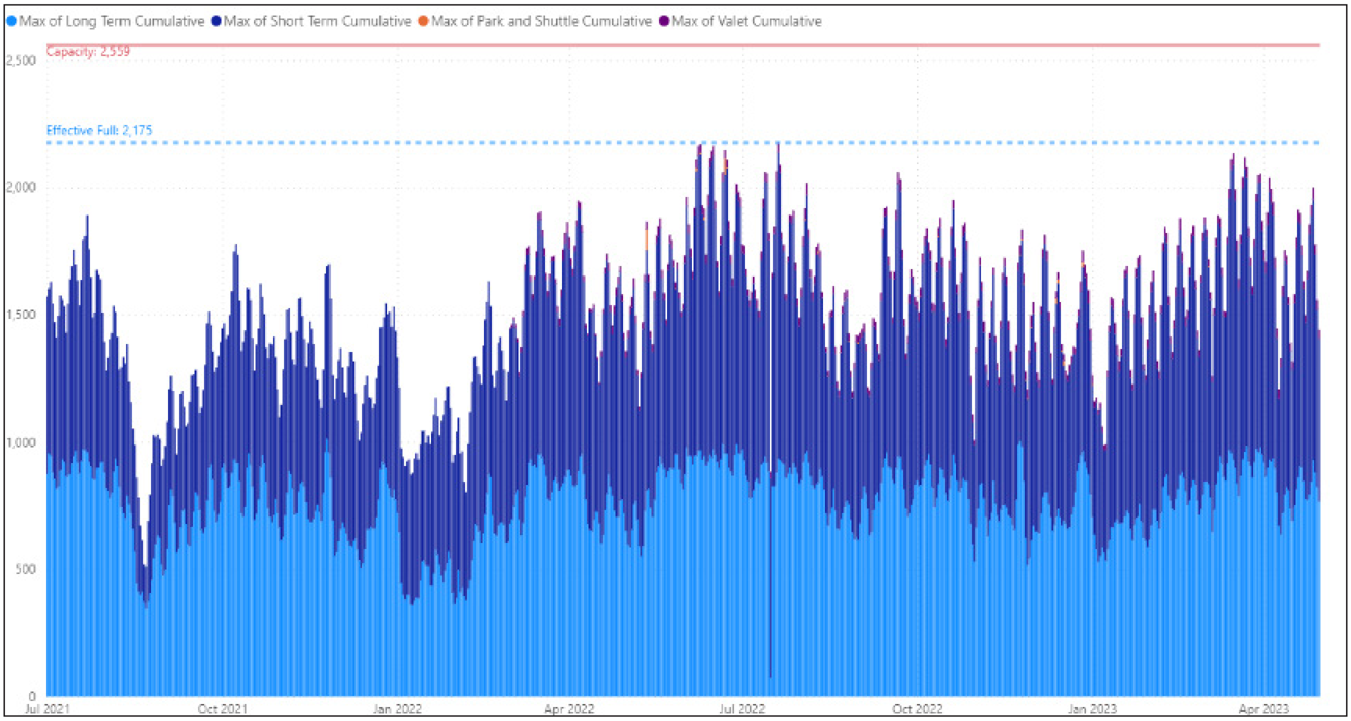
From the daily peak periods identified, the 85th percentile day was then used to represent the "design day" to generate a model of possible future parking demand for the Airport.

Note, the enplanements forecast projects a compound annual growth rate (CAGR) of 5.5 percent throughout the planning horizon, and the transportation analysis established a 3.25 percent year-over-year growth rate regarding transportation volume. Future parking demand was modeled at 3.25 percent year-over-year growth to identify when parking demand is projected to exceed the supply of parking spaces at the Airport.

Historical Parking Demand

As part of this analysis, historical daily reports and parking counts were analyzed from July 2021 through April 2023. Over this period, there were approximately 20 peak days, which approached 85 percent occupancy; however, occupancy was generally less than 75 percent. Note, this capacity analyzed the short-term, long-term, and overflow lots.

