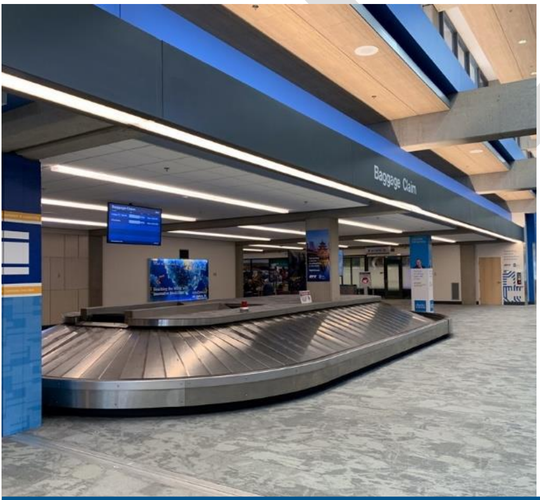
Evansville Regional Airport

Draft Working Paper #4

Airport Master Plan Update

Demand/Capacity and Facility Requirements

November 2024



CHA

TABLE OF CONTENTS

FIGURES

TABLES

4 DEMAND/CAPACITY & FACILITY REQUIREMENTS

This chapter details the analyses conducted to identify facility requirements, nonstandard conditions, and deficiencies for the potential future 20-year planning horizon at Evansville Regional Airport's ('EVV'). The future planning in regards to the development of the Airport and the facility's ability to support future activity is projected and correlated with **Chapter 3**, *Forecasts of Aviation Activity*. Evaluations were conducted to ensure that the recommendations of this Master Plan Update ('MPU') adequately accommodate existing and anticipated activity levels. Using the preferred aviation activity forecast presented in **Chapter 3**, the Airport's facility needs were determined, which will form the basis of the development concepts discussed in the remainder of the MPU document.

The airport demand, capacity, design standards, and the overall facility requirements at EVV were evaluated using guidance contained in several FAA publications, including:

- Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*
- AC 150/5000-17, *Critical Aircraft and Regular Use Determination*
- AC 150/5210-15A, *Aircraft Rescue and Firefighting (ARFF) Station Building Design*
- AC 150/5300-13B, *Airport Design – Change 1*
- AC 150/5325-4B, *Runway Length Requirements for Airport Design*

During the evaluation, additional publications served strictly as technical references (thus not substituting FAA policy), including:

- ACRP, *Report 25, Airport Passenger Terminal Planning and Design, Volume 1: Guidebook & Volume 2: Spreadsheet Models and User's Guide*
- International Air Transportation Association (IATA*), Airport Development Reference Manual (ADRM), 12th Edition*

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

- Airfield Capacity & Delay
- Runway Requirements
  - Wind Coverage
  - Length & Width
  - Design Standards
  - Pavement Strength & Condition
  - Safety Area Review
  - Analysis to Determine Long Term Plan for Runway 9-27
  - Analysis of Runway 36 Landing Threshold Relocation
- Taxiway Requirements
  - Taxiway Design Group (TDG) Determination
  - Safety Area Review
  - Taxiway Pavement Geometry & Analysis of Hot Spots
  - Analysis of Taxiways within Terminal Area
- Airfield Lighting and Navigational & Landing Aids Requirements
  - Airport Navigational Aids
  - Runway Lighting and Navigational Aids
  - Taxiway Lighting
- Passenger Terminal Facilities
  - Aircraft Gates
  - Concourse Holdrooms
  - Passenger Check-In
  - Security Checkpoint
  - Inbound/Outbound Baggage Processing
  - Terminal Apron
- Support Facilities
  - General Aviation Facilities
  - Cargo Facilities
  - Aviation Fueling Facilities
  - Aircraft Rescue and Firefighting Facilities
  - Maintenance Facilities
  - Air Traffic Control Facilities
- Surface Transportation & Parking Facilities

4.1 PLANNING FACTORS

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

4.1.1 Planning Activity Levels

Aviation activity is traditionally susceptible to fluctuations in economic conditions and industry trends. As such, identifying recommended facility improvements based solely on specific years is challenging. The timeline associated with the preferred forecast is representative of the anticipated timing of demand (in 5-year increments – 2023, 2028, 2033, 2038, and 2043). The actual timing of demand can vary; therefore, Planning Activity Levels (PALs), rather than calendar years, were established.

