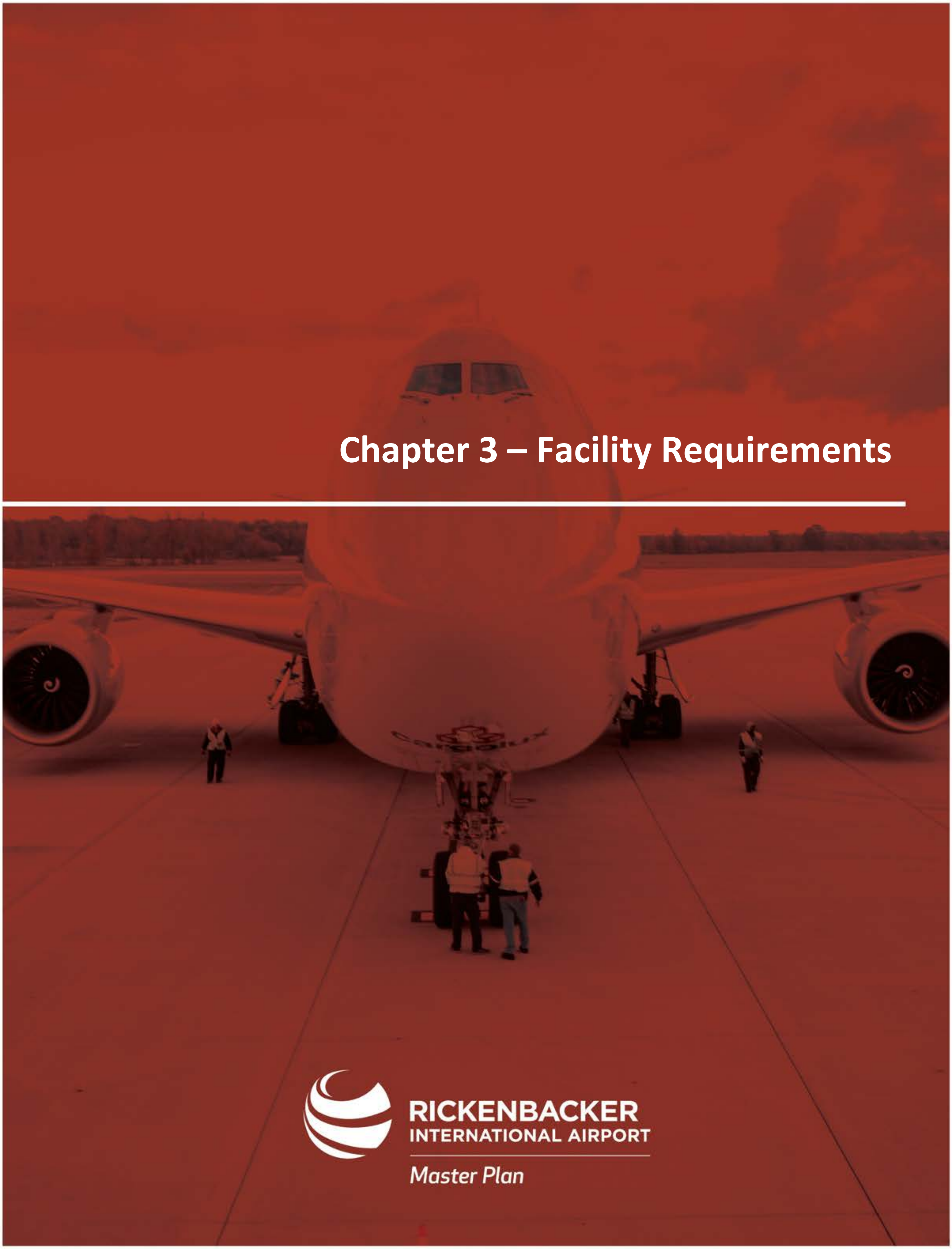
Chapter 3 – Facility Requirements



RICKENBACKER
INTERNATIONAL AIRPORT

Master Plan

3.0 Facility Requirements

The facility requirements chapter includes an assessment of the aviation and non-aviation components of Rickenbacker International Airport (LCK) including the runway and taxiway system, navigational aids and approaches, passenger terminal facilities, aircraft storage facilities, supporting infrastructure (e.g. roadways and parking), and undeveloped properties.

This chapter represents a comprehensive evaluation of the airport's needs over the course of the 20-year planning period extending from 2016 to 2036. An analysis of the following airport components is presented within this chapter:

- Identification of Critical Aircraft
- Runway Use and Wind Coverage Analysis
- Airfield Capacity
- Airfield Design Standards Analysis
- Runway Length Analysis
- Runway Strength Analysis
- Airfield Lighting, Marking, Signage, and Navigational Aids
- Terminal Access
- Passenger Terminal Building
- Cargo Facilities
- General Aviation Facilities
- Support Facilities
- Land Area Requirements

3.1 Planning Horizon

The time frame for addressing development needs includes short-term (0-5 years), medium-term (6-10 years), and long-term (11-20 years) planning periods. The short-term analysis focuses on the immediate action items; the medium term focuses on the more detailed analysis. The long term primarily focuses on the ultimate role of the airport in the local area and in the aviation system.

As presented in the Forecast Chapter, actual activity at the airport may vary over time and may be higher or lower than the forecasted demand. Using the time frames as milestones (**Table 3-1 Planning Horizon Activity Levels**) provides the Columbus Regional Airport Authority (CRAA) the flexibility to make decisions and develop facilities according to the need generated by actual demand levels.

Table 3-1 Planning Horizon Activity Levels

Item	Base Year 2016	2021	2026	2036
Enplaned Passengers	103,289	152,486	160,821	178,881
Air Cargo (lbs.)	202,159,519	441,095,859	882,128,027	2,053,124,500
Total Based Aircraft	3	12	19	33
Annual Operations (Combined Local & Itinerant)				
Commercial Service	1,438	2,129	2,245	2,497
Air Cargo	7,458	12,106	19,275	38,167
General Aviation	10,803	11,358	11,941	13,200
Military	6,608	6,608	6,608	6,608
Total Operations	26,307	32,201	40,070	60,473

Source: Michael Baker International, Inc., 2016

3.2 Airfield Capacity

This section evaluates whether LCK's existing airfield configuration is capable of accommodating forecasted levels of demand over the planning period. According to the FAA, airfield capacity is defined by the number of aircraft operations conducted at the airfield over a defined period of time at an acceptable level of delay. An acceptable level of delay is essentially a policy decision about the tolerability of delay being longer than some specified amount, taking into account the technical feasibility and economic practicality of available remedies.[1] Estimates of airfield capacity were developed in accordance with the methods presented in FAA AC 150/5060-5, Airport Capacity and Delay. This methodology, generally known as the "handbook methodology" does not account for every possible situation at an airport, but rather the most common situations observed at U.S. airports at the time the advisory circular was adopted. FAA AC 150/5060-5 provides a methodology for determining the hourly capacity, Annual Service Volume (ASV), and aircraft delay. According to FAA Order 5090.3C Field Formulation of the National Plan of Integrated Airport Systems (NPIAS), the handbook methodology should be used where capacity is not a constraining factor. The hourly capacity and ASV was calculated for existing conditions and for the last year of the planning period at LCK. The results are used for planning purposes to determine if airfield improvements are needed.

- **Hourly Airfield Capacity** – An airport's hourly airfield capacity represents the maximum number of aircraft that can be accommodated under conditions of continuous demand during a one-hour period. Using peak hour forecasts, the hourly airfield capacity is determined for both Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) activity.
- **Annual Service Volume (ASV)** – The ASV estimates the annual number of operations that the airfield configuration should be capable of handling with minimal delays. Consistent with FAA Order 5090.3C Field Formulation of the National Plan of Integrated

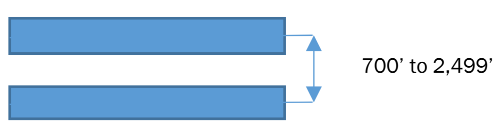
[1] Airfield and Airspace Capacity/Delay Policy Analysis, FAA-APO-81-14 (Washington, DC: Federal Aviation Administration, Office of Aviation Policy and Plans, December 1981).

Airport Systems (NPIAS), delay may be considered minimal when the average delay per operation is four minutes or less. The ASV accounts for peaking characteristics in its calculation of 12-month demand as well as periods of low-volume activity.

- **Delay** – The average anticipated delay is based on a ratio of forecast demand to the calculated ASV. According to the FAA AC 150/5060-5, "as demand approaches capacity, individual aircraft delay is increased. Successive hourly demands exceeding the hourly capacity result in unacceptable delays."

Airfield capacity is estimated based on the Mix Index and the runway configuration. The Mix Index is a mathematical expression that estimates the relative percentage of large aircraft (12,500 to 300,000 pounds) and heavy aircraft (greater than 300,000 pounds). As the weight category of the aircraft increases, particularly as the mix between large and heavy aircraft increases, the wake turbulence separation standards increase. As a consequence, the capacity of the airfield decreases. The Mix Index was estimated to be 88.24%. **Table 3-2 Mix Index vs. Airport Capacity** shows the hourly capacity and the annual service volume for a parallel runway configuration (two runways). The row highlighted in blue shows the hourly capacity and annual service volume associated with the estimated mix index.

Table 3-2 Mix Index vs. Airport Capacity

Runway Configuration	Mix Index	Hourly Capacity Operations/Hour		Annual Service Volume
		VFR	IFR	
	0 to 20	197	59	355,000
	21 to 50	145	57	275,000
	51 to 80	121	56	260,000
	81 to 120	105	59	285,000
	121 to 180	94	60	340,000

Source: Adapted from AC 150/5060-5 Change 2

According to the methodology presented in the AC 150/5060-5, the current runway configuration at LCK has an ASV of 285,000 operations, a VFR hourly capacity of 105 operations, and an IFR hourly capacity of 59 operations. **Table 3-3 LCK Airfield Capacity Calculations** presents the results of the airfield capacity calculations for LCK over the 20-year planning period. By 2036, the number of annual operations is expected to reach 21.22% of ASV, VFR peak hour operations may reach 24.76% of capacity, and IFR peak hour operations may reach 13.56% of capacity. As a result, the current runway configuration meets the capacity needs over the 20-year planning period.

Table 3-3 LCK Airfield Capacity Calculations

Year	Annual		Hourly			
	Operations	% of ASV	VFR Peak Hour	% VFR Capacity	IFR Peak Hour	% IFR Capacity
2016	26,307	9.23%	7	6.67%	7	11.86%
2036	60,473	21.22%	26	24.76%	8	13.56%

Source: Michael Baker International, Inc., 2017

3.3 Identification of Critical Aircraft

According to FAA AC 150/5070-6B, Airport Master Plans, the Critical (Design) Aircraft is defined as "the most demanding aircraft with at least 500 annual operations that operates, or is expected to operate, at the airport." A new FAA advisory circular currently in draft form, FAA AC 150/5000-17, Critical Aircraft and Regular Use Determination, defines the critical aircraft as the most demanding aircraft type, or grouping of aircraft with similar characteristics regularly using the airport. Regular use is defined as 500 annual operations, either a takeoff or landing excluding touch-and-go. The critical aircraft is identified based on documented aeronautical activity, typically for the most recent 12-month period that is available.

The current and conditionally approved Airport Layout Plan (ALP), dated August 4, 2010, identifies the existing and ultimate critical aircraft for LCK as the Boeing 747-400 Freighter jet. This aircraft is classified as Airplane Design Group (ADG) V, Aircraft Approach Category (AAC) D, and Taxiway Design Group (TDG) 5. The air cargo operators are beginning to retire the Boeing 747-400 Freighter and are replacing it with the Boeing 747-8F. In 2016, there were less than one hundred Boeing 747-400 Freighter operations and more than 500 Boeing 747-8F operations at LCK. **Table 3-4 Aircraft with More Than 500 Annual Operations** shows aircraft types with more than 500 total operations in the calendar year 2016. From an airfield design perspective, the most demanding aircraft shown in the table is the Boeing 747-8F. Compared to the other aircraft listed, this aircraft is the most demanding in terms of approach speed, tail height and wing span characteristics. According to the forecast, the 747-8F will remain the most demanding aircraft and total annual operations are expected to remain at or above the current level. Other aircraft such as the Boeing 737, 757, 767, and 777, as well as different versions of the Airbus 320 are also expected to continue operating at LCK over the 20-year planning period. However, from an FAA standards perspective, these aircraft fall in the same aircraft grouping as the Boeing 747-8F or are less demanding. Therefore, the Boeing 747-8F was defined as the critical aircraft for the 20-year planning period.

Table 3-4 Aircraft with More Than 500 Annual Operations

Aircraft	Departures	Arrivals	Total Operations
Airbus A300-B4-600	912	921	1,833
Cessna 208 Caravan	832	827	1,659
Boeing KC-135 Stratotanker	485	475	960
Airbus A320	411	411	822
Boeing 747-8F	353	353	706
Boeing 757-200	316	317	633
McDonnell Douglas 83/88	262	262	524

Source: FAA Traffic Flow Management System Counts (TFMSC) calendar year 2016

FAA airfield design standards (e.g., required separations and safety area dimensions) are determined based on the approach speed and wingspan of the identified critical aircraft. Each runway is assigned a Runway Design Code (RDC) that is a function of the critical aircraft's Aircraft Approach Category (AAC), the Airplane Design Group (ADG), and the visibility minimums expressed in Runway Visibility Range (RVR). The RDC provides the information required to determine the applicable standards. The Aircraft Approach Category (AAC) is based on the reference landing speed (V_{REF}) when specified, or in cases where a V_{REF} is not specified, the AAC is determined based on 1.3 times the stall speed (V_{SO}) at the maximum certificated landing weight. The Airplane Design Group (ADG) is a design parameter based on the wingspan and tail height of the aircraft. **Table 3-5 Aircraft Approach Categories and Airplane Design Groups** summarizes the parameters that define the AAC and the ADG, and highlights (in blue) the AAC and ADG corresponding to the Boeing 747-8F.

Table 3-6 Visibility Minimums describes the RVR visibility minimums and the associated instrument visibility category. The details of the available instrument procedures were provided in the inventory chapter, and it was determined that Runway 5R has the lowest visibility minimums (RVR 1,200), and Runway 23R has the highest visibility minimums of ¾ mile (Equivalent value of RVR 4,000). Both Runways 5L and 23L have a visibility minimum of RVR 2,400. **Table 3-7 Characteristics of the Critical Aircraft** summarizes the characteristics of the critical aircraft.

Table 3-5 Aircraft Approach Categories and Airplane Design Groups

Aircraft Approach Category (AAC)		Airplane Design Group (ADG)		
Category	Approach Speed (Knots)	Group	Tail Height (Feet)	Wingspan (Feet)
A	<91	I	<20	<49
B	91 to <121	II	20 to <30	49 to <79
C	121 to <141	III	30 to <45	79 to <118
D	141 to <166	IV	45 to <60	118 to <171
E	>166	V	60 to <66	171 to <214
		VI	66 to <80	214 to <262

Source: FAA AC 150/5300-13A, Airport Design Change 1
Note: The shaded areas represent the approach category and design group associated with the critical aircraft (Boeing 747-8F).

Table 3-6 Visibility Minimums

RVR (feet)[1]	Instrument Flight Visibility Category (Statute Mile)
5,000	Not lower than 1 mile
4,000	Lower than 1 mile but not lower than ¾ mile
2,400	Lower than ¾ mile but not lower than ½ mile
1,600	Lower than ½ mile but not lower than ¼ mile
1,200	Lower than ¼ mile

Source: FAA AC 150/5300-13A, Airport Design Change 1
Note: The shaded areas represent the visibility minimums associated with existing instrument approaches at LCK.