Figure 4-48
Historical Parking Demand

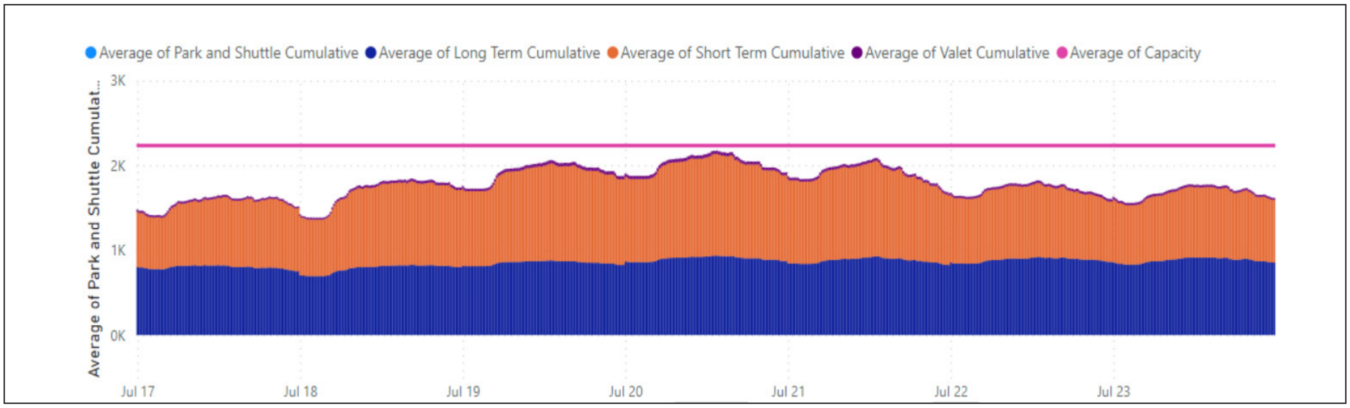


Source: WGI, 2023.

Current Parking Demand – Peak Week

As previously described, occupancy was projected for each 15-minute period for days with reports available. The peak week was the week of July 17, 2022, with a daily average of 910 short-term parkers, 854 long-term parkers, and 28 valet parkers. When examining capacity, only the short-term and long-term locations were utilized, thus excluding the overflow.

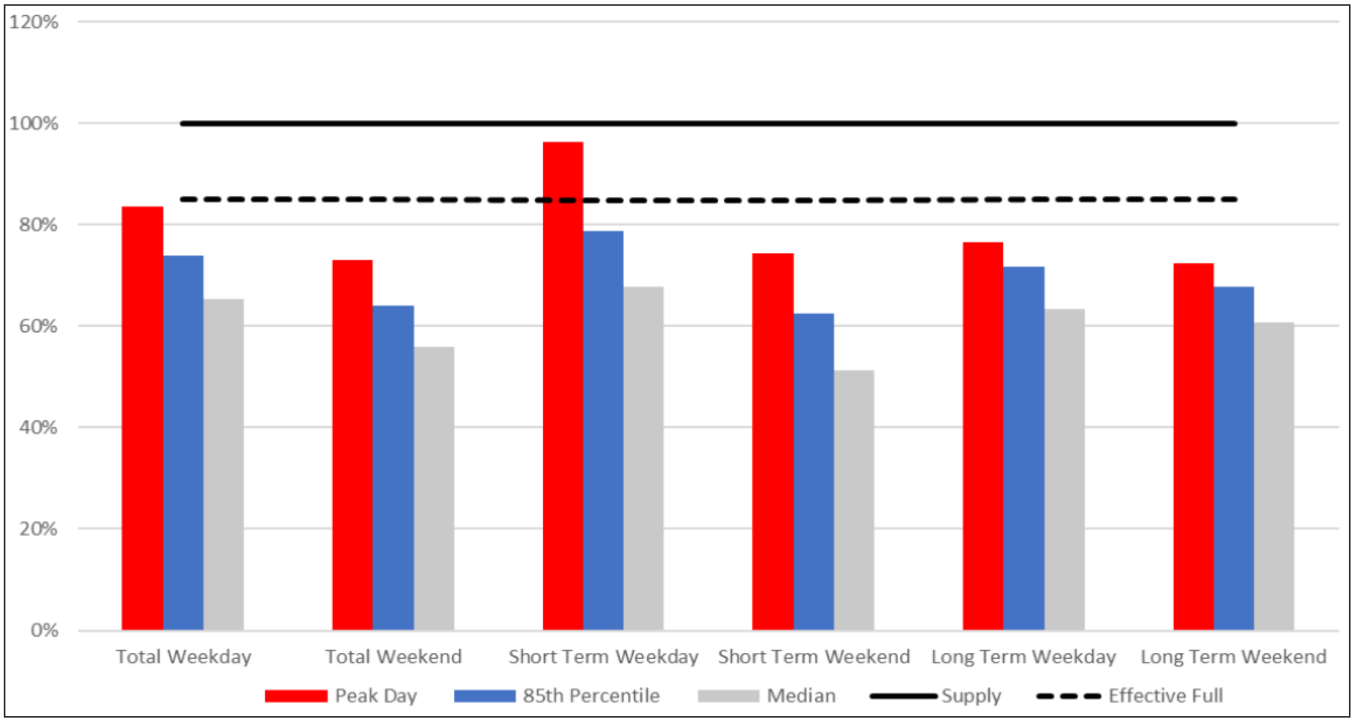
Figure 4-49
Average Peak Activity (Peak Week)



Source: WGI, 2023.