PALs represent ranges of activity that are expected to trigger the need for additional capacity or new development at the Airport, thus identifying significant demand thresholds for implementing recommended facility improvements and providing flexibility to advance or slow the rate of development in response to actualized demand. As an example, if the preferred forecast proves conservative (i.e., the high growth forecast scenario is realized due to successful airport marketing and route development initiatives, etc.), some recommended improvements may be advanced in schedule. In contrast, if demand occurs at a slower rate than predicted, the improvements should be deferred accordingly. As actual activity levels approach a PAL and trigger the need for a facility improvement, sufficient lead time for planning, environmental, 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 2023 and the planning horizon years 2028, 2033, 2038, and 2043.

Figure 4-1 presents a graphical representation of the PALs for passenger enplanements and depicts the relative time range by which each PAL could be reached if one of the forecast scenarios are actualized. For example, facilities capable of accommodating PAL 2 demands (i.e., ± 268,300 annual enplanements) could be needed as early as 2027 if the recommended-growth forecast scenario is experienced or, conversely, facilities capable of accommodate PAL 2 demand (i.e., ±260,593 annual enplanements) could be needed as early as 2033 if the recommended-growth forecast is experienced; or as late as 2037 if the low-growth scenario is realized.

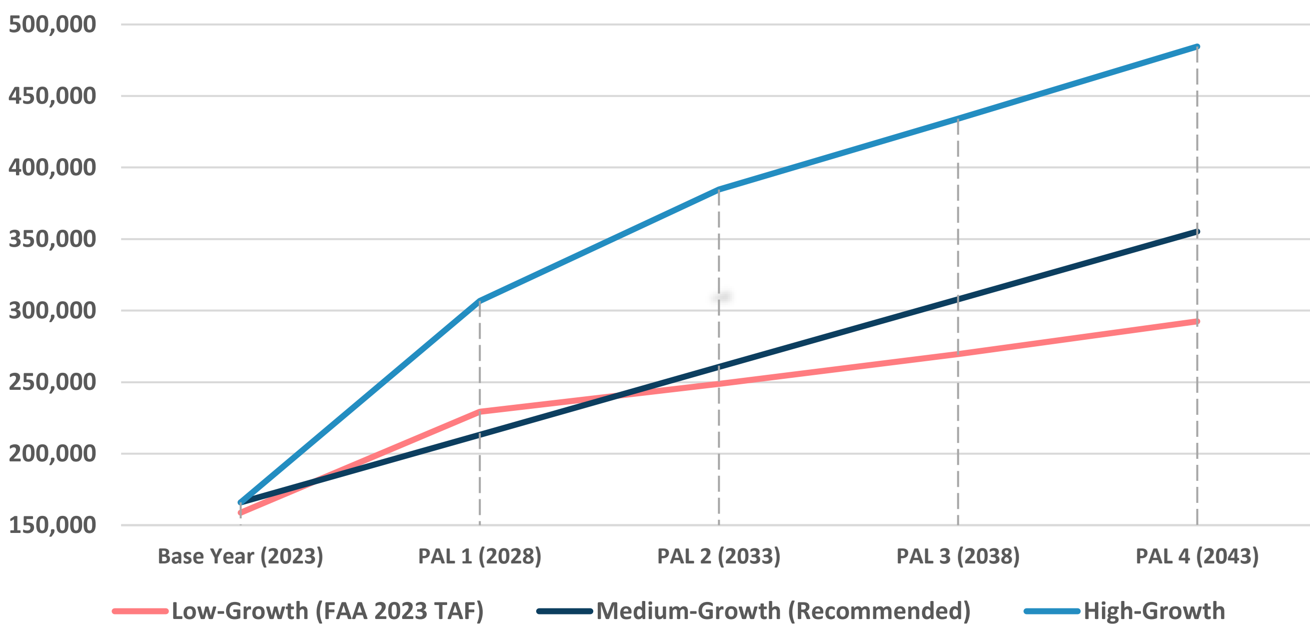
Table 4-1 – Planning Activity Levels (PAL)