Table 3-7 Characteristics of the Critical Aircraft

Characteristics	
Critical Aircraft	Boeing 747-8F
Aircraft Type	Four Engine Wide Body
Aircraft Approach Category (AAC)	D
Airplane Design Group (ADG)	VI
Taxiway Design Group (TDG)	5
Wingspan	224.4 feet
Tail Height	62.7 feet
Length	250.2 feet
Cockpit to Main Gear (CMG) Distance	99.8 feet
Wheelbase	97.3 feet
Main Gear Width (MGW) Outer to Outer	41.8 feet
Approach Speed (V_{REF})	159 knots
Maximum Takeoff Weight (MTOW)	987,000 pounds
Maximum Landing Weight (MLW)	763,000 pounds

Photo of 747-8F at Rickenbacker

Sources: FAA AC 150/5300-13A, Airport Design Change 1, Boeing Aircraft Performance Manual, and Michael Baker International, Inc., 2017. Photo: CRAA

3.4 Airfield Design Standards Analysis

Table 3-8 Airfield Design Parameters summarizes the airfield design parameters that define the applicable standards for the Boeing 747-8F (the critical aircraft). At LCK, both runways and the associated taxiways are currently utilized by the critical aircraft. The existing runway and taxiway configuration was analyzed for compliance with FAA design standards described in AC 150/5300-13A, Change 1, Airport Design. These standards include design, protection, and separation standards that must be followed in order to provide for a safe, effective, efficient, and economical airfield system.

Table 3-8 Airfield Design Parameters

Item	Runway 5L-23R		Runway 5R-23L	
	5L	23R	5R	23L
Critical Aircraft	Boeing 747-8F		Boeing 747-8F	
Aircraft Approach Category (AAC)	D	D	D	D
Airplane Design Group (ADG)	VI	VI	VI	VI
Visibility Minimums (RVR feet)	2,400	4,000	1,200	2,400
Runway Design Code (RDC)	D-VI-2400	D-VI-4000	D-VI-1200	D-VI-2400

Source: Michael Baker International, Inc., 2017

3.5 Runway Configuration Requirements

Table 3-9 Runway Design Standards Analysis summarizes the runway configuration requirements. According to the analysis, the current length of the runways is capable of accommodating operations of the critical aircraft. The orientation of the runways meets the required 95% crosswind coverage for aircraft with 13, 16, and 20 knots maximum allowable crosswind component in all weather, VFR, and IFR operating conditions. The current runway configuration provides approximately 94% of wind coverage for aircraft with a maximum allowable crosswind component of 10.5 knots. However, the forecasted number of operations of aircraft with a maximum allowable crosswind component of 10.5 knots is not significant over the 20-year planning period. Therefore, the current runway orientation is adequate, and additional crosswind runways are not required.

The current configuration of runway shoulders and blast pads do not meet the required dimensional standards. An approved Modification of Standards (MOS) is in place allowing 747-8F operations with the current runway configuration. However, to meet the runway design requirements of the RDC as shown in **Table 3-8 Airfield Design Parameters**, 40 feet of paved shoulders must be added to Runway 5R-23L, and the blast pads located at each end of the runway must be enlarged to a width of 280 feet and a length of 400 feet. In order to accommodate operations of the critical aircraft, the width of Runway 5L-23R must be increased from 150 feet to 200 feet, the corresponding 40-foot paved shoulders must be added, and the blast pads located at each end of the runway must be enlarged to a width of 280 feet and a length of 400 feet.

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Table 3-9 Runway Design Standards Analysis

Design Standard	FAA Required Dimension	Existing Condition/Action Required	
		Runway 5L-23R	Runway 5R-23L
Runway Length	See Section 3.6	☑ 11,902 feet	☑ 12,102 feet
Runway Width	200 feet	Additional 50 feet required	☑
Runway Shoulder Width	40 feet	40-foot shoulders must be added	40-foot shoulders must be added
Runway Blast Pad Width	280 feet	Increase the dimensions of the blast pads to the required dimensions	
Blast Pad Length	400 feet		
Crosswind Component	20 knots	☑ 95% wind coverage	☑ 95% wind coverage

Source: FAA AC 150/5300-13A, Airport Design Change 1. Michael Baker International, Inc., 2017.

3.6 Runway Length Requirements

Runway length requirements were evaluated in accordance with FAA AC 150/5325-4B, Runway Length Requirements for Airport Design, which provides methodologies for determining runway length requirements by aircraft type. In accordance with Chapter 4 of AC 150/5325-4B, runway length requirements were estimated using the aircraft manufacturer's airport planning manuals.

The required runway length was estimated using the Boeing 747-8F Airplane Characteristics for Airport Planning manual (published December 2012). The data provided in this document provided runway length requirements for typical engines and operating conditions. The runway length calculations are based on the mean daily maximum temperature of the hottest month, which is 86.8 degrees Fahrenheit, and the field elevation of 744 feet.

Based on the average meteorological conditions, the required takeoff runway length is approximately 11,200 feet. With 25° flaps, the required landing distance is approximately 8,900 feet, and with 30° flaps the landing distance is approximately 8,600 feet. **Table 3-10 Runway Length Analysis** summarizes the runway length analysis. The runway lengths shown are based on maximum design takeoff weights and maximum average ambient temperatures. These extreme operating conditions are generally not expected to occur at LCK. Therefore, the current length of the runway meets the requirements of the critical aircraft.

Other aircraft such as the Boeing 757-200, Boeing 767-300, and Airbus A300-B4-600 currently operate at LCK and are expected to continue operating within the short-term planning period. However, these aircraft generally operate on a short-haul distance and are not considered a demanding aircraft in terms of runway length requirements. In the mid- to long-term planning horizon, the Boeing 777, particularly the future freighter version of the

Boeing 777X family is expected to operate at LCK. Performance data for the Boeing 777X aircraft family is not available yet. However, it is expected that the runway length requirements of the Boeing 777X will be equal to or less than the Boeing 777F which currently operates at LCK.

The Airbus 320 aircraft family is currently operating at LCK in support of commercial passenger operations. In the mid- to long-term planning periods, airlines are expected to operate A320neo (new engine option) or the Boeing 737Max. These aircraft are expected to have higher performance than the Airbus 320 aircraft family, and therefore the current runway length would be sufficient.

Table 3-10 Runway Length Analysis

Aircraft	Maximum Takeoff/Landing Weight (lbs)	Operation Type	Conditions	Required Runway Length (feet)	
				5L-23R	5R-23L
Boeing B747-8F	987,000	Takeoff	Standard Day	10,700	
			Standard Day + 27°F	11,200	
	763,000	Landing	Standard Day, Flaps 25, Wet Runway	8,900	
			Standard Day, Flaps 30, Wet Runway	8,600	
Boeing B777F	766,800	Takeoff	Standard Day	11,100	
			Standard Day + 27°F	11,700	
	575,000	Landing	Standard Day, Flaps 25, Wet Runway	7,200	
			Standard Day, Flaps 30, Wet Runway	6,700	
Airbus A320	171,961	Takeoff	Standard Day	7,200	
			Standard Day + 59 °F	8,000	
	142,198	Landing	Standard Day	8,200	

Source: Boeing and Airbus Airport Planning Manuals. Michael Baker International, Inc., 2017.
Notes: Includes adjustment for runway grade.

3.7 Runway Strength Requirements

One of the most important features of airfield pavement is its ability to withstand repeated use by the most weight-demanding aircraft operating at the airport. The current pavement classification number (PCN) calculations denoting the pavement's strength are reported as 92/R/C/W/T (load carrying capacity of pavement/rigid or flexible pavement/subgrade strength/maximum tire pressure/load carrying capacity calculated through technical evaluation or usage) for Runway 5R-23L and 69/F/B/W/T for Runway 5L-23R. The load exerted on the pavement by the critical aircraft (Boeing 747-8F), referred to as the aircraft classification number (ACN), should not exceed the PCN in an effort to prolong the pavement life and prevent possible damage to the pavement. According to Boeing's 747-8 Airplane Characteristics for Airport Planning, the ACN for the Boeing 747-8F on Runway 5R-23L is 88 and is 70 on Runway 5L-23R based upon the aircraft gross weight and the pavement types reported above. As a result, despite the ACN slightly exceeding the PCN for Runway 5L-23R, the aircraft can utilize the runway on a regular basis; however, as rehabilitation becomes necessary, recent and anticipated aircraft activity should be reviewed during a project level investigation. The actual pavement strength requirements should be evaluated on a project-by-project basis.

3.8 Runway Protection and Separation Requirements

Runway protection areas include areas designed to protect the aircraft in case of excursion from the runway. The dimensional boundaries, grading and object clearance requirements of these areas are defined by the RDC. Runway separation requirements define the minimum distances between the runway centerline, and parallel runways, taxiways, aprons, and fixed objects. The sections below describe the runway protection and separation requirements.

3.8.1 Runway Safety Area

In addition to the dimension requirements shown in **Table 3-11 Runway Protection Standards Analysis**, the Runway Safety Area (RSA) must be:

- Cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations
- Drained by grading or storm sewers to prevent water accumulation
- Capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft
- Free of objects, except for objects that need to be located in the RSA because of their function.

The current RSAs meet the required standards. However, at the end of Runway 23R (see photo), sections of pavement from the non-standard bypass taxiway used previously by the military (also known as “Hammerhead”) are located in the RSA. These pavement sections are in poor condition and should be removed to improve the grading of the RSA in that area. In addition, the non-standard bypass taxiways adjacent to Taxiway “B” should be removed or appropriately marked to eliminate the potential for aircraft to taxi into the RSA. As part of the ongoing LCK MOS Phase 1 Improvements Project, these pavement sections were removed, therefore improving the condition of the RSA.

3.8.2 Runway Object Free Area

In addition to the dimensional requirements shown in **Table 3-11 Runway Protection Standards Analysis**, the Runway Object Free Area (ROFA) must be clear of ground objects protruding above the RSA edge elevation. The purpose of the ROFA is to enhance the safety of aircraft operations by having the area free of objects, except for objects that need to be located in the ROFA for air navigation or aircraft ground maneuvering purposes. The existing ROFAs meet the current airfield design standard.

3.8.3 Runway Protection Zone

The dimensional standards of the Runway Protection Zones (RPZs) are shown in **Table 3-11 Runway Protection Standards Analysis.** The RPZs are currently located on airport property and under the control of the CRAA. The purpose of the RPZ is to protect people and property on the ground. Therefore, facilities and roads should not be constructed within the RPZs. The existing RPZs meet the current airfield design standard.

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Table 3-11 Runway Protection Standards Analysis

Design Standard	Required Dimension		Runway 5L	Runway 23R	Runway 5R	Runway 23L
Runway Safety Area (RSA)						
Length Beyond Departure End (feet):	1,000 feet		☑	☑	☑	☑
Length Prior to Threshold (feet):	600 feet		☑	☑	☑	☑
Width (feet):	500 feet		☑	☑	☑	☑
Runway Object Free Area (ROFA)						
Length Beyond Runway End (feet):	1,000 feet		☑	☑	☑	☑
Length Prior to Threshold (feet):	600 feet		☑	☑	☑	☑
Width (feet):	800 feet		☑	☑	☑	☑
Runway Obstacle Free Zone (ROFZ)						
Length (feet):	200 feet		☑	☑	☑	☑
Width (feet):	400 feet		☑	☑	☑	☑
Inner-approach OFZ						
Length (feet):	See Note 1		☑	☑	☑	☑
Width (feet):	400		☑	☑	☑	☑
Slope (feet):	50:1		☑	N/A	☑	☑
Inner-transitional OFZ			☑	N/A	☑	☑
Precision Obstacle Free Zone (POFZ)						
Length (feet):	200		☑	☑	☑	☑
Width (feet):	800		☑	☑	☑	☑
Approach Runway Protection Zone (RPZ)	Not Lower than ¾ Mile	Lower than ¾ Mile	Lower than ¾ Mile	Not Lower than ¾ Mile	Lower than ¾ Mile	Lower than ¾ Mile
Length (feet):	1,700	2,500	☑	☑	☑	☑
Inner Width (feet):	1,000	1,000	☑	☑	☑	☑
Outer Width (feet):	1,510	1,750	☑	☑	☑	☑
Departure Runway Protection Zone (RPZ)						
Length (feet):	1,700		☑	☑	☑	☑
Inner Width (feet):	500		☑	☑	☑	☑
Outer Width (feet):	1,010		☑	☑	☑	☑

Source: FAA AC 150/5300-13A, Airport Design Change 1. Michael Baker International, Inc., 2017. ☑: Meets FAA standard

Notes:

1. *The Inner-approach OFZ begins at 200 feet from the runway threshold at the same elevation of the runway threshold and extends 200 feet beyond the last light of the Approach Lighting System (ALS). The inner-approach OFZ applies only to the runways with an ALS.*

3.9 Taxiway Configuration Requirements

Previous taxiway design guidance was based only on the Airplane Design Group (ADG) and did not take into consideration the size of the aircraft undercarriage. The current guidance described in FAA AC 150/5300-13A, Change 1, is based on the Taxiway Design Group (TDG) which takes into account the aircraft Main Gear Width (MGW) and the Cockpit to Main Gear Distance (CMG). Taxiways should be designed for "cockpit over centerline" taxiing with sufficient pavement to provide a small amount of error. The error allowance is considered by providing a Taxiway Edge Safety Margin (TESM), which is measured from the outside of the main landing gear to the taxiway edge. Taxiway design requiring "judgmental oversteering", where the pilot must internally steer the cockpit outside the marked centerline, should be eliminated whenever feasible. Appropriate taxiway design ensures that the required TESM is maintained for all aircraft taxi maneuvers. This can be achieved by designing the taxiway with the width and fillet dimensions corresponding to the TDG of the design aircraft.

The taxiway requirements analysis is summarized in **Table 3-12 Taxiway Design Standards Analysis** and **Table 3-13 Taxiway Protection and Separation Standards Analysis**. In order to meet the requirements of the Boeing 747-8F (critical aircraft), all non-compliant taxiways should be designed to TDG 5 dimensional standards. Taxiways should be designed according to the following general design considerations:

- Judgmental oversteering should be eliminated whenever feasible.
- The aircraft nose gear steering angle should not be more than 50 degrees.
- Taxiway intersection should follow the three-node design concept. The three-node concept means that the pilot of the aircraft is presented with no more than three choices at an intersection. As a result, the three-node concept increases situational awareness.
- Taxiway intersection angles should be 90 degrees wherever possible. Where 90 degrees intersections are not possible, standard angles of 30, 45, 60, 90, 120, 135, and 150 degrees should be used.
- Wide expanses of pavement, particularly near the intersection with a runway or other taxiway should be avoided.
- The number of runway crossings should be minimized.
- Taxiway/Runway intersections should be located in the outer thirds of the runway.
- Right angle intersections should be used to increase visibility. Acute angled taxiways may be used to increase the efficiency of the runway; however, they should not be used as runway entrance or crossing points.
- Dual purpose pavements where runways are used as taxiways should be avoided. Runways should be clearly marked.
- Taxiways should not lead directly from an apron to a runway without requiring a turn.

As shown in **Table 3-12 Taxiway Design Standards Analysis** and **Table 3-13 Taxiway Protection and Separation Standards Analysis**, the current taxiway system does not meet the Taxiway Edge Safety Margin (TESM) requirement. The LCK MOS Phase 1 Improvements Project is currently being implemented to improve safety in the existing taxiway system. The incremental improvements associated with the project would bring the taxiway pavement standards up to TDG 5. Future taxiway developments or major taxiway rehabilitation projects should be designed to meet ADG VI and TDG 5 design standards, particularly the application of the appropriate taxiway fillets.