Using daily peak occupancy for each location (May 2022 through April 2023), occupancy percentages were generated for each location for weekdays and weekends. While parking counts did not exceed the parking supply, the short-term parking during weekdays did exceed the effective full parking supply.

Figure 4-50
Parking Demand (Peak Week)



Source: WGI, 2023.

__Future Parking Demand & Adequacy (Summary)__

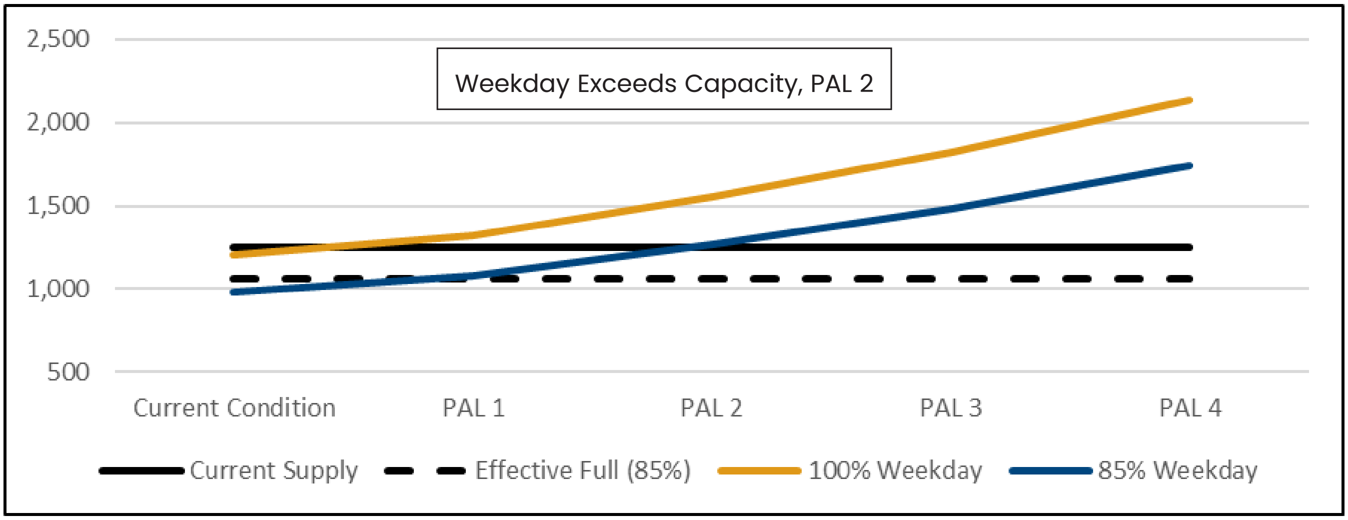
The occupancy analysis of the historical dates of daily reports and parking counts was used in combination with the enplanements forecast and transportation study to model possible future parking demand. Using the 3.25 percent year-over-year growth percentage established by the transportation study, future parking demand was modeled to determine when the current supply of parking at the Airport will be inadequate or will no longer satisfy the parking demand projected to be generated. An analysis of the effective full scenario, using an 85 percent effective full percentage, was included in the future demand and adequacy analysis.

Table 4-99
Short-Term Parking Demand

Label	Adequacy	Current Condition	PAL 1	PAL 2	PAL 3	PAL 4
Current Supply	1,246	1,246	1,246	1,246	1,246	1,246
Effective Full (85%)	1,059	1,059	1,059	1,059	1,059	1,059
100% Weekday	1,059	1,201	**1,322**	**1,551**	**1,820**	**2,136**
85% Weekday	1,059	981	1,080	**1,267**	**1,487**	**1,744**
100% Weekend	1,059	927	1,020	1,197	**1,404**	**1,648**
85% Weekend	1,059	779	857	1,006	1,181	**1,385**

