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4 FACILITY REQUIREMENTS

Aside from a decline in 2013 due to the ceased operation of Frontier Airlines, CAK has experienced consistent enplanement growth since 2007. This is largely due to the Authority's commitment to maintain competitive fares and a superior level of customer service. Additionally, the recent merger between Southwest Airlines and AirTran Airways is expected to draw additional customers and new demand for CAK's services. This Master Plan Update includes recommendations to prepare and make the Airport more capable of handling the expected increase in passenger traffic. The purpose of this chapter is to identify the Airport's facility development needs over the 20-year planning horizon. The FAA Detroit ADO approved the preferred aviation activity forecast presented in **Chapter 3** in February 2013. At that point, the Airport facility needs were determined, helping to form the basis of the development concepts discussed in **Chapter 6**.

The demand, capacity, design standards and overall airport facility requirements at CAK were evaluated using guidance contained in several FAA publications: AC 150/5060-5, *Airport Capacity and Delay*; AC 150/5300-13A, *Airport Design*; AC 150/5325-4B, *Runway Length Requirements for Airport* Design; AC 150/5360-13 *Planning and Design Guidelines for Airport Terminal Facilities*, *Airport Cooperative Research Program Airport Passenger Terminal Planning and Design Manual*; Federal Aviation Regulation (FAR) Part 77, *Objects Affecting Navigable Airspace*; sand Order 5090.3C *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*. The following elements of the Airport are accounted for in this assessment:

- Airfield Systems
- NAVAIDs and Approach Capability
- Passenger Terminal Building
- Surface Transportation Facilities
- General Aviation Facilities
- Support Facilities
- Airspace Protection

4.1 PLANNING FACTORS

Before the facility requirements for CAK could be determined, it was necessary to establish the Planning Activity Levels based on the preferred forecasts, the design aircraft family and the appropriate airport and runway classifications associated with FAA design standards. These parameters are discussed in the following subsections.

4.1.1 Planning Activity Levels (PALs)

Since economic conditions and trends in the aviation industry fluctuate greatly, it can be challenging to make recommendations for facility improvements based solely on specific years. The timeline associated with the preferred forecast is representative of the anticipated timing of demand in five-year increments – 2017, 2022, 2027 and 2032. The actual timing of demand can vary. Therefore, Planning Activity Levels (PALs) – rather than calendar years – were established to identify significant demand thresholds for facility enhancement projects. Separating the forecast timeline from the recommended facility improvements provides the Authority with the flexibility to advance or slow down the rate of development, in response to realized demand. If the preferred forecast proves conservative (i.e., one of the high growth forecast scenarios is realized as a result of successful airport marketing and route development initiatives), any recommended improvements should be moved ahead on the schedule. In contrast, if demand occurs at a rate that is slower than the preferred forecast predicts, the improvements should be deferred accordingly. As activity levels approach a PAL and trigger the need for a facility improvement, sufficient lead time for planning, design and construction must also be given to ensure that the facilities are available for the impending demand.

Table 4-1 identifies the PALs used for this study, which correspond with the preferred aviation activity forecast for the base year of 2012 and the planning horizon years 2017, 2022, 2027 and 2032. **Figure 4-1** presents a graphical representation of how the PALs for enplanements were established and associates them with preferred and alternative forecast scenarios, discussed in **Chapter 3**. The graphic depicts the relative time range during which each PAL could be reached, if one of these other forecast scenarios happen. For example, facilities capable of accommodating PAL 2 demands (i.e., ±1.3 million annual enplanements) could be needed as early as 2017, if the high-growth forecast scenario is experienced; or as late as 2028, if the low-growth scenario is realized.

Table 4-1 – Planning Activity Levels (PALs)

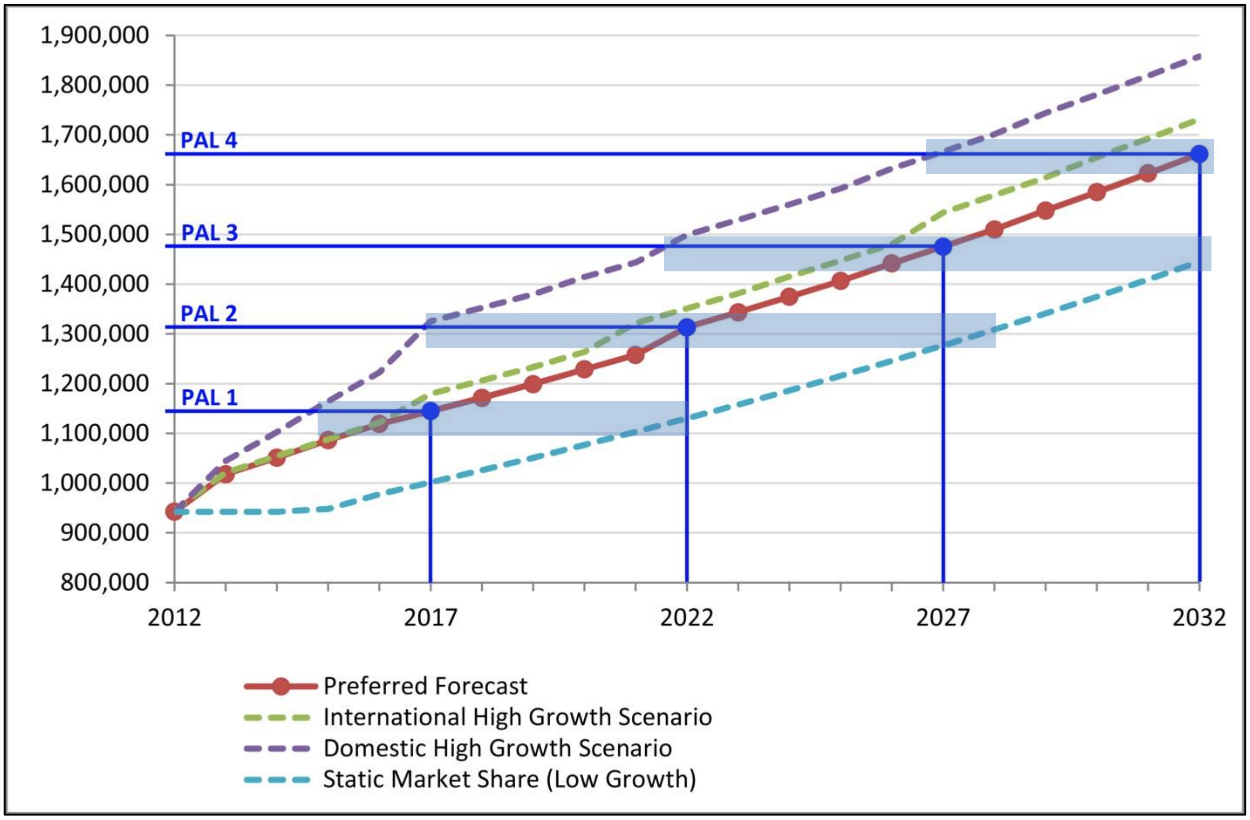
Enplanements						
Activity		**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Annual		942,343	1,144,900	1,313,200	1,475,400	1,661,600
Peak Month		90,465	109,910	126,067	141,638	159,514
Average Day		3,015	3,664	4,202	4,721	5,317
Peak Hour		508	593	671	759	818
Surged Enplanements		635	741	839	948	1022
Operations						
Category	**Activity**	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Commercial Aviation	Annual	31,190	32,839	36,090	39,680	43,696
	Peak Month	2,854	3,005	3,303	3,631	3,999
	Average Day	95	100	110	121	133
	Peak Hour[1]	14	15	16	18	20
	Peak Hour Departures[2]	9	10	10	11	12
	Peak Hour Arrivals[2]	5	5	6	7	8
General Aviation	Annual	47,854	48,938	50,046	51,181	52,341
Military Aviation	Annual	2,618	2,618	2,618	2,618	2,618
TOTAL Operations	**Annual**	**81,662**	**84,395**	**88,754**	**93,479**	**98,655**
	Peak Month	8,083	8,355	8,787	9,254	9,767
	Average Day	269	279	293	308	326
	Peak Hour	26	27	28	30	31

Source: CHA, 2013

[1] The Peak Hour was determined to be 6 to 7 am on weekdays.

[2] The Peak Hour Departures represent 64.3% of the Peak Hour Operations as determined from OAG data.

Figure 4-1 – Enplanement Planning Activity Levels (PALs)



Source: CHA, 2013

4.1.2 Aircraft Classification

The FAA has established aircraft classification systems that group aircraft types based on their performance and geometric characteristics. These classification systems are described below and are used to determine the appropriate airport design standards for specific runway, taxiway, taxilane, apron or other facilities, as described in FAA AC 150/5300-13A *Airport Design*.

Aircraft Approach Category (AAC): A grouping of aircraft based on a reference landing speed (V_{REF}), if specified, or if V_{REF} is not specified, 1.3 times stall speed (V_{SO}) at the maximum certificated landing weight. V_{REF}, V_{SO} and the maximum certificated landing weight are established for the aircraft by the certification authority of the country of registry.

Airplane Design Group (ADG): A classification of aircraft based on wingspan and tail height. When the aircraft wingspan and tail height fall in different groups, the higher group is used.

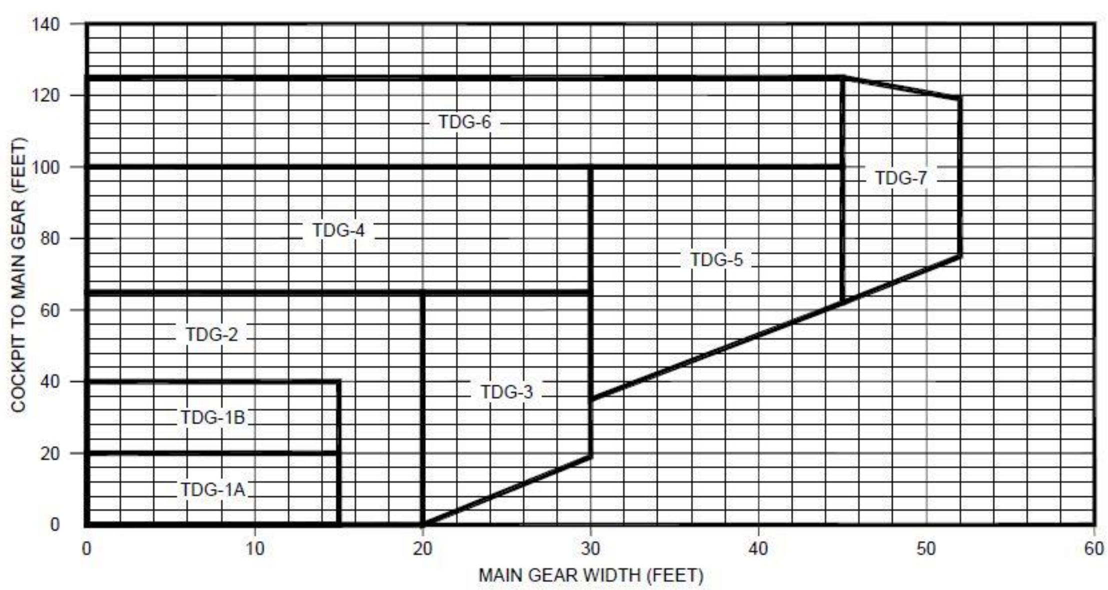
Taxiway Design Group (TDG): A classification of airplanes based on outer to outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance.

Table 4-2 – Aircraft Classification Criteria

Aircraft Approach Category (AAC)		
Approach Category	**Airspeed (knots)**	**Example Aircraft**
A	<91	Cessna 152, Beech Bonanza A36
B	91 ≤ 121	Saab 340, Gulfstream I
C	121 ≤ 141	MD 80, A319
D	141 ≤ 166	Boeing 747, KC-135
E	166+	F-16, A-10

Airplane Design Group (ADG)			
Design Group	**Tail Height (ft)**	**Wingspan (ft)**	**Example Aircraft**
I	<20	<49	Cessna 172, Cirrus SR-22
II	20-<30	49 ≤ 79	Cessna Citation II, Falcon 900, CRJ
III	30-<45	79 ≤ 118	Boeing 737, MD 80
IV	45-<60	118 ≤ 171	Boeing 757, MD 11
V	60-<66	171 ≤ 214	Airbus A340, Boeing 777
VI	66-<80	214 ≤ 262	Airbus A380, C-5 Galaxy

Taxiway Design Group (TDG)



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

The applicability of these classification systems to the FAA airport design standards for individual airport components (such as runways, taxiways or aprons) is presented in **Table 4-3**.

Table 4-3 – Applicability of Aircraft Classifications

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

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

4.1.3 Design Aircraft Family

The design aircraft or design aircraft family represents the most demanding aircraft or grouping of aircraft with similar characteristics (relative to AAC, ADG, TDG) currently using or anticipated to use an airport on a regular basis. Upon review of the FAA's ETMSC data, Official Airline Guide (OAG) data and forecast fleet mix assumptions described in **Chapter 3**, the design aircraft family identified for CAK is presented in **Table 4-4**. This grouping represents typical commercial aircraft and larger based, military, and charter aircraft anticipated to operate at CAK over the planning horizon. Available data indicates that aircraft such as the Airbus A300, Boeing 747SP, 757-200/300 and C-17 Globemaster III have relatively infrequent operations at CAK. These aircraft generally have higher AAC, ADG, and TDG classifications than other regularly scheduled commercial aircraft. While these will not be our focal design aircraft, they should still be considered when planning aircraft parking and taxiing paths, as they may require specific facility design accommodations within the designated areas of operation.

Table 4-4 – Design Aircraft Family

Aircraft	Total Operations in 2011	AAC	ADG	TDG	AAC: Approach Speed (knots)	ADG: Wingspan (ft)	ADG: Tail Height (ft)	TDG: CMG (ft)	TDG: MGW (ft)
Operated by Passenger Airline									
Airbus A318	79	C	III	3	121	117.5	42.3	42.4	29.4
Airbus A319	816	C	III	3	126	117.5	39.7	44.9	29.4
Airbus A320	428	C	III	3	136	117.5	39.6	50.2	29.4
Boeing 717-200	7,742	C	III	2	139	93.2	29.8	55.8	19.4
Boeing 737-700	799	C	III	3	130	117.5	41.7	46.6	23.0
Boeing 737-800	20	D	III	3	142	117.5	41.2	56.4	23.0
McDonnell Douglas MD-88	595	D	III	4	144	107.9	30.2	70.5	20.3
Infrequent Operations in 2011									
Airbus A300/A300-600	1	C	IV	5	137	147.1	55.0	75.0	36.1
Boeing 747SP	6	C	V	5	140	195.5	65.8	75.1	40.7
Boeing 757-200/300	3	C/D	IV	4	152	134.8	44.9	85.3	28.2
Boeing C-17 Globemaster III	1	C	IV	5	132	169.8	55.1	69.3	33.8

Source: CHA, 2013

4.1.4 Airport & Runway Classification

The FAA classifies airports and runways by their current and planned operational capabilities. These classifications – described below – along with the aircraft classifications defined previously are used to determine the appropriate FAA standards, as per AC 150/5300-13A, to which the airfield facilities are to be designed and built.

Airport Reference Code (ARC)

ARC is an airport designation that represents the AAC and ADG of the aircraft that the airfield is intended to accommodate on a regular[1] basis. The ARC is used for planning and design only and does not limit the aircraft that may be able to operate safely at the airport. The airport's previous 2010 Airport Layout Plan (ALP) identified CAK as an ARC C-III facility. Due to increasing use of the Boeing 737-800 by Southwest Airlines, it is recommended that CAK's classification be changed to an ARC of D-III over the planning horizon.

[1] According to FAA AC 150/5325-4B *Runway Length Requirements for Airport Design*, the terminology of "regular use" and "substantial use" is defined as 500 annual itinerant operations by an individual airplane or grouping of airplanes.

Runway Design Code (RDC) and Runway Reference Code (RRC)

RDC are the design standards to which the overall runway is planned and built. RRC are the operational capabilities of each specific runway end. These classifications have three components: AAC, ADG and the highest approach visibility minimums that either end of the runway is planned to provide. Within these classifications, instrument approach visibility minimums are expressed in RVR[2] values of 1200, 1600, 2400 and 4000 feet, as described in **Table 4-5**. In correspondence with the specific published approach procedures, a runway end may have more than one RRC depending on the minimums available to a specific AAC. Currently, each runway end at CAK is equipped with a CAT-I ILS with half-mile visibility minimums (RVR 2400) and meets AAC-C and ADG-III requirements. Therefore, the highest RRC for each runway end and RDC for each runway is C-III-2400. Due to increasing use of the Boeing 737-800, it is recommended that one or both of the runways be developed to meet D-III standards. Additionally, if the Airport were to ever upgrade to a CAT-II ILS – discussed in **Sections 4.5** – the new RDC would become 1600, due to the improved approach minimums.

Table 4-5 – Instrument Approach Visibility Minimums

RVR (ft)	Flight Visibility Category (statute mile)
4000	Lower than 1 mile but not lower than ¾ mile (APV ≥ 3/4 but < 1 mile)
2400	Lower than 3/4 mile but not lower than 1/2 mile (CAT-I PA)
1600	Lower than 1/2 mile but not lower than 1/4 mile (CAT-II PA)
1200	Lower than 1/4 mile (CAT-III PA)

Source: FAA AC 150/5300-13A *Airport Design*
Notes: APV – Approach Procedure with Vertical Guidance
PA – Precision Approach

Although the Boeing 747SP, 757, C-17 Globemaster III and Airbus A300 have a higher AAC and ADG, their operations are anticipated to remain infrequent over the planning horizon and can safely be accommodated through operator and ATC management. As described later in **Section 4.4.1 and 4.6.2**, the majority of the airfield already meets the design standards for these larger aircraft. While there is no current need to further upgrade the Airport's ARC, RDC or RRC classifications, the ability to meet D-IV and D-V standards should be preserved for potential long-term or unforeseen demand (e.g., the addition of longer routes to the west coast or international destinations).

[2] A Runway Visual Range (RVR) transmissometer measures the distance over which an aircraft pilot on the centerline of the runway can see the runway surface markings delineating the runway or identifying its center line.

4.2 AIRFIELD CONFIGURATION

The general configuration of the airfield, including the number of runways and with their location/orientation, should allow the airport to meet anticipated air traffic demands and maximize wind coverage and operational utility for all types of aircraft. As stated in **Chapter 2**, the FAA recommends that the airport's runway system be oriented to provide at least 95 percent wind coverage. This means that 95 percent of the year, the crosswind coverage at an airport is within acceptable limits for the types of aircraft operating on the runways. The current intersecting runway configuration at CAK provides wind coverage greater than the FAA-recommended 95 percent during IFR conditions for all flight conditions except A-I and B-I aircraft. The 2010 *General Aviation and Part 135 Activity Survey* indicates that these smaller aircraft do not fly as often during IFR weather conditions.[3] Due to the infrequency of these weather conditions at CAK (±12%) and the 150-foot runway (the design standard for A/B-I aircraft is 60 feet), there are no recommended changes to the runway configuration during the planning horizon.

Due to the changes in the earth's magnetic declination over time, the compass heading of a runway and its associated end number can change. The current magnetic headings of runways ends at CAK are: Runway 5 is 054 degrees, Runway 23 is 234 degrees, Runway 1 is 009 degrees and Runway 19 is 189 degrees. Currently, there are no changes in orientation needed. However, since magnetic declination changes slowly over time (estimated to be changing by 0.03 degrees annually, according to the National Oceanic and Atmospheric Administration Magnetic Field Calculator), the runway numbers may need to be reevaluated by the year 2043 – at which time the magnetic declination will have changed by one whole degree.

[3] According to the surveys in 2010, single engine piston aircraft only accounted for approximately 27 percent of total GA hours flown during IFR conditions nationwide. During VFR conditions, single engine piston aircraft account for about 52 percent.

4.3 AIRFIELD CAPACITY

Airfield capacity refers to the maximum number of aircraft operations (takeoffs or landings) an airfield can accommodate in a specified amount of time. An assessment of the airfield's current and future capacity was performed using common methods described in FAA AC 150/5060-5 *Airport Capacity and Delay*. This evaluation helps to determine any capacity-related improvements or expansions that may be needed in order to support flight activity levels. The estimated capacity of the airfield at CAK can be expressed in the following three measurements:

Hourly Capacity: The maximum number of aircraft operations an airfield can safely accommodate under continuous demand in a one-hour period. This expression calculates for VFR and IFR conditions, and is used to identify any peak-period constraints on a given day.

Annual Service Volume (ASV): The maximum number of aircraft operations an airfield can accommodate in a one-year period without excessive delay. This calculation is typically used in long-range planning and referenced for capacity-related improvement project approval.

Aircraft Delay: The average number of minutes an aircraft experiences delay on the airfield, and the total hours of delay incurred over a one-year period.

4.3.1 Capacity Calculation Factors

To calculate these three measurements of capacity and delay, several key factors and assumptions specific to CAK had to be defined. Consistent with the guidance provided in AC 150/5060-5, these include:

Aircraft Fleet Mix Index – Ratio of the various classes of aircraft serving an airport

Runway-Use Configuration – Number and orientation of the active runways

Percentage of Aircraft Arrivals – Ratio of landing operations to total operations

"Touch and Go" Factor – Ratio of landings with an immediate takeoff to total operations

Location of Exit Taxiways – Number of taxiways available to an aircraft within a given distance from the arrival end of a runway

Meteorological Conditions – Percentages of times an airfield experiences VFR, IFR and PVC conditions

Aircraft Fleet Mix Index

Due to varying performance features, the types of aircraft operating at an airport can have a significant impact on an airfield's capacity. The FAA states that the heavier the aircraft operating at an airfield, the greater spacing needed in the flight path between the aircraft to avoid wake turbulence. The airport's fleet mix index helps determine the size of typical aircraft and the frequency of their operations. For the purpose of determining an aircraft mix index (a ratio of the various classes of aircraft serving an airport), AC 150/5060-5 *Airport Capacity and Delay,* has established four categories in classifying an aircraft by its maximum certificated takeoff weight (MTOW), as depicted in **Table 4-6**.

Table 4-6 – Aircraft Capacity Classifications

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

Source: AC 150/5060-5 *Airport Capacity and Delay*, CHA, 2013

The aircraft mix index is found using the formula *%(C + 3D)* – the letters corresponding with the aircraft class. This product falls into one of the FAA-established mix index ranges for use in capacity calculations listed below:

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

In review of the 2011 baseline and forecasted operations data, Class C aircraft, a percentage expected to increase to 62 percent by 2032, currently performs 51 percent of operations at CAK. There are no existing or planned Class D aircraft operations for CAK to be a factor in determining the mix index. Baseline and forecast percentages fall under the aircraft fleet mix index range of 51-80 for the planning period.

Runway Use Configuration

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

If an airfield layout consists of more than one runway, those runways can be considered independent or dependent of each other. An independent runway is one that is not operationally affected by the other runways during normal operations (e.g., parallel runways). A dependent runway is one that is configured in such a way that aircraft must wait for operations to complete on another runway before resuming its own (e.g., intersecting runways). Due to this wait time, airfields with dependent runway systems inherently have a more limited capacity than those with independent runways. The two bi-directional runways at Akron Canton Airport have an intersecting configuration, making the runways dependent of each other. **Figure 4-2** portrays runway configuration and usage at CAK.

Figure 4-2 – Runway Configuration and Utilization

Source: CHA, 2013

Runway 5/23 has a northeast/southwest orientation, while Runway 1/19 has a north/south orientation. Because the Airport uses all four runways for takeoff and landing – arrival and departure – operations, the usage rates of each runway (5, 23, 1 and 19) were evaluated. These conclusions were established considering the combined VFR and IFR conditions presented in **Table 4-7**.

Table 4-7 – Runway Usage

Runway End	Runway End Utilization	Runway Utilization
5 **23**	8% 53%	61%
1 **19**	19% 20%	39%

Source: CAK ATCT staff, HMMH, 2011

Percentage of Aircraft Arrivals

Arriving aircraft usually contribute more to delays than departing aircraft. This percentage is the ratio of landing operations to total operations at an airport during a specified period of time, and is generally assumed to be equal to the percentage of departing operations. Therefore, a factor of 50 percent will be used for the capacity calculations of the Airport.

Percentage of Touch-and-Go Operations

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

In 2011, the Air Traffic Activity Data System (ATADS) identified approximately 17,722 local operations at CAK. Currently, two companies provide private flight instruction at the Airport: McKinley Air Transport and Jim Long Aviation. Assuming that roughly half of these operations are T&Gs and that flight instruction operations will not experience a significant growth over the planning horizon, a percentage range of 11-20 is used in the capacity calculations. Based on FAA figures, this percentage equates to a T&G factor of 1.10.

Location of Exit Taxiways

The location and number of exit taxiways affect the capacity of an airport's runway system because they directly relate to runway occupancy time. Runway capacities are highest when they are complimented with full-length, parallel taxiways, ample runway entrance and exit taxiways, and no active runway crossings. All of these components reduce the amount of time an aircraft remains on the runway. FAA AC 150/5060-5 identifies the criteria for determining taxiway exit factors based on: the mix index, how far taxiway exits are from the runway threshold and other taxiway connections. As the airport's existing mix index range was calculated to be 51-80 over the planning period, only exit taxiways ranging from 3,500 and 6,500 feet from the threshold and spaced at least 750 feet apart contribute to the taxiway exit factors. By combining the mix index, percentage of aircraft arrivals and the number of exit taxiways within the specified range, there is a taxiway exit factor of 0.83 percent.

Meteorological Conditions

Meteorological conditions at and around an airport also have significant impacts on the capacity of an airfield. Runway use percentages are a result of prevailing winds dictating which runway an aircraft should use for takeoff and landing operations.

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

Visual Flight Rules (VFR) – Cloud ceiling is greater than 1,000 feet above ground level (AGL) and visibility is at least three statute miles.

Instrument Flight Rules (IFR) – Cloud ceiling is at least 500 feet AGL, but less than 1,000 feet AGL; and/or the visibility is at least one statute mile but less than three statute miles.

Poor Visibility Conditions (PVC) – Cloud ceiling is less than 500 feet AGL and/or the visibility is less than one statute mile.

CAK experiences VFR conditions 87.6 percent of the time, IFR conditions 11.5 percent of the time and PVC conditions 0.9 percent of the time. These are approximate percentages derived from the historical data from the Airport's ASOS[4].

Summary of Capacity Calculation Factors

Table 4-8 summarizes the parameters calculated for CAK used to define the hourly capacity (in VFR and IFR conditions), the ASV and average delay for the Airport.

Table 4-8 – Calculated Capacity Parameters

Factor	2011
Aircraft Fleet Mix Index	51
Runway-Use Configuration	Dual-Intersecting
Percentage of Aircraft Arrivals	50%
Touch and Go Factor (VFR / IFR)	1.04 / 1.0
Taxiway Exit Factor (VFR / IFR)	.83 / .97
Meteorological Conditions (VFR / IFR)	88% / 12%

Source: FAA AC 150/5060-5 *Airport Capacity and Delay*
CHA, 2013

4.3.2 Hourly Capacity

Hourly capacity for the airfield is a measurement of the maximum number of aircraft operations (VFR and IFR) that an airfield can support in an hour, based on runway configuration. Using graphs found in AC 150/5060-5, VFR and IFR hourly capacity *bases* were established by applying the given VFR and IFR operational capacities for the runway use configuration, the aircraft mix index and percentage of aircraft arrivals. Once the hourly capacity *bases* are found, they are multiplied by the touch-and-go factors and taxiway exit factors to find the hourly capacities. This equation is expressed as:

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

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

Table 4-9 shows the results of the hourly capacity for 2011 and for PALs 1-4. Note that as the mix index increases from 51 (2011) to 62 (2032), the operational capacities decrease.

[4] Because PVC conditions occur less than 1 percent of the time, it cannot be accurately used in the calculation and is therefore distributed between the VFR and IFR percentages

Table 4-9 – Calculation of Hourly Capacity

Factors	2011 VFR / IFR	2017 VFR / IFR	2022 VFR / IFR	2027 VFR / IFR	2032 VFR / IFR
Hourly Capacity Base	81 / 56	80 / 55	79 / 55	78 / 55	77 / 55
Touch-and-Go Factor	1.04 / 1.0	1.04 / 1.0	1.04 / 1.0	1.04 / 1.0	1.04 / 1.0
Taxiway Exit Factor	.83 / .97	.83 / .97	.83 / .97	.83 / .97	.83 / .97
Calculated Hourly Capacity	**70 / 54**	**69 / 53**	**68 / 53**	**67 / 53**	**66 / 53**

Source: FAA AC 150/5060-5 *Airport Capacity and Delay*
CHA, 2013

4.3.3 Annual Service Volume

Annual Service Volume (ASV) is an expression of the total number of aircraft operations that an airfield can support annually. The formula for estimating an airport's ASV is based on the ratio of annual operations to average daily operations during the peak month, multiplied by the ratio of average daily operations to average peak hour operations during the peak month. The product of these values is then multiplied by the *weighted* hourly capacity to determine the ASV.

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

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

C_w = *Airfield weighted hourly capacity*

$_n$ = *Number of runway-use configurations. Due to the operational limitations of the intersecting runways, the airfield operates as a single runway with two configurations: VFR and IFR.*

C = *Hourly capacity of each configuration.* ***VFR = 70 / IFR = 54***

W = *FAA ASV weighting factor, based on mix index and percentage, and hourly capacity.* ***VFR = 5 / IFR = 1***

P = *Percent of time the Airport operates under each configuration. For CAK, this is applies as VFR and IFR conditions.* ***VFR = 88% / IFR = 12%***

Applying the 2011 CAK data to this equation yields the following:

$$C_w = \frac{(70 \times 5 \times .88) + (54 \times 1 \times .12)}{((5 \times .88) + (1 \times .12))}$$

$$C_w = 69.6$$

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

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

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

Table 4-10 identifies the daily and hourly demand ratios for 2011-2032.