Taxiway A currently does not meet the taxiway object free area (TOFA) requirement. Incremental improvements through the current LCK MOS Phase 1 Improvements Project allows for safe operations of the Boeing 747-8F along Taxiway A. However, Taxiway A can only accommodate the Boeing 747-8F based on wingtip clearance and not the full ADG VI TOFA requirement. The Alternatives phase of this Study will investigate possible options for meeting ADG VI and TDG 5 design standards on Taxiway A in the future.

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Table 3-12 Taxiway Design Standards Analysis

Design Standard	Required Dimension	Taxiway					
		A	B	C	D	E	G
Taxiway Width (feet)	75	☑	☑	☑	☑	☑	☑
Taxiway Edge Safety Margin (TESM) (feet)	15	☒					
Taxiway Shoulder Width (feet)	30	☑	☑	☑	☑	☑	☑
Taxiway Fillet Dimensions	Table 4-8 in AC 150/5300-13A	Taxiway centerline markings and/or taxiway lead-in fillets for taxiway segments used by the critical aircraft should be designed to TDG 5 requirements					

Source: FAA AC 150/5300-13A, Airport Design Change 1. Michael Baker International, Inc., 2017. ☑: Meets FAA standard ☒: Does not meet FAA standard

Table 3-13 Taxiway Protection and Separation Standards Analysis

Design Standard	Required Dimension	Taxiway					
		A	B	C	D	E	G
Taxiway Protection							
Taxiway Safety Area (TSA) (feet)	262	☑	☑	☑	☑	☑	☑
Taxiway Object Free Area (TOFA) (feet)	386	☒	☑	☑	☑	☑	☑
Taxilane Object Free Area (feet)	334	N/A	N/A	N/A	N/A	N/A	N/A
Taxiway Separation							
Taxiway Centerline to:							
Parallel Taxiway/Taxilane Centerline (feet)	324	☒	☑	☑	☑	☑	☑
Fixed or Movable Object (feet)	193	☒	☑	☑	☑	☑	☑

Source: FAA AC 150/5300-13A, Airport Design Change 1. Michael Baker International, Inc., 2017. ☑: Meets FAA standard ☒: Does not meet FAA standard

3.10 Pavement Condition Requirements

The CRAA has an established Pavement Management Program (PMP) for LCK. The objective of this program is to evaluate the functional condition of existing landside and airfield pavements, as well as identify and prioritize short- and long-term pavement maintenance and rehabilitation requirements. The most recent report, completed in June 2016, is based on pavement data collected between August 2015 and January 2016. As part of the alternatives development phase of this Study, pavement condition information from the PMP will be used to identify and prioritize future pavement rehabilitation projects.

3.11 Airfield Lighting, Markings, Signage, and Navigational Aids

Based on the current standard instrument procedures available at LCK, all four runway ends are provided with the lighting, marking, and navigational aids necessary to comply with FAA requirements. The existing navigational aids such as approach lighting systems (ALS), PAPIs, and Instrument Landing Systems (ILS) meet the requirements for the currently established approaches at LCK. In the future, as new technologies become available or reduced approach minimums are desired, improvements to the existing instrument landing and approach lighting systems will likely be necessary. It is recommended that these opportunities be considered as part of the Alternatives Analysis.

The incremental improvements of the LCK MOS Phase 1 Improvements Project would require modifications for the current airfield lighting, marking, and signage. Replacing incandescent light fixtures with light emitting diode (LED) light fixtures is recommended. This will also require new regulators in the electrical vault. However, LED light fixtures must not be interspersed with incandescent lights of the same type. FAA AC 150/5340-30J, Design and Installation Details for Airport Visual Aids, indicates that LED light fixtures interspersed with incandescent fixtures may present a difference in perceived color and/or brightness of the light, potentially distorting the visual presentation to the pilot. Therefore, because of the incremental nature of the project, incandescent lights are not being replaced with LEDs during the initial phases of the project.

As airfield lights reach the end of their useful life, conversion from incandescent airfield lights to light emitting diode (LED) lights should be considered in conjunction with other new development and rehabilitation projects. Since LED light fixtures must not be interspersed with incandescent lights of the same type, incremental replacement of incandescent lights should be carefully planned.

3.12 Airport Traffic Control Tower Requirements

The airport traffic control tower (ATCT) facility opened in April 2016. The new ATCT was constructed to comply with the standards for the Federal Contract Tower Program in the event LCK is accepted into the program in the future. The ATCT is in operation 24 hours a day and satisfies the current and anticipated future requirements. Future developments on the airport should carefully consider the ATCT line of sight requirements.

3.13 Passenger Terminal Area

This analysis provides further refined and detailed facility requirements for each building space or function within the Passenger Terminal Building and its surrounding facilities. This will include an estimate of the required size of each space during the planning period along with narrative descriptions of the rationale for space demand.

At non-hub commercial service airports such as Rickenbacker, empirical planning forecasts are not always the best indicator of actual space needs within the terminal. With smaller enplanement numbers, often the usual planning formulas will result in space requirements that fall below real-world minimum space needs. The charter operators, airlines and other tenants require minimum amounts of space to operate their businesses and carry out their required functions. The area calculations included in this section are based upon this assumed activity and forms the basis for the terminal peak hour passenger enplanements (**Table 3-14 Peak Hour Enplanement Assumptions**) used in determining the terminal facility space requirements.

Typical planning models also tend to average out enplanement activity, which works well for most airports. However, at Rickenbacker, airline passenger and operations peaks can be challenging due to the limitations of the terminal facility, staffing demands, and desired turnaround times by existing air carriers. In addition, commercial passenger service may have seasonal fluctuations and daily service is likely to be concentrated at specific points within the day. As most of the commercial passenger service relates directly to the Allegiant operation, the concentration of flights during peak periods is assumed to remain similar throughout the planning period. For the purposes of this terminal analysis, the peak hour passenger activity in the terminal will be represented by the critical aircraft for passenger service (Airbus 320). Given Allegiant's plans to add additional frequencies and simultaneous dual operations at LCK, two Airbus 320 aircraft are assumed to be on the ground simultaneously during the peak hour. The peak hour load factor is assumed to remain constant at 90% over the planning period and is in keeping with typical load factors experienced by Allegiant.

Table 3-14 Peak Hour Enplanement Assumptions

Year	Load Factor	Aircraft on Ground/Peak Hour	Total Seats/Peak Hour	Peak Hour Enplanements[1]
2016	90	2	372	335
2021	90	2	372	335
2026	90	2	372	335
2031	90	2	372	335
2036	90	2	372	335

Source: Michael Baker International, Inc., 2017
Note 1: Assumes that peak hour demand is equivalent to 90% of load of Airbus 320.

It is important to point out that many of the requirements presented in this section are based upon peak hour demand. As a result, this analysis essentially caps peak hour demand to two aircraft on the ground simultaneously as a worst case scenario, since CRAA does not plan on expanding the terminal structure as part of this plan. The goal of the terminal analysis is to identify facility needs within the existing terminal facility over the 20-year planning period.

3.13.1 Aircraft Parking Apron

The terminal apron is located adjacent to the southwest side of the passenger terminal. It consists of approximately 161,000 square feet of concrete pavement for the parking and maneuvering of commercial aircraft utilizing the terminal for passenger activities. This area is designated as a security identification display area (SIDA) and access is restricted to badged personnel.

The apron provides space capable of accommodating parking for two narrow body aircraft, with two passenger boarding bridges providing access between the aircraft and terminal gates. Both gates are regularly used by Allegiant Air, which currently uses McDonnell Douglas MD-80 series and Airbus 320 aircraft. The apron is well-suited to accommodate Airbus 320 operations (the critical aircraft for passenger service). However, the apron is also marked to accommodate a variety of narrow-body and smaller commuter sized aircraft parking configurations associated with charter passenger activities. The size of the existing terminal apron is sufficient to support the level of passenger activities projected throughout the 20-year planning period.

3.13.2 Terminal Building Requirements

Within each area of this section, existing and future requirements are identified over the 20-year planning period. A comparison of the future demand for such facilities to the existing capacity of the terminal is found in **Table 3-20 Passenger Terminal Facility Requirements** at the end of the Terminal Building Summary section of this chapter.

Ticketing

At smaller terminal facilities, an airline usually requires a minimum of 20 to 24 feet in width to adequately accommodate its, ticket counters, office space and an accessible corridor. If a conveyor is used to transport the checked baggage through this area into baggage make-up, an additional 4 to 6 feet of width is necessary. Under the Allegiant model, passengers are encouraged to use electronic check-in via smart phone devices and computers, resulting in a high percentage of pre-ticketed passengers. The current ticketing counter/office area width is approximately 30 feet wide, and includes access to the office and a conveyor to the outbound baggage make-up. As a result, the current total width of 30 feet should be adequate at LCK.

Typically, a minimum space 25 to 30 feet is an appropriate amount of depth for the airline ticket offices (as shown in **Figure 3-1 Typical ATO Layouts-Single Level Terminals**). The current ticketing office is a single space of approximately 200 square feet. Due to the limited staffing by Allegiant at LCK, the minimum space provided is assumed to be adequate for their operations.

Ticket Counter Area

Based on the Consultant's experience, airlines require a minimum of two agent positions (and usually prefer four) to effectively serve their passengers. Each ticketing agent requires approximately 5 linear feet of counter (3 foot-6 inch desk position and 1 foot-6 inch bagwell). An additional 3 feet of frontage should be allowed for traffic through the counter between each airline area. Within the frontage (30 feet) determined as necessary for the Airline Ticket Office (ATO) area, enough space is provided at the LCK terminal for a total of 6 agent positions. To verify that enough space is provided, the required number of agent positions is determined by taking 60% of the terminal peak hour passengers for a 30-minute peak demand and dividing by 15 for commercial passengers (the maximum number of passengers that can be efficiently processed by one agent in 30 minutes). While electronic ticket kiosks are gaining in popularity and reducing the time required for check-in, airlines have little capital to install such systems so these are most prevalent at hub and non-hub airports with over 500,000 annual enplanements. Therefore, there are no kiosks at LCK.

The ticket counter area includes the counter and baggage wells, the working space behind the counter and often space for the conveyor. The required area for planning purposes is determined by multiplying the 30 feet of total counter length and through circulation by 10 feet of depth, resulting in an area of 300 square feet. Therefore, the existing 300 square feet of ticket counter area is adequate.

Ticket Lobby

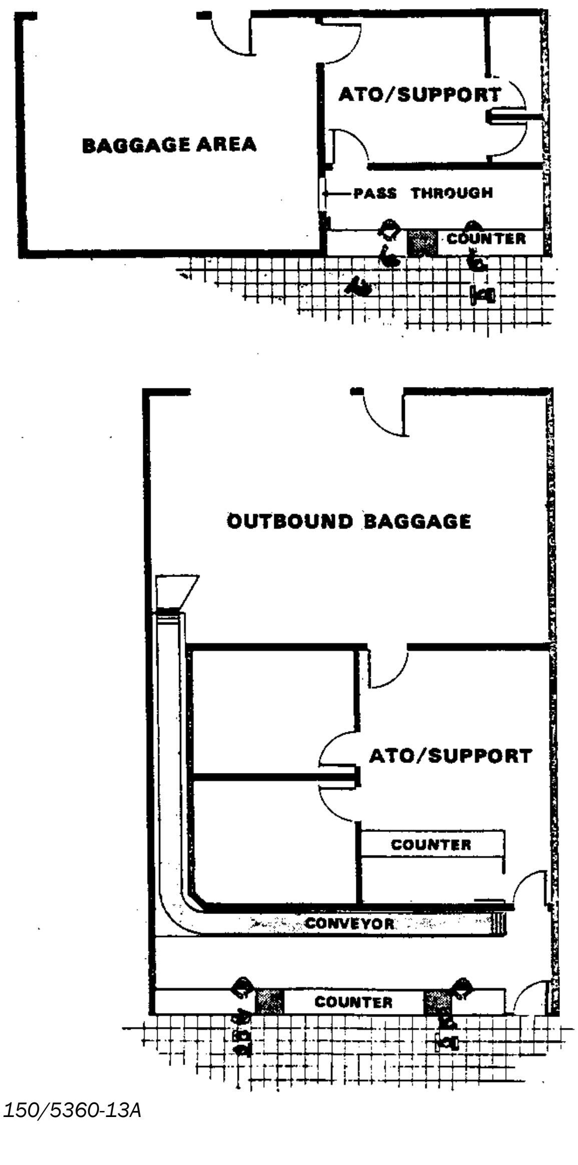
The ticket lobby includes the area required for passengers to queue in front of each agent position, space for the activity occurring at the counter, and some amount of clear circulation space behind queuing. Thirty minutes is the maximum time travelers will typically wait in line without experiencing significant frustration. It is assumed that approximately 2/3 of peak hour enplaned passengers (335) at LCK will check-in at the ticketing counter, with 50% occurring during the peak 30 minutes. Using 12 square feet per person, one can determine the required area of 1,340 square feet for passenger queuing at ticketing. Essentially, the ticketing function is performed by one airline in an alcove area of the terminal. At this time no additional airlines are expected. Therefore, the priority is to provide a minimum of 8 feet of circulation space in front of the ticket counter (industry standard), and the remainder of the area would be dedicated to queuing. There is approximately 1,000 square feet currently available, resulting in a deficiency of approximately 340 square feet. As noted in ACRP Report 55, Passenger Level of Service and Spatial Planning for Airport Terminals, passengers will use adjacent convenient areas (such as the lobby public waiting area at LCK) to avoid excessive congestion. Other options for addressing the queuing deficiency will be considered during the alternatives phase of the Study.

Make-Up (Outbound Baggage) Area

This area is used for processing bags that are checked in at the Ticket Counter. It should be directly behind or beside the ATO and ticket counter area (see **Figure 3-1 Typical ATO Layouts-**

Single Level Terminals) for efficient operations. One baggage cart and the space required to maneuver it requires a minimum of 200 square feet. This represents the physical size of the baggage cart and areas around it for loading bags and connecting to tugs or other carts. A total of six baggage carts (three carts per flight) are required for loading. Therefore, a total of 1,200 square feet is required for the baggage make-up area during the planning period. The existing 1,298 square feet of baggage make-up area is sufficient.

Figure 3-1 Typical ATO Layouts-Single Level Terminals



Source: FAA Advisory Circular AC 150/5360-13A

Baggage Screening

As a result of the events of September 11, 2001, the United States Government created the Transportation Security Administration (TSA). Congress mandated that by December 2002, 100% of all checked baggage be screened for explosives (later extended to December 2003).

The agency met the goal by employing the use of Explosive Trace Detectors (ETD) for the vast majority of non-hub airports. The spatial requirements of these machines and their integration into either the ticketing lobby, baggage make-up area, or some other area of the terminal were determined by the TSA and the airport based on a number of factors including equipment availability, staffing requirements, and capital costs acceptable to the airport. In 2017, a Checked Baggage Inspection System (CBIS) was reallocated by TSA from another airport and installed at LCK. This consists of a Computed Tomography (CT) scanner and ETD components (approximately 285 square feet).

According to the TSA's Planning Guidelines and Design Standards for Checked Baggage Inspection Systems, the TSA standard of 0.70 checked bags per passenger results in a total of 235 bags to screen to meet peak hour demand of 335 outbound passengers. The capacity of the CT scanner is approximately 180 bags per hour per TSA standards. Therefore, the remainder of the bags can be checked by the ETD.

Since check in profiles begin more than one hour before each flight, there is added time for screening of the peak event. Since the bags are typically checked in over a two-hour period, it is likely they will all be scanned by the CT scanner.