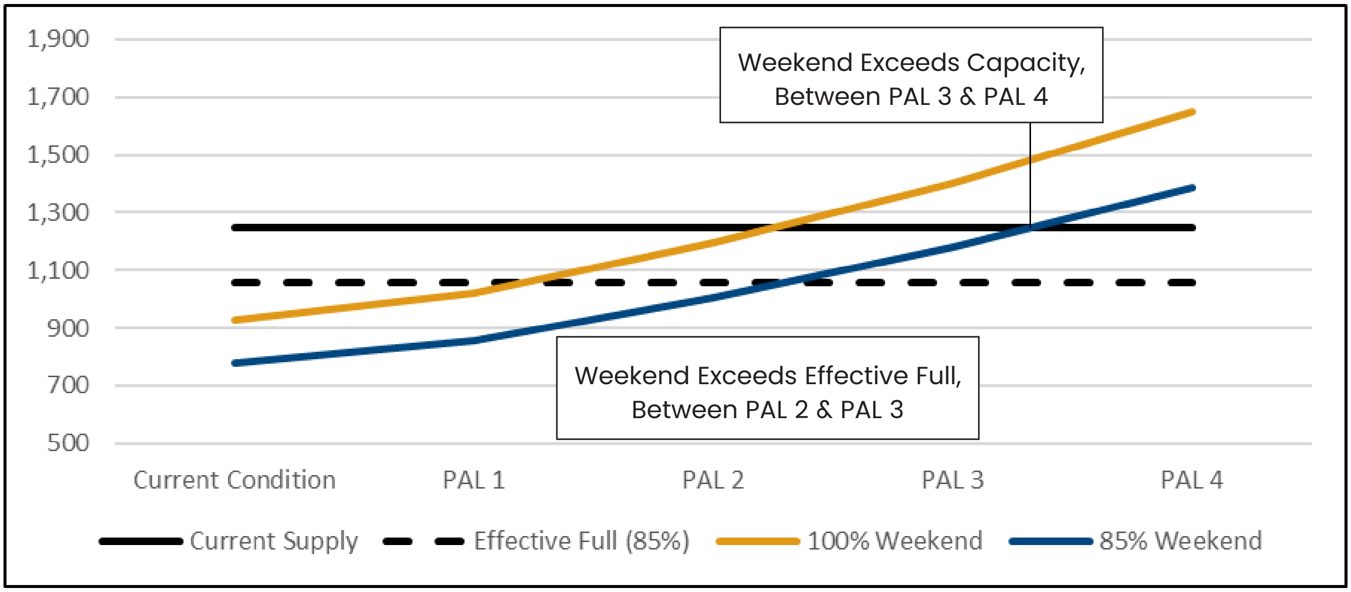
Source: WGI, CHA, 2023.

Figure 4-51
Short-Term Parking Demand (Weekday)



Source: WGI, CHA, 2024.

Figure 4-52
Short-Term Parking Demand (Weekend)



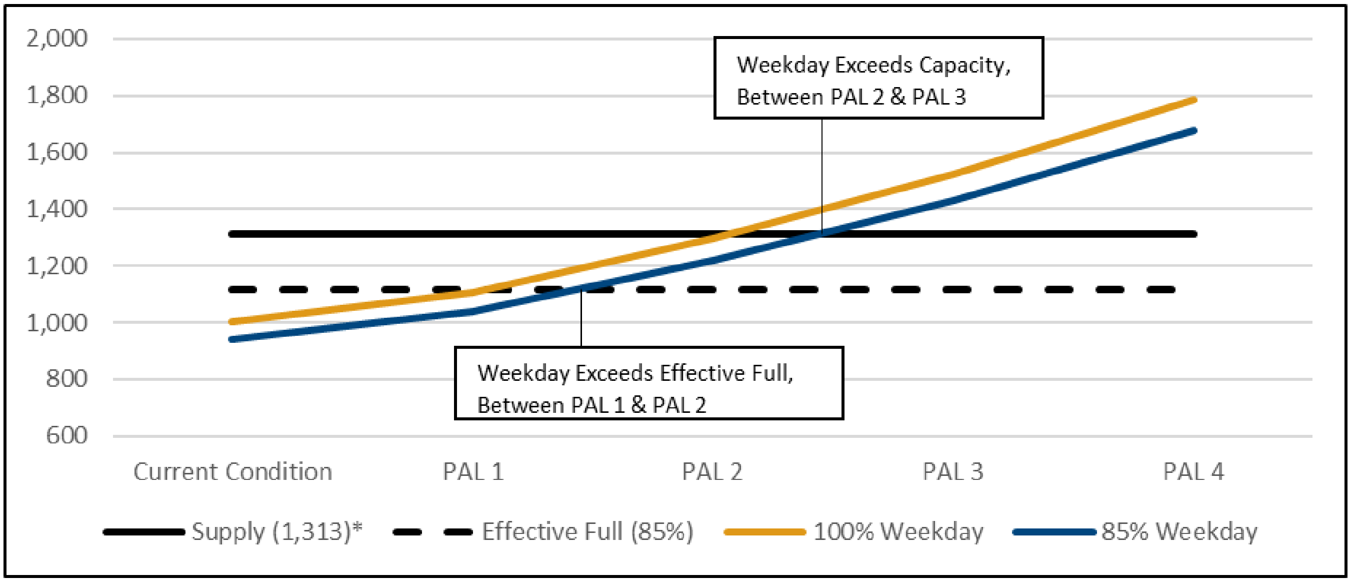
Source: WGI, CHA, 2024.