Table 4-10 – Demand Ratios

Factor	2011	2017	2022	2027	2032
Annual Operations	81,405	84,395	88,755	93,478	98,655
Avg. Daily Operations (in Peak Month)	269	279	293	308	326
Avg. Peak Hour (in Peak Month)	26	27	28	30	31
Daily Demand Ratio (D)	**302.6**	**302.5**	**302.9**	**303.5**	**302.6**
Hourly Demand Ratio (H)	**10.3**	**10.3**	**10.5**	**10.3**	**10.5**

Source: FAA AC 150/5060-5 *Airport Capacity and Delay*
CHA, 2013

The ASV equation for 2011 is:

$$ASV = 69.6 \times 302.6 \times 10.3$$

$$\mathbf{ASV = 216{,}928}$$

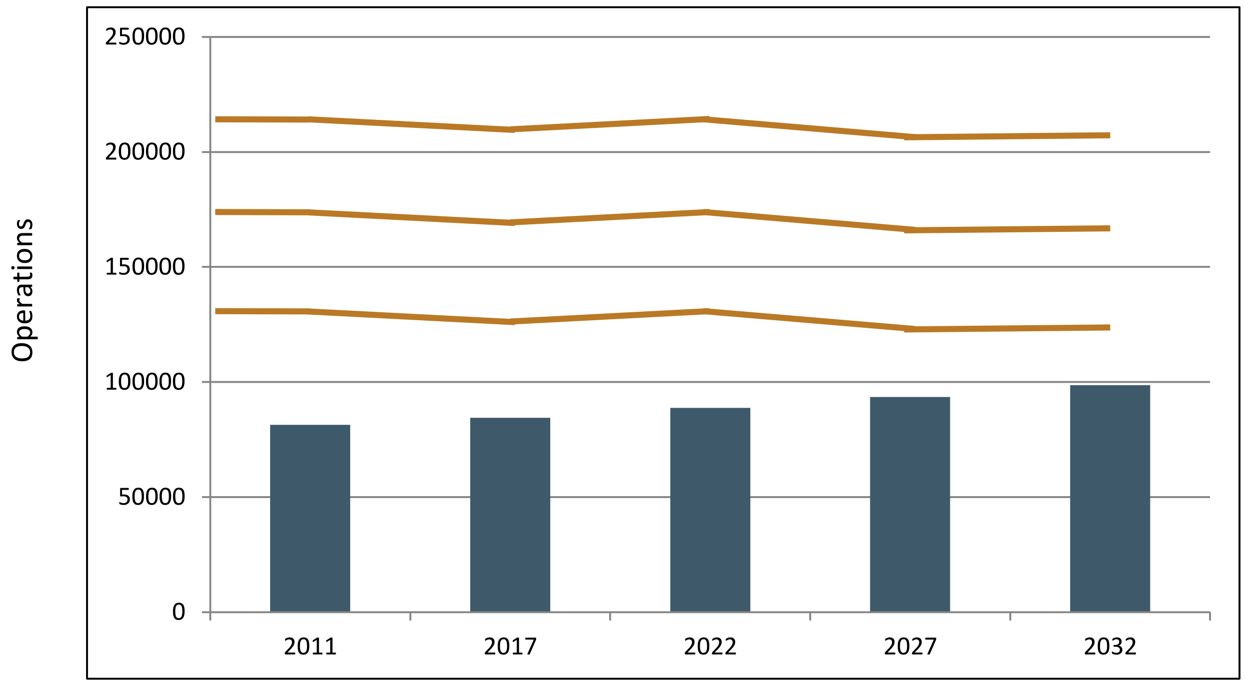
If the annual operations exceed the ASV, the airport is likely to see significant delays. However, an airport can still experience delays before capacity is reached. As stated in the FAA Order 5090.3C *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*, an airport is eligible to secure funding for capacity-enhancing projects once it has reached 60 percent of its annual capacity. This allows an airport to make necessary improvements and avoid delays before they occur. To better understand CAK's current and projected operational capacity levels, base year and PAL 1-4 demands are compared to their respective annual service volumes in **Table 4-11**. The capacity levels are depicted in **Figure 4-3**.

Table 4-11 – Annual Service Volume

Factor	2011	2017	2022	2027	2032
Annual Operations	81,405	84,395	88,755	93,478	98,655
Annual Service Volume	216,928	213,387	214,998	208,195	208,748
Capacity Level	**36.3%**	**39.6%**	**41.3%**	**44.9%**	**47.3%**

Source: FAA AC 150/5060-5 *Airport Capacity and Delay*
CHA, 2013

Figure 4-3 – Projected Demand



Source: CHA, 2013

4.3.4 Aircraft Delay

Although analyses have indicated that CAK's base and forecast level of aeronautical activity is not anticipated to exceed the calculated capacity of the airfield, the potential for aircraft delay still exists due to a variety of reasons such as: poor weather conditions, aircraft maintenance issues, etc. The average delay of aircraft at an airport is generally expressed in minutes per aircraft and hours per year. This expression allows the airport to adequately quantify the delays it may experience over the course of a year. The average delay in minutes per aircraft is determined using FAA guidance and the capacity levels from the previous table. This value is figured into the base and forecast annual demand to total the annual delay in hours per year for an airport. AC 150/5070 *Airport Master Plans* indicates that a four- to six-minute time delay per aircraft is considered acceptable for normal operations at an airport. The results of the aircraft delay calculations as they apply to CAK are in **Table 4-12**.

Table 4-12 – Aircraft Delay

Delay		2011	PAL 4
Average Delay per Aircraft (Minutes)	High	.35	.5
	Low	.15	.22
Total Annual Delay (Hours)	High	474.9	875.2
	Low	203.5	377.1

Source: FAA AC 150/5060-5 *Airport Capacity and Delay*
CHA, 2013

4.3.5 Conclusion

Based on the airfield capacity calculations and discussions with airport staff and ATCT, airfield capacity should not be an issue at CAK through PAL 4. However, the airport still might experience delays during inclement weather conditions or periods of peak activity. The Airport's efficiency should be continuously monitored to appropriately determine any changes or development the airfield may need to maintain a high level of customer service and reduce the potential for delay.

4.4 RUNWAYS

Runway 5/23 is the primary air carrier runway at 8,204 feet long and 150 feet wide. According to data collected from the Passur installation at Cleveland Hopkins International Airport, more than half of the operations at CAK are performed on this runway. Runway 1/19 is 7,601 feet long and 150 feet wide. The application of a 594-foot, displaced threshold on the Runway 19 end allows for 7,601 feet of available takeoff distance in either direction, and 7,007 feet of available landing distance in either direction. The displaced threshold allows the Airport to maintain an additional 594 feet of takeoff length and maintain compliance with all Runway Safety Area (RSA) and Runway Object Free Area (ROFA) requirements.

4.4.1 Runway Design Standards

This Master Planning Update aims to achieve compliance with all FAA design and safety standards related to the airfield facilities, including dimensions, separation distances, protection zones, clearance requirements, etc. These standards vary according to RDC/RRC. The FAA design and safety standards related to runways, as defined in AC 150/5300-13A *Airport Design*, are described below.

Runway Width – The physical width of the runway pavement.

Runway Safety Area (RSA) – Graded surface centered on the runway centerline. The RSA shall be free of objects (except for objects that need to be located in the RSA to serve their function such as NAVAIDs and approach aids) and capable – under dry conditions – of supporting snow removal equipment, aircraft rescue and firefighting (ARFF) equipment, and passage of aircraft without causing structural damage.

Runway Object Free Area (ROFA) – Centered on the runway centerline and requires the clearing of all above ground objects protruding above the RSA edge elevation (unless objects need to be located in the OFA for air navigation or aircraft ground maneuvering purposes).

Runway Object Free Zone (OFZ) – A defined volume of airspace centered above the runway centerline that extends 200 feet beyond each end of the runway surface that precludes taxiing or parked airplanes and object penetrations, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function.

Runway Protection Zone (RPZ) – A trapezoidal area located 200 feet beyond the runway end and centered on the extended runway centerline. The RPZ is a land use control meant to enhance the protection of people and property near the airport through airport control. Such control includes clearing of RPZ areas of incompatible objects and activities. With special application of declared distances, separate approach and departure RPZs are required – as with the Runway 19 end at CAK.

Runway Obstacle Free Zone (OFZ) – A defined volume of airspace above the runway centerline extending 200 feet beyond each end of the runway surface, precluding taxiing or parked airplanes and object penetrations. This excludes frangible visual NAVAIDs that need to be in the OFZ because of their function.

Runway Separation Standards – Separation standards between the runway and other airport facilities are established to ensure operational safety of the airport and are as follows:

- Runway centerline to parallel taxiway centerline
- Runway centerline to holdline
- Runway centerline to edge of aircraft parking area

Building Restriction Line (BRL) – Though not a specific FAA design standard, the BRL is a reference line providing generalized guidance on building location and height restrictions. The BRL is typically established with consideration to Object Free Areas and Runway Protection Zones and airspace protection by identifying areas of allowable building heights 25 or 35 feet above ground level. It should be noted that site-specific terrain considerations (i.e., grade or elevation changes) might allow buildings taller than indicated by the BRL to be developed within the limits. These height restrictions are based on FAR Part 77 standards that will be described in more detail in **Section 4.16** and will need to be evaluated for each specific site development plan.

Table 4-13 identifies the existing conditions at CAK and the geometric requirements of the above standards, relative to RDCs of C-III-2400 through D-V-2400. **Figure 4-4** depicts these standards as they currently exist at CAK (RDC C-III-2400). As supported by **Table 4-13** and **Figure 4-4**, CAK's runways are compliant with all FAA design standards for C-III through D-V aircraft and approach visibility minimums at least a half mile, with the exception of the Runway Centerline to Holdline separation distance.[5] For runways with an RDC reflective of AAC-D or above or ADG-IV or above, the holdline separation distance increases commensurate with the airport's field elevation. As discussed in **Section 4.1.4**, due to increasing operations by the Boeing 737-800 (a D-III aircraft), the holdline separation distance should be increased to 262 feet during the planning horizon.

The impacts of lowering the visibility minimums are discussed in **Section 4.5**.

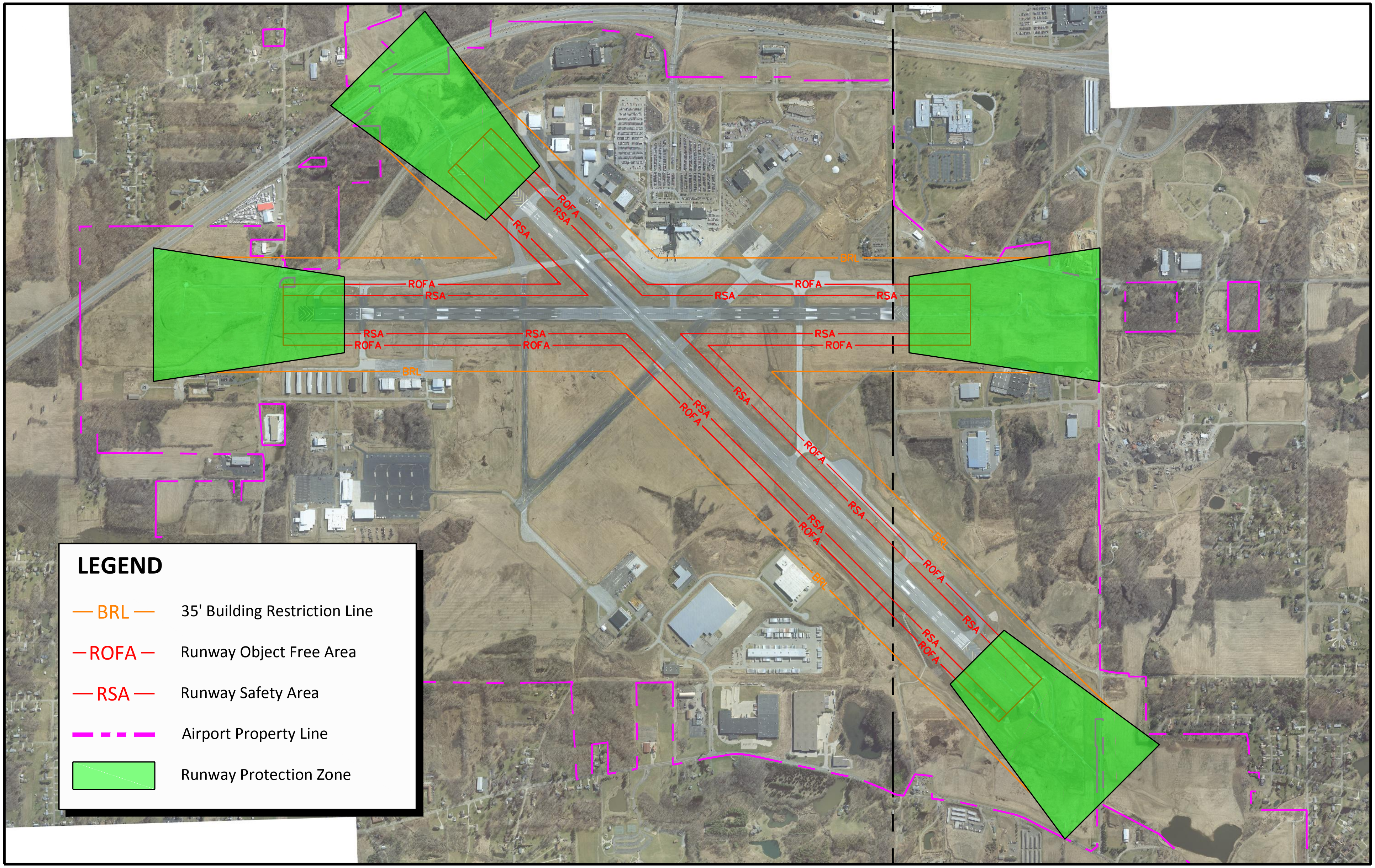
[5] With the exception of the hold line, the design and safety standards do not vary between Approach Categories C and D.

Table 4-13 – FAA Runway Design Standards

Design Standard	Existing Conditions (Both Runways)	Runway Design Code (RDC) (w/visibility minimums ≥ ½-mile)		
		C/D-III	C/D-IV	C/D-V
Runway Width	150 feet	150 feet		
RSA Width	500 feet	500 feet		
RSA Length Past RW End	1,000 feet	1,000 feet		
ROFA Width	800 feet	800 feet		
ROFA Length Past RW End	1,000 feet	1,000 feet		
Runway OFZ Width	400 feet	400 feet		
Separation Between:				
Runway Centerline to Parallel Taxiway Centerline	**23 End** - 512 feat **1/5/19 Ends** - 400 feet	400 feet		
Runway Centerline to Edge of Aircraft Parking	**5/23** - 550 feet **1/19** – 556 feet	500 feet		
Runway Centerline to Hold line	250 feet	250 feet / 262 feet[1]	262 feet	292 feet
Runway Protection Zone (RPZ):				
Length	2,500 feet	2,500 feet		
Inner Width	1,000 feet	1,000 feet		
Outer Width	1,750	1,750 feet		

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

[1] If the runways are designated AAC- D, this runway separation requirement should be increased to 262 feet (the distance is increased one foot for each 100 feet above sea level).



AKRON-CANTON AIRPORT
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Figure 4-4
Existing Runway Design Standards

4.4.2 Runway Length

To ensure that CAK is capable of supporting existing and anticipated aircraft and airline operational demands, a detailed runway length analysis was performed based on specific aircraft performance characteristics, documented in the manufacturer's Aircraft Planning Manuals (APMs). Inadequate runway length limits the operational capability of an airport, including operating aircraft and the destinations that the airport serves. Short runways can place restrictions on the allowable takeoff weight of the aircraft, which then reduces the amount of fuel, passengers or cargo able to be carried. Per the guidance provided in AC 150/5325-4B *Runway Length Requirements for Airport Design*, the following factors were used in the runway length calculations for CAK:

Aircraft Specifics

- **Model and Engine Type –** The aircraft version and engine type. The most common and demanding aircraft specific to CAK were used.
- **Payload** – Represents the carrying capacity of the aircraft, including passengers, baggage and cargo. For this analysis, 90 percent was chosen as the minimum payload.
- **Estimated Takeoff Weight** – The estimated weight at takeoff, including the payload and the fuel required to reach the intended destination – with reserve fuel. The estimated takeoff weight varies by aircraft, payload and destination.
- **Estimated Landing Weight** – The estimated weight at landing. For this analysis, maximum landing weight (MLW) was used to determine runway landing requirements.

Airport Specifics

- **Temperature** – The atmospheric temperature at the airport. Warmer air requires longer runway lengths because the air is less dense, and generates less lift on the aircraft. The average temperature of the warmest month at CAK (72°F) was used in the calculations.
- **Elevation** – The elevation above sea level at the airport. As elevation increases, air density decreases, making takeoffs longer and landings faster. The elevation at CAK is established at 1,225 feet MSL.
- **Runway Gradient –** The average slope of the runway, expressed as a percentage. The runway gradients at CAK are not significant enough to impact runway length requirements.
- **Stage Length (flight distance) –** The length in nautical miles (nm) to the intended destination. The stage length determines the amount of fuel an aircraft will require on takeoff to complete its flight, thus impacting runway length requirements.

Existing Aircraft and Destinations

Currently, the longest stage length at CAK is ±1,064 nautical miles to Denver, CO – operated by Southwest. The runway length requirements for the design aircraft family – passenger airline aircraft only – to this destination were calculated and are presented in **Table 4-14**.

The existing runways at CAK (7,601 feet and 8,204 feet) can accommodate these length requirements. Therefore, the runway system at CAK is considered adequate to accommodate the current traffic. Required landing length was also evaluated, but is not shown, as the takeoff lengths proved to be more demanding.

Table 4-14 – Existing Takeoff (TO) Length Requirements

Aircraft Model	Engine Type	Payload	Stage Length (nm)	Estimated Takeoff Weight (lb)	Takeoff Length Req. (ft)
Airbus A318	CFM56-5B	90%	1,064 (Denver)	126,000	4,500
Airbus A319	CFMI CFM56-5B5/3	90%	1,064 (Denver)	136,300	4,500
Airbus A320	CFMI CFM56-5B4/P	90%	1,064 (Denver)	143,000	5,000
Boeing 717	BMR RR BR715	90%	1,064 (Denver)	116,000	7,500
Boeing 737-700W	CFMI CFM56-7B20 / 22 / 24	90%	1,064 (Denver)	142,000	6,900
Boeing 737-800W	CFMI CFM56-7B22 / 24	90%	1,064 (Denver)	154,000	6,400
McDonnell Douglas MD-88	JT8D-217/217A	90%	1,064 (Denver)	144,000	7,600

Source: AC 150/5325-4B, *Runway Length Requirements for Airport* Design, CHA, 2013
Note: Runway lengths are calculated at 72°F and an elevation of 1,225 feet.

Potential Future Markets

In order to position the Airport to meet future demands, it is important to consider the markets that CAK may ultimately serve. Several domestic and international markets were chosen for analysis, based on existing airline destinations and market development initiatives by the Authority. Out of the markets listed below, several likely airports/destinations were identified and the longest stage lengths – the underlined destinations – were used for the runway length analysis.

- ***Southwest***: Las Vegas, Phoenix
- ***West Coast***: Los Angeles, San Diego, San Francisco, Portland, Seattle
- ***Mexico***: Cancun, Mexico City
- ***Caribbean***: Aruba, Bahamas, Dominican Republic, Puerto Rico
- ***Europe***: London, Paris

Figure 4-5 depicts the maximum ranges of the design aircraft family when departing from CAK, based on existing runway lengths. This graphic focuses on the high-use aircraft (Boeing 717, 737) and was calculated with a 90 percent aircraft payload. With the right variant of the 737, the runway length at CAK is adequate to reach all these potential destinations, except for Paris – which exceeds the range of the aircraft – despite the runway length. For that reason, to properly accommodate changes to the aircraft fleet mix at CAK, several long-range aircraft were added to the analysis – the Boeing 757-200, 767-300, 777-200 and Airbus A330-300. The analysis proved that Runway 5-23 is long enough to accommodate European service, if operated by the 757-200, 767-300ER or the 777-200. In order for the Airbus A330-300 to reach Paris from CAK, a 900 to 1,300 foot runway extension would be required. **Table 4-15** presents the results of this analysis. Based on current market trends, including airline routes and international connections, additional runway length is not warranted at this time.

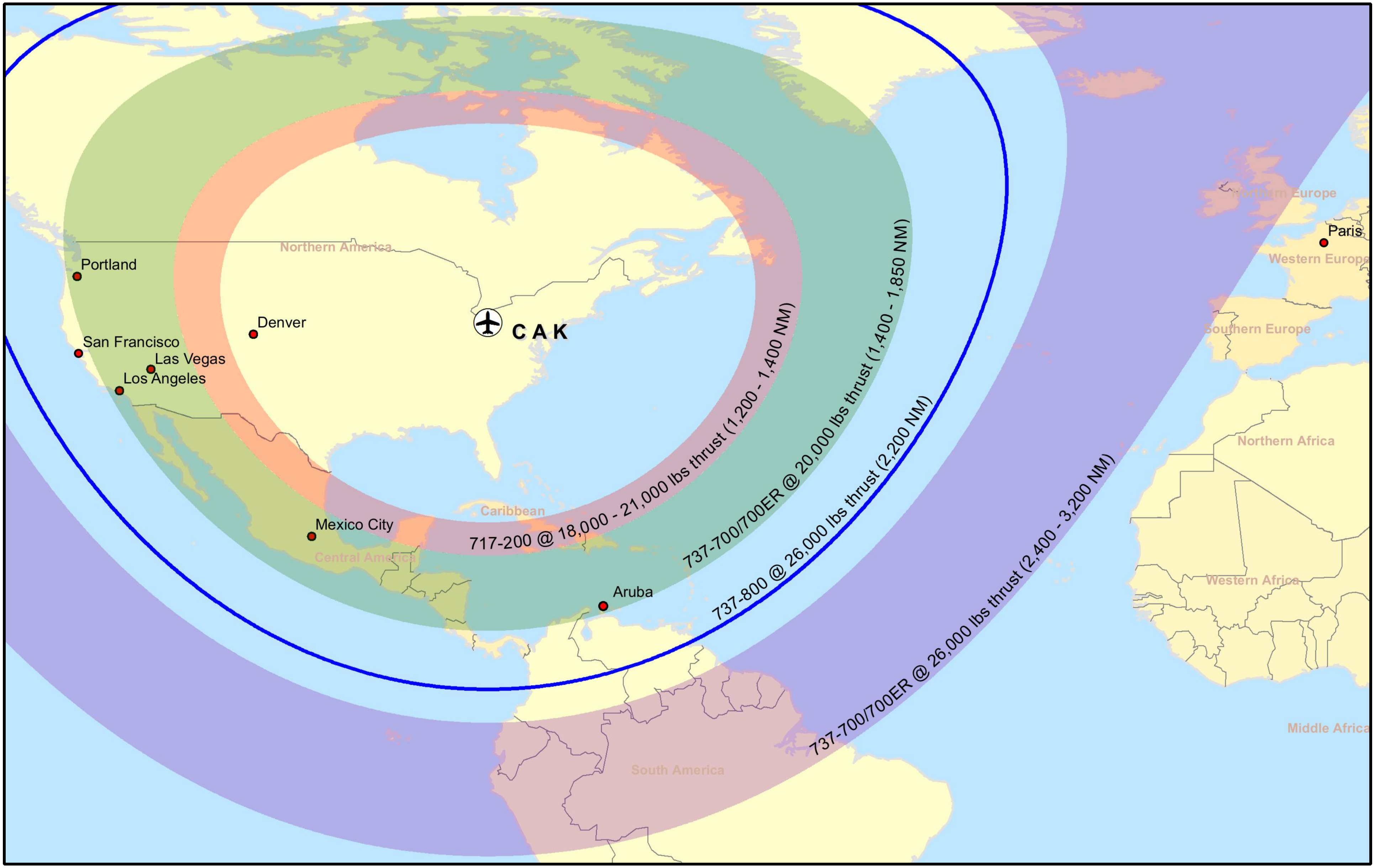

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Figure 4-5
Aircraft Ranges from CAK
(8,200 ft. Runway)

Table 4-15 – Potential Future Destinations

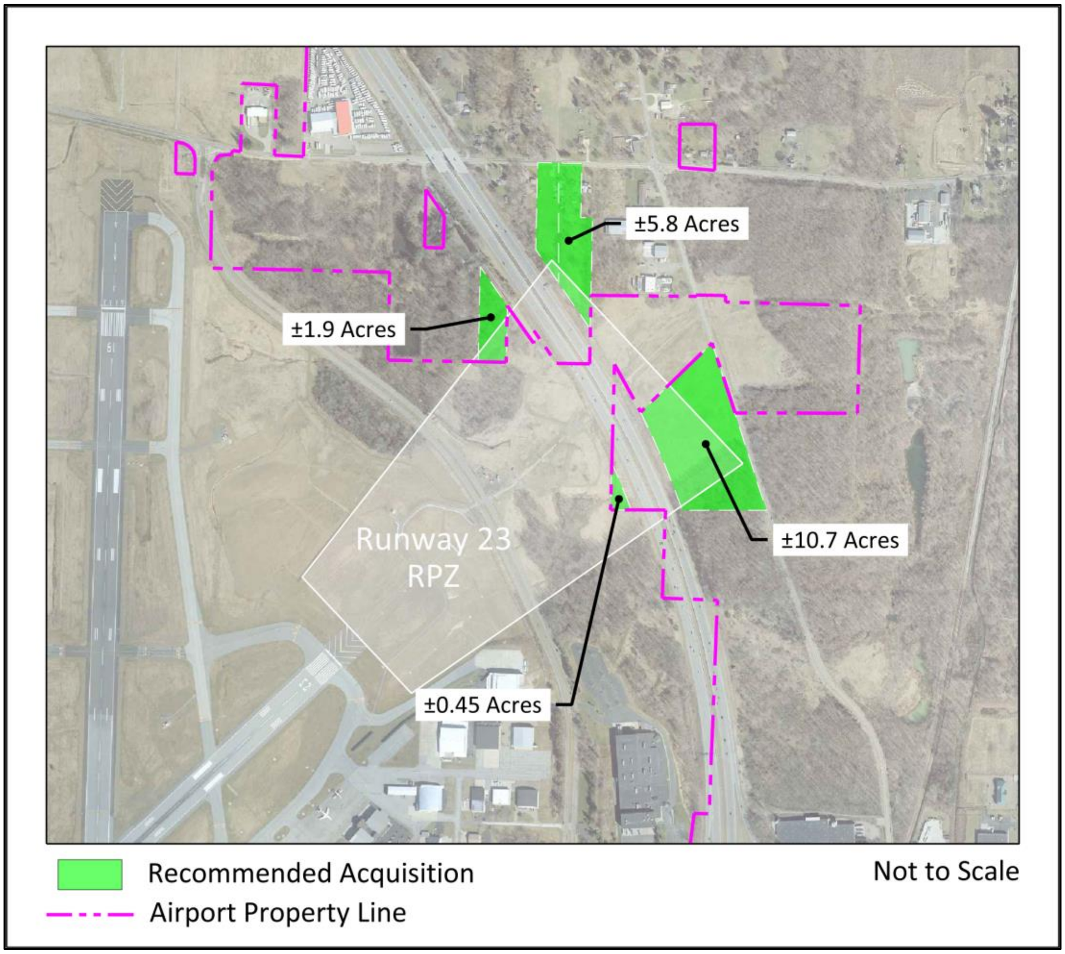
Aircraft Model / Engine	Las Vegas (LAS) *1,604 nm*	San Francisco (SFO) *1,900 nm*	Mexico City (MEX) *1,572 nm*	Aruba (AUA) *1,804 nm*	Paris (CDG) *3,425 nm*
Airbus A320					
CFM56-5A Series	5,300 ft.	5,700 ft.	5,300 ft.	5,600 ft.	Exceeds Range
CFM56-5B Series	5,200 ft.	5,300 ft.	5,200 ft.	5,300 ft.	Exceeds Range
IAE V2500-A1 Series	5,200 ft.	5,500 ft.	5,200 ft.	5,400 ft.	Exceeds Range
IAE V2500-A5 Series	5,200 ft.	5,200 ft.	5,200 ft.	5,400 ft.	Exceeds Range
Boeing 717					
BR715 Series (@ 18,500 lbs. thrust)	Exceeds Range	Exceeds Range	Exceeds Range	Exceeds Range	Exceeds Range
BR715 Series (@ 21,000 lbs. thrust)	Exceeds Range	Exceeds Range	Exceeds Range	Exceeds Range	Exceeds Range
Boeing 737-700 / 700W					
CFM56-7B20/7B22/7B24 (@ 20,000 lbs. thrust)	7,700 ft.	8,700 ft.	7,300 ft.	8,000 ft.	Exceeds Range
CFM56-7B26 (@ 26,000 lbs. thrust)	5,100 ft.	5,400 ft.	5,100 ft.	5,200 ft.	Exceeds Range
Boeing 737-700ER / 700C / BBJ					
CFM56-7B20/7B22/7B24 (@ 20,000 lbs. thrust)	8,700 ft.	9,800 ft.	8,400 ft.	9,500 ft.	Exceeds Range
CFM56-7B26/7B27 (@ 26,000 lbs. thrust)	5,500 ft.	5,700 ft.	5,300 ft.	5,600 ft.	Exceeds Range
Boeing 737-800 / 800W / BBJ2					
CFM56-7B24/7B26/7B27 (@ 26,000 lbs. thrust)	7,200 ft.	7,900 ft.	7,100 ft.	7,600 ft.	Exceeds Range
Boeing 757-200					
RB211-535E4 Series	5,500 ft.	5,900 ft.	5,500 ft.	5,700 ft.	8,200 ft.
Boeing 767-300	Long-Range Aircraft				
CFM56-5A Series					Exceeds Fuel Capacity
IAE V2500-A1 Series					
IAE V2500-A5 Series					
Boeing 767-300ER					
CFM56-5A Series					8,100 ft.
IAE V2500-A5 Series					8,000 ft.
Boeing 777-200					
IAE V2500-A5 Series					8,100 ft.
Airbus A330-300					
CFM56-5A Series					9,300 ft.
CFM56-5B Series					9,100 ft.
IAE V2500-A5 Series					9,500 ft.