The requirements for the ticket counter, ticket lobby, airline offices, and baggage make-up for the planning period are summarized in **Table 3-15 Ticketing Area Facility Requirements**.

Table 3-15 Ticketing Area Facility Requirements

Terminal Area	2016	2021	2026	2036
Ticket Counter Length (LF)	30	30	30	30
Agents Required (EA)	5	5	5	5
Agents Provided (EA)	6	6	6	6
Ticket Counter Area (SF)	300	300	300	300
Ticket Lobby (SF)	1,340	1,340	1,340	1,340
CBIS (SF)	285	285	285	285
Airline Ticket Offices (SF)	200	200	200	200
Baggage Make-Up (SF)	1,200	1,200	1,200	1,200

Source: Michael Baker International, Inc., 2017; ACRP Report 25: Airport Passenger Terminal Planning and Design, 2010

Baggage Claim Lobby

The baggage claim area consists of a waiting lobby, which overlaps with circulation and a baggage display device. Typically, in an airport this size, the baggage display device is a baggage conveyor unit. The linear footage of the device is calculated by assuming 0.7 bags per peak hour deplaning passenger checking baggage (approximately 50%) and allowing for this baggage to be retrieved in a 20-minute period. Due to the peak activity represented by two narrow body jets arriving with approximately 335 passengers, a flat plate conveyor system is appropriate. A flat plate conveyor can display 2.5 bags per linear foot in a 20-minute period. An additional 6 feet of lobby length should be allowed for circulation from the inbound baggage area to the baggage claim lobby. The current baggage claim frontage is 170 feet long versus the requirement of 53 feet.

After determining the length of the claim device, the baggage claim lobby is determined by multiplying 35 feet by the length of the device, plus the additional 6 feet of lobby length for through traffic. The 35 feet provides approximately 25 feet of depth for waiting, retrieving, and stacking baggage, and approximately 10 feet for circulation beyond the claim device. The current baggage claim lobby (with circulation) is 2,845 square feet versus the requirement of 1,855 square feet.

Inbound Baggage Area

The inbound baggage area relates directly to the baggage claim device because a certain amount of space is needed to access the claim device and handle incoming baggage. Again, use of a conveyor is assumed. Twenty-five feet of overall depth for this area allows for one 12-foot tug lane, 6 feet for the depth of the conveyor device, 5 feet of space for unloading equipment and 2 feet for structure. The overall square footage has been determined by multiplying the 25-foot depth by the total lobby length of 50 feet (1,250 square feet), including the 6 feet for through traffic. There is an existing 860 square foot canopy which is suitable for a tug and train of carts. Currently, there is approximately 2,000 square feet of total pavement area available for this purpose.

Rental Cars

A minimum of 100 square feet per rental car vendor should be provided (10-foot counter by 10 foot depth) with an additional 100 square feet for office space per agency. Some allowance should be made for queuing outside of circulation areas (6 to 10 feet in depth is recommended). Assuming the minimum queuing space, a total of 260 square feet per agency is recommended for planning purposes. Although one agency currently serves LCK, they serve the airport from an offsite location and do not occupy space in the terminal. For planning purposes, space should be allowed for new entrants to the market and for other forms of ground transportation service counters. Actual space requirements should be verified with potential tenants prior to proceeding with a schematic design.

The requirements for the baggage claim lobby, inbound baggage area, and rental car areas for the planning period are summarized in **Table 3-16 Baggage Claim Facility Requirements.**

Table 3-16 Baggage Claim Facility Requirements

Terminal Area	2016	2021	2026	2036
Claim Devices (EA)	1	1	1	1
Conveyor Frontage (LF)	53 (47+6)	53 (47+6)	53 (47+6)	53 (47+6)
Claim Lobby w/ Circulation	1,855	1,855	1,855	1,855
Inbound Baggage Operations (SF)	1,250	1,250	1,250	1,250
Rental Car Areas (SF)	520	520	520	520

Source: Michael Baker International, Inc., 2017; ACRP Report 25: Airport Passenger Terminal Planning and Design, 2010

Public Waiting

Public Waiting Area(s) should be provided at an airport for passengers and visitors arriving early before their flight, and for those individuals waiting for ground transportation after their flight arrives. Many small airports do not open the holding areas until shortly before boarding due to staffing requirements at the security screening station. Also, with the current screening regulations, only ticketed passengers are allowed beyond the screening station. Therefore, the public waiting areas need to accommodate 50% of both the terminal peak hour (enplaning) passengers (168 passengers) and an average of one visitor per four passengers (42 visitors). An area of 20 square feet per person (4,200 square feet) is appropriate for small airports such as Rickenbacker to allow for seating and circulation within the waiting area. The current public waiting area is 1,172 square feet versus the requirement of 4,200 square feet. This deficiency is addressed further in **Chapter 4, Airport Alternatives Analysis** (Section 4.6, p. 4-13).

Secure Passenger Holding

The passenger holding area provides secured areas where passengers can sit or stand while they wait to board a flight. As discussed previously, at many small airports these holding areas are not open all the time, and when they are open, only passengers may access them. Due to the current screening regulations, visitors are not allowed beyond the screening station (except in certain circumstances for youth and elderly needing assistance). When sizing these areas, a peak 30-minute load factor of 100% of the terminal peak hour (enplaning) passengers is used (335 passengers). Again, 20 square feet per passenger is used to determine the required area for seating and circulation. Some flexibility in holdroom and waiting areas would accommodate charters with larger passenger capacity. In addition to seating, the holdroom should allow 250 square feet per airline gate (500 square feet total) for queuing and ticket lift station. LCK currently has 7,335 square feet of secure hold room space available to meet the requirement of 7,200 square feet.

Security Screening

The United States Congress mandated that by November 2002, 100% of all passenger screening by TSA screeners be accomplished using the new TSA screening standards. Screening standards required by TSA, employ the use of more extensive review of passengers and their carry-on items which creates new space requirements for body searches, X-ray equipment and Explosive Trace Detectors (ETD). The space required for each lane is approximately 500 square feet. Another 400 square feet (space for 20-25 persons) should be provided for queuing for each lane. Space for private screening of passengers should also be incorporated into any layout. This room should be at least 60 square feet.

Allegiant has simultaneous dual operations at LCK. At times, the flights will be spaced 20-30 minutes apart creating potential impacts to current security screening activities. To accommodate this growth, CRAA and TSA installed an Advanced Imaging Technology scanner (AIT) and an additional x-ray lane within the existing Security Screening Check Point (SSCP) area. This includes a new x-ray machine and an additional Travel Document Checker (TDC) at the entrance into the SSCP area. Due to the limited space available, queuing for the SSCP will be further reviewed as part of the alternatives phase of the Study. As part of the proposed SSCP improvements, an 8.5 foot wide circulation path for deplaning passengers is planned. This is slightly less than the recommended 10 foot width to the circulation area. The total for the Security Screening Area (including queuing, screening and circulation) considered by TSA is approximately 2,300 square feet, not including office space for the TSA. This allows space for the use of two screening lanes, which is important for future flexibility and to allow for equipment problems or maintenance. The second screening lane was installed in 2017.

The requirements for public waiting, passenger holding, and security screening for the planning period are summarized in **Table 3-17 Concourse Area Facility Requirements** that follows.

Table 3-17 Concourse Area Facility Requirements

Terminal Area	2016	2021	2026	2036
Public Waiting (SF)	4,200	4,200	4,200	4,200
Passenger Holding (SF)	7,200	7,200	7,200	7,200
Security Screening (SF)	2,300	2,300	2,300	2,300

Source: Michael Baker International, Inc., 2017

As noted previously, the requirements presented above are based upon peak hour demand. As a result, this analysis essentially caps peak hour demand to two aircraft on the ground simultaneously as a worst case scenario, since CRAA does not plan on expanding the terminal structure as part of this plan. The goal of the terminal analysis is to identify facility needs within the existing terminal facility over the 20-year planning period.

Miscellaneous Concessions

Concessions requirements from FAA AC 150/5360-13A, Airport Terminal Planning, are expressed in terms of space requirements per 1 million enplanements. For smaller airports such as LCK, miscellaneous concessions such as newsstands, gift shops, and similar areas need approximately 1 square foot of space for every 200 annual enplanements.

Snack Bar/Restaurant Area

Many times a small airport cannot support a full service restaurant; however, this varies from community to community. For the purpose of planning, some space has been programmed to serve as a snack bar/restaurant with a limited kitchen facility. An area 400 to 600 square feet is suggested by FAA AC 150/5360-13A, Airport Terminal Planning, for the size of these areas at small airports. Allow 500 square feet in the program for this function, which includes seating, circulation, and service areas related to the preparation of food. Approximately 500 square feet is currently provided.

Vending

A total vending area of 150 square feet should be provided on both the secure and non-secure portions of the terminal for machines providing drinks and self-service packaged foods. These provide a service to passengers outside the normal operating hours of other concessions. Currently, there is a total of 27 square feet provided (9 SF non-secure area/18 SF secure area).

Public Restrooms

Because of the fluctuating activity of LCK, it is assumed that most of the peak hour (enplaning) passengers may be enplaning or deplaning within a 15-minute period. Airport Cooperative Research Program (ACRP) Report 130, Guidebook for Airport Terminal Restroom Planning and Design (Section 2.4.1), was used as a resource for determining public restroom needs. To determine the number of fixtures for planning purposes, it is assumed that of these passengers, 25% may require the use of restroom facilities and that the facilities can be used three times in the peak 15 minutes. Once the number of fixtures has been determined, approximately 80 square feet per fixture should be provided. This results in a total space requirement of 1,120 square feet. Currently, the terminal has 1,280 square feet available. It is also assumed that of the total number of fixtures necessary, approximately 50% would be utilized by each gender. Currently, there are a total of 16 fixtures (8 men/8 women) located at the terminal (8 pre-security and 8 post-security). This exceeds the total terminal requirement of 14 fixtures.

Some over-sizing of this element can help accommodate larger flights. Also, restrooms are expensive to expand later, since the space is small, but difficult to modify to add only one or two more fixtures. Restroom locations are desirable in both the secure holdroom and the unsecured public areas. The existing restrooms are accessible in accordance with the requirements of the Americans with Disabilities Act (ADA).

The requirements for Concessions, Snack Bar/Restaurant, Vending, and Restrooms for the planning period are summarized in **Table 3-18 Public Area Facility Requirements**.

Table 3-18 Public Area Facility Requirements

Terminal Area	2016	2021	2026	2036
Concessions/Gift Shop (SF)	516	762	804	894
Snack Bar/Restaurant (SF)	500	500	500	500
Vending (SF)	150	150	150	150
Fixture Requirement (M/F)	7/7	7/7	7/7	7/7
Public Restrooms (SF)	1,120	1,120	1,120	1,120

Source: Michael Baker International, Inc., 2017

As noted previously, the requirements presented above are based upon peak hour demand. As a result, this analysis essentially caps peak hour demand to two aircraft on the ground simultaneously as a worst case scenario, since CRAA does not plan on expanding the terminal structure as part of this plan. The goal of the terminal analysis is to identify facility needs within the existing terminal facility over the 20-year planning period.

Circulation, Mechanical, Maintenance, and Miscellaneous

In addition to the specific functional areas analyzed above for the terminal building, other miscellaneous space is not so readily calculated without a specific layout. The largest of these areas is circulation. In airport terminal buildings, this can account for nearly 50% of the facility.

Approximately 14,500 square feet of the terminal is currently utilized as circulation space. It is quite common for smaller airports to undersize the circulation elements, or to allow queuing, displays, or other elements to obstruct the flow of travelers. Also, other spaces such as mechanical and electrical rooms and janitor's closets have to be included. Guidance from FAA AC 150/5360-13A, Airport Terminal Planning, suggests 12% to 15% of programmed space for these uses. Further, the walls and structure of the building take up about 5% of gross area. Finally, the open circulation in the airport, including vertical circulation such as stairs, elevators, and escalators must be accounted for. A rule-of-thumb for planning terminals of this size is to assume this miscellaneous space to be a total between 35% and 55% of the rest of the terminal (not including administration space) with the percentage declining as the size of the building increases. These areas should be sized to allow for some flexibility due to difficulty in expanding the service core and circulation areas at a later date.

Administration and Support

The administration and support requirements of airports vary to a wide degree due to the different operations at every airport, the number of enplanements and the activities performed by airport administration staff. Currently, none of the passenger terminal area is utilized for administration activities. These functions are accommodated in other facilities on the airport property.

For planning purposes, a minimum amount of administrative and support space has been determined to house maintenance for the passenger terminal and a limited amount of storage. The program includes 500 square feet for these functions.

Security Space Requirements

Airport security procedures and system enhancements continue to be an important priority at our nation's airports. For planning purposes, a minimum 2% allowance of space in the terminal for TSA offices and breakroom, administration and local law enforcement is recommended. There is 1,012 square feet of space currently allocated to law enforcement activities that could be used to meet the 900 square foot requirement. This requirement is based upon the consultant's past experience with planning and designing small commercial passenger terminal facilities.

Miscellaneous, administration, and terminal security space requirements for the planning period are summarized in **Table 3-19 Miscellaneous Facility Requirements**.

Table 3-19 Miscellaneous Facility Requirements

Terminal Area	2016	2021	2026	2036
Circulation/Miscellaneous (SF)[1]	14,910	14,910	14,910	14,910
Administration (SF)	500	500	500	500
TSA Offices and Break (SF)	150	150	150	150
Law Enforcement (SF)	250	250	250	250

Source: Michael Baker International, Inc., 2017
1) Assumes 35% as the ratio of circulation/mechanical/structure/miscellaneous to program spaces, less administrative functions.

Terminal Building Summary

The demand/capacity and facility requirements analysis summary sheet (**Table 3-20 Passenger Terminal Facility Requirements**) takes the information for each area and combines them together to determine overall terminal building needs. The areas allocated are based on the descriptions and formulas applied to the assumed peak hour passenger numbers.

Table 3-20 Passenger Terminal Facility Requirements

Terminal Area	Existing	2016	2021	2026	2036
Ticket Counter Length (LF)	30	30	30	30	30
Agent Positions Required (EA)	6	5	5	5	5
Agent Positions Provided (EA)	6	6	6	6	6
Ticket Counter Area (SF)	300	300	300	300	300
Ticket Lobby (SF)	1,000	1,340	1,340	1,340	1,340
CBIS (SF)	353	285	285	285	285
Airline Ticket Offices (SF)	200	200	200	200	200
Baggage Make-Up (SF)	1,298	1,200	1,200	1,200	1,200
Claim Devices (EA)	1	1	1	1	1
Conveyor Frontage (LF)	170	53 (47+6)	53 (47+6)	53 (47+6)	53 (47+6)
Claim Lobby w/ Circulation (SF)	2,845	1,855	1,855	1,855	1,855
Inbound Bag Operations (SF)	2,000	1,250	1,250	1,250	1,250
Rental Car Areas (SF)	0	520	520	520	520
Public Waiting (SF)	1,172	4,200	4,200	4,200	4,200
Passenger Holding (SF)	7,335	7,200	7,200	7,200	7,200
Security Screening (SF)	2,300	2,300	2,300	2,300	2,300
Concessions/Gift Shop (SF)	0	516	762	804	894
Snack Bar/Restaurant (SF)	500	500	500	500	500
Vending (SF)	27	150	150	150	150
Public Restrooms (SF)	1,280	1,120	1,120	1,120	1,120
AREA SUBTOTAL (SF)	**20,610**	**22,936**	**23,182**	**23,224**	**23,314**
Circulation/Miscellaneous Space at 35% (SF)	14,500	14,910	14,910	14,910	14,910
Administration Space (SF)	0	500	500	500	500
TSA Offices / Break (SF)	200	150	150	150	150
Law Enforcement (SF)	1,012	250	250	250	250
TOTAL AREA (SF)	**36,322**	**38,746**	**38,992**	**39,034**	**39,124**

Source: Michael Baker International, Inc., 2017

3.13.3 Federal Inspection Services

All airports located in the United States that have incoming flights originating from areas outside the United States must have Federal Inspection Services (FIS) with regulated facilities to examine all passengers to determine their admissibility and inspect their cargo. Passengers arriving from international destinations must be completely isolated from domestic passengers until appropriately screened. LCK currently receives international traffic through charter passenger service. On a related note, any aircraft requiring FIS inspection will also reduce the domestic flight capacity of the terminal apron. Therefore, international flights should be scheduled as not to conflict with domestic operations.