Passenger Activity					
Passenger Enplanements	Base (2023)	PAL 1 (2028)	PAL 2 (2033)	PAL 3 (2038)	PAL 4 (2043)
Annual	165,933	213,263	260,593	307,923	355,244
Peak Month	16,415	21,097	25,779	30,461	35,143
Peak Month-Average Day (PMAD)	547	703	859	1,015	1,171
Peak Hour	164	211	258	304	351

Aircraft Operations						
Category	**Activity**	**Base (2023)**	**PAL 1 (2028)**	**PAL 2 (2033)**	**PAL 3 (2038)**	**PAL 4 (2043)**
Commercial Aviation	Annual	5,973	7,158	8,459	9,905	11,325
	Peak Month	565	677	800	937	1,071
	PMAD	18	22	26	30	35
	Peak Hour	4	5	6	7	8
Cargo	Annual	245	284	327	378	437
General Aviation	Annual	27,958	28,121	28,283	28,453	28,629
Military Aviation	Annual	3,425	3,425	3,425	3,425	3,425
Total Operations	Annual	**36,212**	**37,599**	**39,105**	**40,772**	**42,427**
	Peak Month	**3,820**	**3,948**	**4,106**	**4,281**	**4,455**
	PMAD	**127**	**132**	**137**	**143**	**148**
	Peak Hour	**8**	**8**	**8**	**9**	**9**
	Average Hour (Non-Peak)	**6**	**7**	**8**	**8**	**9**

Source: FAA 2023 TAF, FAA Operations Network (OPSNET), Bureau of Transportation Statistics (BTS) T-100 data, FAA Aerospace Forecast (FY 2024-2044), Boeing World Air Cargo Forecast (2022), Airbus Global Market Forecast (2023), Woods & Poole Economics, Inc., Evansville-Vanderburgh Airport Authority District (EVAAD), CHA, 2024.

Figure 4-1 – Planning Activity Levels (PALs)



Source: FAA 2023 TAF; Bureau of Transportation Statistics (BTS) T-100 data; EVAAD; CHA, 2024.

4.2 DESIGN/CRITICAL AIRCRAFT CLASSIFICATION

As discussed within **Chapter 3**, the 'critical aircraft' or 'design aircraft family' represents the most demanding aircraft or grouping of aircraft with similar characteristics that are currently using or are anticipated to make 'regular use' of an airport. The FAA defines 'regular use' within AC 150/5000-17, *Critical Aircraft and Regular Use Determination* as an aircraft or grouping of aircraft that operates at an airport or a specific runway by conducting at least 500 annual operations, including both itinerant and local operations. Note that regular use excludes touch-and-go operation as an operation is considered either an arrival or departure. This is critical in identifying a critical aircraft or design aircraft family for a runway.

When identifying the critical aircraft or design aircraft family, standard aircraft classifications are used based on aircraft approach speed and various dimensional lengths. These classifications are used to determine the Runway Design Code (RDC). The RDC is a code signifying the design standards that apply to an existing or planned runway. The RDC is a three-component code relating Aircraft Approach Category (AAC), Airplane Design Group (ADG), and approach visibility minimums establishing the design characteristics for a particular runway. The critical aircraft with regular use defines the AAC and ADG components of the RDC, whereas the runway's lowest visibility published on an instrument approach chart determines the visibility component. EVV's existing and future critical aircraft analysis can be reviewed in **Chapter 3**. Applying the RDC is used for planning and design only, and does not limit the aircraft that may be able to operate safely at an airport. Found below is a description of a runway's RDC:

- ***Aircraft Approach Category (AAC):*** Consists of a letter (e.g., A through E) corresponding to the critical aircraft's approach speed in a landing configuration.
- ***Airplane Design Group (ADG):*** Consists of a Roman numeral (e.g., I through VI) corresponding to the critical aircraft's wingspan or tail height, whichever is most restrictive.
- ***Runway Visibility Minimum:*** The minimum visibility required to see a runway which allows pilots to identify the runway and maintain directional control during takeoff.

The operations for each runway at EVV were observed in 2023 using monitoring equipment via MotionInfo are presented in **Table 4-2**. As shown, EVV experienced more than 500 annual operations for AAC Category D and ADG III aircraft in 2023; therefore, based on the analysis of TFMSC operations data, D-III represents the current group of aircraft with similar characteristics, or the current critical aircraft grouping for Runway 4-22. The analysis concluded that Runway 18-36 has a RDC of B-II and Runway 9-27 has a RDC of A-I Small.