4.4.3 Runway Protection Zone

The purpose of the Runway Protection Zone is to enhance protection of people and property on the ground by restricting land uses that would result in the congregation of people. Preventing these types of uses is best achieved through the airport sponsor's fee-simple ownership of the land within the RPZs. Based on the dimensions identified in **Table 4-13**, the RPZs for Runway 5 and Runway 19 are located within airport property (refer to **Figure 2-1**). The RPZs for Runway 1 and Runway 23 extend beyond airport property (refer to **Figure 4-6** below). It is recommended that the Airport acquire all the unowned parcels within the Runway 23 RPZ as they become available (five parcels totaling 18.95 acres). These parcels should be purchased in whole, but partial acquisitions may be sufficient in some areas. The Runway 1 RPZ contains 2 unowned parcels that are under the protection of an avigation easement. During the design and construction of the Stark State College facility on these parcels, coordination was taken with the Airport to ensure that the facility remains out of the RPZ.

The Airport owns avigation easements over some of these parcels that are recommended for acquisition. Typically, avigation easements restrict vertical construction by giving the Airport the rights of the airspace above a specified height. Although land use restrictions are sometimes worked into these agreements, they typically only restrict uses that could disrupt aircraft flight procedures – such as uses that emit electromagnetic signals that could interfere with navigation instruments and uses that attract birds.

Figure 4-6 – Runway Protection Zone (RPZ) Recommended Acquisitions



Source: CHA, 2013

4.5 INSTRUMENT APPROACH NAVAIDS AND PROCEDURES

Instrument approach capability is predicated on instrument approach NAVAIDs available at an airport and the approach procedure minimums established by the FAA. All of CAK's runways are equipped with a CAT-I Instrument Landing System (ILS), which provides precision approach capabilities with a 200-foot ceiling and a half statute mile visibility – the best possible for CAT-I approaches. RNAV (GPS) approaches are also available to each runway end and VOR approaches to Runways 5 and 23. **Table 4-16** summarizes the available instrument approach procedures at CAK.

The approach capability at CAK is considered to be suitable for an airport of its size, and there has been no explicit demand for additional facilities. However, the feasibility of upgrading one of the ILS systems to CAT-II was evaluated as a part of this Master Plan Update.

Table 4-16 – Instrument Approach Procedures

Runway End	Approach Type	Approach Method	Minimums – Ceiling (AGL) / Visibility
Runway 5	Precision	ILS	200' / ½ mile
		RNAV (GPS)	200' / ½ mile
	Non-Precision	VOR	500' / 1 mile
Runway 23	Precision	ILS	200' / ½ mile
		RNAV (GPS)	200' / ½ mile
	Non-Precision	VOR	500' / 1 mile
Runway 1	Precision	ILS	200' / ½ mile
		RNAV (GPS)	200' / ½ mile
Runway 19	Precision	ILS	200' / ½ mile
		RNAV (GPS)	200' / ½ mile

Source: Akron-Canton Airport Instrument Approach Procedure Charts, accessed September 2014

4.5.1 ILS Upgrade Potential

The feasibility of upgrading one of the ILS systems at CAK was evaluated using the guidance provided in: FAA AC 150/5300-13A, AC 120-29A *Criteria for Approval of Category I and Category II Weather Minima for Approach*, and FAA Order 6750.16E *Siting Criteria for Instrument Landing Systems.* A detailed ILS Upgrade Feasibility Report was prepared and is included in **Appendix B**. A CAT-II ILS would benefit the Airport by lowering the approach visibility minimums to accommodate a greater percentage of landings in poor weather conditions. Historical data recorded by the ASOS at CAK was obtained to determine how often these poor weather conditions occur. The results are presented in **Table 4-17**. Out of 82,953 recorded weather observations from 2000-2009, there were 773 observations during conditions below the minimums at CAK. This indicates that approximately 1 percent of the year, the airport is closed to aviation traffic. A CAT-II ILS would keep the airport open to appropriately trained flight crews and certified aircraft for an additional 0.7 percent of the year.

Table 4-17 – Weather Conditions at CAK (2000 – 2009)

Weather Condition	Criteria	Number of Recorded Observations	Percentage of Occurrence
All Weather *(Total Observations)*	All ceiling and visibility weather conditions	82,953	100%
VMC	Ceiling ≥ 1,000’ and visibility ≥ 3 miles	72,678	87.6%
IMC *Non-Precision and Category I*	Ceiling ≥ 200’ and < 1,000’ and Visibility ≥ ½ mile and < 3 miles	9,502	11.5%
IMC *Category II*	Ceiling ≥ 100’ and < 200’ and Visibility ≥ ¼ mile and < ½ mile	558	0.7%
IMC *Below Category II*	Ceiling < 100’ and Visibility < ¼ mile	215	0.3%

Source: NOAA, National Climate Center, Station 72521 (2000-2009)
VMC: Visual Meteorological Conditions, Visual Flight Rules (VFR) apply
IMC: Instrument Meteorological Conditions, Instrument Flight Rules (IFR) apply

Upgrade Requirements

Upon evaluation of the existing ILS equipment, it was determined that both runways have the potential to meet CAT-II requirements. However, several conditions specific to CAK exist that would need to be addressed prior to being upgraded. These include:

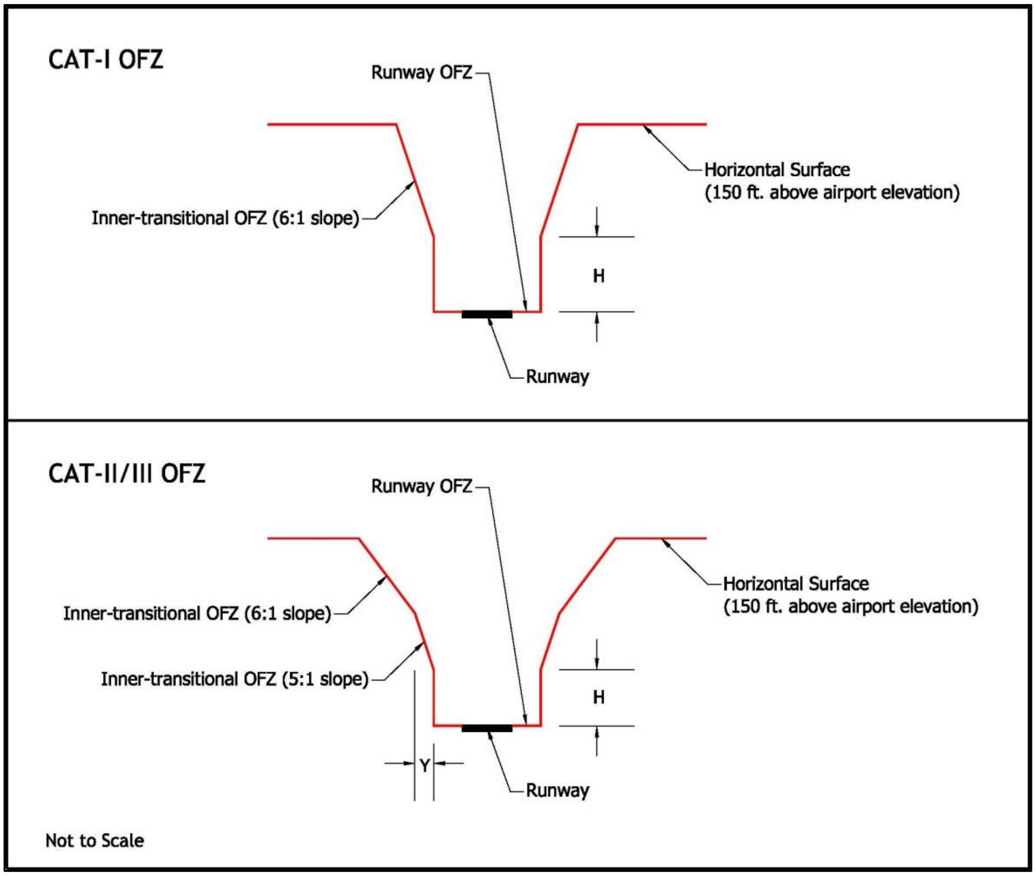
- The Runway 5 glideslope does not meet the required minimum runway centerline offset distance of 400 feet for Category II approaches. Relocation would require extensive fill and grading.
- Both runways have touchdown and rollout RVRs. For runways longer than 8,000 feet – Runway 5/23 – a third midpoint RVR would need to be established.
- Portions of Taxiways B and D penetrate the Runway 23 ILS glideslope critical area. Portions of Taxiways H and J penetrate the Runway 19 ILS glideslope critical area. Ground vehicle or aircraft taxi operations in these areas could cause signal interference during CAT-II approaches. While manageable by ATC, these conditions are not ideal.
- Runway 1/19’s existing ILS equipment would need to be replaced with newer localizer and glide slope hardware to meet the appropriate performance standards for CAT-II procedures.
- Either runway would require lighting upgrades to replace MALSR – High-Intensity Approach Lighting System with Sequenced Flashing Lights (ALSF-2), in-pavement touchdown zone, centerline lighting systems and taxiway turn-off lighting.

Runway 5/23 has ILS equipment that meets the current CAT-II requirements and has the longer landing length of the two runways. Passur Radar data from 2012 indicates that Runway 23 has the highest fixed-wing arrival utilization – approximately 42 percent. At this point, the Runway 23 ILS would appear to be the preferred ILS to upgrade to CAT-II.

Impacts to OFZ Object Free Zone (OFZ)

According to AC 150/5300-13A, lowering the existing approach visibility minimums to less than a 200-foot ceiling and a half mile visibility (CAT-I) would require modification of OFZ dimensions of the affected runway. The modification of OFZ dimensions applies to the vertical H and inner-transitional surfaces illustrated in **Figure 4-7**.

Figure 4-7 – CAT-I and CAT-II/III OFZs



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

As seen above, the inner-transitional surface of the OFZ starts at the top of the vertical dimension H. For a CAT-I OFZ, the H is equal *to 61 – 0.094(S) – 0.003(E)*. For a CAT-II/III OFZ, the H is equal to *53 - 0.13(S) – 0.0022(E)*. S is equal to the most demanding wingspan of the RDC of the runway; and E is equal to the runway threshold elevation above sea level. Using the Boeing 737-800's wingspan (112.58 feet) and Runway 23's threshold elevation (1,225.4 feet MSL), the CAT-I H dimension was calculated to be 46.74 feet; the CAT-II/III H dimension was calculated to be 35.66 feet.

While a CAT-I OFZ has a single inner-transitional surface of 6:1 extending to the horizontal surface, a CAT-II/III OFZ has two inner-transitional surfaces. The first surface has a 5:1 slope for a horizontal distance of Y, equal to *440 + 1.08(S) - .024(E)*. This was calculated to be 532.18 feet. At that point, the second surface begins, and extends at a 6:1 slope until it reaches the horizontal surface.

The results of this analysis indicate that a CAT-II/III ILS would place greater restrictions on object heights around Runway 5/23, so that the lower surfaces of the new OFZ are not penetrated. The height of the existing facilities and structures at CAK are currently below these surfaces, and would not require removal or modification.

Summary

Based on this evaluation, upgrading CAK to CAT-II ILS capability would provide benefit to many of the airport's users and stakeholders. While both runways at CAK could be developed to support CAT-II operations, Runway 5/23 has the longer landing length and newest ILS equipment and is therefore the most likely candidate for upgrade. Due to its predominate utilization for approaches by all turbine aircraft, Runway 23 would be the priority end to upgrade. It appears that the existing facilities and ILS equipment associated with Runway 23 could support "Special Authorization" CAT-II approach procedures with modest navaid equipment upgrades, modifications to the runway lighting backup generator and power source feeds, and minor airfield marking improvements. This is described in more detail in the ILS Upgrade Feasibility Report included in **Appendix B**. Development of a Standard CAT-II ILS system at CAK would require a new approach lighting system (ALSF-2), installation of runway centerline and touchdown zone lighting, and installation of a Far Field Monitor and midpoint RVR. Either scenario would also require changes to the system monitoring procedures performed by maintenance and air traffic control personnel. Air traffic control staff would also require additional training to manage the new approach procedures.

4.6 TAXIWAYS

The taxiway system links the runway and other operational areas at an airport. An effective taxiway system allows for the orderly movement of aircraft and enhances operational efficiency and safety by reducing the potential for congestion, runway crossings and pilot confusion.

4.6.1 Design Goals

The overall goal of airfield planning and design is to enhance the efficiency and margin of safety of all operational activities. Through discussions with the Authority and review of current FAA guidance, the following goals were identified for CAK's ongoing taxiway system development.

Accommodate all existing and projected users. The existing and forecasted commercial and general aviation fleet mix should be considered when designing the taxiway system. Existing tenants and user groups should also be considered.

Reduce runway crossings. The opportunity for runway minimizing the number of runway crossings can reduce incursions.

Reduce risk of pilot confusion. Complexity of a taxiway system can lead to pilot confusion, which can lead to human error and the increased potential for runway incursions. Reducing the risk of pilot confusion includes: reducing the number of taxiways intersecting at a single location, increasing the pilot's situational awareness – through proper signage and marking, avoiding wide expanses of pavement, removing hot spots and increasing visibility.

Allow for expandability of all Airport facilities. The taxiway system should be designed with the long-term expansion of other aviation facilities in mind. The ability to provide efficient airside access to developable parcels of Airport land should be considered.

Adhere to all FAA design standards (based on ADG and TDG). Taxiways should be developed to the appropriate FAA standards associated with the ADG and TDG of the aircraft, for which the specific taxiway is intended to accommodate.

4.6.2 Taxiway Design Standards

Similar to runways, taxiways are subject to FAA design requirements such as pavement width, edge safety margins, shoulder width and safety and object free area dimensions. The FAA standards in relation to taxiways, as defined in AC 150/5300-13 *Airport Design,* are described below.

Taxiway Width – The physical width of the taxiway pavement.

Taxiway Edge Safety Margin – The minimum acceptable distance between the outside of the airplane wheels and the pavement edge.

Taxiway Shoulder Width – Taxiway shoulders provide stabilized or paved surfaces to reduce the possibility of blast erosion and engine ingestion problems associated with jet engines that overhang the edge of the taxiway pavement.

Taxiway/Taxilane Safety Area (TSA) – The TSA is located on the taxiway centerline. It shall be: cleared and graded, properly drained and capable, under dry conditions, of supporting snow removal equipment, ARFF equipment and the occasional passage of aircraft without causing structural damage to the aircraft.

Taxiway/Taxilane Object Free Area (TOFA) – The TOFA is centered on the taxiway centerline. It prohibits service vehicle roads, parked airplanes and above ground objects – except for objects that located in the TOFA for air navigation or aircraft ground maneuvering purposes.

Taxiway Separation Standards – Separation standards between the taxiways and other airport facilities are established to ensure operational safety of the airport:

- Taxiway centerline to parallel taxiway/taxilane centerline
- Taxiway centerline to fixed or movable object

The dimensions for each of these standards vary according to the group of aircraft the taxiways are intended to accommodate. With consideration of CAK's design aircraft family, **Table 4-18** identifies the geometric requirements for ADG-III, IV and V; and **Table 4-19** identifies the requirements for TDG-3, 4, 5 and 6.

Table 4-18 – Taxiway Design Standards based on Airplane Design Group (ADG)

Design Standard	ADG		
	III	IV	V
Protection Standards			
Taxiway Safety Area (TSA) Width	118 feet	171 feet	214 feet
Taxiway Object Free Area (TOFA) Width	186 feet	259 feet	320 feet
Wingtip Clearance	34 feet	44 feet	53 feet
Paved Taxiway Shoulders	Recommended	Required	
Separation Standards			
Taxiway Centerline to Parallel Taxiway	152 feet	215 feet	267 feet
Taxiway Centerline to Fixed or Moveable Object	93 feet	129.5 feet	160 feet

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

Table 4-19 – Taxiway Design Standards based on Taxiway Design Group (TDG)

Design Standard	TDG			
	3	4	5	6
Protection Standards				
Taxiway Width	50 feet		75 feet	
Taxiway Edge Safety Margin	10 feet		15 feet	
Taxiway Shoulder Width[1]	20 feet		30 feet	
Separation Standards				
Taxiway Centerline to Parallel Taxiway	162 feet	240 feet		312 feet

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

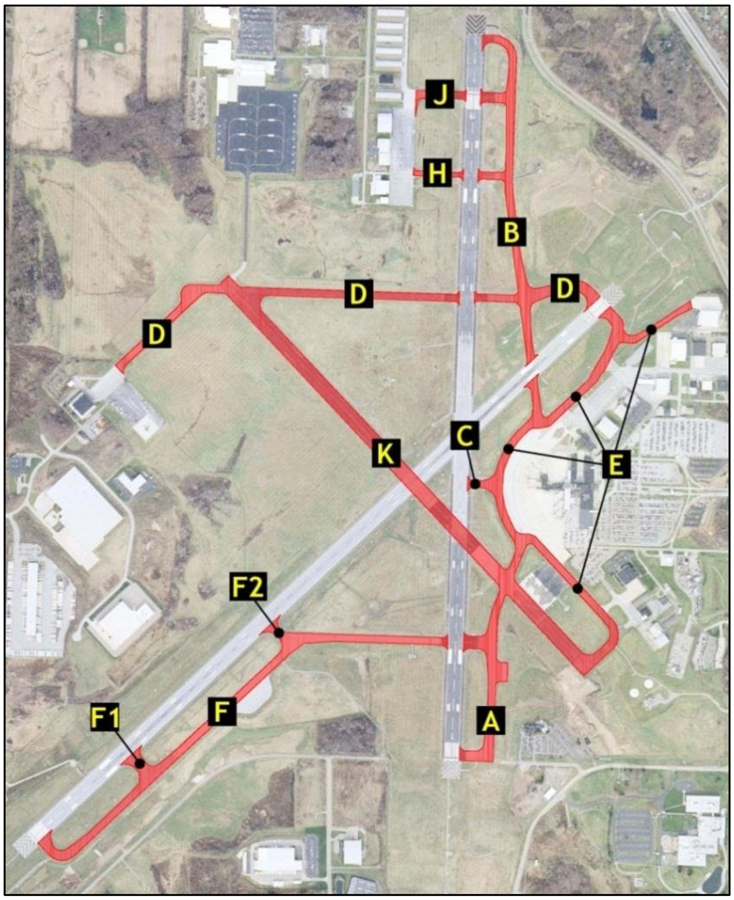
4.6.3 Current System

The existing taxiway system at CAK is depicted in **Figure 4-8**. All taxiways are 75-feet wide, constructed of bituminous asphalt and meet or exceed the ADG-III and TDG-3 design standards[6]. Taxiway K is an exception, with 150-foot wide remnants of the decommissioned Runway 14/32. The majority of aircraft in the design aircraft family fall into these two aircraft classifications. Exceptions include the McDonnell Douglas MD-88 (ADG-III, TDG-4),

[6] It should be noted that the existing taxiways were designed and constructed prior to FAA's revised Taxiway Design Group based fillet methodology described in the 2012 release of AC 150/5300-13A. The current system meets all applicable previous FAA standards. Future taxiway development will need to be in accordance with the FAA standards in effect at that time.

infrequent operations by the based Boeing 747SP (ADG-V, TDG-5) and transient Boeing 757-200/300 (ADG-IV, TDG-4). According to forecasts presented in **Chapter 3**, it is anticipated that scheduled airline service by MD-88s will be phased out of CAK by 2016. It is recommended that the primary taxiway system at CAK be maintained to the minimum of ADG-III and TDG-3 requirements.

Figure 4-8 – Existing Taxiway Configuration



Source: CHA, 2013

4.6.4 Issues and Recommendations

While the existing taxiway system is adequate and manageable for current airfield activities, there are some issues and operational efficiencies that could be improved. In an effort to maximize long-term aeronautical use of airport property – for commercial and general aviation operators – additional taxiways or modifications to the current configuration may also be necessary. The various taxiway concerns and requirements are addressed below.

Large Aircraft Accommodation

At CAK, there are occasional operations from aircraft larger than ADG-III and TDG-3, such as the Boeing 747SP (ADG-V, TDG-5), the Boeing 757-300 (ADG-IV, TDG-4), the Airbus A300-600 (ADG-IV, TDG-5), and the Boeing C-17 Globemaster III (ADG-IV, TDG-5). Although operations from these types of aircraft are infrequent, it is recommended that the capability of accommodating these aircraft be preserved. The existing taxiway system meets or exceeds the ADG-III and TDG-3 standards. The existing 75-foot wide taxiways are capable of accommodating aircraft in the ADG-IV and V categories on an occasional basis and with special attention from air traffic control. No improvements to increase the ADG or TDG of the taxiways at CAK are warranted at this time. However, should operation by these aircraft become more frequent, the Authority should consider upgrading some of their taxiways to ADG-V and TDG-5 standards. The design requirements to accommodate this increase are presented in **Table 4-20**.

Table 4-20 – ADG/TDG Upgrade Requirements

Upgrade	Impacts
ADG-IV or ADG-V	• Paved shoulders required • TSA / TOFA widths impacted • Taxiway centerline to fixed or moveable object distance impacted • Distance to hold lines increased
TDG-4	• Paved shoulders required if ADG is IV or higher
TDG-5	• Paved shoulders required if ADG is IV or higher • Taxiway Edge Safety Margin increased

Source: AC 150/5300-13A *Airport Design*

West Side Access

The current taxiway configuration often requires circuitous routing and multiple runway crossings to access the various runway ends. This is particularly true for the general aviation users and tenants on the west sides of the airfield. The recommended land use plan focuses on general aviation development on the west side. To support the future development of facilities (i.e., hangars, aprons, cargo handling, aircraft maintenance) on the west side, and to reduce the need to cross active runways while taxiing to and from the operational runway ends, additional taxiway infrastructure will need to be added. This can be accomplished through development of full or partial parallel taxiways, additional exit taxiways and modifications to the exiting taxiways J, H, D and K. Taxiway configuration must also maintain access to the National Guard facilities and the MAPS Museum. Recommendations for a preferred configuration of the west side taxiway system will be discussed in **Chapter 6**.

Full Length Parallel Taxiway

The FAA requires a full-length parallel taxiway be coupled with a precision instrument runway that provides approach minimums of less than one-mile visibility and a decision height of less than 250 feet. Both runways at CAK support half-mile visibility and 200-foot decision height. While neither of the runways at CAK have a continuous, parallel taxiway consistent with FAA guidance, the intent is fulfilled by a series of taxiways parallel to the runways and taxiing between each runway end without crossing the runway. For example, taxiways F, A and E span the length of Runway 5-23 and taxiways B, E and A span the length of Runway 1-19.

While these taxiways provide access to all runway ends, they are all on the east side of the airfield and do result in aircraft following circuitous routes, crossing active runways and taxiways – and navigating around the commercial apron. This holds especially true for those aircraft beginning or ending operations on the west side general aviation area. When takeoffs are being conducted on Runway 5 or landings on Runway 23, aircraft must cross three runways during their taxi. Developing at least portions of west side parallel taxiways to both runways will increase efficiency and reduce the potential of airfield incursions. FAA air traffic control staff has acknowledged the operational benefits of improved west side taxiway facilities. The ability to improve operational efficiency, reduce runway crossings and support west side access through the development of improved parallel taxiways will be examined in **Chapter 6**.

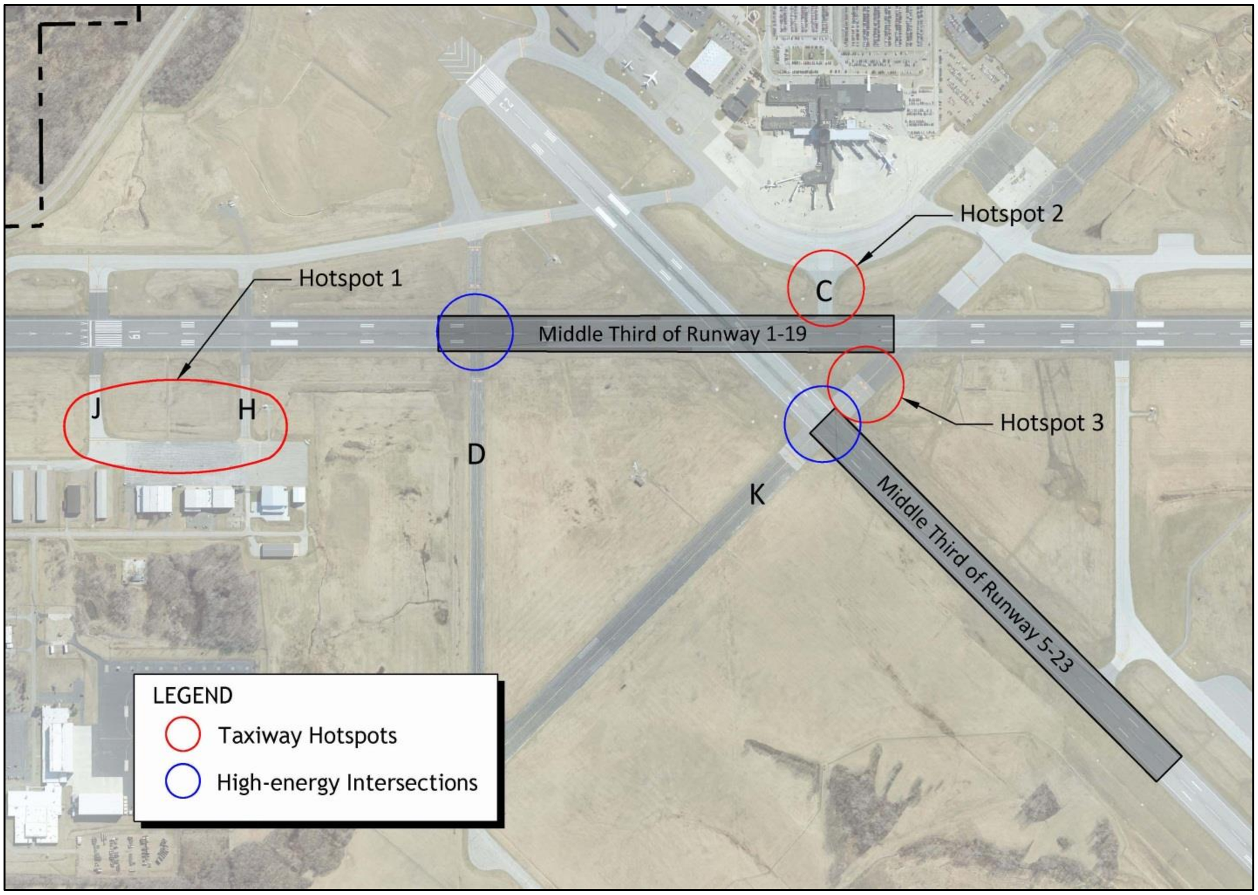
Hot Spots and High Energy Intersections

Taxiway hot spots are intersections or locations on the airfield that are considered complex or confusing and may cause aircraft separation standards to be compromised or increase the potential for runway incursion. Because these areas require heightened attention by pilots and drivers, the FAA has initiated a program to identify and document known hot spots on the published FAA Airport Diagrams.

High energy intersections are those in the middle third of the runways. This is the portion of the runway where the pilot is thought to have the least maneuverability to avoid a collision.

The FAA has identified three hot spots at CAK depicted in **Figure 4-9** and described in the following paragraphs. Additionally, Taxiway D is located in the middle third of Runway 1-19 and Taxiway K crosses the middle third of both runways. Taxiway geometry should be improved to remove or mitigate hot spots and high-energy intersections.

Figure 4-9 – Taxiway Hot Spots and High-Energy Intersections



Source: CHA, 2013

At Hot Spot 1, the ILS hold short lines are at the immediate edge of the transient apron. While well marked, this location may not be readily anticipated – particularly by transient pilots – which could lead to aircraft entering the taxiway prematurely. Additionally, aircraft holdings at these positions become obstacles for other aircraft attempting to maneuver around the apron. Currently, due to the location and nature of the ILS critical area and space constraints within the exiting west side general aviation facilities, neither the relocation of the ILS nor the reconfiguration of the apron is readily feasible. FAA ground control manages traffic in this area. However, long-term planning, development and expansion of the west side facilities should strive to minimize this hot spot through improved taxiway circulation and apron access.

Due to its proximity to the intersection of the two runways, Hot Spot 2 holds the short line on Taxiway C, serving to hold aircraft for both runways. This configuration and the resulting maneuvering between: the commercial apron, Taxiway C and either of the runways could lead to pilot confusion. Additionally, as a midfield exit from Runway 1-19, Taxiway C could appear to a pilot to lead directly onto the commercial apron, even though it intersects Taxiway E, which spans the perimeter of the apron. Improvements to the taxiway configuration, including possible modifications to taxiways F, K and E could enable the removal of Taxiway C while maintaining adequate runway exit capability.

Hot Spot 3 was identified due to the hold short lines on Taxiway K between Runway 1-19 and Runway 5-23 being so close together, potentially causing confusion to pilots attempting to cross the two active runways. With the close proximity of the intersection between both runways and Taxiways K and C and the fact that Taxiway K is considered a high-energy intersection for both runways, this configuration is less than ideal. While FAA ground and air traffic control can manage the traffic flow in this area, reconfiguration of Taxiway K, coordinated with improving access and circulation on the west side, is strongly encouraged.

West of Runway 1-19, Taxiways D and K essentially serve the same function – providing airside access from the terminal area to the National Guard and MAPS aprons. Taxiway K east of Runway 1-19 provides access to and from the south deicing pad and the new ARFF facility. The removal or abandonment of Taxiway K west of Runway 1-19 would eliminate Hot Spot 3 and taxiway crossings in the middle third of both runways. The ability to modify Taxiway K and maintain sufficient cross field access will be evaluated in **Chapter 6**.

Restrictions on Taxiway E

The section of Taxiway E east of Taxiway B is limited to aircraft with wingspans less than 118 feet (i.e., ADG-III). While this is satisfactory for the majority of the design aircraft family, it does limit the ability of the occasional large aircraft to directly access Runway 23 from the terminal area. The separation distance between Taxiway E and Runway 5-23 in this area is more than 500 feet. Consistent with other sections of parallel taxiways at CAK and in accordance with FAA standards for aircraft up to ADG-V and approach minimums at least a half-mile, realigning this section of Taxiway E to a 400-foot separation and adding a bypass taxiway would eliminate this concern. This reconfiguration would also reduce aircraft-turning movements and improve circulation, particularly near the north de-icing pad and north transient apron.