The current Federal Inspection Station (FIS) was constructed in 2003 and remains essentially as built at that time. A set of folding partitions and additional doors to connect the FIS to the main baggage claim area, were also constructed in 2003, which allows for separated access to the baggage carousel during FIS use.

The design requirements for FIS facilities have changed several times, most notably in 2002 when the standards were revised by the INS (Immigration and Naturalization Service) and subsequently moved to the jurisdiction of the Department of Homeland Security/Customs and Border Patrol (DHS/CBP) for further revision to the current standards issued in 2012. The design standards indicate the requirements for passenger processing and support space for INS, CBP, and related agencies. Since the standards are baselined for processing of 400 passengers an hour, derivation of the requirements for a lower level is needed.

For LCK, it is appropriate to review the demand based on the processing of a single flight of a specific type of aircraft as an event, not in terms of passengers per hour, as multiple or continuous arrivals are not expected in the planning period. The key to this is that LCK has four INS booths which are capable of processing approximately 180 passengers per hour (45 persons per hour each). The existing FIS facility was designed to accommodate the 150 to 180 passenger loads associated with narrow body flights currently operating at LCK. The facility is capable of handling larger aircraft like the Boeing 757-300 (250 passengers), if the load factor does not create a passenger load that requires more than one hour for all passengers and crew to be cleared. A key consideration is keeping international passenger processing and baggage claim separate when domestic operations are occurring at the same time.

3.13.4 Automobile Parking Requirements

Public Parking

Rickenbacker International Airport is an origin and destination (O & D) airport; as such there is a need for parking passengers as well as visitors. Due to the frequency and nature of Allegiant and passenger charter operations, vehicle parking is reported to be constrained during peak operational periods.

As a general rule-of-of-thumb, parking supply should range from 450 to 700 spaces per 500,000 enplaned passengers[2]. As a result, the FAA methodology is not useful to determine parking requirements for this facility. Since most of the passenger activity is related to the leisure travel as opposed to business, it is common for passengers to park at LCK an average of three days at a time. LCK provides a total parking capacity of 894 parking spaces.

Therefore, to accurately predict future public parking demand, a ratio of public parking to annual passenger enplanements was developed. Assuming that 75% of the existing parking capacity, which consists of 586 public parking spaces, and dividing by 103,289 passenger enplanements (2016) resulted in a factor of 0.0043 parking spaces per annual passenger enplanement. Applying this ratio to forecast passenger enplanements for key forecast years resulted in a demand for 769 total public parking spaces by the year 2036.

For ease of use and circulation, it is not suggested that parking be divided into long-term and short-term lots. Per FAA AC 150/5360-13A, Airport Terminal Planning, separation of parking is recommended only after annual enplanements exceed 200,000 per year. Travel distances to the terminal are short and minimally varied. As shown in Table 3-21 Parking Requirements, no additional parking capacity is required throughout the 20-year planning period.

Employee Parking

Employee parking associated with the passenger terminal operation is accommodated in the parking area adjacent to the Airport Traffic Control Tower (68 spaces). As of 2019, the ATCT parking lot also serves as a cell phone lot for terminal operations. In addition, CRAA employees utilize other parking areas associated with administration, operations and maintenance facilities at the airport. Existing employee parking facilities were determined to be sufficient and no additional capacity is required during the planning period.

Ample parking is provided adjacent to existing tenant facilities throughout the airport. In the future, all parking facilities associated with new development proposed in this airport master plan update must meet applicable Ohio and local code requirements.

Rental Car Parking

Rental car parking spaces can be determined by providing one-half to one-third of a space for each peak hour deplaning passenger. Of these spaces, 50% would be considered to be ready/return spaces and the other 50% considered as storage/maintenance spaces. Currently, there is one rental car agency (Enterprise) serving LCK from off-airport facilities. There is one spot at the curbside designated for Enterprise shuttle pick-up. A second more appropriate method for the initial development, described in FAA AC 150/5360-13A, Airport Terminal Planning, is to provide a minimum of 10 spaces for each rental car agency. Based upon further discussions with CRAA personnel regarding the current rental car activities at LCK, 30 parking spaces for rental cars has been allocated in Parking Lot 2. Additional parking may be added when actual demand is demonstrated to exceed this amount.

[2] ACRP Report 25: Airport Passenger Terminal Planning and Design, 2010.

Commercial Vehicle Parking

As passenger activity increases over the planning period, an increase in commercial vehicle activity is expected. The simplest method to accommodate commercial vehicle activity is to provide sufficient curb frontage to allow the vehicles to park at the curbfront, and at the appropriate area for arrivals or departures. However, commercial vehicles including local taxis, rideshare providers and shuttles can contribute to the congested curbfront during peak periods.

Since the vehicle volume exceeds the capacity of the curbfront during peak periods, commercial curb areas can be developed for this purpose. Currently there is no designated commercial vehicle parking at LCK. However, it is desirable to have the vehicles located close to the terminal front for easy transfer of people and baggage. These are better located at the ends of the building so that crossing the curb road is not required. A designated commercial vehicle staging area (prior to the curbfront area, especially for the largest vehicles) should be considered and evaluated as part of the alternatives development process.

Curbside Drop-off Parking

The curb walkway should be a minimum of 12 feet wide, plus room to allow for opened car doors, to allow passengers' movement along the curb at all times. Typically, at least two 12 foot traffic lanes, one for loading/unloading and one for through traffic, should be provided. A 20-foot combined drop-off/traffic lane and a 12-foot through lane is more desirable, while the best level of service adds a second 12-foot through lane for a total curbfront road width of 44 feet.

The existing curbside is comprised of three 12-foot lanes that run the length of the terminal – one lane for loading/unloading of passengers and two lanes for drive-through. There are two crosswalks across the terminal curbside roadways aligned with each major terminal entrance/exit. Under this configuration, the current length of the curbside (235 feet) is inadequate to accommodate passenger loading/unloading during peak periods throughout the planning period. As a result, vehicles are double (sometimes triple) parked along the curb which limits the flow of passenger traffic to the terminal. This condition often results in a backup of vehicles that extends towards the beginning of John Circle Drive.

Curbside parking requirements were determined by allowing for a mix of transport vehicles along the curb for the peak hour passenger load. Of these passengers it is assumed that 90% of them will use the curb for loading and unloading. An average time parked on the curb is assumed to be 3 minutes for passenger cars, taxis and ride share, thus 30 vehicles may use a single space in one hour. It is assumed that the dwell times for the shuttles (i.e. hotel and car rental) will be as long as 2 minutes. Adequate capacity prevents double parking and speeds the flow of passengers at peak periods. Parking space lengths for the various vehicle types are included in **Table 3-21 Parking Requirements**.

Table 3-21 Parking Requirements

Terminal Area	Existing	2016	2021	2026	2036
Public (spaces)	894	439	655	691	769
Employee (spaces)*	*	68	68	68	68
Rental Car (spaces)	30	30	30	30	30
Total Curb Length (LF)	235	283	283	283	283

Sources: Michael Baker International, Inc., 2017; AC 150/5360-13A ; ACRP Report 25
*Note: * No specific parking spaces are allocated for employees. .*

3.13.5 Terminal Access Requirements

Access to the Rickenbacker International Airport is provided from Interstate 270 via Alum Creek Drive, a four-lane divided highway. Terminal access is provided via John Circle Drive from Alum Creek Drive. This terminal loop road begins as a two-lane road which turns into a two-lane one-way loop road providing access to the Passenger Terminal and the two associated parking lots. A third lane is provided for passenger loading/off-loading directly in front of the Passenger Terminal. As mentioned previously, the three-lane section along the terminal curb front experiences high levels of congestion following flight arrivals and preceding flight departures during peak travel periods. This causes a breakdown of vehicular flow that forms behind bottlenecks created in front of the terminal (LOS F). Levels of service are defined in **Table 3-22 Level of Service** below.

According to ACRP Report 07-02, Airport Curbside and Terminal Area Roadway Operations, on-airport roadways, where only a single path is available, LOS C is typically considered to be the minimum acceptable level of service because of the lack of alternative travel paths and the significant negative consequences resulting from travel delays (e.g., passengers missing their flights). Options to remedy this situation will be further evaluated as part of the alternatives analysis presented later in this Study.

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Table 3-22 Level of Service

Level of Service	Definition
A	Represents operations where free-flow speeds prevail. The ability of each driver to maneuver within the traffic stream, change lanes, merge, or weave is almost completely unimpeded by other vehicles because of low traffic densities. The effects of transient blockages or incidents (e.g., an accident, vehicle breakdown, or other event that impedes the flow of traffic) are easily absorbed at this level of service.
B	Represents conditions in which free-flow speeds are maintained. The ability of each driver to maneuver within the traffic stream, change lanes, or weave is only slightly restricted by the presence of other vehicles. The general physical and psychological comfort of drivers is still high. The effects of minor incidents and point breakdowns (e.g., a breakdown in traffic flow where traffic enters, leaves, or crosses a roadway) are still easily absorbed.
C	Represents traffic flow with speeds at or near the free flow speeds of the roadway. Freedom to maneuver within the traffic stream is noticeably restricted (by the presence of other vehicles) and lane changes may require more care and vigilance on the part of the driver because of high traffic densities. Minor blockages or incidents may still be absorbed, but the local deterioration in service will be substantial. Queues may be expected to form behind any significant blockage.
D	Represents the level at which speeds begin to decline slightly with increasing flows, and density (on freeways and other roadways with uninterrupted flows) begins to increase somewhat more quickly. Freedom to maneuver within the traffic stream is more noticeably limited (because of the lack of gaps between successive vehicles), and the driver experiences reduced physical and psychological comfort. Even minor blockages or incidents can be expected to quickly create queues because the traffic stream has little space to absorb disruptions.
E	Represents operations at or near capacity. Operations at this level are volatile because there are virtually no usable gaps in the traffic stream. Vehicles are closely spaced, leaving little room to maneuver (or allow for lane changes or weaving) within the traffic stream. Any disruption of the traffic stream, such as vehicles entering from a ramp or a vehicle changing lanes, can disrupt upstream traffic flows. At capacity, the traffic stream has no ability to absorb even the most minor disruptions, and any incident can be expected to produce a serious breakdown with extensive queuing. Maneuverability within the traffic stream is extremely limited and the level of physical and psychological comfort afforded the driver is poor.
F	Represents breakdowns in vehicular flow. Such conditions generally exist within queues forming behind bottleneck points. Bottlenecks occur as a result of (1) traffic accidents or incidents, (2) typical traffic congestion areas, such as lane drops, weaving segments, or merges, (3) parking maneuvers, or (4) traffic conditions when the projected hourly flow exceeds the estimated capacity of the roadway segment.

Source: ACRP Report 40, Airport Curbside and Terminal Area Roadway Operations, 2010

3.14 Air Cargo Facility Requirements

In the forecast chapter of this Study, the planning team recommended that an Aggressive Cargo Forecast, referred to earlier in **Tables 2-14 LCK Aggressive Cargo Forecast** (page 2-47) **and 2-20 Forecast of Dedicated Air Cargo Fleet Mix (2016-2036)** (Page 2-54), be utilized to show the growth in air tonnage enplaned or deplaned at LCK. Included in this report are the accompanying demand schedules and timeframes for new facilities, ramp space and parking for the aircraft that would arrive and depart LCK during the 20-year planning period. The analysis contained in this section identifies space requirements needed to support the selected forecast of cargo demand.

3.14.1 Cargo Forecast Business Development Considerations

The Aggressive Cargo Forecast contains several inputs related to the efforts for equally aggressive business development actions that must be conducted in order to accomplish the growth of tonnage at LCK. These actions, enumerated below, require multiple efforts to capture new cargo volumes from the region and to expand the impact of LCK to include the development of a global e-commerce hub for both imports and exports. These contingency actions by the CRAA Business Development staff, and others in the community who have economic development responsibilities, are critical if the Aggressive Cargo Forecast is to become a reality. The forecast also addresses the facilities and the parallel requirements for ramp/apron space as each infrastructure element will be essential to the success of LCK. The CRAA and economic development stakeholders will need to advance these contingencies and turn them from opportunity to reality in the timeframe that matches the schedules for cargo growth and the supporting facilities and infrastructure to support this new growth.

Table 3-23 LCK Aggressive Cargo Forecast below contains the Aggressive Cargo Forecast (Columns AA, BB and CC) for the global air carriers who are active at LCK today. Based on the past success and current business development efforts, the increases in cargo volumes will align with the future prediction for growth. This will also drive the demand for new facilities and the supporting infrastructure at LCK. In this report, the planning team provided inputs related to the schedule for delivery of new cargo facilities, aircraft parking/apron requirements, GSE storage requirements, pad site requirements for facilities, and an analysis that demonstrates the total amount of acres required to support the forecast. In addition, the planning team provided an analysis of the demand for parking on the landside of the new facilities and the total number of access points required for each facility on the landside and on the airside. The methodologies utilized and the ratios applied to support the recommendations are enumerated in this section.

3.14.2 Factors Impacting Facilities and Infrastructure Requirements

The planning team considered the significant growth over the short period while LCK has operated as a global cargo hub or gateway. Until 2014, LCK served as a destination for ad-hoc charters and did not have global carriers operating scheduled freighters loaded and unloaded at the airport. However, in recent years, the global carrier loads have increased dramatically with new export volumes being added to the high volumes of imports that arrive on the global carrier schedules. As cargo loads increase, the load factors change. Load factors were considered as a strategy to determine the parking and ramp space required; however, Airports Council International, North America - Air Cargo Guide for 2013 recommends a more simplistic demand ratio that is linked to the delivery of new facilities rather than linked to the relationship between loads, load factors and aircraft arrivals and departures. This provided the planning team with an alternative to forecasting the highly variable and rapidly changing growth of exports that impact the overall load factor for the airport. The ultimate goal of having aircraft arrive "full" and depart "full" also presented challenges to the planning team as some of the carriers prefer to make LCK one of two stops in the US, while other carriers are unloading and loading at LCK and are provided enough volume that a second stop is not required. Changes in load factors will impact the number of operations required to support the overall volumes in the forecast. Assigning higher load factors reduces the operations, while lowering the load factor increases the operations required to support the forecast volumes.

Table 2-20 Forecast of Dedicated Air Cargo Fleet Mix (2016-2036) (page 2-54), is not materially impacted even if some of the carriers accomplish a "full" load on both inbound and outbound activities. The planning team reviewed the impact for the scheduled carriers anticipating higher load factors reaching a "full" load for the aircraft assigned to the route. In the context of the overall count of operations for LCK, if some of the carriers operate on the single stop at LCK and others apply a multiple stop strategy, the overall operations count is not impacted materially. In 2026 and in 2036, the application of all aircraft as "fully loaded" is under 10% of the total of dedicated aircraft in the forecast. Given that some future airlines will apply the multiple stop strategy, the planning team does not consider the impact to meet the requirement to revise the forecast.