Table 4-100
Long-Term Parking Demand

Label	Adequacy	Current Condition	PAL 1	PAL 2	PAL 3	PAL 4
Current Supply	987	987	987	987	987	987
Supply (1,313)*	1,313	1,313	1,313	1,313	1,313	1,313
Effective Full (85%)	1,116	1,116	1,116	1,116	1,116	1,116
100% Weekday	1,116	**1,004**	**1,105**	**1,297**	**1,522**	**1,785**
85% Weekday	1,116	942	**1,037**	**1,217**	**1,428**	**1,676**
100% Weekend	1,116	952	**1,048**	**1,229**	**1,442**	**1,692**
85% Weekend	1,116	890	979	**1,149**	**1,348**	**1,582**

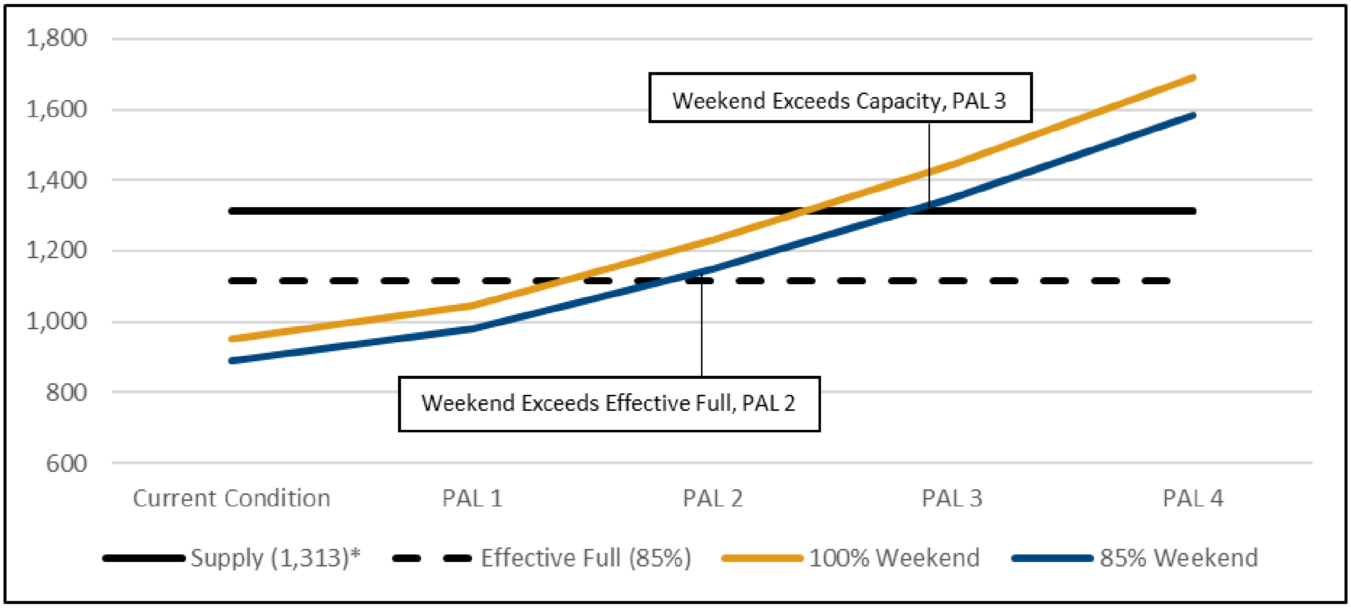
*Includes Overflow Lot
Source: WGI, CHA, 2024.