Exit Taxiways

Exit taxiways are connectors used by aircraft exiting the runway and providing free flow to the adjacent parallel taxiway, at least to a point where the aircraft is completely clear of the hold line. There are three basic types of exit taxiways:

> Right Angle – These are configured 90 degrees perpendicular to the runway and depending on longitudinal location, can be used by aircraft in either direction. FAA guidance suggests that right-angled exits will typically provide adequate traffic flow for airfields when peak hour activity is less than 30 operations. As identified in Chapter 3 or **Table 4-1**, peak hour commercial operations are anticipated to remain below 30 through PAL 4. However, total airport operations could reach 30 in the peak hour by PAL 3. Right-angled exits are also most commonly used at runway ends, serving as an exit and entrance taxiway; and at runway crossing points, as they provide taxiing pilots with the best view of runway in both directions.

Acute Angle – Due to site constraints, engineering concerns or desired traffic flow, an exit taxiway orientation of less than 90 degrees is often preferred. These are typically configured between 30 and 45 degrees from the runway centerline and go in one direction (i.e., exit only).

High-Speed – These exit taxiways are intended to enhance capacity by allowing aircraft to exit the runway onto a parallel taxiway at a relatively high rate of speed. The exit angle is typically 30 degrees.

In each operating direction, there are multiple runway exits available for aircraft landing at CAK. The majority of these exits are right-angled. However, Taxiways K and B provide angled exits. There are currently no high-speed exits. The recommended minimization of hot spots and high-energy intersections, like the removal of Taxiway C and sections of Taxiway K, will result in fewer exit taxiways, requiring some aircraft to travel further along the runway prior to exiting. The FAA provides guidance on evaluating an exit taxiway's use percentage or capture rate by aircraft size of an exit taxiway, based on the exit's distance from the landing threshold. An analysis of the existing exit taxiways is provided in **Table 4-21**.

FAA air traffic control (ATC) staff at CAK have identified an operational need for an additional exit serving commercial aircraft landing on Runway 23 – the predominant arrivals runway (i.e., 44% of commercial arrivals). As indicated in **Table 4-21**, the majority of large aircraft cannot effectively use Taxiway K as an exit. However, ATC staff note that many are at taxi speed after Taxiway K and prior to Taxiway F2. They want to have an additional exit located between K and F2 – preferably a high-speed exit – to reduce runway occupancy time particularly during peak activity periods. The estimated capture rate of a potential exit located half way between taxiways K and F2 is also identified in **Table 4-21**. The ability to develop an exit taxiway in this location will be discussed in **Chapter 6**, along with recommendations for an overall taxiway configuration.

Table 4-21 – Exit Taxiway Cumulative Utilization Percent

Exit	Type	Distance from Threshold	Wet Runway				Dry Runway			
			S	T	L	H	S	T	L	H
Runway 1 End										
Exit 1 - Taxiway F	Right	1,240 ft.	4	0	0	0	6	0	0	0
Exit 2 - Taxiway K	Acute	2,385 ft.	60	0	0	0	90	1	0	0
Exit 3 - Taxiway C	Right	2,890 ft.	84	1	0	0	99	10	0	0
Exit 4 - Taxiway D	Right	4,840 ft.	100	97	4	0	100	100	24	2
Exit 5 - Taxiway H	Right	6,120 ft.	100	100	48	10	100	100	92	71
Exit 6 - Taxiway J	Right	6,945 ft.	100	100	71	35	100	100	98	90
Exit 7 - Taxiway B	Right	7,540 ft.	100	100	97	84	100	100	100	100
Runway 19 End										
Exit	Type	Distance from Threshold	Wet Runway				Dry Runway			
			S	T	L	H	S	T	L	H
Exit 1 - Taxiway H	Right	865 ft.	0	0	0	0	0	0	0	0
Exit 2 - Taxiway D	Right	2,148 ft.	60	0	0	0	84	1	0	0
Exit 3 - Taxiway C	Right	4,095 ft.	100	80	1	0	100	98	8	0
Exit 4 - Taxiway K	Acute	4,600 ft.	100	97	4	0	100	100	51	19
Exit 5 - Taxiway F	Right	5,755 ft.	100	100	27	0	100	100	75	24
Exit 6 - Taxiway A	Right	6,945 ft.	100	100	71	35	100	100	98	90
Runway 5 End										
Exit	Type	Distance from Threshold	Wet Runway				Dry Runway			
			S	T	L	H	S	T	L	H
Exit 1 - Taxiway F1	Right	1,340 ft.	4	0	0	0	6	0	0	0
Exit 2 - Taxiway F2	Right	3,330 ft.	96	10	0	0	100	39	0	0
Exit 3 - Taxiway K	Right	5,435 ft.	100	100	12	0	100	100	49	9
Exit 4 - Taxiway B	Acute	7,140 ft.	100	100	88	64	100	100	100	100
Exit 5 - Taxiway D/ E	Right	8,160 ft.	100	100	100	93	100	100	100	100
Potential Exit Between F1 & K - 4,500 ft.		4,500 ft.	100	97	4	0	100	100	24 (Right) 51 (Acute)	2 (Right) 19 (Acute)

S - Small, single engine, 12,500 lbs or less   L - Large, 12,500 lbs to 300,000 lbs
T - Small, twin engine, 12,500 lbs or less   H - Heavy, 300,000 lbs

Table continued on Next Page

Runway 23 End										
Exit	Type	Distance from Threshold	Wet Runway				Dry Runway			
			S	T	L	H	S	T	L	H
Exit 1 - Taxiway B	Acute	1,045 ft.	4	0	0	0	13	0	0	0
Exit 2 - Taxiway K	Right	2,760 ft.	84	1	0	0	99	10	0	0
Exit 3 -Taxiway F2	Right	4,840 ft.	100	97	4	0	100	100	24	2
Exit 4 - Taxiway F1	Right	6,845 ft.	100	100	71	35	100	100	98	90
Exit 5 - Taxiway F	Right	8,160 ft.	100	100	100	93	100	100	100	100
Potential Exit Between F1 & K - 3,715 ft.		3,715 ft.	99	41	0	0	100	81 (Right) 82 (Acute)	2 (Right) 9 (Acute)	0
S - Small, single engine, 12,500 lbs or less T - Small, twin engine, 12,500 lbs or less			L - Large, 12,500 lbs to 300,000 lbs H - Heavy, 300,000 lbs							

Source: CHA, 2013

Bypass Capability and Holding Bays

Providing bypass capability at each runway end allows aircraft with received clearance to move into the takeoff position and go around those that are awaiting departure clearance or performing pre-flight run-ups. This can be accomplished by either bypass taxiways or holding bays. Due to the nature of a separate location, bypass taxiways are recommended for segregating the mix of large and small aircraft at the departure runway, since smaller aircraft may not require the full runway length. Alternatively, holding bays provide a standing space for aircraft off the taxiway path to the runway end, improving overall circulation and efficiency.

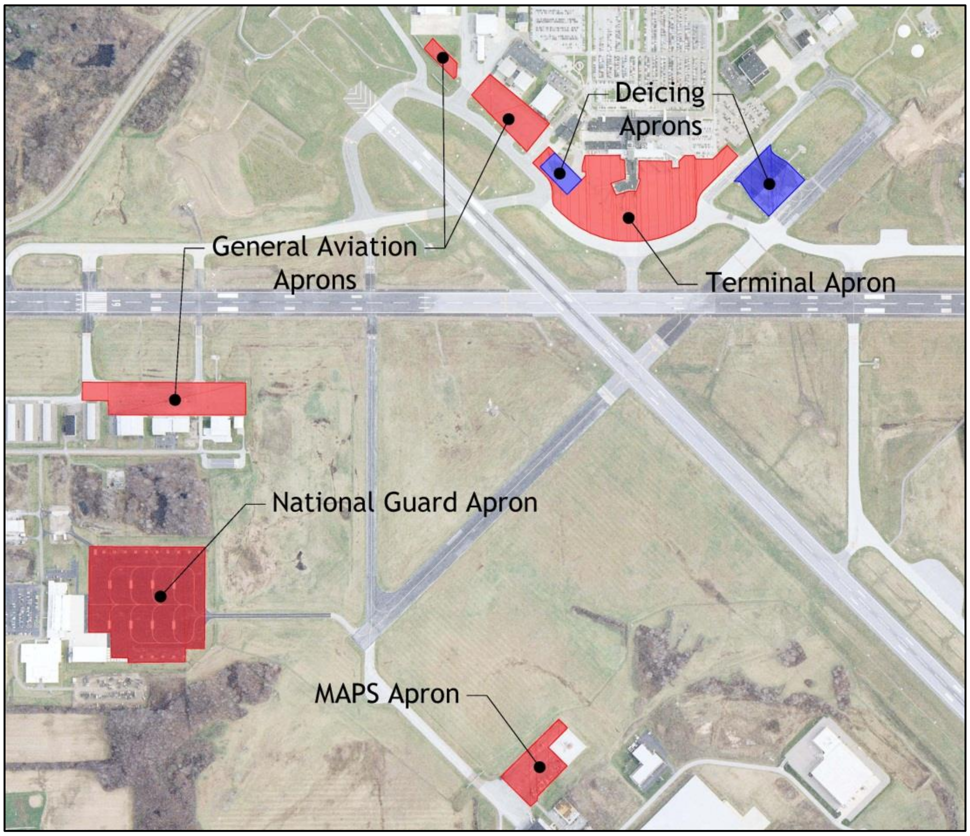
At CAK, bypass taxiways are provided at each runway end and holding bays are provided near Runways 1 and 5. With the development of GA facilities on the west side of the airfield and associated taxiway infrastructure, the interaction between large and small (i.e., commercial and personal) aircraft will be minimized. With Runway 23 being the primary departure runway – particularly for commercial aircraft – due to its proximity to the commercial apron, it would be desirable to have a holding bay near that runway. Additionally, the FAA recommends developing holding bays when peak hour activity reaches a level of 30 operations per hour[7] that could be reached by PAL 3. The ability to develop holding bays at CAK is limited due to steep terrain constraints and existing infrastructure. The feasibility of developing a holding bay to serve Runway 23 will be addressed in **Chapter 6**, along with recommendations for an overall taxiway configuration.

[7] FAA Advisory Circular 150/5300-13A *Airport Design*, Sec. 412

4.7 APRONS

Aircraft parking aprons are intended to accommodate a variety of functions, including loading and unloading passengers or cargo, refueling, servicing, maintenance, aircraft parking and any movements of aircraft, vehicles and pedestrians necessary for such purposes. As depicted in **Figure 4-10**, there are five distinct apron areas at CAK serving various functions.

Figure 4-10 – Apron Areas

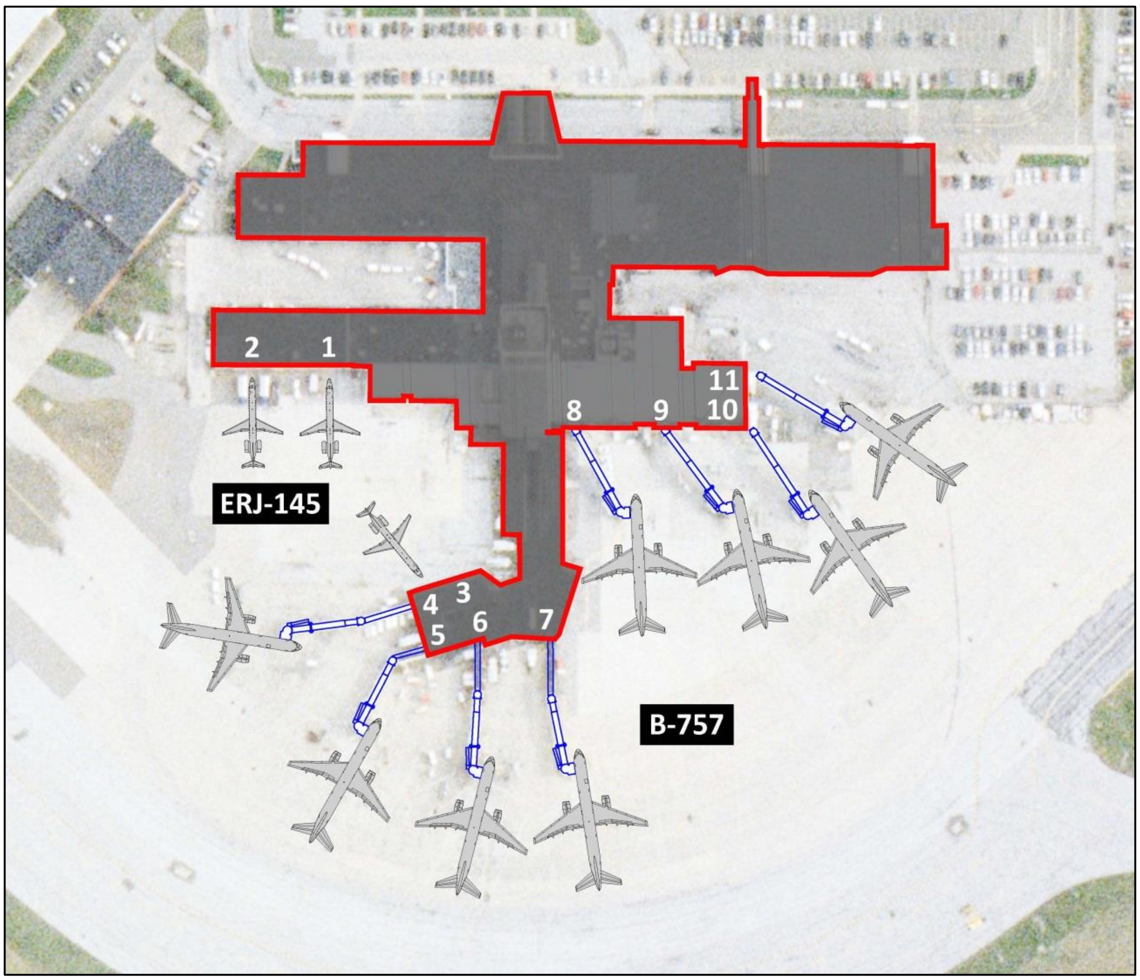


Source: CHA, 2013

4.7.1 Terminal Apron

The terminal apron is comprised of the facilities used for commercial aircraft gate parking, airline support and servicing operations. **Figure 4-11** depicts the existing terminal apron and gate configuration. Gates 4-11 include passenger-boarding bridges (PBB) capable of supporting up to Boeing 757 aircraft. Gates 1-7 are lower-level boarding and Gates 8-11 are second-level boarding. Due to the configuration of Gates 1-3, all three gates cannot be used simultaneously. While the PBBs are capable of accommodating Boeing 757s – providing operational flexibility in accommodating airline needs – eight 757s cannot be accommodated simultaneously. Concerns related to the ongoing development and operation of the terminal apron are addressed in the following subsections.

Figure 4-11 – Existing Gate Configuration



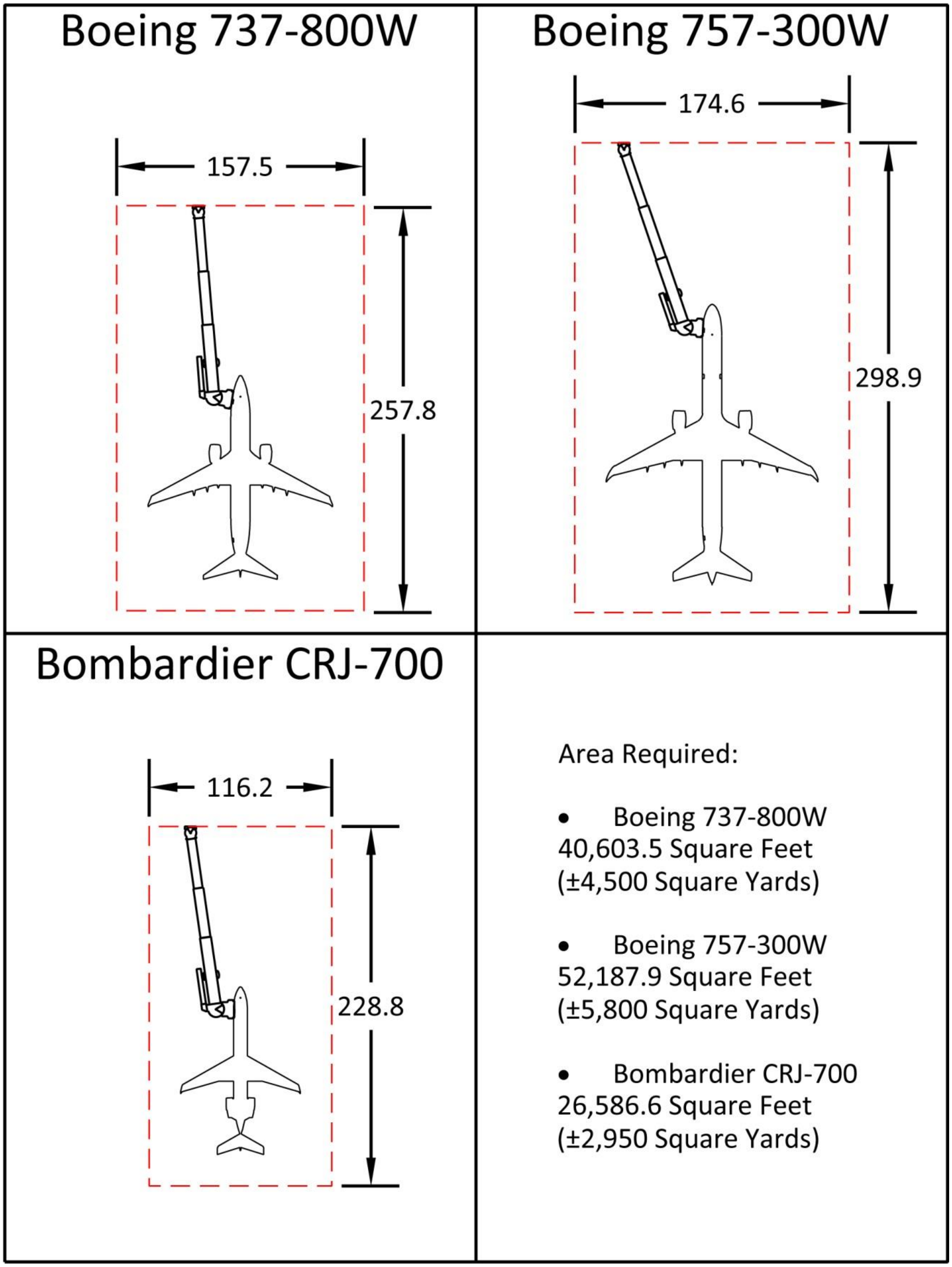
Source: CHA, 2013

Size and Configuration

The size and configuration of the terminal apron is driven by the number of gates and terminal configuration; the type of aircraft to be accommodated at each gate; airline safety and setback requirements; airfield configuration; apron maneuvering; and FAA design standards. Adjacent buildings and land uses, security procedures, utility corridors, storm water management and drainage infrastructure, and other site/terrain constraints also influence the layout of the terminal apron. Because of these variables, the need to identify terminal building requirements and a recommended development concept, the amount of additional commercial apron space needed over the planning horizon cannot yet be quantified. While overall terminal area development will be addressed in **Chapter 6**, the following represents a typical per gate space requirement to be considered in ongoing site planning.

The diagrams in **Figure 4-12** represent second-floor boarding gates with minimum – or optimal – slope on the passenger boarding bridges and 20-foot clearances on all sides of the aircraft. Based on this analysis, future airport planning should aim to provide ±4,500 SY for narrow body aircraft gates and ±2,950 SY for regional jet gates. For comparative purposes, the next likely size of aircraft to use the airfield – Boeing 757-300W, ADG-IV, TDG-6 – is included to show the space required (±5,800 SY) to accommodate these larger aircraft. These space requirements are for planning purposes only. Alternate parking configurations and PBB slopes could optimize the gate/apron configuration and possibly reduce the overall apron space requirement.

Figure 4-12 – Apron Space Requirements

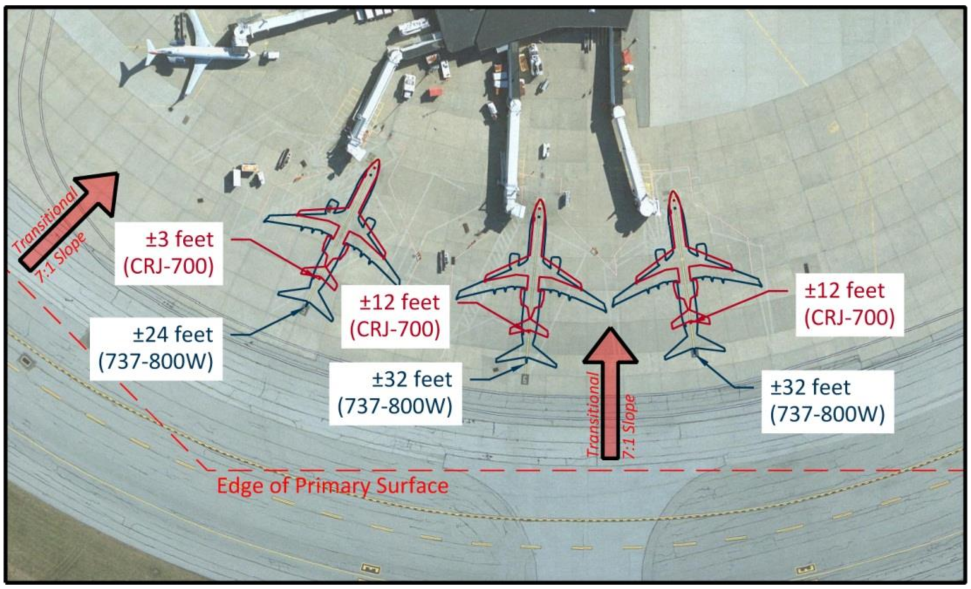


Source: CHA, 2013

Part 77 Concerns

Federal Aviation Regulation (FAR) Part 77 establishes imaginary surfaces for determining obstructions to air navigation. These surfaces are described in detail in **Section 4.16**. Due to the close proximity of the single story pier concourse that contains Gates 3-7 to both active runways, the tails of the aircraft parked at these gates penetrate the transitional surfaces and extend outward and upward from the edges of the primary surface of each runway. The extent of the penetration is based on the aircraft type, shown in **Figure 4-13**. It is recommended that this concourse be relocated away from the runways.

Figure 4-13 – Airspace Concerns – Terminal Apron



Source: CHA, 2013

Snow Storage

Snow from the terminal apron is currently cleared and piled in a ±6,000 SF area, left to melt naturally. This area is adjacent to the north de-icing pad, between the terminal building and previous ARFF building (refer to **Figure 4-14**). To date, snow storage on the terminal apron has not been deemed a significant problem at CAK, but could impede operation of the deicing pad during years of significant snowfall. In addition, this location may need to be reclaimed for future terminal building expansion or apron reconfiguration. While overall terminal area development will be addressed in **Chapter 6**, it is recommended that alternate locations be identified for future snow storage sites. Any stormwater management and environmental concerns related to snow disposal will be addressed in **Chapter 6**.

Figure 4-14 – Snow Piling Area

Source: CHA, 2013

Ground Service Equipment Storage

The airlines at CAK possess and operate their own ground service equipment (GSE), including a variety of aircraft tugs, pushbacks, cabin service vehicles, deicers, ground power units (GPUs), belt-loaders and waste disposal vehicles. Due to a lack of storage space near the terminal area, this equipment is often stored outside wherever free space is available. If provided with a shelter from harsh weather conditions, the service life of the equipment could be significantly increased. The airlines have expressed a desire to have a dedicated storage facility to protect critical equipment from the elements. Analysis of the airlines' GSE inventory indicates that approximately 18,000 SF of space would be sufficient to house the equipment.

4.7.2 Remain Overnight (RON) Parking

There is currently no designated RON parking apron at CAK. Commercial aircraft typically park overnight at the terminal gates. While this currently serves the airlines' needs, additional parking may be needed in the future. Large charter aircraft will often overnight at the Airport during events like the Pro Football Hall of Fame Induction Ceremony or the Professional Golf Tournament in Akron. Information provided by the Airport staff indicates that it is not uncommon for aircraft as large as a Boeing 757 or 767 to overnight at the airport during these events. In addition, large charter or private aircraft, such as the 747SP and the 737-200 based at the Airport, are often parked in front of the PSA Hangar or on infrequently used taxiways. For these reasons, it is recommended that two to three RON parking positions be provided at PAL 1 and should accommodate aircraft as large as ADG-IV. This project could be incorporated into a future terminal expansion project.

4.7.3 General Aviation Aprons

Because GA activity represents approximately 56 percent of total annual airport operations, an evaluation of existing and future GA parking requirements was performed. Special annual events such as the Pro Football Hall of Fame Enshrinement Festival in August and the Cleveland National Air Show in September contribute to the peak number of transient aircraft operations experienced by the Airport.

For the purpose of this analysis, a peak month-average day (PMAD) methodology was used to gauge the approximate number of GA aircraft parked on the apron during an average day of the peak month. The following is a description of the PMAD aircraft parking metric shown in **Table 4-22**.

GA Itinerant Operations – According to the CAK TAF data for 2011 - described in **Chapter 3** – itinerant GA operations accounted for approximately 62 percent of total GA operations.

GA Peak Month Itinerant Operations – According to 2011 data obtained from the Air Traffic Control Tower at CAK, the month of August experienced the greatest number of GA itinerant operations, approximately 11 percent.

GA PMAD Operations – The GA peak month itinerant operations were divided by the number of days in August 31.

GA Itinerant Arrivals – The number of PMAD operations was reduced by half to derive the approximate number of GA itinerant arrivals requiring parking.

GA Itinerant Aircraft Parked on the Apron – According to the Fixed Based Operators, approximately 80 percent of the GA itinerant arrivals remain parked on the apron for an extended period during the day. Therefore, adequate parking space should be provided for the number of aircraft anticipated to use the apron during an average day of the peak month.

Table 4-22 – GA Itinerant Aircraft Parked on the Apron

	2011	PAL 1	PAL 2	PAL 3	PAL 4
GA Operations	47,641	48,938	50,046	51,181	52,341
GA Itinerant Operations	31,827	34,676	35,416	36,212	37,074
GA Transient Operations (70%)	22,279	24,273	24,791	25,348	25,951
GA Peak Month Transient Operations	2,451	2,670	2,727	2,788	2,855
GA PMAD Transient Operations	79	86	88	90	92
GA Transient Arrivals	40	43	44	45	46
GA Transient Aircraft Parked on the Apron	32	34	35	36	37

Source: CHA, 2013

According to 2011 data, itinerant operations comprised of approximately 26 percent single and multi-engine piston aircraft, 24 percent turboprop and 50 percent business jet. Applying these percentages to the number of GA itinerant aircraft parked on the apron at peak periods produced the number of each type of aircraft that will need space for parking. General planning assumptions and professional experience were used to determine the following apron space requirements for the different aircraft types:

- Single/Multi-Engine Piston = 1,300 square yards per aircraft
- Turboprop = 2,440 square yards per aircraft
- Business Jet = 2,940 square yards per aircraft

Between the GA west apron (±28,000 SY) and the aprons in the north GA area (±50,000 SY), there is approximately 78,000 SY of apron space currently available for GA itinerant aircraft. **Table 4-23** shows the apron space needed to support existing and future demand.

Table 4-23 – Transient Apron Space Requirement

Aircraft Type	2011	PAL 1	PAL 2	PAL 3	PAL 4
Single/Multi-Engine Piston	8 10,400 SY	9 11,700 SY	9 11,700 SY	9 11,700 SY	10 13,000 SY
Turboprop	8 19,520 SY	8 19,520 SY	8 19,520 SY	9 21,960 SY	9 21,960 SY
Business Jet	16 47,040 SY	17 49,980 SY	18 52,920 SY	18 52,920 SY	19 55,860 SY
Total Space Required	**76,960 SY**	**81,200 SY**	**84,140 SY**	**86,580 SY**	**90,820 SY**
Total Existing Apron Space	**78,000 SY**	**78,000 SY**	**78,000 SY**	**78,000 SY**	**78,000 SY**
Space Deficit	**(1,040 SY)**	**(3,200 SY)**	**(6,140 SY)**	**(8,580 SY)**	**(12,820 SY)**

Source: CHA, 2013

Based on this assessment, it is recommended that the Airport begin pursuing the development of at least 3,200 SY of new GA apron space to accommodate the first PAL of transient aircraft.

The airport has long wanted to expand the GA west apron to support increasing corporate traffic. In accordance with previous recommendations, it is suggested that the apron be expanded to the south and aligned with Taxiway D for the most effective use of existing airfield geometry. Surplus aircraft parking space is limited on the other GA aprons. Therefore, construction of the apron expansion should be accomplished prior to the demolition of the existing apron. Expansion concepts will be discussed in greater detail in the following chapter.

4.7.4 Deicing Aprons

As explained in **Chapter 2**, there are presently two concrete aircraft deicing aprons at CAK, located north and south of the passenger terminal building. These deicing facilities were originally designed to accommodate the Boeing 717 – one aircraft on the north pad and three on the south pad. The circulation around the north de-icing pad has been known to cause congestion issues on the apron. For that reason, the majority of deicing operations occur on the south pad. In 2013, the Authority expanded the south deicing pad to accommodate three 737-700s. Because the airlines had requested greater throughput, expansion of the apron to provide four positions was considered, though it was decided that three spots would suffice at this time. There are no recommendations for improving the deicing facilities at CAK. However, any potential terminal expansions could result in the need to reconfigure or relocate the north deicing pad, due to its proximity to the terminal and the congestion in this area.

4.7.5 Ohio Army National Guard Apron

On the west side of the airfield, beyond the GA area, sits the Army National Guard's ±77,800 SY apron, which accommodates its six based CH47 Chinooks and four based UH72 Lakota helicopters and the occasional transient military aircraft. Based on discussions with the installation commander, it is anticipated that the apron will provide sufficient parking space in the foreseeable future.