It should also be noted that assigning higher load factors to the aircraft that operate at LCK does not impact the schedule for delivery of new facilities. These two factors are independent of each other. Assigning higher loads to cargo aircraft operating at LCK changes the number of aircraft that are required to move the forecast volume for that particular period of time. The demand for new cargo facilities as scheduled and presented are a function of applying space requirement ratios based on the forecast tonnage requirements over the 20-year planning period.

In **Table 3-23 LCK Aggressive Cargo Forecast**, below, the Additional Facilities column reflects the year in which the tonnage milestone requiring a new facility to be delivered for occupancy is reached. The supporting requirements are presented later in this section. For planning purposes, each additional facility is anticipated to be 100,000 square feet in size, however in later years, it may be prudent to deliver a larger facility to support the demand. Further, for planning purposes, CRAA will need to review the timeframe from selected contractors to determine when the construction must start to deliver a finished facility on time. The schedule may provide some flexibility by shifting carrier arrivals and departures and handling of cargo operations so the facilities are utilized for longer hours per day, allowing more throughput to be achieved. ACT 3 could also be utilized as a buffer if necessary. However, this facility will only accommodate a modest amount of cargo in the 46,000 square feet footprint.

Table 3-23 LCK Aggressive Cargo Forecast

Year	Additional Facilities	AA	BB	CC
		Carrier (US Tons)	Carrier (Metric Tons)	Carrier Total (Pounds)
2016		37,568	34,081	75,137,385
2017		48,838	44,305	97,678,601
2018		63,490	57,597	126,982,181
2019		82,537	74,876	165,076,835
2020		107,298	97,339	214,599,885
2021		139,487	126,541	278,979,851
2022		167,385	151,849	334,775,821
2023		200,862	182,219	401,730,985
2024	Yes	241,034	218,663	482,077,182
2025		289,241	262,395	578,492,619
2026	Yes	347,089	314,874	694,191,143
2027		381,798	346,362	763,610,257
2028		419,978	380,998	839,971,282
2029	Yes	461,976	419,097	923,968,411
2030		508,173	461,007	1,016,365,252
2031	Yes	558,991	507,108	1,118,001,777
2032		614,890	557,819	1,229,801,955
2033	Yes	676,379	613,601	1,352,782,150
2034		744,016	674,961	1,488,060,365
2035	Yes	818,418	742,457	1,636,866,402
2036	Yes	900,260	816,702	1,800,553,042

3.14.3 Forecast Overview

The Aggressive Forecast shown in Column AA was presented and recommended as the model for predicting air cargo growth, facilities and infrastructure requirements over the course of the cargo forecast. The key considerations in this forecast are:

1. The sustained growth of the carriers' import and export volumes, and
2. The addition of new carriers for arrivals and departures at LCK.

This sustained growth must be accompanied with corresponding growth in facilities to support aircraft arrivals and departures, along with the enplanement and deplanement of global cargo volumes.

Facilities planning must take into account ramp space for parking and storage of aircraft and the related ground support and snow removal equipment, as well as the equipment needed to support the build-up or break-down of cargo. Ramp parking is only one element in the design and capacity of ramp space, as throughput for loading or unloading must also be considered. The design for the total aircraft infrastructure is critically linked to the number of aircraft arrivals and departures that can be sustained at each building daily during the operations cycles at the facilities.

In addition to new facilities, efficiencies in terms of airport operations including loading/unloading and servicing for aircraft must be monitored to maintain a competitive environment for the carriers. Reviews of arrival/departure schedules must be maintained for ground handling and services to be efficiently accomplished. Operational planning must take into consideration the differences between “peak” operations and normal operations. Based on shifts in trends and demand, CRAA must include during their operational planning sessions, how they can accommodate a higher number of aircraft while maintaining a high level of the necessary corresponding services and infrastructure that would be required for loading or unloading of cargo at LCK. Details such as tail height, wing span, overall aircraft length or “total area” for each aircraft will need to be considered in the space surrounding the facilities.

The Aggressive Forecast presented in this narrative requires planning, execution and flexibility in adapting to new growth industries and sectors where global demand is exceeding projections for cargo growth worldwide. Seeking these high growth industries or sectors will be critical to the success of the LCK forecast model. Industries such as the “cold supply chain” made up of frozen, perishable or temperature-controlled conditions not only drive growth, but create an opportunity for incremental contribution to the value proposition and profit for the supply chain stakeholders. Cross-border e-commerce represents another significant growth opportunity to create a new global e-commerce processing center, for both arriving volumes and departing consolidations. While the attending facilities and technology infrastructure are significant, the opportunity is available to LCK if driven by the right mix of vision and dedication by CRAA and other business development/economic development stakeholders in Columbus.

As a final consideration, strategic and operational planning must accommodate the requirements for future cargo configuration including sorting, handling and storage requirements. As new industry sectors are added to the cargo volumes at LCK, the CRAA must consider and implement the necessary operational efficiencies to ensure that appropriate personnel, from private or public sectors, are in place and can manage the increase in freight supply chains to ensure that they will not impact the overall pace of throughput at LCK.

- Global “cold chain” (food, pharma, perishables) is a strong growth sector, but today there are only minor volumes of this industry sector loaded or discharged at LCK. However, if this industry sector becomes a part of the carriers’ supply chain requirements, it will be necessary to determine the specific requirements and prepare environmentally controlled areas and handling procedures applicable for this type of cargo.
- In the forecast volumes presented in this Study, there was an expectation for a new high-volume package sortation operation to be established at LCK. This sortation facility would support both import and export shipments and require expedited handling of e-commerce packages to ensure that these goods can be moved rapidly into the final delivery cycle. The e-commerce providers who would move this cargo will also have a responsibility to connect with US Customs and Border Protection (CBP) or other governmental agencies who have a role in the clearance and release of imports to individuals. The rapid release and transfer to the final mile delivery carrier is critical to the success of e-commerce fulfillment at LCK. As demand for international e-

commerce grows, it will be necessary to accommodate a future logistics provider who would aggregate volumes for disparate retailers and sellers for exports. These consolidations require expedited processing and rapid deployment between the arriving ground carriers and loading activity for the air carriers' export program.

3.14.4 Facilities Ratios/Volumes, Capacity and Related Infrastructure Considerations

The Guidebook for Air Cargo Facility Planning and Development, published by the Airport Cooperative Research Program (ACRP) in 2015, established two primary approaches to determining the requirements for air cargo facility planning. In preparation for this cargo analysis, the planning team sought input from several industry users who manage large air cargo facilities in major US markets to support their air carrier customers. Their input provides supplemental guidance, decision support and perspective for defining when there will be demand for new facilities at LCK, and what accompanying parking, ramp, apron or support infrastructure will be necessary for planning purposes.

Application of ACRP Tonnage Ratios for Facilities:

- According to ACRP, the "area per annual ton ratio" defines the average building throughput rates at US airports as between 1.0 and 2.5 SF per ton. The reason for the high variance is due to the efficiencies in processing cargo within the facility and handling protocols on the ramp.
- According to ACRP, the "annual tonnage per area ratio" defines the annual tons of cargo that can be processed per square foot of cargo floor space. This ratio is typically between 0.5 tons/SF to 3.0 tons/SF. The ACRP supports these high variances in throughput based on the efficiencies applied by the operator of the facility and the combination or configuration of cargo in the build-up or break-down process.
    - The ACRP provides guidance for this ratio related to international gateway operations and suggests using a ratio of 0.81 tons/SF for all cargo carriers and third-party logistics providers at these airports.
- According to Total Air Cargo Services (TAS), who operates significant operations in support of global carriers and their clients at LCK and elsewhere, the ratio applied at their major gateway services is 1 million kilos per 1,000 SF (11,002 tons per 1,000 SF) annually.

3.14.5 Facilities Requirements Scenarios

The cargo facility requirements in this section are based on the space in ACT 4 and ACT 5 which is 153,000 square feet. The ratios are applied to demonstrate when this available capacity will be fully utilized. Each of the ratios below reflect when new facilities of 100,000 square feet are required to support continued cargo operations. There is not a direct correlation between the actual ratio calculation and the demand for space, rather it demonstrates the year in which the milestone for weight/tonnage occurs. An optional strategy is the utilization of ACT 3 with 46,000 square feet of space that could become available to support the growth of new cargo volumes. However, the small footprint of ACT 3 and accompanying volume of cargo throughput that could be achieved does not materially change the timing for the first facility requirement delivery in/near 2024.

- By applying the ACRP international gateway annual tonnage per area ratio to the above forecast, the requirement for a new 100,000 SF facility would occur in 2022, 2025, 2028, 2031, 2033, and 2035. For this narrative, each new facility delivered for use by cargo stakeholders at LCK was assumed to be 100,000 SF in space. Ratios and calculation for freight supporting infrastructure was based on this assumption. During the 20-year planning period, a total of six (6) additional facilities will be required based on the application of the current ACRP ratio. This does not take into consideration any specialized cargo categories such as cold chain or e-commerce, which may or may not require a purpose-built facility in addition to the demand outlined in this scenario.
  - Annual Tonnage Per Area Ratio = 0.81 tons per SF
  - 2022 forecast is for 167,385 tons x 0.81 = 135,582 SF
  - 2023 forecast is for 200,860 tons x 0.81 = 162,698 SF
  - This indicates that the next facility will need to be delivered between 2022 and 2023.
- Applying the ACRP's area per annual ton ratio, the demand for new facilities of 100,000 SF would come in 2024, 2026, 2028, 2031, 2032, 2034, and 2036. This scenario requires a total of seven facilities to be constructed over the planning period.
  - Area Per Annual Ton Ratio = 1.0 SF per annual ton
  - 2024 forecast is for 241,034 tons x 1.0 = 241,034 SF Required
  - This indicates that the next facility will need to be delivered by 2024.
- Applying the industry standard utilized and recommended by TAS, the demand for facilities of 100,000 SF is slower, and the overall number of facilities required to support demand is reduced. Seven new facilities would be needed in 2024, 2026, 2029, 2031, 2033, 2035, and 2036 based on this ratio. This ratio and throughput does not take into consideration any specialized cargo categories such as cold chain or e-commerce.
  - Total Air Cargo Services Ratio = 1m kilos/1000 SF annually
  - The threshold for delivery is at 235,000 x 1.102 = 278,806 tons = 258,970 SF
  - 2024 forecast is for 241,034 tons
  - 2025 forecast is for 289,241 tons
  - This indicates that the next facility will need to be delivered between 2024 and 2025.
- When considering the three demand ratios together there is evidence of a consensus that demonstrates it will be necessary to start delivery of new facilities in 2024. In addition, a minimum of 1,166,667 square feet of land, or 26.78 acres, will be the required to support this forecast. These facility requirements only demonstrate the demand for actual cargo handling facilities and do not consider demand for ramp, parking, ground handling and related space outside the facilities. Those considerations are addressed later in this section.

The three ratios above were used together as the baseline, instead of the wide-ranging ACRP "tonnage per area ratio" (0.5 tons/SF to 3.0 tons/SF) which significantly shifts requirements based on how the range of demand is applied to the ratio calculation.

Finally, this demand forecast applies to current cargo handling operation protocols for building up or breaking down cargo from tugs/dollies and sortation of cargo with labor applied on the facility floor. It does not accommodate future demands for high-volume sortation or aggregation of global cross-border packages moving for e-commerce providers. Such a sortation facility for e-commerce could be located off-airport.

Industrial real estate requires planning for new facilities to include the amount of land required to support a specific building "footprint." This additional ratio, the Floor Area Ratio (FAR), uses the measurement of a building's floor area in relation to the size of the land that is beneath the building. FAR is calculated by dividing the gross floor area of a building(s) by the total buildable area. The allowable FAR is determined by local governments. The City of Columbus defines the "maximum total calculated floor area permitted for any lot" as 0.6, unless it is either a "substantial rehabilitation of an original contributing building involving an increase in floor area or a change of use" or a "project that replaces a noncontributing building not original to the lot."

Applying a 0.6 FAR to the seven new 100,000 square foot air cargo facilities, a minimum of 1,166,667 square feet of land, or 26.78 acres, will be required to support the projected new cargo facilities at LCK. The ramp, apron, parking and related infrastructure requirements below, are in addition to the planning for locating and managing the flow of goods, trucks, personnel and aircraft to/from these new facilities.

3.14.6 Aggressive Cargo Forecast Sales, Business Development Assumptions

The assumptions when building the Aggressive Cargo Forecast included specific actions by the CRAA Business Development staff and regional economic development stakeholders in order to divert, capture or shift volumes toward LCK for both origin and destination gateway centers. These actions and their outcomes are critical to the success of implementing this Aggressive Cargo Forecast and include the following elements, which will result in new cargo volumes at LCK:

- A 5% capture of the Pilot Air Freight weekly sort conducted by Forward Air Freight (FAF) in Columbus by 2017-2018 as new export volumes loaded at LCK
- A growth of up to 50,000 e-commerce packages delivered inbound per day to the new Expedited Carrier Consignment Facility (ECCF) at or near LCK
- A 5%-10% capture of the CMH-terminated FAF hub facility cargo to be loaded as new export volumes at LCK rather than trucked by FAF to ORD, JFK, EWR or ATL
- Continued CRAA business development efforts in the catchment area and increases in forwarder freight (both imports and exports) from new forwarders who operate in the catchment area of CVG, IND, PIT, CLE, SDF and DTW
- One global freight forwarder or third-party logistics provider re-routing their ORD/JFK cargo to LCK per year with 50% capture of imports/exports
- Construction/utilization of existing off-airport property or a new ECCF high volume package sortation facility as soon as volumes demand

- Considerable effort by CRAA, public-private economic and business development stakeholders to expand export volumes in order to provide the air carriers with balance for the increase in import e-commerce to the ECCF facility
- Success in gaining one new export e-commerce aggregator to utilize LCK to route cross-border export e-commerce from LCK rather than competing hubs

3.14.7 Ramp, Apron, Parking and Infrastructure Considerations

The ACRP also provides advice regarding ramp, parking, and ground support equipment (GSE). This is supplemented by the Airports Council International-North America which provides general guidelines for facility guidelines. **Table 3-24 Additional Cargo Infrastructure Requirements** utilizes both sources to define the total additional land utilization requirements over the course of the planning period.

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Table 3-24 Additional Cargo Infrastructure Requirements

Time Period	Number of Cargo Buildings (100,000 SF each)	Aircraft Parking/Apron Area		GSE Storage Area		Floor Area Ratio (FAR) Area		TOTAL Area	
		SF	Acres	SF	Acres	SF	Acres	SF	Acres
2016-2021		0	0	0	0	0	0	0	0
2021-2026	2	1,200,000	27.5	231,727	5.32	333,333	7.65	1,765,060	40.47
2027-2031	2	1,200,000	27.5	231,727	5.32	333,333	7.65	1,765,060	40.47
2032-2036	3	1,800,000	41.42	347,591	7.98	500,000	11.48	2,647,591	60.88
TOTAL	7	4,200,000	96.42	811,045	18.62	1,166,666	26.78	6,177,711	141.82

Source: IMS Worldwide, 2017

From Airports Council International, North America - Air Cargo Guide 2013: *"For general purposes, a very rough rule-of-thumb for estimating apron requirements assumes six square feet of apron for every one square foot of available cargo building area. This must also consider the fleet mix of the potential tenants and users. This number includes taxiways/taxilanes, service roads, marshalling areas and aircraft parking positions." For the table above, the ratio used is number of buildings multiplied by 100,000 SF.*

From ACRP Report 143: *The GSE Storage Ratio is determined by taking the total tons estimated for 2036 at 900,260 and dividing by 1.11 to determine the SF required for GSE which will total 811,045 as reflected above.*

From City of Columbus Code of Ordinances 3372.567: *The Floor Area Ratio is based on their local requirement of total number of SF divided by 0.6.*

By applying the ACRP's ratios for parking space (1.2 SF of parking space for every square foot) and square feet to truck dock/door ratio (2,900 SF/door), it was determined that a 100,000-square foot facility will require 120,000 square feet of parking space, which means 840,000 square feet will be needed for the seven new facilities combined. Each facility will require up to 35 truck dock/doors or access points on both the landside and airside of the facility (i.e. ACT 5 has 24 truck/landside doors and two drive-in ramps for a total of 26 truck landside access points). ACRP recommends that for all warehouses, 25% of doors are required on the airside of the building, while 75% are required on the landside.