Figure 4-53
Long-Term Parking Demand (Weekday)



*Includes Overflow Lot
Source: WGI, CHA, 2024.

Figure 4-54
Long-Term Parking Demand (Weekend)



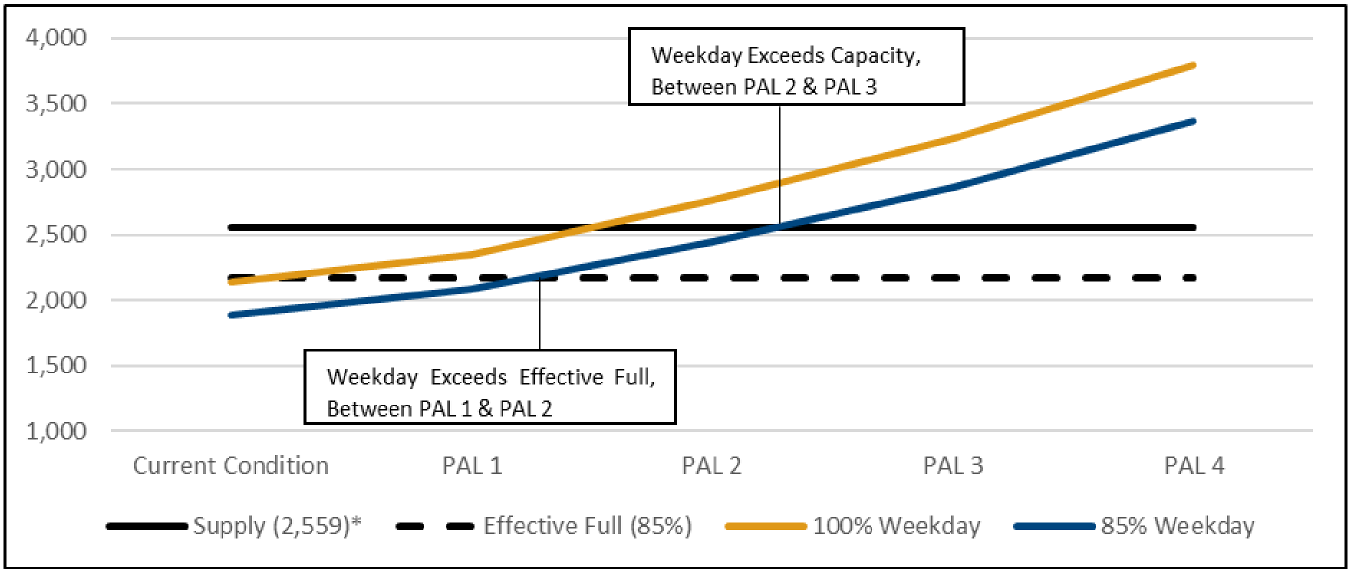
*Includes Overflow Lot
Source: WGI, CHA, 2024.

Table 4-101
Combined Parking Demand

Label	Adequacy	Current Condition	PAL 1	PAL 2	PAL 3	PAL 4
Current Supply	2,233	2,233	2,233	2,233	2,233	2,233
Supply (2,559)*	2,559	2,559	2,559	2,559	2,559	2,559
Effective Full (85%)	2,175	2,175	2,175	2,175	2,175	2,175
100% Weekday	2,175	2,137	**2,352**	**2,760**	**3,238**	**3,800**
85% Weekday	2,175	1,891	2,081	**2,442**	**2,866**	**3,363**
100% Weekend	2,175	1,869	2,057	**2,414**	**2,833**	**3,324**
85% Weekend	2,175	1,639	1,804	2,117	**2,484**	**2,915**