4.7.6 MAPS Apron

The Military Aviation Preservation Society (MAPS) apron is used to store and showcase retired military aircraft. The 16,700 SY of pavement is in good condition and, aside from general maintenance, should not require improvements over the 20-year planning period. While MAPS may desire more apron space, there has been no need for expansion expressed at this time. The ability to accommodate an expanded MAPS facility – or other airside access tenants – in this area should be preserved and coordinated with the ongoing development of the west side GA facilities.

4.8 AIRFIELD PAVEMENT STRENGTH AND CONDITION

Knowing the strengths and conditions of an airfield's pavements is critical for an airport to evaluate potential new aircraft or increased operations, and manage pavement maintenance operations. The design strength and life of the pavement at an airport is determined by the strength of the subgrade, the weight of the aircraft using the airfield, the configuration of the landing gear and the number of operations from these aircraft.

4.8.1 Pavement Strength

According to the Airport Diagram for CAK – dated September 2014 – the runways have a reported load-bearing capacity of 120,000 pounds for aircraft with single-wheel landing gear configurations; and 160,000 pounds for aircraft with dual-wheel landing gear configurations. Of the design aircraft family, the Boeing 737-800 has a dual-wheel gear configuration and the heaviest MTOW of 174,200 pounds, higher than the pavement's load-bearing capacity for dual-wheel configurations.

Per FAA AC 150/5335-5B - *Standardized Method of Reporting Airport Pavement Strength – PCN*, the Aircraft Classification Number–Pavement Classification Number (ACN-PCN) method was developed and adopted as an international standard for reporting the strength of pavement and has facilitated the exchange of pavement strength rating information. This system compares the ACN with the PCN to determine the bearing strength of specified pavements on the airfield. ACN is a value provided by the aircraft manufacturer that is based on operational characteristics such as maximum aft center of gravity, maximum ramp weight, wheel spacing, tire pressure, etc. The PCN is based on the allowable load rating of the design aircraft family – a function of those individual aircrafts' frequency of operations, gear type, maximum gross weight and other factors. If an aircraft's ACN value is equal to or less than the PCN value of a pavement, it can safely operate without restrictions. This classification method applies only to pavements that have a weight-bearing capacity of more than 12,500 pounds. All public-use paved runways at primary airports with air carrier aircraft should be assigned ACN and PCN data. This is a mandatory report for airports wanting federal grant monies through the Airport Improvement Program (AIP) and revenues from the Passenger Facility Charge (PFC) program to fund projects.

Because an ACN-PCN analysis is not within the scope of this Master Plan Update, it is recommended that the Airport perform this analysis in the near term planning horizon. This action will ensure that the Airport qualifies for grant monies, but it will also identify any pavement areas that have strength concerns.

4.8.2 Pavement Condition

The type and timing of needed pavement maintenance and repair is based on a structural integrity evaluation metric called the Pavement Condition Index (PCI). Pavements are evaluated in logical inspection units (small sections of pavement inspected in detail) then given a rating number of 0-100. A rating of 100 indicates that the pavement is in excellent condition. This pavement distress condition rating procedure is a process developed by the

U.S. Army Corps of Engineers and adopted as the standard pavement evaluation procedure by the FAA.

A PCI study for the airfield pavements at CAK was conducted in February 2012. The data was collected in accordance with the requirements of the MicroPAVER 6.1 software program. Portions of the airfield's pavement have been rehabbed since the study and are considered to be in "good" condition, as shown in **Figure 2-6**.

Both runways at CAK were given a "good" rating, and all of the taxiways and aprons at CAK were given ratings ranging from "fair" to "good," with the exception of Taxiway H, which received a "poor" rating. Visual inspection of the airfield pavement is performed annually and crack sealing is applied where needed by Airport maintenance staff. Aside from routine pavement maintenance, necessary pavement improvements have been identified at this time.

4.9 AIRFIELD LIGHTING AND GROUND NAVIGATION

Airports use a wide array of navigational systems to aid pilots in maneuvering about the airfield. The placement and conditions of the lighting, signage and pavement markings at CAK were evaluated to determine if any improvements are required.

4.9.1 Airfield Lighting

Both runways at CAK are equipped with high-intensity runway edge lights (HIRL), threshold lights and end lights. Taxiways are lighted by medium-intensity taxiway lights (MITL) and centerline lights. All runway and taxiway lighting systems are considered to be in good condition, are consistent with precision approach runway requirements and, aside from routine maintenance, should be sufficient throughout the planning horizon. If an ILS system on one of the runways is upgraded to CAT-II, then the improvements discussed in **Section 4.5** would need to be implemented.

4.9.2 Signage

Runway and taxiway signage are in place to provide pilots directional guidance to ensure safe and efficient movement of aircraft and ground vehicles on the airfield. Existing airfield signage is considered to be in good condition and meets all of the current FAA requirements. If one of its ILS systems is eventually upgraded to Category II, signage replacement and/or relocation may be required. There are currently no additional, anticipated signage improvements over the planning horizon. Though any changes to the airfield geometry – such as new or reconfigured taxiways – may require alteration of, or addition to, the existing signage.

4.9.3 Pavement Markings

Pavement markings are critical in providing visual guidance to the various areas of the airport and preventing incursions on the airfield. A lack of necessary markings or the deterioration of markings can result in confusion of pilots navigating the airfield. All airfield markings are marked in accordance with AC 150/5340-1K *Standards for Airport Markings* and are considered to be in good condition based on a visual inspection by the planning team.

Periodic re-marking should be performed as needed to enhance safety during inclement weather or low visibility conditions. This kind of maintenance can be performed in accordance with regular pavement maintenance. Additionally, an ILS upgrade or an upgrade to the RDC or ARC – described in previous sections – may involve changes to the holding position requirements, thus requiring remarking. Any changes to FAA marking standards throughout the planning horizon will need to be addressed accordingly.

4.10 PASSENGER TERMINAL BUILDING

Based upon the activity forecasts described in **Chapter 3** and the PALs described in **Section 4.1.1**, programmatic terminal building requirements were identified to accommodate the growing passenger activity at the Airport. Specific facility demands, quantified by area square footages for the various components of the terminal, were generated by applying FAA and International Air Transport Association (IATA) industry standards and guidelines to the projections of annual and peak hour passenger enplanements, aircraft operations and aircraft fleet mix. The requirements were then tailored and refined to reflect CAK specific staff, airline and tenant operational needs and observations.

Comparing the programmatic spatial requirements at each PAL to the existing terminal facilities described in **Chapter 2**, recommended terminal modifications can be identified to accommodate projected passenger activity levels. Although the forecast passenger demand throughout the planning period shows steady increase, such growth does not necessarily translate to equal or proportional expansion of the existing terminal facilities. The current use and configuration of the terminal building, evolving technologies and increased passenger reliance on self-service functions, indicate that efficient redevelopment and space re-purposing needs to be completed in the terminal before facility expansion occurs.

4.10.1 Terminal Planning Factors

The facility evaluation considered the following functional areas of the terminal building:

- Airline Space
- Baggage Service Space
- Public Space
- Concessions Space
- Agency Space
- Terminal Service Space
- Airport Administration
- Curbside

Space requirements in these areas are directly related to general assumptions of passenger volume and commercial aircraft fleet mix described below. Additional planning assumptions, specific to each functional area of the terminal, are described in the respective subsection of this chapter.

Passenger Activity Levels

From the forecasts and PALs mentioned, **Table 4-1** identifies the planning level peak hour passenger volumes to be accommodated in the terminal building. Throughout the planning period, these PALs and respective peak hour activity are used to establish milestone triggers, signifying future terminal development action needed to support forecast increases in enplaned passenger activity. The 1.25 enplanement surge factor is applied to the terminal facility planning to account for those periods when flight departures are delayed due to maintenance, weather, crew scheduling or late aircraft arrivals. These events can add to the total number of persons accommodated in the terminal building at any given time. It is important that the airport upholds optimal customer service and efficiency – particularly in the post security, gate and hold room areas during these times.

Table 4-24 – Passenger Activity Levels

PAL	Annual Enplanements	Peak Hour Enplanements	Enplanements w/ 1.25 Surge Factor
Baseline	942,343	508	635
PAL 1	1,144,900	593	741
PAL 2	1,313,200	671	839
PAL 3	1,475,400	759	948
PAL 4	1,661,600	818	1,022

Source: CHA, 2013

Selected Design Aircraft

Using the peak hour commercial operations and projected aircraft fleet mix information from **Chapter 3**, terminal-planning design aircraft were selected for each PAL. These were identified based on the dominant regional and narrow body aircraft types operating at the Airport during peak hour departures. As summarized in **Table 4-2**, the CRJ-700 has been selected as the dominant regional aircraft and the B737 series has been selected as the dominant narrow body aircraft.

Table 4-25 – Design Aircraft Summary

		Peak Hour Departures[1]				
Aircraft Type	**No. of Seats**	**Baseline**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Regional Aircraft		**5.9**	**6.0**	**6.3**	**6.8**	**7.5**
ERJ-145	50	0.8	0.8	0.6	0.5	0.0
CRJ-100/200	50	3.7	1.2	0.2	0.0	0.0
CRJ-700 (design aircraft)	65	1.4	2.6	3.0	3.5	4.1
CRJ-900	76	0.0	1.4	2.5	2.9	3.3
Narrow Body Aircraft		**3.1**	**3.7**	**4.0**	**4.7**	**5.4**
B717	106	2.1	1.5	1.6	2.0	2.3
DC-9	120	0.1	0.0	0.0	0.0	0.0
MD-80/88	149	0.2	0.0	0.0	0.0	0.0
A318/A319/320/A321	136	0.5	0.5	0.5	0.6	0.6
B737 Series (design aircraft)	134	0.3	1.6	1.9	2.2	2.4
Total Peak Hour Departures		**9**	**10**	**10**	**12**	**13**

Source: CHA, Gresham, Smith and Partners, 2013

[1] Based on Official Airline Guide (OAG) data, peak hour departures are between 6:00 and 7:00 am and represent 64.3% of peak hour operations.

4.10.2 Airline Space

Airline space represents the areas of the terminal directly related to and used for airline operations. These areas include: ticket counter agent positions, baggage check-in positions, self-service kiosks, boarding gates, gate hold rooms, airline offices and airline clubs. **Table 4-28** is a summary of the airline space program requirements throughout the planning period.

Passenger Check-in Trends

The increasing reliance on evolving technologies has changed and, will likely continue to change, passenger behavior throughout the check-in process. Self-service equipment for passengers to check in and print boarding passes on or off airport property and self bag check hold potential to reduce demand for ticket lobby space and occupied ticket agent positions. The evolving technology trends and planning assumptions pertaining to locations and percentage of passenger ticketing and baggage check-ins are represented in **Table 4-26**. These factors have been used in determining requirements for curbside and agent positions, baggage check positions and self-service kiosks.

Table 4-26 – Passenger Check-in Assumptions

	Location	PAL			
		1	2	3	4
Percentage Of Total Bags Checked By Location	Terminal	95%	95%	90%	90%
	Curbside	5%	5%	10%	10%
	Off-Airport	0%	0%	0%	0%
Percentage Of Passenger Check In By Location	Ticket Counter Agent Assist	25%	25%	20%	20%
	Kiosk Check-In Landside Terminal	30%	25%	20%	15%
	Kiosk Passenger Check-In Curbside	5%	5%	10%	10%
	Self-Ticketing Off-Airport (Excl. Terminal And Landside)	40%	45%	50%	55%

Source: Gresham, Smith and Partners, 2013

Passenger Check-in Locations

There are currently five active commercial air carriers providing service at CAK, each with a presence in the ticket lobby. The ticket lobby area provides airline check-in and bag check functions, including ticket counter space, passenger queue area, kiosks, airline ticketing offices and some baggage screening. The existing lobby is considered shallow by FAA standards, with a minimal queue depth of 15 feet. Circulation is at the absolute minimum recommended 15 feet and does not extend the entire length of the hall. A limited customer work zone at the ticket counters combined with minimal cross circulation adds to congestion in the ticketing hall during peak periods.

Passenger check-in trend data was provided by air carriers and used in formulating the requirements for check-in areas. An average of 50 percent of passengers check bags. **Table 4-26** shows percentages of where passengers check-in for flights and where they check their bags. Trending factors can be pulled from these percentages. During the planning period, it is assumed that the majority of all checked baggage will be done in the terminal. For planning purposes, two curbside check-in positions have been introduced at PAL 1, as increased passenger activity levels may justify this service. Trends in ticket counter and baggage check demand reflect a consistent reduction, as the travel industry continues to optimize self-service technology – reducing the need for staffed positions and kiosks in the terminal. Automated baggage check-in is not fully developed in the United States at this point. However, self-bag tagging has been implemented at a few airports. Off-airport baggage check-in is the subject of much industry speculation and not likely to be introduced to the CAK business-oriented travel market, as it is better suited for the bulk handling of baggage at large destination airports.

The number of agent positions is directly related to the number of transactions at the counter, based on a three-minute per check-in transaction. Using a linear dimension of 6 feet 6 inches of counter frontage per position – including baggage check positions – there appears to be sufficient counter space to address passenger and airline needs through PAL 1. Ticket lobby circulation requirements assume a 30-foot corridor times the length of the ticket counters to determine circulation between the queue and the terminal exterior.

Aircraft Gates and Lounges

There are currently 11 aircraft boarding gate positions: seven at ramp level (Gates 1-7) and four at upper concourse level (Gate 8-11). Each position has areas for passenger seating, gate counters, queue space and public corridors. Four of the seven ramp level gates (Gates 4-7) use grade level boarding bridges, which accommodate up to B757 aircraft. The other three ramp level gates (Gates 1-3) accommodate only ground boarding and are used by the smaller regional jets. The four upper level concourse gates (Gates 8-11) use passenger-boarding bridges (PBB), capable of accommodating up to B757 aircraft.

It should be noted that while boarding bridges can physically accommodate up to B757 aircraft, they couldn't all do so simultaneously, due to the existing terminal and apron configuration. Additionally, due to terminal configuration and constrained aircraft movements, Gates 1, 2 and 3 cannot be used simultaneously and are dependent upon each other's activity. Depending on the aircraft mix at any one time, this results in an effective total of up to 10 boarding gates that can be operated independently.

Using the peak hour departure and design aircraft information from **Table 4-25**, the number and type of gates needed to accommodate activity at each PAL is presented in **Table 4-27**. To provide the highest level of customer service and operational flexibility, the same 1.25 enplanement surge factor was applied to the peak hour departures to account for periods of delayed flights or early arrivals. A contingency gate was also added to the total planning level gate requirement to accommodate unanticipated charter flights or long-term delayed or additional overnight aircraft

Table 4-27 – Total Gate Requirements

	Baseline	PAL 1	PAL 2	PAL 3	PAL 4
Peak Hour Departures (minimum gate need)	9	10	10	12	13
w/ 1.25 Surge	11	12	13	14	16
Total w/ One Contingency Gate	**12**	**13**	**14**	**15**	**17**
Regional Aircraft Gates	7	8	8	9	10
Narrow body Aircraft Gates	5	5	6	6	7

Source: CHA, 2013
Note: Numbers have been rounded from **Table 4-25**.

Gate lounge sizing criteria is based on 1,730 square feet for a regional jet gate hold room and 2,700 square feet for a narrow body gate. The methodology takes into account an 82 percent average load factor for each aircraft and an assumption that 75 percent of the passengers would be seated, and the remaining 25 percent of the passengers would stand in the gate lounge. Based on these factors, a gate lounge floor area deficit was found while applying the facility planning methodology to the current/baseline peak hour enplanements of 635 passengers. The PAL 1 facility requirements include overcoming this deficit, as well as accommodating the forecasted activity level.

Additional gate lounge space would be necessary throughout the planning period on the order of one to two gates upon reaching each PAL. Consideration throughout the planning period should be given to the evolving changes in the airline industry with regards to mergers and opportunities for existing air carrier relocation, including the introduction of new entrant air carriers, with regards to future gate and hold room layouts. It may be desirable, and in the best interest of operational flexibility, to space the gates and size the majority of hold rooms to accommodate narrow body aircraft. As activity levels increase, consideration should also be given to creating a continuous elevated concourse to allow for elevated boarding bridges at all gates to service the forecast fleet mixes and to improve the level of customer service.

Airline Ticket Office (ATO)

There are currently 5,356 square feet of area within the terminal used for airline ticket offices behind the ticket counters. Using a programming criterion of 900 square feet of office space per air carrier, the programmed office area of 4,500 square feet throughout the planning period is less than the existing space. Therefore, it appears that additional space is not needed. If a new airline were to start service at CAK, there may not necessarily be an increase in forecasted passenger activity levels. At that point, the Airport might consider providing a 900 square feet, sixth airline ticket office and additional counter space.

Airline Ramp Offices and Ramp Services

Airline administrative offices and ramp services use 4,105 square feet in the terminal. Using a programming criterion of 1,300 square feet of office space and 2,500 square feet for ramp services – assuming five air carriers – it has been determined that the programmed office area of 19,000 square feet throughout the planning period requires additional ramp level construction. In the event that a new carrier begins service at CAK – depending on outsourcing of ramp services – an additional ramp service space to serve the new air carrier would require an additional 3,800 square feet of space. It is reasonable to anticipate ramp level office and service functions will be accommodated within the overall footprint of the second level concourse above, and may be customized and expanded as needed during the planning period without changes to the passenger operations above.

Airline Clubs and Business Center

Currently, the Authority provides a public business center for use by passengers. However, there are no proprietary airline or airport clubs for premium passengers. Assuming that the business center activity is closely related to the peak hour passengers, the demand for space would increase accordingly. As passenger levels increase, there may be a need for a third party or pay-for-use premium passenger club of approximately 1,200 square feet – including welcome desk, seating areas and restrooms.

Table 4-28 – Airline Space Requirements

Terminal Area Function	Existing	Unit	PAL			
			1	2	3	4
Function						
Curbside Positions	0	Each	2	2	3	3
Ticket Kiosks - Self Service	15	Each	10	10	9	7
Bag Check Positions	6	Each	11	12	13	14
Agent Assist Positions	15	Each	10	11	10	11
Total Counter Frontage	149	LF	137	150	150	163
Gates	11	Each	13	14	16	17
Area						
Kiosks & Queuing	0	SF	340	340	306	238
Ticket Counter & Work Zone	2,921	SF	2,740	3,000	3,000	3,260
Ticket Counters Queuing	1,872	SF	2,055	2,250	2,250	2,445
Ticket Lobby Circulation	2,405	SF	4,110	4,500	4,500	4,890
Airline Ticket Offices	5,356	SF	4,500	4,500	4,500	4,500
Gate Lounge	14,478	SF	27,330	30,028	34,456	36,502
Airline Ramp Operations	1,266	SF	6,500	6,500	6,500	6,500
Airline Ramp Services	2,839	SF	12,500	12,500	12,500	12,500
Total	31,137	SF	60,075	63,618	68,012	70,835
Airline Clubs	0	SF	1,200	1,200	1,200	1,200
Business Center	890	SF	1,037	1,175	1,327	1,431

Source: Gresham, Smith and Partners, 2013
Note: Numbers represented in square feet or actual number requirements.

4.10.3 Baggage Services

The baggage services category represents the area of the terminal dedicated to the processing of checked baggage. This category includes the inbound checked baggage process for the baggage claim lobby, baggage claim carousels and baggage claim loading areas. It also includes the outbound checked baggage loading process, consisting of the area dedicated to baggage make-up and sorting. **Table 4-29** represents a summary of the baggage services program requirements throughout the planning period.

Baggage Claim

The existing baggage claim lobby uses four, flat-plate, baggage-claim devices with a total presentation frontage of 360 feet – in an area of approximately 11,000 square feet. The current configuration of passenger circulation through the hall and among the claim devices does not allow expansion of the current systems without restricting normal passenger flow. From the perspective of the arriving passenger, the baggage claim devices are arranged sequentially. This means that, passengers moving to and from the baggage claim devices are congested due to actively claiming passengers, waiting passengers and the adjacent rental car customer service counters. For planning purposes, the number of peak hour arriving passengers drives the demand for baggage claim capacity and is estimated to be equivalent to the peak hour departing passengers. A planning factor of 150 feet of presentation frontage and 5,000 square feet per U-shape, flat-plate style baggage claim device has been used to determine the area required for each carousel.

The associated enclosed tug drive must also be considered in conjunction with the baggage claim hall. Additional baggage claim devices must be configured with adequate frontage for offloading baggage from carts while providing a bypass lane for one-way tug traffic. This calculation should also consider the potentially overlapping flight schedules of competing airlines sharing the same claim device. The enclosed tug drive projected for the planning period includes one additional unloading zone associated with one additional claim device, and an increase in the depth of the room for the existing unloading zones. Portions of the existing enclosed tug drive are too shallow and should be widened for better access to the exterior doors.

Baggage Make-Up

There are five airline baggage make-up rooms located directly behind the ticket counters and subdivided by airline offices. Bags are delivered to these make-up rooms using the individual airline ticket counter conveyors and individual dead-end conveyors. In these make-up rooms bags are manually sorted and placed on baggage carts to be delivered to outbound aircraft. There is approximately 3,300 square feet of existing baggage make-up area in the terminal.

As passenger enplanements and checked baggage volume increase across the planning period, consideration should be given to shared make-up carousels for sorting checked baggage. Seven make-up carousels have been programmed, at 5,000 square feet per device plus related vehicle corridors, resulting in approximately 36,750 square feet of area for baggage make-up.

Table 4-29 – Baggage Service Space Requirements

Terminal Area Function	Existing	Unit	PAL			
			1	2	3	4
Function						
Bag Makeup Devices	5	Each	6	6	7	7
Bag Claim Devices	4	Each	4	4	5	5
Baggage Claim Frontage	360	LF	434	491	555	598
Area						
Baggage Claim Hall	10,921	SF	20,000	20,000	25,000	25,000
Baggage Service Office	693	SF	500	500	500	500
Inbound Baggage Room	6,936	SF	7,952	7,952	9,940	9,940
Outbound Bag Makeup	3,341	SF	31,500	31,500	36,750	36,750
Total	21,891	SF	59,952	59,952	72,190	72,190

Source: Gresham, Smith and Partners, 2013
Note: Numbers represented in square feet or actual number requirements.

4.10.4 Public Space

The public space category represents areas in the terminal used by the public for general circulation and restrooms. **Table 4-30** represents a summary of the public space program requirements throughout the planning period.

General circulation space represents approximately 12 percent of the overall existing terminal area. The area is further divided into concourse circulation, circulation between concourses, ticket lobby circulation, circulation behind and around the rental car counters and an area for meeters and greeters. The results of this planning study suggest 16 percent of space be designated for general circulation. The areas represented in **Table 4-30** are non-leasable public space requirements necessary to support specific terminal and airline functions.

Concourse circulation area is the common post-security public corridor connecting the Security Screening Checkpoint (SSCP), concessions, restrooms and amenities with the gate lounges. The calculated space requirement is based on the cumulative wingspan of the gated aircraft, with 25 feet between wingtips, multiplied by a 15-foot circulation corridor. This assumes a single loaded concourse. Planning for a double loaded concourse would use a 30-foot wide corridor.

For meeters and greeters, a factor of 10 percent of the total arriving passengers represent those people defined as meters and greeters awaiting deplaning passengers within the terminal. This space is generally accounted for in the existing general circulation space.

There are currently 6,096 square feet of existing restroom facilities throughout the terminal – 40 percent are on the landside and 60 percent are on the airside. Landside restroom facility requirements are determined by assuming peak hour enplanements and deplanements occur at differing periods. Airside restrooms are sized assuming the peak hour enplanements and deplanements occur at the same time. It is assumed 15 percent of people use the restroom facilities at an area factor of 25 square feet per person. The calculated area forecast results in the restrooms total distributed with 35 percent on the landside and 65 percent on the airside.

Table 4-30 – Public Space Requirements

TERMINAL AREA FUNCTION	Existing	Unit	PAL			
			1	2	3	4
Area						
Concourse Circulation	6,675	SF	23,190	25,261	28,935	30,540
Ticket Lobby Circulation	Listed under Airline Space					
Meeter and Greeter Waiting	1,114	SF	1,850	2,100	2,375	2,550
Restrooms	6,096	SF	8,600	9,750	11,000	11,900
Passenger Services	In Concourse	SF	1,730	1,930	2,150	2,290
Stairs, Elevators, Escalators	4,990	SF	13,126	13,773	15,202	15,705
Total	18,875	SF	48,496	52,814	59,662	62,985

Source: Gresham, Smith and Partners, 2013
Note: Numbers represented in square feet or actual number requirements.

4.10.5 Concessions

The concessions requirements represent all of the areas of the terminal facility used for retail space – airside and landside – including storage requirements. Each concession area requirement has been divided into specific retail type: food and beverage, news/gifts/specialty, services and amenities such as: advertising, information desks, banking etc. The current distribution between pre-secure and post-secure concessions is 54 percent pre-secure to 47 percent post-secure. Consistent with national airport retailing trends and based on information provided by the major retail concessionaire at CAK, emphasis and expansion of the post-security concession should be focused on in the future. **Table 4-31** presents a summary of the Concessions program requirements throughout the planning period. It shows a shift toward 74 percent post-secure concessions. Areas for rental car and ground transportation counters are represented as a separate concession category.

Pre-Secure Concessions

To provide needed space for the CAK checkpoint renovation and expansion in December 2011, a new food and beverage concession area was constructed adjacent to baggage claim –

allowing for the checkpoint to be expanded where the existing food and beverage concessions were located. The primary pre-secure food and beverage concessions represent 4,627 square feet. An additional 263 square feet is used for news/gifts/specialty and there is 80 square feet used for services and amenities such as: massage chairs, vending machines and charging stations. Food and beverage make up 93 percent of concessions, news/gifts/specialty make up 5 percent, and services and amenities make up 2 percent. Sales revenue data provided by the concessionaires show a steady decrease in volume from pre-secure concessions. Therefore, no future space increases are recommended. **Table 4-31** has a detailed listing of pre-secure concession distribution areas by concession type.

Post-Secure Concessions

The current primary post-secure food and beverage concessions are 3,477 square feet. An additional 828 square feet is used for news/gifts/specialty and 80 square feet is used for services and amenities such as: massage chairs, vending and information counter. Using the same distribution for planning, post-secure concessions are allocated 79 percent food and beverage, 19 percent news/gifts/specialty, and 2 percent services and amenities. Using a square foot utilization factor of 10 square feet per 1,000 enplaned passengers of concession offerings and maintaining the current post-secure distribution by type, CAK's airside concession requirements are summarized in **Table 4-31**. Duty-free concessions associated with international departures should be considered a subset of the total post-secure concession area.

Concessions Storage

The current CAK concessions storage facilities occupy more than 5 percent of the overall concessions area, or 504 square feet. As the concessions program expands to keep pace with forecast passenger activity levels growth, the concession storage needs will increase as well. Using the same sizing factor of 5 percent of the total concessions program, the storage area needs will increase consistently throughout the planning period as shown in **Table 4-31**.

Rental Car and Ground Transportation Counters

There are currently six rental car counter facilities located adjacent to the baggage claim area served by Alamo, National, Enterprise, Hertz and Avis/Budget. The existing area used by the rental car operators is 3,060 square feet for customer service counters and queuing. At the south end of baggage claim, there are three counter areas and offices used for ground transportation services that occupy 503 square feet of area.

To determine future requirements for rental car counter and office needs, each operator was surveyed and their requirements were considered in determining sizing factors. Using an average of these requirements, for PAL 1, it is assumed for each operator: the counter is 20 feet long and the queue depth is 10 feet; each workspace is 10 feet deep; and each office is 8 feet deep. The requirements for rental car counters for PAL 1 and 2 are 3,870 square feet, an increase of 307 square feet. For PAL 3 and 4, there is an increase in office space requirements to accommodate anticipated staffing increases and storage needs to keep pace with the forecast increase in passenger levels. The average office depth is adjusted for these PALs to 12 feet, which requires 480 additional feet. There is no current need for additional ground transportation space, as the current facilities aren't often used.

Table 4-31 – Concessions Space Requirements

TERMINAL AREA FUNCTION	Existing	Unit	PAL			
			1	2	3	4
Pre-Security Concessions						
Food and Beverage	4,627	SF	4,970	4,970	4,970	4,970
News/Gifts/Specialty	263	SF				
Services and Amenities	80	SF				
Subtotal	4,970	SF	4,970	4,970	4,970	4,970
Post Security Concessions						
Food and Beverage	3,464	SF	5,156	6,406	7,751	8,729
News, Gifts and Specialty	833	SF	1,240	1,541	1,864	2,099
Services/Amenities	88	SF	130	162	196	221
RWA Surge Factor*		SF	1,632	2,027	2,453	2,762
Subtotal	4,385		8,158	10,136	12,264	13,811
Concessions Storage	504	SF	572	657	738	831
Total Concessions	9,859	SF	13,700	15,763	17,972	19,612
RENTAL CAR / GROUND TRANS	3,563	SF	3,870	3,870	4,350	4,350

Source: Gresham, Smith and Partners, 2013
Notes: Numbers represented in square feet or actual number requirements.
*Surge Factor of 1.25 applied to this facility category as the metric is based on the total annual enplanement activity levels and not peak hour enplanement levels, which already included a surge factor.

4.10.6 Agency Space

The agency space category represents the areas of the terminal facility that are dedicated to governmental agencies focused on the security functions of screening passengers and checked baggage. Consideration has also been given to a potential future U.S. Customs and Border Protection (CBP) facility to allow CAK to process arriving international passengers. **Table 4-32** represents a summary of the agency space program requirements throughout the planning period.

Security Checkpoint

In December 2011, CAK completed the expansion and renovation of its TSA passenger security-screening checkpoint. This new, 10,116 square-foot area includes two Advanced Imaging Technology passenger screening portal lanes, with the ability to expand to an additional portal lane as passenger levels increase.

As CAK experiences consistent passenger level growth throughout the planning period, the current checkpoint area, including future built-in expansion capability, is sufficient based on current technologies and protocols to address these increases up to PAL 1. Once PAL 1 is reached, there is a deficiency of 188 square feet, but once addressed, will be sufficient throughout the remainder of PAL 2. At each PAL, TSA screening protocols and technology developments should be evaluated to determine if there are any impacts to the checkpoint area or configuration. Based on current protocols and technologies, a larger checkpoint should be considered upon reaching PAL 3.