3.14.8 Additional Considerations

Ground handling operations occur at different paces in different markets. The "turn time" for a fully loaded Boeing 747-8 or 777 with a complete unload and a complete upload, or "taxi in" to "taxi out" times, varies greatly depending on the airport and the operator. Compression of this cycle is one of the clear advantages LCK has over large, more congested gateways. If a carrier chooses to use LCK for their inbound rotation but not fully load for their outbound operation, this will impact the total time required to support the combined operations. At LCK, as loads for imports and export match-up in terms of volumes, it will change the cycle time for the aircraft on the ramp. During this transition, it will be necessary to add labor and facilities in order to manage dwell time once both inbound and outbound operations are full down/up loads rather than partial loads.

This may not be a critical consideration during normal operations, but during peak season the timing of arrivals and departures and aircraft dwell time on the ramp/apron will directly impact the utilization of the apron and ramp. Another element that must be included is the access available to aircraft by loaders and snow-removal service equipment, which must be built into the demand expectation for the ramp and apron. On the landside, accommodations for parking of employees, pick-up, delivery, and line-haul vehicles will need to be factored as will the storage space required for support equipment that can be located outside the cargo security space.

3.15 General Aviation Facilities

General aviation (GA) typically accommodates a wide range of facilities and businesses, including all aviation segments except commercial passenger, air cargo, or military. At most airports, the general aviation fleet consists primarily of small single- and multi-engine aircraft, as well as small to mid-sized corporate business jets. However, at LCK, general aviation activity does not follow this common pattern. The majority of the small general aviation aircraft in the area, including small business jets are accommodated at Bolton Field Airport (TZR) and The Ohio State University Airport (OSU). Mid-sized to large corporate business jets are accommodated at John Glenn Columbus International (CMH). At LCK, general aviation includes a wide range of aircraft types, from small single-engine aircraft to large charter aircraft. However, the focus of the GA facilities and services is primarily on large aircraft. Rickenbacker Aviation, currently housed in Building 532, provides a wide variety of FBO services, including aircraft fueling, aircraft de-icing, ground service equipment, and ground handling of aircraft. Rickenbacker Aviation is capable of servicing large aircraft such as the Boeing 747-8F, as well as other cargo, passenger, and small general aviation aircraft. Planning guidance for general aviation facilities provided in FAA and ACRP guidebooks are primarily oriented towards facilities serving ADG I and II aircraft. However, general aviation facilities at LCK should be able to accommodate aircraft as large as ADG IV. Therefore, the analysis of the general aviation requirements at LCK needs special attention and adaptation of the design guidelines. In addition, planning for general aviation facilities at LCK is largely dependent upon the airport business plans and marketing efforts directed to attract certain kinds of general aviation market segments, as well as the need for the continuation of services and the availability of facilities currently being provided to general aviation users.

The requirements for the GA area are based on data presented in the inventory, activity forecasts, and information obtained during meetings with CRAA staff. The primary components analyzed include:

- Aircraft Storage (Hangar & Aircraft Tie-down Facilities)
- General Aviation Terminal Facilities
- Fixed Base Operator (FBO)

3.15.1 General Aviation Facilities Basic Requirements

According to ACRP Report 113, Guidebook on General Aviation Facility Planning, the guidelines shown in **Table 3-25 General Aviation Facilities Basic Requirements** are general requirements and principles for planning general aviation facilities.

Table 3-25 General Aviation Facilities Basic Requirements

Safety	Facilities should be developed according to FAA standards. New facilities should not create hazards to air navigation or obstruct the line-of-sight. Location of new facilities should be planned to minimize the potential for runway incursions.
Efficiency	Facilities should be planned to maximize the development of space, take into account the flow of traffic, minimize conflicts between operations and service providers, and provide adequate and efficient ground access.
Economics	Facility developments should take into consideration the benefits versus the costs. New facilities should be planned based on reasonable construction costs and a reasonable financial plan, providing opportunities for revenue generation to support the operation and maintenance of the facilities.
Expansion	Facilities should be planned to facilitate expansion when the demand triggers are reached. New facilities should not constrain the available space for future development.
Balance	Facilities should be planned consistent with the airplane design group (ADG). Facilities should be consistent with other facilities and the runway/taxiway capability.
Consistency	Facilities should be planned consistent with the CRAA's visions, community goals and plans, the ALP, FAA grant assurances, and the established airport minimum standards.

Source: Adapted from ACRP Report 113 Guidebook on General Aviation Facility Planning

3.15.2 Based Aircraft Storage

Table 3-26 Based Aircraft Parking Preferences shows the general aviation user preferences regarding the type of aircraft storage. Small single-engine aircraft can be accommodated in T-Hangars, which are generally designed to accommodate 5 to 20 aircraft in a single building. A lower cost option is the apron tie-down. However, apron tie-down parking positions do not protect aircraft from the environment. Multi-engine and turbo-prop aircraft are more expensive aircraft and users generally prefer the protection provided by a T-Hangar or, in the case of larger aircraft, a conventional hangar. The general preference is to store jet aircraft in conventional hangars. Helicopters, depending on their use, are generally stored in conventional hangars or on the tie-down apron. Smaller helicopters may be accommodated in T-Hangars. Large general aviation aircraft are usually chartered from airlines or other aircraft operators, and typically they remain on the apron for a short period.

Table 3-26 Based Aircraft Parking Preferences

Storage Type	Single Engine	Multi-Engine	Turboprop	Jet	Helicopter
Apron Tie-Down	20%	20%	0%	0%	50%
T-Hangar	80%	60%	0%	0%	10%
Conventional Hangar	0%	20%	100%	100%	40%
Total	100%	100%	100%	100%	100%

Source: Michael Baker International, Inc., 2017

The aircraft storage percentages were applied to the based aircraft forecasts for the 20-year planning period to identify the storage needs at the five-year benchmarks. **Table 3-27 Aircraft Storage Demand,** identifies the based aircraft requirements for each aircraft type. The number of based aircraft is forecasted to increase from 3 in 2016 to 33 by 2036.

Table 3-27 Aircraft Storage Demand

Storage Type	Single-Engine	Multi-Engine	Turboprop	Jet	Helicopter	Total
2016						
Apron	2	0	0	0	0	2
T-Hangar	0	0	0	0	0	0
Conventional	0	0	1	0	0	1
Total	2	0	1	0	0	3
2021						
Apron	2	0	0	0	0	2
T-Hangar	5	2	0	0	0	7
Conventional	0	0	1	2	0	3
Total	7	2	1	2	0	12
2026						
Apron	3	0	0	0	0	3
T-Hangar	9	2	0	0	0	11
Conventional	0	0	1	3	0	4
Total	12	2	1	3	0	18
2031						
Apron	3	0	0	0	0	3
T-Hangar	14	3	0	0	0	17
Conventional	0	0	1	5	0	6
Total	17	3	1	5	0	26
2036						
Apron	4	0	0	0	0	4
T-Hangar	18	4	0	0	0	22
Conventional	0	0	1	6	0	7
Total	22	4	1	6	0	33

Source: Michael Baker International, Inc., 2017.
Note: Numbers may not add up due to rounding.

Currently there are no T-Hangars or conventional hangars for general aviation aircraft storage at LCK. However, the multi-tenant building is now the home of the FBO and provides hangar space for general aviation aircraft. Development of additional hangar space will depend on the CRAA's business plan, cost/benefit analysis, and/or the ability of these facilities to generate revenue and be self-sustaining.

3.15.3 Transient Aircraft Apron

As previously noted in the inventory chapter, the FBO Apron, adjacent to the multi-tenant facility (Building 7250), is the primary apron for transient general aviation aircraft parking. This FBO Apron provides approximately 418,000 square feet (46,444 square yards) of apron space. The apron adjacent to the former FBO (Building 532) and apron adjacent to the Airnet

II hangar (Building 1001) provide a total of 141,000 square feet (15,666 square yards). The approximate total general aviation apron space available is 559,000 square feet (62,111 square yards).

The demand for an aircraft parking apron can be estimated based on itinerant aircraft operations. This demand is estimated assuming that 50% of average day peak month (ADPM) are itinerant aircraft that will be using the apron. The area required per aircraft for a typical itinerant/transient apron will vary based on the design aircraft or fleet mix. The analysis assumes space requirements to include 300 square yards (SY) for small GA aircraft and 1,000 (SY) for larger aircraft (i.e. jets and multi-engine turboprop aircraft). Based on historical and forecasted operations data, the split between small aircraft and large aircraft was estimated to be approximately 50%. As presented in **Table 3-28 Transient Apron Demand**, a need for transient apron parking space is not required over the 20-year planning period compared to the total apron area available. However, this estimated area would accommodate primarily ADG I and ADG II aircraft. Due to the nature of the GA operations at LCK previously described, the transient apron can also accommodate up to ADG IV aircraft. Based on taxilane and parking position markings, the current size of the FBO Ramp would provide sufficient space for ADG I through ADG IV aircraft. However, the required dimensions of the taxilane object free area would limit the number of ADG III and ADG IV aircraft that could use the apron simultaneously. Different taxilane and parking position markings will be analyzed in the Alternatives Chapter.

Table 3-28 Transient Apron Demand

Year	ADPM	50% ADPM	300 SY Per Aircraft		1,000 SY Per Aircraft		Total SY
			50%	SY	50%	SY	
2016	84	42	21	6,300	21	21,000	27,300
2021	103	52	26	7,800	26	26,000	33,800
2026	128	64	32	9.600	32	32,000	41,600
2031	155	78	39	11,700	39	39,000	50,700
2036	193	97	49	14,550	49	48,500	63,050

Source: Michael Baker International, Inc., 2017

3.15.4 General Aviation Multi-Tenant Building

General aviation includes a variety of users and activities, from recreational flyers to large corporate flight departments, from small aircraft maintenance facilities to large maintenance, repair, and overhaul (MRO) facilities. As a result, planning for general aviation facilities does not depend just on the forecast of general aviation activity, but it is largely dependent upon the airport business plans and marketing efforts directed to attract certain kinds of general aviation market segments.

In 2017, CRAA consolidated their FBO, administration and operations functions into a new location (Building 7250). This 149,000 SF multi-tenant building consists of two floors. The first and second floors will include approximately 44,000 SF of space for CRAA administration and the FBO operation, including space for public reception, ground handling staff, a pilot's lounge, a bistro and a conference room. In addition, approximately 13,000 SF on the first floor, and nearly 9,000 SF on the second floor are anticipated to be leased to an aeronautical activity business. Approximately 17,000 SF of the first floor and 14,000 SF of the second floor will be dedicated to offices for either aeronautical or non-aeronautical administrative (office). Office space is available on each floor in support of hangar tenant functions.

The new location also includes approximately 50,000 SF of hangar space in support of the FBO and future tenant activities. Approximately 8,500 SF of the hangar is anticipated to be leased by an aeronautical user. The hangar is a high-capacity space suitable for aircraft storage, corporate aircraft maintenance, repair and overhaul activities and a corporate flight department. The hangar is equipped with a fire suppression system, radiant floor heat, and air conditioning and electric throughout. Shop space is located adjacent to the hangar. On the west side of the facility there is outside space available for ground support equipment storage and fuel truck parking. The FBO Apron is located adjacent to the facility's southwest side.

According to the ACRP Report 113, Guidebook on General Aviation Facility Planning, the size of the facility can be estimated using a factor of 2.5 people (pilots and passenger) per peak-hour operation. The square footage per person will depend on the functions anticipated to occur inside the building. For planning purposes, an area of 100 to 150 square feet can be considered adequate to accommodate the peak-hour traffic. **Table 3-29 General Aviation Facility Requirements** shows the general aviation facility capacity demands for the 20-year planning period at five-year milestones.

Table 3-29 General Aviation Facility Requirements

Year	Factor	Square Feet	Peak Hour Operations (IFR and VFR)	Required Building Square Footage
2016	2.5	100 - 150	3	750 – 1,125
2021	2.5	100 - 150	5	1,250 – 1,875
2026	2.5	100 - 150	5	1,250 – 1,875
2031	2.5	100 - 150	5	1,250 – 1,875
2036	2.5	100 - 150	5	1,250 – 1,875

Source: Michael Baker International, Inc., 2017

Table 3-29 General Aviation Facility Requirements represents the minimum space required to accommodate the recreational and corporate aviation segment. Within this space the minimum services such as restrooms, flight planning rooms, and small waiting areas can be accommodated. Additional space is required to accommodate other segments of general aviation, such as large maintenance facilities and large business or charter aircraft. This multi-tenant facility is capable of accommodating the airport's FBO and airport administration requirements throughout the planning period.

3.16 Support Facilities

As described in AC 150/5070-6B, support facilities include a wide range of functions intended to ensure the smooth, efficient, and safe operation of the airport. The FAA provides design guidelines for these facilities in the Advisory Circulars and ACRP reports. However, the requirements for these facilities were also based on interviews with airport staff, airport tenants, and users which facilitated a better understanding of the existing and future facility requirements.

3.16.1 Aircraft Rescue and Firefighting Services

The airport is currently a 14 CFR Part 139, Class I certificated airport, categorized as ARFF Index B. However, the facility maintains equipment capable of meeting Index E requirements. Over the 20-year planning horizon, a requirement to increase the ARFF Index is not expected. The availability of this equipment is expected to continue over the 20-year planning horizon. Therefore, there are no additional ARFF requirements.

3.16.2 Aircraft Fuel Storage Requirements

The objective of the analysis below is to determine the fuel storage requirements at LCK. The analysis is based on the ability of the fuel farm to maintain a five-day supply of Jet-A and a two-week supply of AvGas (100 LL) fuel. The analysis begins by classifying the forecasted operations by the type of fuel, as shown in **Table 3-30 Operations Forecast by Fuel Type**. The classification assumes that single- and multi-engine general aviation aircraft use AvGas and all other operations use Jet-A.

Table 3-30 Operations Forecast by Fuel Type

Year	Jet-A Operations				AvGas Operations
	Air Carrier	Air Cargo	General Aviation	Total	General Aviation[1]
2016	1,438	7,458	2,113	11,009	8,690
2021	2,129	12,106	2,330	16,565	9,028
2026	2,245	19,275	2,571	24,091	9,370
2031	2,368	26,772	2,841	31,981	9,714
2036	2,497	38,167	3,143	43,807	10,058

Source: Michael Baker International, Inc., 2017
Notes:
1. *Assumes that all single- and multi-engine general aviation aircraft use AvGas*

Table 3-31 Year 2016 Fuel Flowage shows the monthly and annual average fuel flowage, as well as the approximate average fuel supply required.