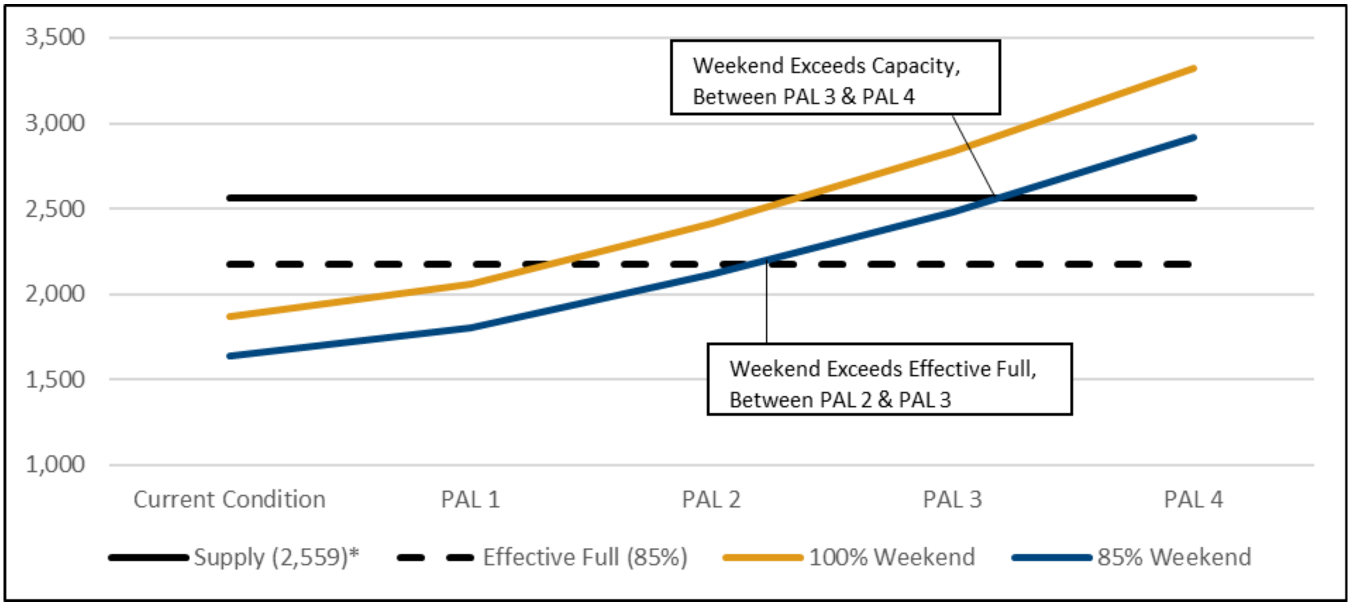
*Includes Overflow Lot
Source: WGI, CHA, 2024.

Figure 4-55
Combined Parking Demand (Weekday)



*Includes Overflow Lot
Source: WGI, CHA, 2024.

Figure 4-56
Combined Parking Demand (Weekend)



*Includes Overflow Lot
Source: WGI, CHA, 2024.

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4.12 Summary of Facility Requirements

This chapter identifies safety and development needs for LEX and provides recommendations for the basis for formulating alternatives and development concepts to address improvements. The following is a summary of the facility recommendations:

4.12.1 FAA Airfield Design Standards

- Maintain RDC D-III-1800 and B-II-4000 for Runways 4-22 and 9-27, respectively
- Maintain Runway 4-22's width of 150 feet
- Widen Runway 9-27 from 75 to 100 feet to accommodate potential lower than 0.75 mile instrument approach visibility minima
- Consider adding 25-foot-wide shoulders to each side of Runway 4-22, per FAA AC 150/5300-13b. This is recommended, not required.
- Add a 304-foot-long EMAS bed over the blast pad on Runway 22's approach end, per FAA approval of the 2022 RSAD
- Widen the first 200 linear feet of Runway 22's approach end blast pad by 50 feet (25 feet on either side)
- In conjunction with runway rehabilitation or reconstruction projects, the transverse grades of Runways 4-22 and 9-27 should be corrected to be between 1.0 to 1.5 and 1.0 to 2.0 percent, respectively, from their center crowns.
- Runway 4's approach end gradient exceeds the allowable 0.8 percent slope change during its first 2,500 feet. Corrections to that non-standard condition should be implemented in conjunction with the runway's next rehabilitation or reconstruction project.
- Over half of 'Parallel' Taxiway A's centerline separation from Runway 4-22 does not meet the standard minimum dimension of 400 feet. Alternatives to correct that should be considered and evaluated.
- Similarly, partial-full parallel Taxiway B's centerline separation of 309 feet from Runway 4-22 does not meet the standard 400 feet.
- Parallel Taxiway F's centerline separation of 300 feet from Runway 9-27 meets current standards. Additionally, the separation would allow the Airport to lower the visibility minima to 0.75-mile visibility.
- Incompatible land uses are located within most of the Airport's RPZs. Alternatives to mitigate such should be considered and evaluated.
- To provide unrestricted departure operations to the Airport's existing fleet mix to existing and planned routes during temperatures greater than 86 degrees F would require a runway length of approximately 7,700 feet. Alternatives to provide such a length should be explored.
- Unrestricted operations to 100 percent of the small aircraft with less than 10 passenger seats require a length of 4,220 feet. Ninety-five percent of that fleet requires just 3,605 feet. The current length of 9-27 should suffice through the planning period, but an extension to 4,500 feet should be explored to protect ultimate airspace.
- The FAA's current taxiway fillet geometry standards are not met by almost every taxiway connector (depicted in **Figure 4-5**) at the Airport. Alternatives to correct each non-standard condition should be developed.