Baggage Screening

Currently, checked baggage is screened using reduced size Explosive Detection System (EDS) screening equipment. TSA personnel place bags in two lobby-based machines. There are also are two machines located behind the ticket counters adjacent to the Delta and Southwest/AirTran baggage make-up rooms, in-line with the conveyor for automated delivery of bags. The area of the terminal dedicated to checked baggage screening is approximately 2,555 square feet.

As consistent passenger growth increases throughout the planning period, the number of passengers checking baggage will increase, placing a larger demand on the facilities to screen these bags. At PAL 1, a more consolidated, automated, fully in-line EDS system should be considered to support the increased baggage screening requirements. The in-line baggage screening area requirements assume one centralized baggage-screening matrix, the conveyor system feeding the matrix and TSA support offices. It is assumed baggage would be distributed between at least two EDS machines, plus one contingency machine for screening. Baggage volumes at PAL 1 and PAL 2 suggest a system comprised of four screening units, processing baggage at 220-bags per hour to be sufficient. However, higher baggage volumes (PAL 3 and PAL 4) suggest three units screening at 540 bags per hour is appropriate. Once PAL 2 requirements have been addressed, the bag screening area should be adequate throughout the remainder of the planning period. The PAL 3 baggage-screening matrix considers the use of higher throughput EDS equipment at 540 bags per hour processing rates. This would reduce the number of required, reduced-size EDS machines to address the same baggage volume, thus opening up portions of the facility for other uses.

Transportation Security Administration (TSA) Offices

The existing TSA offices located in the CAK terminal facility provide support and administrative facilities for the TSA staff. Currently, TSA office space is comprised of approximately 3 percent of the combined security screening checkpoint (SSCP) and baggage screening areas.

TSA has expressed the objective of consolidating their regional administration to the Airport. However, the timing and full extent was not known at the time of the Master Plan Update. Using the same 3 percent of the combined checkpoint and baggage screening areas in total to determine TSA office needs, an additional 372 square feet of office area would be needed at PAL 1 in addition to the TSA administrative consolidation area of 4,430 square feet.

U.S. Customs and Border Protection (CBP) and International Arrivals

Currently, CAK does not have scheduled international air carrier service and does not have a CBP facility for processing international passengers. The agency space category includes programmatic requirements for a CBP facility that can process up to 400-peak hour arriving international passengers, or the equivalent of two narrow body flights processed an hour. Any future international gates designated as international capable should be configured to independently function in either domestic or international configuration.

Federal Aviation Administration (FAA) and Air Traffic Control Tower (ATCT)

The FAA currently occupies space in the terminal and the ATCT above the terminal. For planning purposes, these space requirements are assumed to remain without change. However, due to an FAA initiative for all ATCTs to be stand-alone facilities, the control tower at CAK is poised for relocation. Should this relocation occur, the current FAA space could be reallocated to other terminal functions such as office, administrative or storage space.

A previous Comparative Safety Assessment was completed in 2011, identifying three preferred alternative sites on the Airport's property for ATCT relocation. Numerous safety hazards and risks in accordance with the FAA's Safety Management System were found to be associated with these locations. It was determined that the current location maintains the highest overall visibility of the airfield and is most conducive to safe and efficient operations. The differing opinions of FAA panel members have delayed the relocation decision. Due to the FAA's desire for this facility to function independently of the terminal, potential relocation sites will be further assessed in **Chapter 6**, with consideration of effects on future development plans of the Airport.

Table 4-32 – Agency Space Requirements

TERMINAL AREA FUNCTION	Existing	Unit	PAL			
			1	2	3	4
Agencies						
Security Checkpoint & Queue	10,116	SF	10,304	10,304	13,675	13,675
In-Line Baggage Screening	2,555	SF	15,840	15,840	12,240	12,240
TSA offices	412	SF	784	784	777	777
TSA supplemental office	0	SF	4,430	4,430	4,430	4,430
CBP/International Arrivals	0	SF	16,150	16,150	16,150	16,150
FAA	13,134	SF	13,134	13,134	13,134	13,134
Total	26,217	SF	60,642	60,642	60,406	60,406

Source: Gresham, Smith and Partners, 2013; and U.S. Customs and Border Protection, Airport Technical Design Standards, 2006
Note: The highlighted functions are considered to be "supplemental" to the terminal development program. The timing and potential development of these facilities is dependent on factors unknown at the time of this Master Plan Update.

4.10.7 Terminal Services

The terminal services category represents terminal facility areas directly related to non-public space, such as: mechanical, electrical and storage rooms. It also includes area for deliveries, loading dock, compactor/recycling area and building maintenances equipment storage such as lifts. **Table 4-33** presents a summary of the terminal services requirements throughout the planning period.

The mechanical and electrical areas in the CAK terminal facility account for approximately 12 percent of the overall terminal square foot area, which is 18,379 square feet. These areas typically include mechanical rooms, electrical rooms, communication rooms, roof top equipment penthouses, building shafts and chases. The future mechanical and electrical area space requirements use a slightly smaller sizing factor of 10 percent acknowledging the greater efficiency of modern systems.

The building services for the terminal facility include Airport operations (not including those located in the ARFF/Maintenance building), Airport storage, delivery and loading areas, compactor/recycling areas and maintenance equipment storage. Currently, about percent of the total terminal area is allocated for building services. Future sizing is based on a factor of two percent.

Table 4-33 – Terminal Services Space Requirements

Terminal Area Function	Existing	Unit	PAL			
			1	2	3	4
Area						
Mechanical and Electrical	18,379	SF	26,252	27,546	30,405	31,410
Building Services	In above	SF	5,250	5,509	6,081	6,282
Total	18,379	SF	31,502	33,055	36,486	37,692

Source: Gresham, Smith and Partners, 2013
Note: Numbers represented in square feet or actual number requirements.

4.10.8 Airport Administration

The airport administration category represents areas of the terminal directly related to CAK staff operations including offices, conference rooms, file storage, police, security and internal circulation. There are currently 21,596 square feet of airport administration space distributed between landside and airside areas of the terminal, including offices on levels three and four of the tower. Future administrative office and support space needs are associated with passenger and facility growth, and what staffing levels and facilities are necessary to support that growth. Using a planning factor of 36 square feet per forecast peak passenger, an overall administration office area total can be projected. **Table 4-34** presents a summary of the airport administration programmatic space requirements throughout the planning period.

Table 4-34 – Airport Administration Space Requirements

Terminal Area Function	Existing	Unit	PAL			
			1	2	3	4
Area						
Airport Administration	21,596	SF	26,678	30,203	34,129	36,794

Source: Gresham, Smith and Partners, 2013

4.10.9 Terminal Facility Curbside Requirements

CAK has one primary terminal curbside made up of four traffic lanes. The following is a summary of each curbside lane and its respective characteristics that were used to develop the curbside requirements.

Lane 1 – The terminal curbside immediately adjacent to the terminal facility represents approximately 680 linear feet of curbside capacity. Private occupancy vehicles (POV) and commercial vehicles use approximately 340 linear feet of this curbside to the north for departing passengers being dropped in front of the ticket lobby. The remaining 340 linear feet to the south is used for arriving passengers being picked up in front of baggage claim.

Lanes 2 and 3 – These dedicated lanes are primarily used for vehicle circulation. During peak operating times, the Lane 1 curb can become congested, with additional vehicle traffic defaulting to Lane 2 as a secondary curb for picking up or dropping off passengers. While not a preferred situation due to safety concerns, this effectively increases available curbside POV staging by approximately 680 additional feet for added capacity.

Lane 4 – This outer curbside lane, which is furthest from the terminal facility, is primarily used for staging commercial vehicles, such as taxi cabs, limousines and shuttle buses on the southern portion of the curb. Airport and agency vehicles stage at the northern portion of this curbside frontage. This curb provides approximately 680 linear feet of curbside capacity, of which 490 feet is used for public and commercial vehicle staging.

Table 4-35 represents the current CAK lengths for each curbside. These lengths are used as the baseline comparison for the planning periods and establish the curbside requirements for each period.

Table 4-35 – Existing Curbside Lengths

Ground Level	Linear Feet
Lane 1 Curbside	680
Lane 2 Circulation and Secondary Curbside	NA
Lane 3 Circulation	NA
Lane 4 Curbside	680
Total	**1,360**

Source: Akron Canton Airport, 2013

Terminal Curbside Programming Assumptions

Using ACRP Report 25: *Airport Passenger Terminal Planning and Design, Volume 1 Guidebook* (2010) which documents industry accepted design criteria for terminal planning and design, curbside programming assumptions for a 15-minute peak planning period were used to determine the required curbside linear frontage and capacity for each curb. Using past CAK master plans and studies, it was determined an average total forecasted peak hour vehicle quantity could be determined by using a factor of .5 vehicles per peak hour enplanement. These vehicle totals are then separated into vehicle type, vehicle length and anticipated curb-level dwell time. These criteria were used to determine the curbside frontage requirements.

A more significant factor in determining required curbside length is the anticipated dwell time for each vehicle type at each specific curb. Using industry standards documented in ACRP Report 25, average vehicle dwell times based on specific vehicle types were used to define vehicle behavior patterns specific to CAK. **Table 4-36** represents the vehicle dwell time assumptions for the individual terminal curbs.

Table 4-36 – Vehicle Dwell Time by Curb

Lane 1 - Private Occupancy Vehicles and Taxi Cabs		
Type	**Time in Min.**	**Comment**
POV	3.0	Average for unloading
Taxi	3.0	Average for unloading and transaction time
Limo	3.0	Average for unloading and transaction time
POV	5.0	Average for additional waiting and loading time
Lanes 2 and 3 - Private Occupancy Vehicles and Taxi Cabs		
POV	3.0	Average for unloading
Taxi	3.0	Average for unloading and transaction time
Limo	3.0	Average for unloading and transaction time
POV	5.0	Average for additional waiting and loading time
Lane 4 - Commercial Vehicles		
Taxi	3.0	Average for loading
Limo	3.0	Average for loading
Shuttle	5.0	Average for loading and unloading
Bus	15.0	Average loading and unloading

Source: Gresham, Smith and Partners, 2013

Future Curbside Requirements

Table 4-37 summarizes the terminal curbside demand requirements for the baseline passenger forecast scenarios.

Table 4-37 – Curbside Demand Requirements

Curbside Demand Summary					
PAL	Peak Hour Vehicles		Curbside Requirements in Feet		
	POV	Comm	Existing	Required	Surplus/Deficit
Lane 1 Curbside					
Baseline	237	19	680	470	210
PAL 1	277	23	680	479	201
PAL 2	313	26	680	625	55
PAL 3	354	30	680	699	(19)
PAL 4	381	31	680	921	(241)
Lane 4 Curbside					
Baseline	0	61	490	286	204
PAL 1	0	72	490	374	116
PAL 2	0	81	490	411	79
PAL 3	0	91	490	445	45
PAL 4	0	98	490	466	24

Source: Gresham, Smith and Partners, 2013

The following assumptions and methodologies determined curbside requirements in **Table 4-37**.

Assumptions:

- **Vehicle Distribution by Primary Curbside** –
  - **Lane 1**: 80 percent of total peak hour vehicles
  - **Lane 4**: 20 percent of total peak hour vehicles

- **Vehicle Type Distribution by Curbside Location** – Using each peak hour vehicle total from individual curbsides, the vehicles have been divided by vehicle type – POV, taxi cab, limousine, shuttle vehicles and motor coaches.
  - **Lane 1**:
    - POV – 8 percent (half of linear curbside length is dedicated to dropping off passengers and half of linear curbside is dedicated to picking up passengers)
    - Taxi Cab – 10 percent (only used for dropping off passengers)
    - Limousine – 5 percent (only used for dropping off passengers)
  - **Lane 4**:
    - Taxi Cab – 25 percent of commercial vehicle total
    - Limousine – 10 percent of commercial vehicle total
    - Shuttle – 60 percent of commercial vehicle total
    - Motor Coach/Bus – 5 percent of commercial vehicle total

- Lane 4 curbside capacity, with 680 linear feet of existing curb capacity being used, has been reduced. Approximately 190 linear feet of this curbside is used for agency vehicle staging. Assuming five agency vehicles parked and occupying curbside capacity, the effective length assumed available for commercial vehicles is 490 linear feet.

- Operational assumptions - POVs pick up and drop off passengers exclusively at Lane 1 curbside. Taxicabs and limousines drop off passengers at Lane 1 curbside, but return to Lane 4 curbside to pick up passengers. Shuttles, motor coaches and buses pick up and drop off passengers at Lane 4 curbside.

Methodology:

- Required Curbside Capacity – Based on the 15-minute peak vehicle demand quantities (peak hour vehicles x 30 percent), curbside linear capacity requirements are determined. Peak 15-minute volume x (dwell time/15 min) x vehicle length

This curbside capacity calculation is applied to each individual vehicle type per curbside level, with the total curbside requirement at each level determined by the sum of each vehicles linear curbside requirement.

Based on existing curbside capacity of Lanes 1 and 4, there is sufficient curbside capacity to address future increases in vehicles using the curb. This is assuming there are .5 vehicles per enplaned passenger. When the Lane 1 curb becomes congested during peak times, Lane 2 can be used for double parking to relieve this congestion – though not ideal. As forecast passenger activity levels increase throughout the planning period, the amount of vehicles using the curbside will increase as well. Curbside requirements and capacity should be confirmed at each PAL to verify that vehicle types, numbers and distribution using the curb have not changed significantly, impacting the use or capacity of the curbside. Consideration should be given to expanding the curbside length of Lane 1 adjacent to the terminal to accommodate unforeseen changes in how the curb is used.

4.10.10 Passenger Terminal Summary

Terminal size and configuration should reflect the various characteristics and volume of passengers and baggage to be handled at each specific airport. While many airports share common trends, there is no single model that will work for every airport. Planning and designing facilities with each area function in mind are key to the successful development of airport passenger terminals and will have long-term financial and operational implications for the airport sponsor.

Based on the previous analyses, the programmatic terminal space requirements are summarized in **Table 4-38**. This identifies what functional area and at what PAL terminal facility development is recommended to accommodate anticipated demand. Over the planning horizon, a notably larger facility appears necessary – with emphasis on a few specific functional areas. With respect to the existing facility, the greatest change in facility demand is triggered at PAL 1, to satisfy the forecasted peak hour departures. This forecasted passenger activity requires the overall terminal area at PAL 1 to be roughly *double* the existing facility's size, with primary growth in the gate and hold room, baggage handling and agency – including international traffic areas.

Significant increases are required in the outbound baggage handling and screening areas. The existing baggage screening, which is conducted in the lobby or in existing outbound baggage areas, occupies a floor area much smaller than a fully automated TSA-certified, in-line baggage processing system. Similarly, the existing outbound baggage handling process relies on manual handling of baggage and manual staging of baggage carts in most cases. These outbound systems are labor intensive and would require a measurable increase in floor area for automated equipment to efficiently meet even today's baggage make-up demand.

Public space for passengers will also see a significant increase, primarily due to increased quantity of gate lounges and associated amenities, concessions, restrooms and corridors. The baggage claim hall will require enlargement, since baggage claim carousels do not lend themselves to expansion. Additional claim devices and associated floor space are the only feasible solution to accommodate an increase in arriving passenger and baggage volume. Related to the baggage claim is the area for delivery of inbound baggage from the aircraft. Without a conveyor system, this area requires an increase in adjacent baggage cart staging and work area.

Areas of proposed space increases include those related to government agencies. A U.S. Customs and Border Protection (CBP) international arrival facility sized for the handling of two simultaneous international flight arrivals is proposed – approximately 400 passengers per hour. The TSA also proposes to consolidate regional administrative functions to the terminal in the future. These areas are not included in the present day facility.

Other areas requiring increase include airline ramp spaces, based on individual carriers providing their own dedicated ramp services. Currently, air carrier ramp services are outsourced to vendors through limited operational contracts, which tend to consolidate, and even eliminate, space requirements from the terminal. However, the long-term master plan should not be constrained by such short-term administrative arrangements. It is reasonable to anticipate that as air carrier activities increase, so will the air carrier's interest and level of control over its own operations. This could potentially require measurable local space in the terminal.

Table 4-38 – Terminal Area Requirements

Core Terminal Functions	Existing		PAL 1	PAL 2	PAL 3	PAL 4
Airline Space	31,137	SF	60,075	63,618	68,012	70,835
Airport Clubs & Business Centers	890	SF	2,237	2,375	2,527	2,631
Baggage Service Space	21,891	SF	59,952	59,952	72,190	72,190
Public Space	18,875	SF	48,496	52,814	59,662	62,985
Concessions Space	9,859	SF	13,700	15,763	17,972	19,612
Rental Car / Ground Transportation	3,563	SF	3,870	3,870	4,350	4,350
Agency Space	26,217	SF	40,062	40,062	39,826	39,826
Terminal Service Space	18,379	SF	31,502	33,055	36,486	37,692
Airport Administration	21,596	SF	26,678	30,203	34,129	36,794
Total	152,407	SF	286,572	301,712	335,154	346,915

Supplemental Functions	Existing		PAL 1	PAL 2	PAL 3	PAL 4
TSA Supplemental Office	0	SF	4,430	4,430	4,430	4,430
CBP/International Arrivals	0	SF	16,150	16,150	16,150	16,150
Total (W/ Core Functions)			307,152	322,292	355,734	367,495

Source: Gresham, Smith and Partners, 2013

4.11 AUTOMOBILE PARKING AND ACCESS

The amount of required automobile parking at an airport is directly related to annual enplaned passenger traffic levels. The following is an analysis of the public, employee and rental car parking space requirements over the planning period.

4.11.1 Airport Parking Supply - Effective

Table 4-39 presents a breakdown of the parking supply at the Airport in 2013. There are a total of 5,136 parking spaces at the Airport, of which 4,738 (92 percent) are used for public parking and 398 (8 percent) are designated as non-public spaces - rental cars and employees. This table also presents the effective supply. Effective supply is 90 percent of actual supply to account for parking contingencies, including vacancies resulting from improperly parked vehicles and maintenance work and to provide enough open spaces for circulating parkers.

Table 4-39 – Airport Parking Supply

Public Parking	Actual	Effective
Short Term	382	344
Long Term	1,396	1,256
Economy	1,622	1,460
Overflow	208	187
Remote Lot	1,130	1,017
Total	**4,738**	**4,264**
Employee Parking	**Actual**	**Effective**
Employee Lot	283	255
Rental Car Parking	**Actual**	**Effective**
Ready/Return Lot	115	104
Grand Total	**5,136**	**4,623**

Source: CAK, 2013

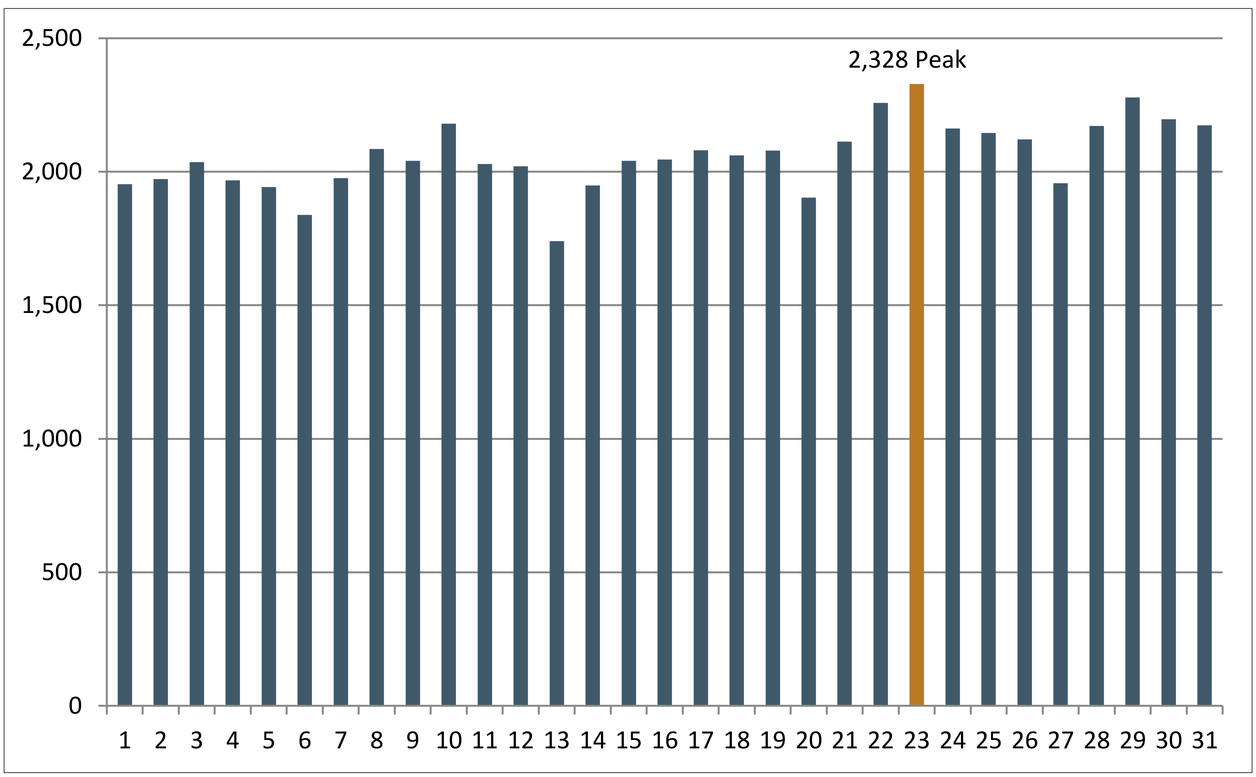
The effective supply was used for the public and employee parkers when calculating the demand. A review of the table above shows the total effective supply for public parking is 4,264 spaces and the effective supply for employees is 255 spaces.

4.11.2 Public Parking Demand Ratio

Public parking demand is the number of spaces required during the peak day in the peak month. Since 2007, March consistently had the highest number of occupied parking spaces in the overnight inventory. **Figure 4-15** depicts the overnight occupancy in March 2011. Wednesday, March 23 had the highest overnight peak occupancy for 2011 with 2,328 spaces. This is used as the design date, and the date from which a parking demand ratio has been developed. Although this day is not the absolute peak parking demand, it does represent the number of occupied spaces on all but a few abnormal peak parking days. This overnight peak occupancy number was then increased by 20 percent to account for the daytime accumulation of parkers. This yields a peak parking demand number of 2,794 spaces.

Public parking demand at an airport is a direct function of airline passenger activity. The public parking demand ratio is calculated by comparing annual enplanements with the peak demand to determine the number of parking spaces required per 1,000 annual enplanements. In 2011, there were more than 834,454 enplaned passengers. Based on the Airport parking demand of 2,794 spaces, the parking demand ratio for CAK is 3.35 spaces per thousand annual enplanements. Based on this ratio, the parking system at CAK is operating at or near capacity – consistent with observations and interviews with Airport staff.

Figure 4-15 – Overnight Occupancy (March 2011)



Source: CAK, CHA, Albersman & Armstrong, 2013

4.11.3 Parking User Groups

There are typically three parking user groups at airports: short-term parkers, premium long-term parkers and economy parkers.

Short-term parkers are usually meeters and greeters and well-wishers. These spaces are generally the closest and most convenient parking to the terminal building. Typically, 75 percent of all parkers are short-term but, because of high turnover, the number of parking spaces required is only about 25 percent. According to data provided by the Airport (See **Table 4-40),** only 51 percent of all parkers at CAK use the short-term lot. Although there is no length-of-stay data available, this is likely due to a large number of long-term parkers using the short-term lot. It is also possible that the short-term lot is undersized and a number of short-term parkers are forced to use the long-term lot, or a combination of the two.

Premium long-term parkers are those who are willing to pay more for the added convenience of parking near the terminal building. These parkers are often associated with business travel.

Economy parkers are parkers who are willing to endure some inconvenience to save money. Economy parkers are the most likely to be lured to less expensive, private off-site parking facilities. Currently, no private off-airport parking venders operate at CAK. However, the longer occupancy at the Airport remains high, the more likely off-Airport competition will enter the market.

Table 4-40 shows the total parkers in 2011 in these three lot types. Future facility concepts will consider the size and configuration required to satisfy these user groups. Note that table is not a reflection of the number of long-term, economy and short-term parkers. Rather, it summarizes the number of parkers who use each facility. As previously suggested, it is likely that long-term parkers are using the short-term lot and short-term parkers are using the long-term lot, because spaces are not available.

Table 4-40 – Parkers per Facility Summary (2011)

Month	Long-Term	Economy	Short-Term	Total
January	9,340	4,511	14,658	28,509
February	9,994	5,281	11,839	27,114
March	11,077	6,191	15,339	32,607
April	10,965	5,743	15,741	32,449
May	11,686	5,595	17,541	34,822
June	10,957	5,729	20,954	37,640
July	10,274	5,548	21,731	37,553
August	10,207	5,364	20,047	35,618
September	11,921	6,053	16,048	34,022
October	12,683	6,558	16,308	35,549
November	11,823	6,240	16,543	34,606
December	10,326	5,090	18,944	34,360
Total	**131,253**	**67,903**	**205,693**	**404,849**
Percent	**32%**	**17%**	**51%**	**100.0%**

Source: CAK, CHA, Albersman & Armstrong, 2013

4.11.4 Projected Public Parking Demand

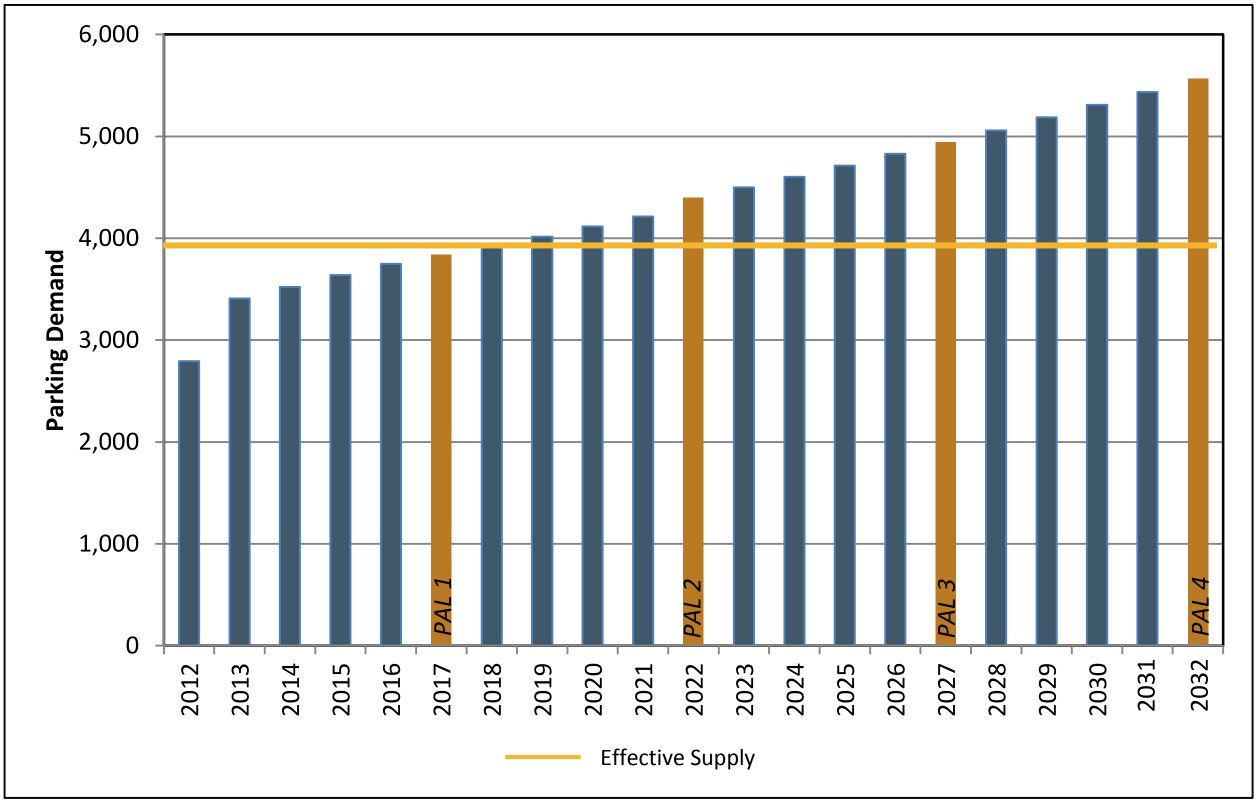
Table 4-41 and **Figure 4-16** present the summary results of the public parking demand analysis, based on the parking ratio of 3.35 stalls per 1,000 enplanements. Using the PALs described in **Section 4.1.1**, there is projected to be a 836-space shortfall by PAL 2 and a 2,189-space shortfall by PAL 4. Using a planning factor of 325 square feet per parking space, approximately 16 acres of additional parking would be needed by PAL 4.

Table 4-41 – Projected Public Parking Surplus and Deficit

Year	PAL	Enplanements	Demand	Effective Supply	Surplus/Deficit
2012	Current	942,343	3,953	4,264	311
2017	PAL 1	1,144,900	4,446	4,264	-182
2022	PAL 2	1,313,200	5,100	4,264	-836
2027	PAL 3	1,475,400	5,730	4,264	-1,466
2032	PAL 4	1,661,600	6,453	4,264	-2,189

Source: CAK, CHA, Albersman & Armstrong, 2013

Figure 4-16 – Projected Public Parking Supply and Demand



Source: Albersman & Armstrong, 2013

Public Parking Roadway Access and Circulation

Airport parking systems should provide three basic parking products: short term parking, long-term parking and economy parking. To the extent possible, each parking product should be provided in a single parking facility. At CAK, there are separate lots for short-term and long-term parking within the ring road and there are multiple economy lots. In the future, the economy lots should be consolidated into one facility to reduce decision points for patrons and improve way finding.

Currently, the entry and exit from the long-term lot is located in the middle of the parking lot. The entry to the short-term lot is located off of the terminal entrance roadway, but exiting short-term parkers must pass through the long-term lot and use the same exit as the long-term parkers.