Table 3-31 Year 2016 Fuel Flowage

Month	Jet-A (gallons)	AvGas (gallons)
January	463,926	1,192
February	375,738	1,471
March	479,233	1,882
April	420,548	960
May	520,889	587
June	563,351	1,826
July	584,375	1,933
August	546,837	1,184
September	535,360	829
October	612,461	421
November	616,611	393
December	792,554	595
Annual Total	6,511,883	13,273
Average Five-Day (Jet-A)[1] /Two-Week (AvGas)[2]	89,204	511
Annual Gallons per Annual Operations Ratio[3]	591.51	1.53

Source: CRAA

Notes:

1. *Estimated by dividing the annual fuel flowage by 73*
2. *Estimated by dividing the annual fuel flowage by 26*
3. *Estimated based on the 2016 operations shown in Table*

The estimated fuel storage requirements shown in **Table 3-32 Fuel Storage Requirements** assume that the annual gallons per annual operations ratio will remain constant over the planning period. Currently there are eight 50,000-gallon underground Jet A tanks and one 20,000-gallon above ground AvGas tank. The underground tanks date back to 1953 and provide a total capacity of 400,000 gallons of Jet-A. Therefore, based on the assumptions, the current fuel farm is capable of providing an adequate average fuel supply throughout the 20-year planning period.

Table 3-32 Fuel Storage Requirements

Year	Jet A (gallons)		AvGas (gallons)	
	Annual Requirement	Average Five-Day Requirement	Annual Requirement	Average Two-Week Requirement
2016	6,511,883	89,204	13,273	511
2021	9,798,287	134,223	13,789	530
2026	14,249,957	195,205	14,312	550
2031	18,916,934	259,136	14,837	571
2036	25,912,077	354,960	15,362	591

Source: Michael Baker International, Inc., 2017

Based upon the methodology assumptions above, approximately 354,960 gallons of Jet-A and 591 gallons of AvGas storage would be required to provide an average five-day supply of Jet-A fuel and two-week supply of AvGas fuel at LCK by the end of the 20-year planning period. Based upon the age of the fuel storage facilities, the use of above ground fuel tanks tied into the fuel hydrant system should be considered in conjunction with the future expansion of fuel farm capacity. Different expansion alternatives and locations will be evaluated in the development alternatives chapter.

3.16.3 Snow Removal Equipment

FAA AC 150/5220-20A, Airport Snow and Ice Control Equipment provides guidance regarding the selection of the appropriate snow and ice control equipment for airport use. As a general requirement, runways and taxiways should be maintained, if possible, to a no worse than wet condition. In other words, there should be no accumulation of contaminants (snow or ice) during winter storms.

The minimum snow and ice control equipment requirements are defined by two parameters, the total square footage of the Priority 1 paved area, and the airport's service classification area. The Priority 1 airfield clearing area is described in the LCK Snow and Ice Control Plan (SICP), and includes the following areas:

- Runway 5R-23L
- Taxiways A, B, and G
- Ramp 1 taxilane route to Ramp 1 aircraft parking spaces
- Ramp 2 aircraft parking spaces
- Terminal Ramp (if flights are scheduled)
- Ramp 3 parking spaces
- FBO Ramp (adjacent to Building 7250)
- Emergency access roads
- ILS critical areas

FAA AC 150/5200-30D Airport Field Condition Assessments and Winter Operations Safety, defines the minimum clearance times for commercial service airports. The clearance times for commercial service airports are determined by the total annual airplane operations (including cargo operations). Over the 20-year planning period, the total annual aircraft operations are forecasted to increase from 26,307 operations in 2016 to 60,473 operations in 2036. According to this operational level, the minimum time to clear 1 inch of falling snow weighing up to 25 lb/ft^3 on the Priority 1 areas is one hour. According to the current SICP, historically LCK averages approximately 28 inches of snow per winter year and most snow and ice events produce less than 4 inches of total contaminant accumulation. The SICP also indicates that the current clearance time for the Priority 1 areas is typically under two hours.

Table 3-33 Minimum Required Snow Removal Equipment shows the minimum snow removal equipment requirements described in FAA AC 150/5220-20A. **Table 3-34 Snow Removal Equipment Inventory** shows the existing inventory of snow removal equipment as of 2018. The current snow and ice removal equipment at LCK exceeds the minimum requirements. Additional supplemental equipment such as plow trucks, front-end loaders, and solid deicer are also available. The equipment is currently housed in the Snow Removal Equipment (SRE) building located in the airport maintenance complex. Future equipment requirements are dependent upon the square footage of the future Priority 1 area, which may increase as new critical areas such as taxiways and aprons are developed in the future.

Table 3-33 Minimum Required Snow Removal Equipment

Equipment	Minimum Required[1]
High-Speed Rotary Plows	2
Displacement Plows	4
Sweeper	8[2]
Hopper Spreader	8[3]
Front End Loader	3[4]

Source: Snow and Ice Control Plan, CRAA. FAA AC 150/5220-20A Airport Snow and Ice Control Equipment
Notes:

1. *Determined using the FAA Central Region Airport Division Planning Section snow removal equipment calculation spreadsheet provided by CRAA*
2. *One per 750,000 square feet pavement*
3. *One hopper spreader per 750,000 square feet of pavement*
4. *One front end loader per 500,000 square feet of critical apron space*

Table 3-34 Snow Removal Equipment Inventory

Equipment Type	Brand	Model	Mfg Year	Size/Capacity
Tractor/Plow	John Deere	2500	2008	14 ft Ramp Hog
Tractor/Plow	John Deere	2500	2008	14 ft Ramp Hog
Tractor/Plow	John Deere	2500	2008	14 ft Ramp Hog
Tractor/Plow	New Holland	2500	2014	Small Loader Bucket/Ramp Hog
6x4 Plow/Sander	Oshkosh	7400	1990	18 ft Polycarb Blade/ Spreader
6x4 Plow/Sander	Oshkosh	7400	1990	18 ft Plow
6x6 Plow/Sander	Oshkosh	7400	1996	22 ft Plow/V-bed-Rub
6x6 Plow/Sander	Oshkosh	2654	1997	22 ft Plow/V-bed-Rub
Dump/Plow Truck	International	2654	1999	11 ft Plow/V-bed
Dump/Plow Truck	Oshkosh	7400	1990	21 ft Sectional
Frontend Loader	Michigan	7400	1990	20 ft Ramp Hog
Frontend Loader	Case	7400	2002	20 ft Ramp Hog
Liquid De-icer Spray Truck	Ford	HB2518-16	1989	2,000 gal tank w/50 ft boom
Runway Broom	Oshkosh	HB2518-16	1997	18 ft Broom head
Runway Broom	MB	HA2318-53116	2016	18 ft Broom head
Runway Broom	MB	HA2318-53116	2016	18 ft Broom head
Runway Broom	FWD/Wausau	HB2518-53116	2006	18 ft Broom head
Runway Broom	FWD/Wausau	HB2518-53116	2006	18 ft Broom head
Runway Broom	FWD/Wausau	4900-2000	2006	18 ft Broom head
Runway Broom	Oshkosh/MB	4900-2000	1992	16 ft Broom head
Runway Broom	Oshkosh/Sweepster	6430	1997	16 ft Broom head
Runway Broom	Oshkosh/Sweepster	6430	2000	16 ft Broom head
Skid Steer Loader	Kubota	721	2016	Small Loader Bucket
Snow Blower	Idaho Norland	721	1990	3,000 ton/hour
Snow Blower	Wausau	721	2013	6,000 ton/hour
Snow Blower	Wausau	921	2013	6,000 ton/hour
Solid De-icer/Plow Truck	International	HB2518-3000	2019	12 ft Rollover Plow/V-bed

Source: CRAA (March 2019)

3.16.4 Aircraft and Airfield Pavement Deicing Activities

The CRAA is responsible for deicing common airfield paved surfaces using potassium acetate and sodium formate, and the U.S. Environmental Protection Agency (USEPA) prohibits the use of urea. The CRAA also plows runways, taxiways, and aprons as necessary and performs limited deicing for walkways and other paved areas using conventional pavement deicers. Tenants at LCK are responsible for pavement deicing in their leasehold areas. Minimal pavement deicer chemicals are applied and controls are not expected unless significant airfield pavement expansions occur. Propylene glycol-based aircraft deicing fluids (ADF) and aircraft anti-icing fluids (AAF) are applied by individual carriers or the LCK FBO at dedicated locations within the terminal and cargo ramps following FAA safety guidelines. The amount of ADF/AAF applied varies greatly depending on weather conditions and flight schedules, but entities performing aircraft deicing/anti-icing activities apply the minimum amount of fluid that allows for safe operation of the aircraft and minimizes the impact on storm water discharges.

LCK operates in accordance with a National Pollutant Discharge Elimination System (NPDES) permit issued by Ohio EPA (expires December 31, 2021). While no deicing effluent limitations are contained in the permit, projected 30-day average effluent limitations for $CBOD_5$ (200 mg/l), ethylene glycol (140,000 ug/l), and propylene glycol (71,000 ug/l) are provided. Should projected effluent limitations be consistently exceeded, additional operational or structural controls will be necessary.

In 2019, CRAA will purchase a glycol recovery vehicle (GRV) to assist in the collection of high strength ADF-impacted stormwater runoff from aircraft deicing/anti-icing application areas. While the GRV is expected to reduce discharges based on current operations, additional controls may be needed as cargo and passenger flights increase. These controls may include structural or operational controls within the cargo and passenger ramp areas using the existing drainage systems, block and pump, additional GRVs or a combination of controls.

3.16.5 Airport Maintenance Complex

Airport maintenance facilities are located within the maintenance complex off Club Road, northwest of the existing CRAA administrative offices (Building 7250). The complex includes facilities for the storage of maintenance equipment, a maintenance garage, fueling station and a triturator for disposing of airline waste. Recommendations for future maintenance facility improvements are highlighted below.

Maintenance Storage Facilities

CRAA has two maintenance storage facilities (Buildings 556 and 557) that are currently used to store sand, sodium formate and salt materials used for snow and ice control. The buildings are severely deteriorated, in poor condition and the doors and heating systems are not functional. The facilities are adequate for storage of snow removal material; however, during periods of increased aircraft activity CRAA must replenish the supply more often. In addition, CRAA should consider providing a heated space in support of the FAA recommendation of heating the sand prior to spreading. This best practice helps to prevent clogging and ice blockage of equipment. It is recommended that a larger heated facility be assessed during the alternatives phase of this Study in support of future airport development plans.

Maintenance Garage

The Maintenance Garage (Building 558) consists of three maintenance bays (including one drive-on lift), one bay with a 7.5-ton crane, and one wash bay. The facility is in good condition, functional and is well maintained. Originally, the garage facility was designed to work on smaller equipment and small trucks. Since CRAA became the fixed base operator at the airport, this facility is now used to maintain over 139 pieces of larger FBO support equipment. At times maintenance personnel must use the wash bay for maintenance activities due to size limitations of the existing bays. As the airport operation continues to grow, CRAA should consider expanding this facility to provide an additional larger service bay capable of accommodating current equipment. With the increase of service technicians, additional offices and technical room areas will also be needed. Recommendations related to future expansion will be addressed during the alternatives phase of this Study.

Snow Removal Equipment Building

The Snow Removal Equipment (SRE) building is used to store large snow removal equipment. The facility is equipped with drive through bays, a fire protection system, adjacent offices, a break room, rest rooms and a storage room. The facility is in good condition, well maintained, and is heated. The SRE facility serves its purpose by keeping the snow removal equipment fleet in ready condition in accordance with the airport's approved Snow and Ice Control Plan. Because this building is heated, crews often park snow removal trucks loaded with sand inside the main garage area to keep the material warm prior to spreading. In the future, additional snow removal equipment storage capacity may be needed in support of future airfield expansion. This would occur if the snow removal priority areas increase in size. This increase will be determined as part of the alternatives analysis phase of this Study.

Other Maintenance Facilities

Within the airport maintenance complex, CRAA maintains a series of other facilities which include additional maintenance storage (Building 558B), a fueling station (Building 558A), and a triturator (Building 559). These facilities are in good condition and well maintained. Beyond regular maintenance, no additional expansion of these facilities is required during the planning period.

Perimeter Road

As mentioned in the inventory section of this Study, an Airport Perimeter Road is located just outside the security fence line of the airport. By definition, an Airport Perimeter Road is commonly used by airport support vehicles to access areas of the airport to perform work functions without having to cross active taxiways and runways or travel on public roadways.

As new warehouse and distribution facility development continues to occur outside the southern and southeastern boundaries of the airport, opportunities to inspect the fence are reduced. Therefore, it is recommended that an Airport Perimeter Road be developed inside the fence line to remedy this situation. In addition, an inner perimeter road would have the added benefit of reducing the number of vehicle crossings of open movement area on the airfield. According to CRAA operations staff, equipment regularly crosses movement areas to gain access to the east side of the airfield. This also results in the need to provide movement area training to individuals only for the purpose of trying to gain access to the far side of the airfield. Options for providing the inner perimeter road access will be evaluated as part of the airport development alternatives process.

3.17 Utilities

Utility services at LCK are provided primarily by off-airport organizations. Utility organizations include the City of Columbus (storm drainage/sewer/water), Franklin County (water/sewer), Earnhart Hill (water/sanitary), Columbia Gas (natural gas), South Central Power (electric), American Electric Power (electric), Spectrum (telecommunications), Sprint (telecommunications), and AT&T (telecommunications).

The existing utility infrastructure systems meet the current needs and demand of airport users. However, future growth in existing and undeveloped areas may require additional utility infrastructure enhancements. For example, future development of the south side of the airport will require coordination with the respective utility organizations as infrastructure is limited or nonexistent in this area. As CRAA implements the capital improvement program developed in this Study, the Authority should consult and coordinate with utility organizations to ensure the efficient upgrade of utility infrastructure.

CRAA, utility, and tenant representatives should be actively engaged during the development process. It is recommended that coordination be conducted during the planning and preliminary design stages to help ensure that airport users are sufficiently served by utility services. Coordination efforts should also focus on preserving appropriate and compatible land area for the implementation of utility infrastructure.

A detailed description of the existing utility infrastructure and services at LCK is included in **Chapter 1, Inventory of Existing Conditions** (Section 1.2.16, page 1-56).

3.18 Airspace and Obstruction to Air Navigation

Based on the airfield capacity analysis it was determined that LCK is currently not constrained by its capacity to handle future aviation demand. The capacity analysis concluded that additional runways or major airfield reconfigurations are not necessary over the 20-year planning period. Therefore, reconfiguration of the airspace or major re-design of the existing standard instrument procedures is not required. However, with the implementation of NextGen technologies and flight procedures, continuous airspace obstruction analysis is recommended to ensure availability and capability of future technologies for standard instrument procedures.

The ultimate location of the runway ends is not expected to change over the 20-year planning period. Therefore, the location and dimensions of the Part 77 surfaces and obstacle clearance surfaces are not expected to change. Analysis of potential penetrations of the Part 77 surfaces and obstacle clearance surfaces will be performed as part of the evaluation of the proposed development alternatives.

3.19 Land Area Requirements

The purpose of the land area requirements is to review the airport's facilities in comparison to FAA standards in order to identify additional property that may be required for inclusion into the land property envelope. The additional properties may be necessary for land use compatibility purposes, future development needs, or to obtain control over an RPZ. For LCK, the developments envisioned in this Study should not require additional property acquisition during the planning period. However, the establishment of additional avigation easements will be further assessed based upon the results of the noise analyses performed as part of this Study.

In addition to possible easements, CRAA should continue to work with the Cities of Columbus and Groveport, the Village of Lockbourne, and Franklin and Pickaway Counties to ensure prevention of future incompatible land uses. It is noted that the City of Columbus, Groveport, and Franklin County have established an Airport Environs Overlay (AEO). The general purpose of the AEO is to protect public health, safety, and welfare by regulating development and land use within the areas surrounding the airport. Updated noise contour information and land use compatibility recommendations developed as part of this Study will also be shared with the Mid-Ohio Regional Planning Commission (MORPC) for use in their 2018 Rickenbacker Area Comprehensive Study.

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