4.12.2 Airfield Lighting and NAVAID Systems

- Potential changes to future or ultimate runway ends or landing thresholds will require subsequent relocations or modifications to the following airfield lighting system:
  - Runway edge lights
  - Runway centerline lights
  - PAPIs
  - REILs
  - Threshold lights
  - TZLs
- The Airport's rotating beacon may require relocation as a result of various alternatives. Such alternatives should identify potential locations for a relocated rotating beacon.
- If Runway 9-27 is transitioned to be the Airport's primary runway, even for a temporary period, airline operators may require the runway to be equipped with an instrument landing system (ILS) and its associated components (glideslope, localizer, approach lighting system, etc.). As such, planning for the locations of those systems should be developed.

4.12.3 Aircraft Storage and Parking Apron Requirements

- The Terminal Apron is expected to need two additional aircraft parking gates within the planning period.
- The GA aprons are expected to need an additional 56,183 square yards of pavement by the end of the planning period.
- By the end of the planning period, the single-engine, multi-engine, jet, and helicopter aircraft storage hangar deficiencies are expected to reach 11,000, 2,500, 42,300, and 5,500 square feet, respectively. The total hangar deficiency is expected to reach 61,300 square feet by the end of the planning period. Furthermore, existing tenants, Thoroughbred Aviation and Air Mart, expressed the need for an additional 120,000 and 25,000 square feet of hangar space, respectively, to sustain their growing business through the year 2040.

4.12.4 Cargo Requirements

- Cargo demand was forecast to remain consistent with the average number of operations experienced in the last decade. As such, additional cargo facilities are not expected to be needed within the planning period. However, alternative areas that could support a feeder cargo carrier should be identified in case such an operator desires to conduct regular, scheduled service at the Airport.

4.12.5 Terminal Requirements

- Forecast gate demand is expected to require additional positions beyond the existing 12 gates, starting in PAL 3 with 13 gates, and a facility total of 14 gates by the end of the planning period.
- Check-in demand is expected to increase from the existing 25 ticket counters to approximately 33 positions by the end of the planning period.
- The total passenger check-in hall, which includes the ticketing counter processing area, kiosks, agent-assisted bag drop stations, and passenger self-serve bag drop stations, is projected to increase from the existing 6,222 SF to 10,476 SF by PAL 4.

- Security demand is driven by an assumed PreCheck proportion of 40 percent. The Airport currently has three lanes. Demand is projected to increase, with a demand for four total lanes in PAL 1 and a demand for five to six total lanes in PAL 2. The demand for five to six lanes is projected to satisfy demand through the end of the forecast horizon; however, demand could decrease with technological changes that enhance throughput.
- Holdrooms currently do not meet existing demand. The current overall area of the 12 holdrooms is approximately 23,500 SF. Demand is projected to increase to approximately 32,475 SF in PAL 1, 31,439 SF in PAL 2, 34,810 SF in PAL 3, and 38,694 SF in PAL 4.
- The pre-security concession area is currently approximately 7,960 SF, which is anticipated to satisfy demand throughout the planning horizon. The post-security concession area is currently approximately 8,625 SF, with a projection of approximately 22,130 SF in PAL 4.
- The outbound baggage screening area currently is comprised of approximately 10,230 SF, with a demand for approximately 15,170 SF by PAL 4.
- The Airport currently has two baggage claim devices, with up to four required by the end of the planning period. The baggage claim processor is approximately 12,980 SF, with approximately 14,784 SF needed by PAL 4.

4.12.6 Parking and Access Requirements

- Short-term parking demand for weekdays is projected to exceed the effective full parking supply in PAL 1 and to exceed capacity in PAL 2.
- On weekends, the short-term parking demand is projected to exceed the effective full parking supply between PAL 2 and PAL 3 and to exceed capacity between PAL 3 and PAL 4.
- Long-term parking demand for weekdays is projected to exceed the effective full parking supply between PAL 1 and PAL 2 and to exceed capacity between PAL 2 and PAL 3.
- On weekends, the long-term parking demand is projected to exceed the effective full parking supply in PAL 2 and to exceed capacity in PAL 3.

A full summary table indicating the timing of facility requirements can be found in **Appendix K**.