The central entry/exit location splits the long-term lot and makes it difficult for parkers to find available space during busy periods. The central entry and exit location uses valuable real estate that could be used for public parking. For efficiency and customer convenience, it is ideal to separate entering and exiting vehicles to avoid vehicular conflicts. A more common parking layout for an airport would have the entrances to short and long-term parking along the entrance road on the north side of the parking lot, and an exit plaza located near the south side, merging traffic onto the exit road.

The trend in the industry is to automate the cashier functions to reduce personnel costs. The Authority should consider an automated credit card system when a new cashier plaza is developed.

4.11.5 Projected Employee Parking Demand

The Airport provides 283 employee parking spaces in a lot just south of the rental car ready/return lot. Occupancy counts over the past four years suggest that the current employee parking supply is adequate (see **Table 4-42**). In order to calculate future demand, the occupancy from April 6, 2012 (presented in **Table 4-42**) of 70 percent (198 spaces) was used and increased by 20 percent to allow for any peaks during busy days, holidays and shift changes. This yields a current demand of 238 spaces.

Table 4-42 – Historical Employee Parking Supply and Occupancy

Date of Count	Actual Supply	Percent Occupied	Demand (Occupancy)
April 6, 2012	283	70%	198
October 27, 2011	283	52%	148
May 29, 2010	283	43%	122
December 31, 2009	283	60%	169
June 4, 2009	283	59%	168

Source: Occupancy counts from Google Earth Pro Imagery
Albersman & Armstrong, 2013

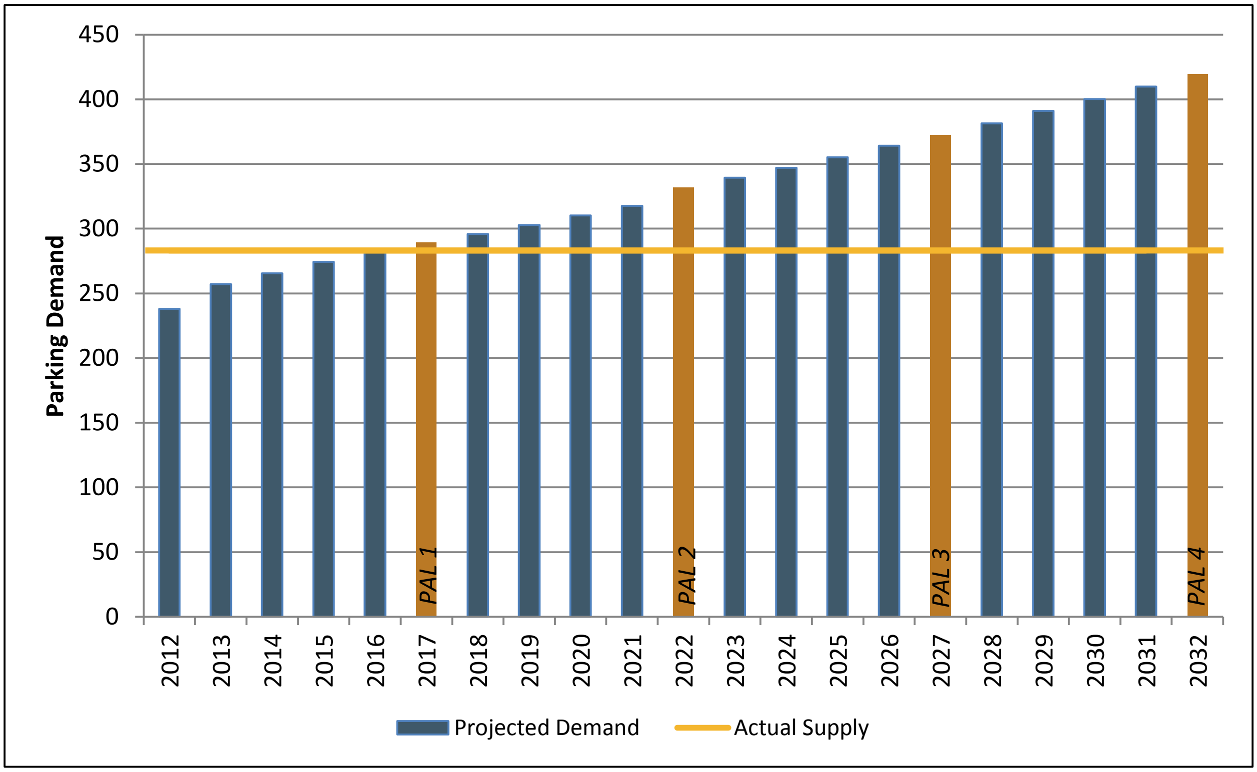
The employee parking demand number above increased at the same rate as the projected enplanements to achieve the projected employee parking demand (see **Table 4-43** and **Figure 4-17**). The assessment of the projected employee parking demand shows a deficit of employee spaces starting at PAL 1.

Table 4-43 – Projected Employee Parking Surplus and Deficit

Year	PAL	Enplanements	Demand	Actual Supply	Surplus/Deficit
2012	Current	942,343	238	283	45
2017	PAL 1	1,144,900	289	283	-6
2022	PAL 2	1,313,200	332	283	-49
2027	PAL 3	1,475,400	373	283	-90
2032	PAL 4	1,661,600	420	283	-137

Source: Albersman & Armstrong, 2013

Figure 4-17 – Projected Employee Parking Supply and Demand



Source: Albersman & Armstrong, Ltd., 2013

Employee Parking Roadway Access and Circulation

The employee parking lot is accessed by a separate service road that runs east to west and connects to Lauby Road. This service road is located about 600 feet south of the main entry to the Airport ring road. The advantage to this service road is that there is no employee traffic on the main Airport ring road, minimizing congestion. Airports typically provide their most convenient parking to airline patrons. As you will see later in this report, the number of rental car ready/return spaces provided by CAK is lower than that of comparable airports. CAK should consider reassigning employee parking to a less convenient parking lot and expand the ready/return parking area into the existing employee lot.

4.11.6 Projected Rental Car Parking Demand

The rental car facility consists of rental counters inside of the terminal building next to baggage claim with ready/return cars located outside, just south of the passenger terminal. The service center sites are located remotely, but on airport property, south of the Airport Service Road (see **Section 2.3** in **Chapter 2**).

Total Rental Car Area Requirements

The total rental car facility requirements include the area for ready/return car parking, vehicle storage, service areas (fuel and wash) and associated vehicle circulation. Despite the slight differences shown in **Table 4-44**, the total rental car area at CAK is comparable to other airports with similar size rental markets in terms of gross revenue.

Table 4-44 – Comparison/Benchmark – RAC Revenue versus Acres

Airport	Location	2010 Gross Revenue [1]	% of CAK Market	Total Rental Car Acres
Gulfport International	Gulfport, MS	$1,756,929	120%	6.4
Ashville Regional	Fletcher, NC	$1,704,629	116%	5.7
Burlington International	Burlington, VT	$1,535,930	105%	6.1
Hilo International	Hilo, HI	$1,513,180	103%	8.0
Gallatin Field	Belgrade, MT	$1,493,843	102%	6.0
Akron-Canton Airport	**Akron, OH**	**$1,468,771**	**100%**	**6.3**
Valley International	Harlingen, TX	$1,440,166	98%	5.9
Lehigh Valley	Allentown, PA	$1,407,930	96%	7.4
The Eastern Iowa	Cedar Rapids, IA	$1,328,228	90%	7.1
Quad City	Moline, IL	$1,326,833	90%	5.6
Midland International	Midland, TX	$1,285,114	87%	4.1
Lovell Field	Chattanooga, TN	$1,257,814	86%	8.2

Source: Albersman & Armstrong, 2013

[1] FAA Compliance Activity Tracking System (CATS)

Ready/Return Car Parking

The demand for rental cars grows with enplanements. As airline traffic increases, the size of the rental car fleet increases to meet the demand, and the size of area required to park rental cars increases. However, the size of the ready and return car parking area does not necessarily increase. As rental car demand increases, the rental car agencies will increase shuttling between the service center sites and the ready car area. Because of this dynamic, the range in the size of ready/return car parking areas varies from airport to airport.

The following **Table 4-45** shows that, with the exception of Ashville Regional, all other airports provide ready/return areas larger than that of CAK. In fact, six other airports provide ready/ returns areas that are more than double in size. This suggests that the current ready and return area at CAK is inadequate to serve the Airport’s needs. As a result, the rental car agencies must provide a high level of shuttling between the service areas and the ready/return area. This can have a negative impact on operational costs and traffic congestion, especially during peak rental and return periods.

Table 4-45 – Ready/Return Comparison/Benchmark – Similar Airports (RAC Revenue)

Airport	Location	2010 Gross Revenue [1]	Ready/Return Acres	% of CAK Ready/Return
Gulfport International	Gulfport, MS	$1,756,929	1.2	103%
Ashville Regional	Fletcher, NC	$1,704,629	0.9	80%
Burlington International	Burlington, VT	$1,535,930	1.9	164%
Hilo International	Hilo, HI	$1,513,180	1.5	132%
Gallatin Field	Belgrade, MT	$1,493,843	2.9	256%
Akron-Canton Airport	**Akron, OH**	**$1,468,771**	**1.1**	**100%**
Valley International	Harlingen, TX	$1,440,166	2.3	202%
Lehigh Valley	Allentown, PA	$1,407,930	3.2	278%
The Eastern Iowa	Cedar Rapids, IA	$1,328,228	1.6	135%
Quad City	Moline, IL	$1,326,833	2.9	249%
Midland International	Midland, TX	$1,285,114	2.5	222%
Lovell Field	Chattanooga, TN	$1,257,814	2.9	252%

Source: Albersman & Armstrong, 2013
[1] FAA Compliance Activity Tracking System (CATS)

Rental and return car areas are typically sized to accommodate two to three times the peak hour rentals, plus one hour of peak returns. In April 2012, a survey of all on-Airport rental car agencies was conducted to determine the peak hour transaction numbers from the peak day in the peak month. According to the survey, there were 87 rentals and 77 returns during the peak hour. For the purpose of this demand analysis, two times the peak hour rentals plus one-hour peak returns yields a demand of 215 stalls – ready/return parking. This number is 218 percent higher than the current supply of 115 spaces. When this percentage is compared to the table above, it is evident that the current ready/return supply at CAK is inadequate.

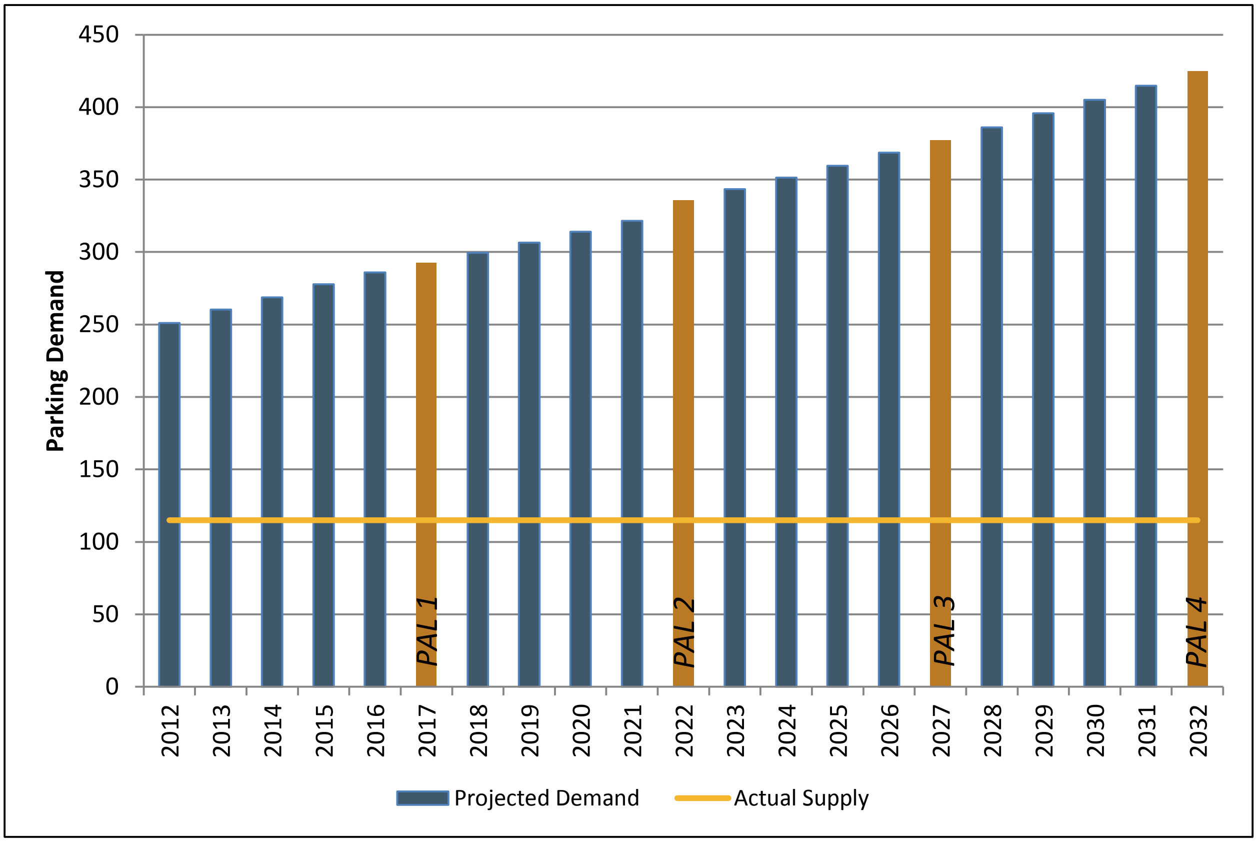
Using the rental car demand number as calculated above, **Table 4-46** and **Figure 4-18** show the inadequacy of the current ready/return car area from today and in the future.

Table 4-46 – Projected Ready and Return Parking Surplus and Deficit

Year	PAL	Enplanements	Demand	Actual Supply	Surplus/Deficit
2012	Current	942,343	251	115	-136
2017	PAL 1	1,144,900	293	115	-178
2022	PAL 2	1,313,200	336	115	-221
2027	PAL 3	1,475,400	377	115	-262
2032	PAL 4	1,661,600	425	115	-310

Source: Albersman & Armstrong, 2013

Figure 4-18 – Projected Ready/Return Parking Supply and Demand



Source: Albersman & Armstrong, Ltd., 2013

Total Rental Car Facility Requirements

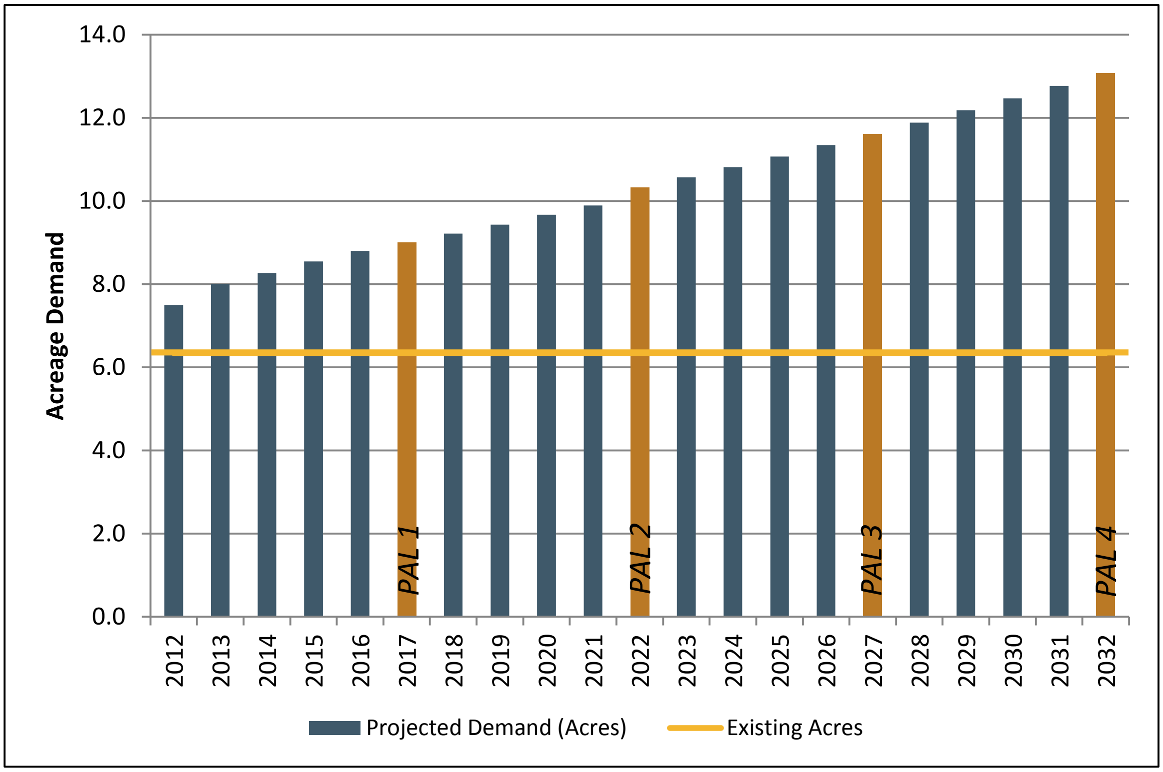
The deficit of the ready/return area above was added to the total existing rental car facility area to calculate the total rental facility area demand. The table for projected ready/return-parking shows a deficit of 136 vehicles. The square footage of a typical ready/return area is 400 square feet per car. This yields about 54,400 square feet, or 1.2 acres. This acreage was added to the existing acreage for a total area demand of 7.5 acres. As **Table 4-47** shows, there is currently a deficit at CAK of 1.2 acres and there will be deficit of 6.7 acres, by the time PAL 4 is reached.

Table 4-47 – Projected Total Rental Car Facility Area Surplus and Deficit

Year	PAL	Enplanements	Demand in Acres	Actual Acres	Surplus/Deficit
2012	Current	942,343	7.5	6.3	-1.2
2017	PAL 1	1,144,900	9.0	6.3	-2.7
2022	PAL 2	1,313,200	10.3	6.3	-4.0
2027	PAL 3	1,475,400	11.6	6.3	-5.3
2032	PAL 4	1,661,600	13.1	6.3	-6.7

Source: Albersman & Armstrong, Ltd., 2013

Figure 4-19 - Projected Total Rental Car Facility Area Supply and Demand



Source: Albersman & Armstrong, Ltd., 2013

Rental Car Roadway Access and Circulation

Access to the rental car ready/return lot is by a separate service road that runs east to west and connects to Lauby Road. This service road is located about 600 feet south of the main entry to the Airport ring road. The advantage of this service road is there is no rental car traffic on the main Airport ring road, minimizing congestion. The rental car ready/return lot is located adjacent to the south end of the passenger terminal. A more common practice is to provide access to the ready/return car area off of the airport ring road. This approach enables return car signage to be located within the terminal area, when the motorist is most likely to expect it.

4.11.7 Projected Taxi Queue and Cell Phone Lot Demand

The taxi queue and cell phone waiting lot is located just north of the short-term lot and has 52 available parking spaces. The lot provides space for taxicab staging and patrons waiting to pick up arriving passengers at the terminal curbside. While airports typically strive to maintain separate facilities for these functions, co-location of these two services at CAK appears to work well at this time, due to the current landside configuration of the terminal area. Since these landside transportation services rely on a single parking lot resource, their projected demands were evaluated together.

Taxi Queue Demand

Taxicabs servicing arriving passengers at CAK currently use the curbside roadway just outside of the passenger terminal by the rental car counters, where there are four designated taxicab spaces. As the taxis leave the curbside, they are replaced with taxis from the cell phone lot. CAK currently issues permits to on-Airport taxi operators for an annual fee and, to date, have issued about 20 permits. Theoretically, this will limit the number of taxis at the Airport at any given time.

Table 4-48 shows a comparison of taxi queue areas at other airports of similar size in terms of enplanements. As this table shows, the queue capacity varies widely and there is no real correlation in size between airports.

Table 4-48 – Taxi Queue Comparison/Benchmark - Similar Size Airports

Airport	Location	Similar Enplanements [1]	Taxi Queue Capacity
Tulsa International	Tulsa, OK	1,382,895	36
Adams Field	Little Rock, AR	1,097,403	12
Gerald R. Ford	Grand Rapids, MI	1,089,002	20
Syracuse Hancock	Syracuse, NY	1,013,418	28
Westchester County	White Plains, NY	999,831	40
Akron-Canton Airport	**Akron, OH**	**942,343**	**20[2]**
Des Moines International	Des Moines, IA	898,840	8[3]
Colorado Springs	Colorado Springs, CO	877,367	24
Portland International	Portland, OR	851,566	32
Savannah Hilton Head	Savannah, GA	798,194	30
Myrtle Beach International	Myrtle Beach, SC	792,737	8

Source: Albersman & Armstrong, 2013

[1] FAA Compliance Activity Tracking System (CATS)

[2] Operating permits issued by airport

[3] Not including a very generous cab queue along curbside

Providing that the current number of taxi permits issued satisfies the airport's desired customer service level, the demand for taxi queue requirements needs to be evaluated. Assuming that all 20 taxis were in service, only 50 percent of the taxis would be at the Airport at any given time.

Since there are four designated spaces at curbside, this would yield a current demand of six additional queue spaces. For this analysis, it was assumed that the number of curbside taxi positions remains the same and that demand for additional queuing spaces increases commensurate with enplanement growth.

Cell Phone Waiting Lot Demand

The purpose of a cell phone lot is to allow meeters and greeters to park in relatively close proximity to the airport – usually for free – and wait for their arriving party to call when they are ready to be picked up. Drivers in a cell phone lot are typically required to stay in their vehicle while waiting, although some airports apply time limits to cell phone parking, which implies the patron may leave the vehicle for a short period. The sizing comparison presented in **Table 4-49** shows that available cell phone parking at other airports of similar size varies widely. This suggests that there is no real correlation in size between airports.

Table 4-49 - Cell Phone Lot Comparison/Benchmark – Similar Size Airports

Airport		Similar Enplanements[1]	Cell Phone Parking Capacity
Tulsa International	Tulsa, OK	1,382,895	24
Adams Field	Little Rock, AR	1,097,403	None
Gerald R. Ford	Grand Rapids, MI	1,089,002	15
Syracuse Hancock	Syracuse, NY	1,013,418	20
Westchester County	White Plains, NY	999,831	48
Akron-Canton Airport	**Akron, OH**	**942,343**	**46[2]**
Des Moines International	Des Moines, IA	898,840	None
Colorado Springs	Colorado Springs, CO	877,367	25
Portland International	Portland, OR	851,566	32
Savannah Hilton Head	Savannah, GA	798,194	30
Myrtle Beach International	Myrtle Beach, SC	792,737	None

Source: Albersman & Armstrong, 2013
1 FAA Compliance Activity Tracking System (CATS)
2 Total of 52 spaces minus 6 taxi queue spaces

For the purpose of this analysis and, in order to calculate future demand, the occupancy from October 27, 2011 – as presented in **Table 4-50** – of 41 percent (19 spaces) was used and increased by 20 percent, to allow for any peaks during busy days and holidays. This yields a current demand of 23 spaces and it is assumed that cell phone lot demand will increase at the same rate as the projected enplanements.

Table 4-50 – Cell Phone Lot Supply and Occupancy – Historical

Date of Count	Actual Supply[1]	Percent Occupied	Demand (Occupancy)
April 6, 2012	46	39%	18
October 27, 2011	46	41%	19
May 29, 2010	46	7%	3
December 31, 2009	46	24%	11
June 4, 2009	46	24%	11

Source: Occupancy counts from Google Earth Pro Imagery
Albersman & Armstrong, 2013
[1] Total of 52 spaces minus demand of six taxi queue spaces

Projected Total Demand versus Capacity

Since the taxi queue and the cell phone parkers use the same lot, the projected demands for both users are calculated in the following **Table 4-51**. The projected demand shows a shortfall of four parking spaces by PAL 4.

Table 4-51 – Projected Taxi Queue/Cell Phone Lot Surplus and Deficit

Year	Enplanements	PAL	Taxi Queue Demand	Cell Phone Demand	TOTAL DEMAND	Actual Supply[1]	Surplus/Deficit
2012	942,343	Current	6	23	29	52	23
2017	1,144,900	PAL 1	9	30	39	52	13
2022	1,313,200	PAL 2	10	34	44	52	8
2027	1,475,400	PAL 3	11	39	50	52	2
2032	1,661,600	PAL 4	12	44	56	52	-4

Source: Albersman & Armstrong, 2013
1 Total of 52 spaces minus demand of 6 taxi queue spaces

Taxi Queue/Cell Phone Lot Roadway Access and Circulation

This lot is located just west of the economy lot and north – or outside – of the Airport ring road. Patrons and taxis access the cell phone and taxi queue lot from the Airport ring road. The four curbside taxicab spaces are filled from taxis waiting in the queue lot. When the arriving airline passenger is ready to be picked up, the cell phone patron has easy and quick access to the passenger terminal curbside. When a taxi passenger is picked up curbside, a staged taxi from the queue lot moves into that curbside position. Departing vehicles then exit by the Airport ring road system to Lauby Road. This circulation is typical of airports similar to CAK. Although most other airports have a dedicated taxi queue lot not shared with any other functions.

4.11.8 Landside Pavement Conditions

CAK does not have an existing pavement management program for the landside pavements. Therefore, an evaluation of those pavements was conducted to establish a Pavement Condition Index (PCI). As explained in **Section 4.8.2**, the PCI is a measurement of the structural integrity of the existing pavements, based on the quantity and severity of a number of distinct distress types commonly found in roadway and parking pavements – on a 0-100 scale. Based on the analysis completed in January 2012, the landside pavement PCI values at CAK range from "very poor" (PCI = 19) to "excellent"(PCI = 100). See **Figure 2-12**.

While there are no specific rules or guidance regarding minimum PCI levels for roadway and parking pavements, the PCI should be maintained at a level sufficient to provide safe and reliable service. Typically, airfield pavements – runways, taxiways and aprons – should be maintained above 70. However, automobiles using landside pavements are not as sensitive to pavement conditions as aircraft. Therefore, rehabilitating and maintaining pavements to achieve a PCI of at least 56 has been identified as the objective of this Master Plan Update.

4.12 CARGO FACILITIES

Cargo activity at CAK consists of airline belly cargo and on-demand cargo transportation. As described in **Chapter 3**, the FAA anticipates growth in domestic and international air cargo over the forecast period, with the greatest growth in international shipments. The preferred air cargo forecast for CAK, based on a static market share trend, shows a modest growth in cargo operations (49 percent) and cargo volume (37 percent) over the 20-year planning period. This modest growth is primarily due to the fact that Cleveland Hopkins International Airport accommodates the majority of international freight and all-cargo airlines for the northern Ohio region.

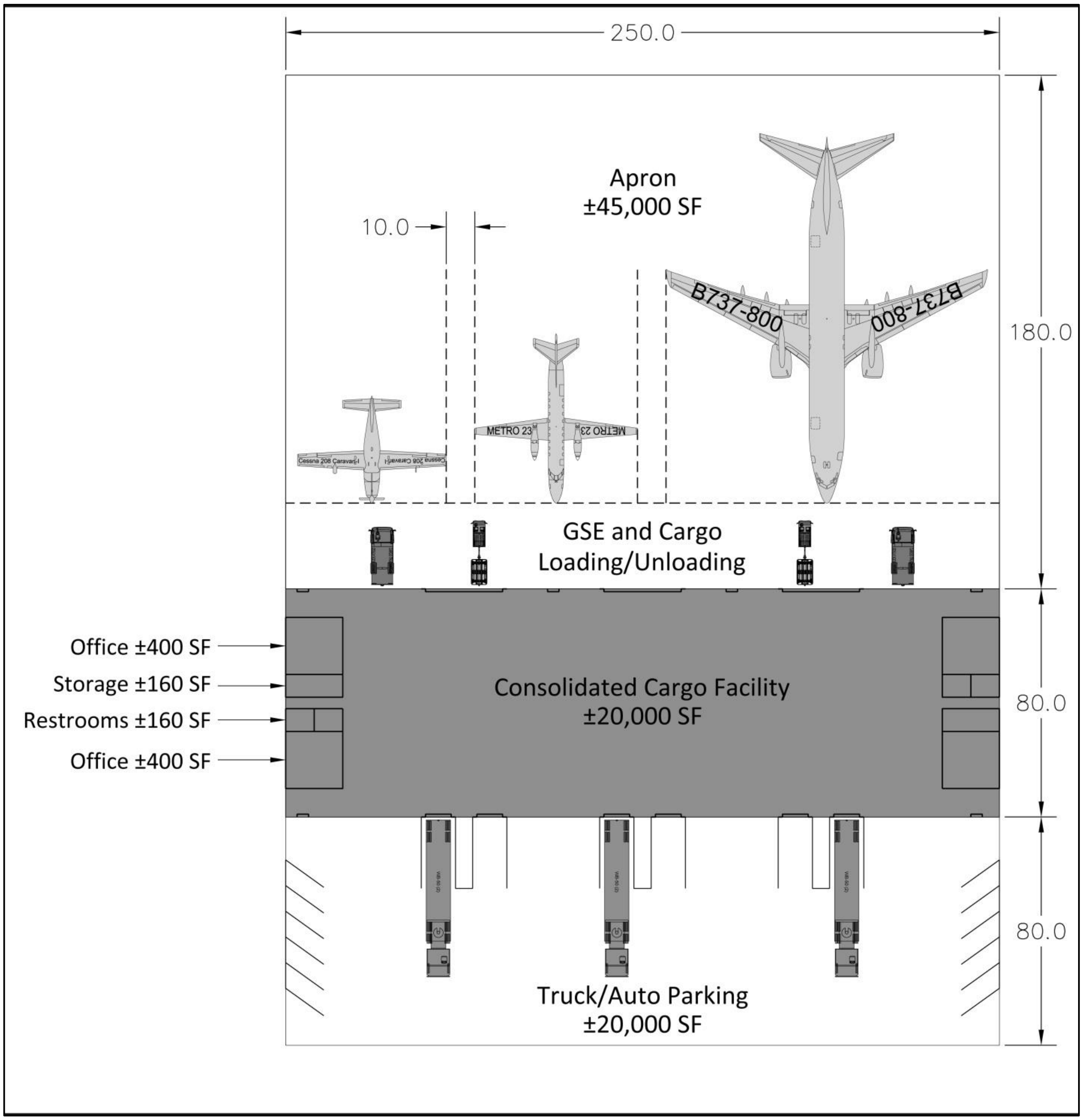
While all of the airlines at CAK support belly-cargo operations in varying capacities, Southwest accommodates the majority of volume. They currently have a broad network of cargo facilities throughout the U.S. and are maintaining a focus on the growth of belly-cargo operations – including those at CAK. Castle Aviation performs all dedicated-cargo operations with five trips per night, five nights a week. They operate nine aircraft, five of which are
Dedicated cargo and the other four used as passenger charter cargo mix. Their fleet includes Cessna 208 Caravans, SAAB 340s, Piper Aerostars and Swearingen Merlins. Purolator, Inc., a Canadian-based, integrated freight and parcel shipping company (www.purolator.com), is currently CAK's largest cargo customer. Purolator ships freight with Southwest Airlines and Castle Aviation. Purolator also operates Boeing 727s and MD-80s, but not into CAK at this time. Indications suggest Purolator's activity continues to increase. As of early 2013, Castle is adding aircraft to its fleet to accommodate cargo demands. Conversations with tenants and Airport staff have found that Purolator desires to eventually establish a mini-hub – consolidated cargo facility – in the U.S. CAK is believed to be the leading candidate location, due to its proximity to Canada, its central U.S. location, the availability of developable airside land and Purolator's existing contracts with Southwest and Castle Aviation.

A hub type facility like this could significantly increase the cargo operators' business and overall operations – international and domestic – at CAK. With the budding progression of this business, growing national trends in air cargo and continued market globalization, it is recommended that the Authority incorporate – or at least identify potential space – for the development of a stand-alone, consolidated cargo facility into the overall long-term land use plan for the Airport.

Should it become warranted to move ahead, the evaluation of an archetypal cargo facility was performed to identify the space required for such a facility. With Purolator, Southwest and Castle Aviation as the driving factors, a review of the shipping facilities for Purolator yielded a range of 5,000 to 25,000 square foot buildings, while those dedicated for Southwest range from 10,000 to 20,000 square feet. Considering the level of potential activity, a 20,000 square foot cargo building is believed to be adequate for this conceptual facility. This sizing includes area for cargo storage, loading and unloading operations, administrative space, bathrooms, etc. A minimum parking and maneuvering lot for trucks and automobiles was determined to be approximately 20,000 square feet.

Approximately 45,000 square feet of apron space is needed to accommodate up to one B737-800 and two-three smaller aircraft operated by Castle Air. This area also includes space for ground loading, unloading and transfer operations. This brings the total area required for a conceptual cargo facility (refer to **Figure 4-20**) to approximately 85,000 square feet or two acres. Potential locations for such a facility at CAK will be discussed in **Chapter 6**.

Figure 4-20 – Conceptual Consolidated Air Cargo Facility



Source: CHA, 2013

4.13 GENERAL AVIATION (GA) AIRCRAFT STORAGE FACILITIES

General aviation comprises all civil aviation activities except for commercial airline service. GA facilities are important components at CAK because they provide storage for 146 based aircraft (2012 total, including aircraft belonging to three Fortune 500 companies) and provide necessary Fixed Base Operator (FBO) and aircraft services such as maintenance, fuel and deicing.

Aircraft storage requirements for a general aviation facility are a function of the number of based aircraft, the type of aircraft to be accommodated, owner preferences and local climate. Due to the harsh winters at CAK, all based aircraft are stored in hangars instead of on the apron. Hangars are typically classified as T-hangars or group conventional hangars, both of which exist at CAK. These hangars are privately developed or leased from the Airport and operated and maintained by their respective tenants. A list detailing the 33 hangar facilities at CAK is presented in **Chapter 2**.

It is understood that the based aircraft at CAK are all currently accommodated, and the hangars are mostly at capacity. While a few more aircraft could be accommodated, it is assumed that any increase in based aircraft will require new hangar facilities. According to the forecasts presented in **Chapter 3**, the based aircraft count is expected to grow to 156 by 2032, with jet type aircraft comprising the majority of growth. Depending on the specific size and type of these 10 additional aircraft, they could be accommodated in two-three group hangars – or in up to ten individual hangars. Including associated apron, automobile parking and tenant office space, an area of approximately three-six acres would be needed to develop those facilities.

These facilities can and should be developed on an as-needed basis, with evidence of viable tenants and financial feasibility. Development of these new or expanded GA facilities should be focused in the area west of the runway intersection, consistent with the on-Airport land use plan discussed in **Chapter 5.** Since unforeseen circumstances (economy growth, establishment of new flying club) could potentially drive greater growth in based aircraft numbers, preserving space for additional expansion of the west side GA facilities should also be factored into the long-term, on-Airport land use planning.

4.14 MILITARY FACILITIES

The military facilities at CAK support Army and Navy reserve components and their training and readiness missions. The Army National Guard facilities and Navy Operational Support Center (NOSC) are located on Airport property. Discussions with the installation commander indicate that their aviation facilities – apron and hangars – are anticipated to be sufficient through the planning horizon and there are no plans for expansion at this time. Refer also to the apron discussion in **Section 0**.

However, the NOSC – built in October 2011 under the Base Realignment and Closure (BRAC) program – consolidated NOSC Akron and NOSC Cleveland. The influx of Navy personnel from the Cleveland site has subsequently generated a need for increased automobile parking capacity during drill weekends. Discussions with the installation commander indicate that they do not have plans to expand during their current leasehold, but may eventually consider modifying or adding space for parking in the future. Ongoing coordination between the Authority, the Army National Guard and the Navy will ensure that facilities remain sufficient for current and future military operations. Space for potential future expansion of these military facilities should be factored into the long-term, on-Airport land use planning.

4.15 SUPPORT FACILITIES

Various support facilities are needed at an airport to maintain safe, efficient aircraft operations and effectively serve the travelling public. At CAK, support facilities include fueling, Aircraft Rescue and Fire Fighting (ARFF), Customs and Border Patrol (CBP), rental cars, utility infrastructure and internal access.

4.15.1 Fueling Facilities

As stated in **Chapter 2**, numerous fuel facilities and tanks exist at the Airport, most of which are small tanks maintained by individual tenants. As the contract supplier of fuel to the airlines operating at CAK, McKinley Air Transport operates and maintains the primary fuel farm, located south of the long-term parking lot. This fuel farm consists of four 25,000-gallon Jet-A and one 15,000-gallon 100LL tank. The existing storage capacity is considered adequate to support current traffic levels and anticipated traffic levels brought on by Southwest. Moreover, before initial construction of the farm, McKinley allocated enough land to accommodate three additional 25,000-gallon Jet-A tanks. This storage increased the total capacity to 175,000 gallons, supporting any future increase in fuel uplift. Ultimate Air Center also maintains fuel storage facilities for GA aircraft, with two 20,000-gallon Jet-A tanks and one 10,000-gallon 100LL tank. There has been no need for additional fueling facilities expressed. Should additional fuel tanks be needed, the existing fuel farm could be expanded, in accordance with the expansion plan already in place.

4.15.2 Aircraft Rescue and Firefighting (ARFF)

The 30,000 square foot ARFF facility is located south of the passenger terminal building, on the east end of Taxiway K. This facility became operational in early 2013 and houses all of the ARFF staff, equipment and vehicles. The building also serves as an airfield management center, weather center and storage for airport maintenance equipment.

Federal Aviation Regulation (FAR) Part 139 mandates that, within three minutes from the time of alarm, at least one firefighting vehicle must be capable of reaching the midpoint of the farthest runway from its assigned post and applying extinguishing agent. Within four minutes from the time of alarm, all other vehicles must reach the above point and begin application of extinguishing agent. The new ARFF site at CAK is located so that response times to the midpoint of all existing runways are within allowable limits.

As described in **Chapter 2**, the Airport currently operates with an ARFF Index of B corresponding to the Boeing 737-700, the longest aircraft (110 feet, four inches). The aircraft has at least five daily departures at CAK. The operational threshold for moving to Index C is five daily departures by aircraft with a length of 126-159 feet. With consideration of the commercial fleet mix described in **Chapter 3**, increased operations by the Boeing 737-800 would trigger the Index C requirements. The Airport currently meets the equipment requirements for ARFF Index C, when the need arises, but changes to the staff's operating procedures (i.e., adjustments to staff schedules) would be required.

4.15.3 Customs and Border Patrol

There are currently no Customs and Border Protection (CPB) facilities located at CAK. Any international charter or cargo flights operating into the Airport are cleared by CBP on a pre-arranged, on-call basis. Or the flights are directed to other facilities, such as Cleveland Hopkins International Airport or Pittsburgh International Airport.

Consistent with the *CAK 2018 Capital Improvement Plan*, the Authority is coordinating with the Department of Homeland Security to develop a CBP facility. The facility would allow the Airport to function more effectively as a point of entry. In the short term, a portion of the previous ARFF building was converted into a General Aviation Facility (GAF) where CBP staff can be accommodated and GA international traffic can be processed. Expansion of the CBP facilities, in the GAF and in the terminal building, as described in **Section 4.10.6** would likely be pursued with evidence of demand and airline commitment.

4.15.4 Utility Infrastructure

Existing utility lines and structures at CAK were assessed in 2012. The conditions of the utilities are described in the following subsections. Ongoing facility development at the Airport will likely require the relocation, replacement and/or updating of portions of these systems. A detailed Utility Layout mapping set was prepared as a part of this Master Plan Update and provided to the Authority in 2012. A half-size version of this set is included in **Appendix C**.

Communications

Communication lines for telephone service are owned and maintained by AT&T, but some communication lines are owned and maintained by the Airport. The Airport-owned lines are all relatively new and are considered to be in good condition.

Gas

All gas lines and appurtenances are owned and maintained by Dominion East Ohio Gas Company. This includes lines that carry gas for customers (domestic lines), large diameter (12-20”) transmission lines that carry gas over long distances and gathering and storage lines (well lines). Gathering and storage lines are part of a system that enables the gas company to store the excess gas produced during low consumption months (summer) underground for later use when the demand is higher, typically in the winter. There are no known problems or issues with any of these lines. As part of the Runway 5/23 Safety Area Improvement project, the transmission lines and gathering and storage lines in the southwest portion of the Airport’s property were relocated. These lines are considered to be in good condition. All other lines are considered to be in fair condition.

Power

Power lines and appurtenances are owned and maintained by First Energy Ohio Edison. There are known no problems or issues, and the lines are considered to be in fair condition.

Sanitary Sewer

Sanitary sewer, force main and pump stations within public road right-of-way or easements are owned and maintained by their respective public sewer authorities – Stark County Sanitary Engineer or Summit County Department of Environmental Services. This excludes 10-foot and eight-foot sewers along Lauby Road, extending north from the Airport's south service road to its ending manhole. The Airport owns and maintains them, as well as the system along West Airport Drive. The pipes along West Airport Drive are PVC and approximately 30 years old. There are no known problems with this pipe system. It is considered to be in fair condition.

There are eight-foot and six-foot vitrified clay sewers in close proximity to the terminal building and various tenant buildings. In recent years, a few sections of the pipe in the vicinity of the terminal building have been repaired after collapsing. Additionally, after high rainfall events, there have been sewer backups into the terminal building, possibly due to leaking pipe joints. The exact age of these pipes is not known, but they are thought to be at least 60 years old. These pipes and manholes are considered to be in poor condition. This portion of the system connects to an eight-foot pipe that runs east along the south service road to the sewer along Lauby Road. This section of sewer is approximately 50 years old, and considered to be in fair/poor condition. The section of eight-foot and 10-foot sewer along Lauby Road is maintained by the Airport and is approximately 30 years old. This portion of the system is considered to be in fair condition.

There are two short sanitary sewer extensions from the Lauby Road sewer – one to rental car facilities and one to the glycol treatment plant. Both are relatively new (PVC pipe) having been installed within the last 10 years. They are considered to be in good condition. Also, there is a new six-inch PVC sanitary sewer installed to the new ARFF facility, considered to be in good condition. The airport maintains these pipe systems.

There are two small pump stations serving tenant buildings in the north portion of the terminal building area. One serves building 27, and is owned and operated by the tenant. The age and condition of this system is not known. The other pump station and force main serve buildings 12, 13 and 25. It is owned and operated by the Airport and is considered to be in poor condition.

Water

Waterlines, hydrants and appurtenances within public road right-of-way are owned and maintained by their respective public water authorities (City of North Canton or Aqua Ohio Water Company). North Canton Water operates and maintains the waterline along Lauby Road. North Canton Water also operates and maintains some waterlines on Airport property in the vicinity of the terminal building. These are eight-foot and 12 foot lines located in the vicinity of tenant buildings 16, 17, 18, 19 and 39, as well as the rental car maintenance facilities, located south of the terminal building. The City operates and maintains a 12-foot waterline that runs east to west along the south service road, and also a 12-foot line that crosses Lauby Road and runs for a short distance along the north service road. North Canton also operates and maintains new 8-foot ductile iron water lines, extended from their water main on Lauby Road to the Glycol Treatment plant and the ARFF building. All the ductile iron waterlines noted above are all relatively new and are considered to be in good condition.

The Airport owns four-foot and six-foot water lines located in front of the terminal building and in front of tenant buildings 2-13, 25, 27 and 28 – located north of the terminal building. The lines are thought to be approximately 60 years old and only occasionally break. The Airport and the city of North Canton have a service agreement in place. Thus, the city has all the waterlines in the vicinity of the terminal building incorporated into their computerized water model. Analysis using the model results in a recommendation to replace the four-foot and six-foot lines, due to their small diameter, age and looping capability. New lines will be 12 feet in diameter. The portion of the system comprised of four-foot and six-foot waterlines is considered to be in poor condition.

There is an existing 10-foot fire line that surrounds the terminal building. It includes a 10- foot spur that provides water to building 16 for firefighting. There is an existing well, booster pump and storage tank in a building in front of the terminal building that supplies the fire line. This system is approximately 60 years old. This portion of the system is considered to be in fair/poor condition. The Airport anticipates removing the well, pump and storage tank after the new 12-foot waterline noted above is installed and connected to the 10-foot fire line. This will need to be verified using the city's water model.

4.15.5 Internal Access

The Airport and FAA have expressed a desire for a full internal access road system that would provide automobile access to the remote areas of the airfield (e.g., NAVAIDs, GA West) while separating automobile traffic from aircraft traffic. An access road system would eliminate the need for ground vehicles to navigate on taxiways, cross active runways or leave Airport property to reach these sites. A full-loop, internal access road is recommended, but may not be feasible, given the terrain challenges at the Airport. Access road connections between certain areas of the airfield (e.g., between the terminal area and GA west area) will be evaluated in **Chapter 6**.

4.16 AIRSPACE PROTECTION

As directed by Federal Aviation Regulation (FAR) Part 77 *Obstructions to Navigable Airspace*, imaginary surfaces around the airfield are established for determining obstructions to air navigation. These surfaces can vary in shape, size and slope, depending on the available approach procedures to each runway end. Any penetration of these imaginary surfaces, either manmade or natural, are identified as obstructions and must be evaluated by the FAA to determine if they present a hazard to air navigation. If determined to be a hazard, the obstacle should be removed or altered to mitigate the penetration. If not mitigated appropriately, the obstacle could adversely affect approach and departure minimums and/or procedures. Based on the instrument approach capabilities described in **Section 4.5** and the requirements of FAR Part 77, below are the imaginary surfaces as they apply to CAK:

Primary Surface – This surface is longitudinally centered on the runway. The elevation of any point on the surface is the same as the elevation of the nearest point on the runway centerline. For Runways 5/23 and 1/19, this surface is 1,000 feet wide and extends 200 feet beyond the ends of pavement usable for takeoff and landing.

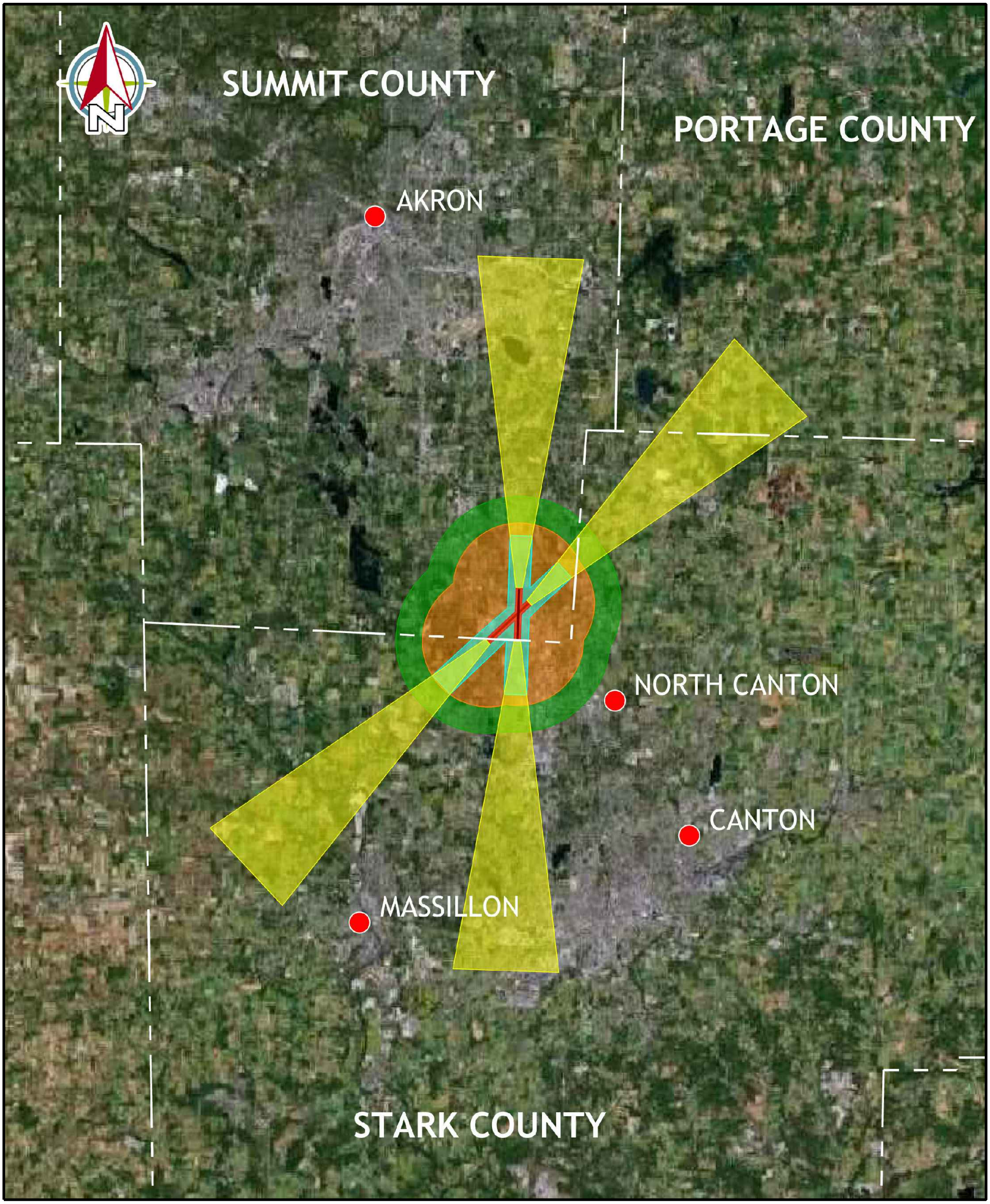
Approach Surface – This surface is longitudinally centered on the extended runway centerline and extends outward and upward from the end of the Primary Surface. An Approach Surface is applied to each end of each runway, based upon the type of approach available or planned for that runway end. The inner width of the Approach Surface is the same width of the Primary Surface. The Approach Surface extends at a specific slope to a uniform width and distance based on the approach capabilities of the runway. For the each runway at CAK, this surface is 50,000 feet long, at a slope of 50 to 1 for the first 10,000 feet and a slope of 40 to 1 for the additional 40,000 feet, to an outer width of 16,000 feet.

Transitional Surface – This surface extends outward and upward from the sides of the Primary Surface and from the sides of the Approach Surfaces at a slope of 7 to 1 up to the height of the Horizontal Surface. For those portions of the Precision Approach Surface that extend beyond the limits of the Conical Surface, the Transitional Surface extends 5,000 feet horizontally from the edge of the Approach Surface.

Horizontal Surface – This surface is a horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii from the center of each end of the Primary Surface of each runway and connecting the adjacent arcs by lines tangent to those arcs. At CAK, the Horizontal Surface extends 10,000 feet from the ends of the runways, at an elevation of 1,358 feet MSL.

Conical Surface – This surface extends outward and upward from the periphery of the Horizontal Surface. The Conical Surface extends at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

These surfaces are illustrated in **Figure 4-21**.



AKRON-CANTON AIRPORT

MASTER PLAN UPDATE

Figure 4-2□

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4.16.1 Runway End Siting Requirements

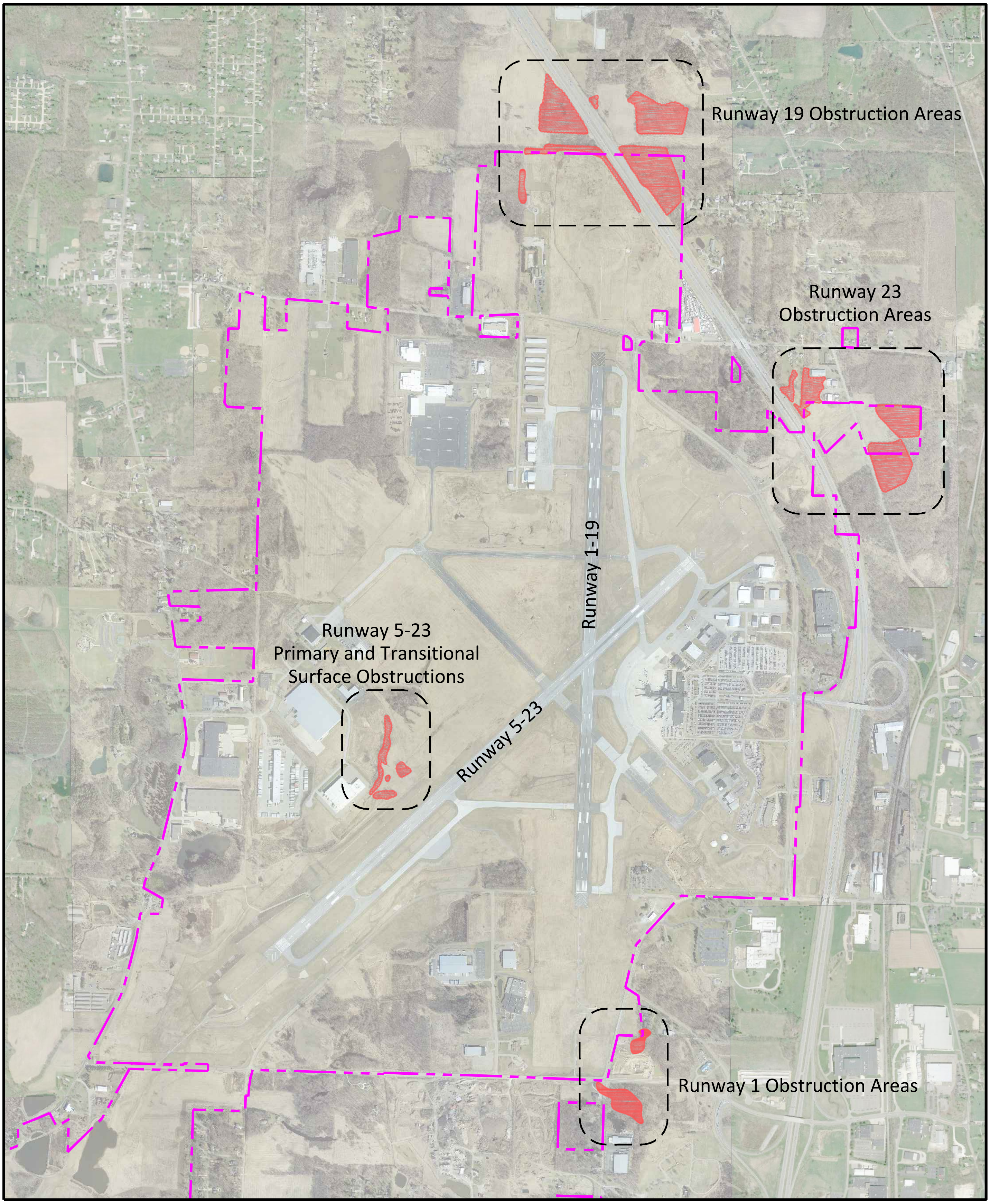
The FAA has also established sloping Obstacle Clearance Surfaces (OCS) that are used in the design and approval of instrument flight procedures, outlined in Order 8260.3 *United States Standard for Terminal Instrument Procedures (TERPS)*. These surfaces are based on an aircraft descending on a glide path or climbing in a departure or missed approach. Although no changes to the runway ends are currently planned as a result of this Master Plan Update, these surfaces were evaluated to determine hazards to air navigation. Like the Part 77 surfaces, these surfaces can vary in shape, size and slope and are described below.

Approach Surface – These surfaces are designed to protect the use of the runways in visual and instrument meteorological conditions near the Airport. The approach surface typically has a trapezoidal shape that extends away from the runway along the centerline and at a specific slope, expressed in horizontal feet by vertical feet. For example, a 20:1 slope rises one unit vertically for every 20 units horizontally. The specific size, slope and starting point of the trapezoid depends upon the visibility minimums and the type of procedure associated with the runway end.

Departure Surface – These surfaces, when clear, allow pilots to follow standard departure procedures. Except for runways that have a designated clearway, the departure surface is a trapezoid shape that begins at the end of the Takeoff Distance Available (TODA) and extends along the extended runway centerline and with a slope of one unit vertically for every 40 units horizontally (40:1). For runways that have a clearway, the departure surface begins at the far end of the clearway at the elevation of the clearway at that point.

4.16.2 Airspace Analysis

An airspace analysis was conducted to identify any obstructions to the Part 77 and runway end siting surfaces described previously. This analysis used terrain data and tree and obstacle heights obtained from the 2011 aeronautical survey of CAK and nearby areas. In this analysis areas of concern were identified that should be monitored and addressed in the ongoing maintenance and operation of the Airport. The result of this analysis is documented in more detail on *Sheets 6 through 14* of the Airport Layout Plan (ALP) Drawing Set. There were no determined obstructions to the Runway End Siting Surfaces, which the FAA uses to design and approve instrument flight procedures. There were obstructions to the Part 77 surfaces. It is recommended that the Authority coordinate with the FAA to develop a hazard mitigation project.



AKRON-CANTON AIRPORT

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Figure 4-22
Airspace Analysis - Areas of Concern

4.17 SUMMARY OF FACILITY REQUIREMENTS

This chapter identified Akron Canton Airport's capacity and development needs for existing and anticipated activity levels. Largely based on the aviation activity forecasts presented in **Chapter 3**, the recommendations determined in this chapter are the basis of the development concepts and recommendations discussed in **Chapters 5 and 6**. The following summarizes the recommendations presented in this chapter.

Property/Land Use

- Acquire approximately 19 acres of land within the Runway 23 RPZ. Partial acquisition in some areas may be sufficient.
- Identify two acres of land available for a potential future cargo facility.
- Preserve areas for terminal and commercial apron expansion.
- Preserve space for future GA facilities on the west side of the airfield – aprons, hangars, fuel farm, etc.
- Preserve space for expansion of military facilities.
- Preserve space for potential fuel farm expansion.
- Continue to promote development in the Foreign Trade Zone, Port Green Industrial Park and Port Jackson Business Park.
- Continue to work with local governments to sustain compatible land use around the Airport.

Airfield

- Reclassify Airport as a D-III facility (currently C-III).
- In compliance with D-III standards, the runway to hold line separation distance will need to be increased from 250 feet to 262 feet.
- Preserve capability for airfield to meet D-IV and D-V standards.
- Provide additional taxiway infrastructure to provide west side access and reduce active runway crossings.
- Remove or mitigate taxiway hot spots and high-energy intersections.
- Realign Taxiway E to a 400-foot runway to taxiway separation east of Taxiway B.
- Provide additional exit taxiway for aircraft landing on Runway 23 between Taxiways K and F2.
- Develop a holding bay or bypass capability at the Runway 23 end, if feasible.
- Conduct routine maintenance of airfield pavements. An ACN-PCN analysis should be done in the near term planning horizon.
- Upgrade one ILS system to CAT-II if warranted in the NAVAID upgrade feasibility analysis.

Terminal

- Remove pier concourse to relieve Part 77 concerns.
- Gates from pier concourse should be replaced with second story gates capable of accommodating at least the Boeing 737-800.
- Expand the terminal building to meet PAL demands. The major areas of expansion include:
  - Outbound baggage handling and screening areas
  - Increased number of passenger gate lounges and associated amenities, concessions, restrooms and corridors
  - Baggage claim area
  - Space for a future U.S. Customs and Border Protection (CBP) facility
  - Space to accommodate consolidation of Transportation Security Administration (TSA) regional administrative functions

Terminal Area

- Expand terminal apron commensurate with the number of gates in the terminal.
- Provide 18,000 SF of dedicated covered GSE storage space.
- Provide two-three remain-overnight (RON) parking spaces for aircraft as large as ADG-IV.
- Relocate deicing pads if warranted or necessary due to terminal expansion.

Parking and Access

- Provide additional public parking (structure or surface) to accommodate PAL demands.
- Provide additional rental car ready/return parking to accommodate PAL demands.
- Reorient public access road to separate entering and exiting vehicles to improve efficiency and customer convenience.
- Install automated credit card in/out system when a new cashier plaza is developed to reduce personnel costs.
- Rehab and maintain parking and access pavements to achieve a PCI of at least 56.

General Aviation

- Provide 3,200 SY of additional apron space to accommodate PAL 1 demands.
- Construct fueling and deicing facilities on the west side of the airfield as more GA facilities are relocated there.
- Provide two-three group hangars or one t-hangar bank for projected increase in GA based aircraft.
- Provide additional hangar storage on an as-needed basis, as evidence of demand increases.