Runway 9-27 and Runway 18-36 primarily serve GA users, with commercial and cargo activity occurring via Runway 4-22.

Table 4-2 – Existing EVV Operations by AAC & ADG – All Users Per Runway

		Runway 4-22		Runway 18-36		Runway 9-27
AAC & ADG		Operations*	AAC & ADG	Operations*	AAC & ADG	Operations*
Subtotal by AAC	A	967	A	1,771	A	101
	B	1,089	B	1,276	B	10
	C	2,798	C	263	C	10
	D	1,007	D	18	D	4
Subtotal by ADG	I	1,472	I	2,118	I	101
	II	2,171	II	1,138	II	18
	III	2,210	III	71	III	6
	IV	8	IV	1	IV	0

*The totals shown within this table only include those reported in the ADS-B database via MotionInfo's monitoring equipment. Not all aircraft are equipped with ADS-B equipment, thus are not accounted for in the data provided in this table. The data further accounted for 1,148 helicopters in 2023.
Source: MotionInfo, CHA, 2024.

Table 4-3 represents the Airport's identified and forecasted design aircraft family as discussed within **Chapter 3**. Determining the critical aircraft is important when planning airfield and apron facilities as they may require specific facility design accommodations within their designated areas of operation. However, to evaluate the projected activity each runway will need to accommodate, the RDC was evaluated during the planning horizon which will be discussed.

Table 4-3 – EVV Operations by AAC Category & ADG Group (Projected) – All Users

AAC & ADG		Total Ops				
		[illegible] (202[illegible])	[illegible] (2028)	PAL [illegible] ([illegible]033)		
Subtotal by AAC	A	9,273	9,273	9,350	9,447	9,552
	B	4,502	16,011	16,100	16,192	16,286
	C	5,830	9,346	10,252	11,305	12,341
	D	362	2,215	2,648	3,071	3,490
Subtotal by ADG	I	3,882	12,184	12,238	12,307	12,378
	II	6,934	18,128	17,595	17,814	18,041
	III	2,408	6,490	8,473	9,850	11,205
	IV	10	43	44	44	45
Helicopters		148	754	755	757	758

Source: FAA TFMSC, Bureau of Transportation Statistics (BTS) T-100 data, CHA, 2024.

As discussed within **Chapter 3** and presented in **Table 4-4** a grouping of D-III represents the projected RDC for Runway 4-22, thus retaining its current grouping and runway use. Runway 18-36, which is currently a B-II, is projected to increase to C-II as fleet mixes continue to change and experience increases in commercial and cargo activity. Runway 9-27 is projected to remain A-I. Runway utilization, was projected by analyzing historical ads-b data and applying percent use assumptions to the overall operations.

Table 4-4 – EVV Operations by AAC & ADG (Projected) – All Users (By Runway)

AAC & ADG		2028	2033	2038	2043
Runway 4-22					
Subtotal by AAC	A	3,159	3,185	3,218	3,254
	B	7,341	7,382	7,424	7,468
	C	8,515	9,341	10,300	11,244
	D	2,168	2,591	3,005	3,415
Subtotal by ADG	I	4,859	4,881	4,908	4,936
	II	11,829	11,481	11,624	11,772
	III	6,271	8,188	9,518	10,828
	IV	38	39	39	40
Runway 18-36					
Subtotal by AAC	A	5,785	5,833	5,893	5,959
	B	8,602	8,650	8,699	8,750
	C	800	878	968	1,057
	D	39	46	54	61
Subtotal by ADG	I	6,992	7,023	7,062	7,103
	II	6,201	6,018	6,093	6,171
	III	201	263	306	348
	IV	5	5	5	5
Runway 9-27					
Subtotal by AAC	A	330	333	336	340
	B	67	68	68	69
	C	30	33	37	40
	D	9	10	12	14
Subtotal by ADG	I	333	335	337	339
	II	98	95	96	98
	III	17	22	26	29
	IV	0	0	0	0
Helicopters					
Helicopters		754	755	757	758

Source: MotionInfo, CHA, 2024.

4.3 AIRFIELD CAPACITY REQUIREMENTS

The aforementioned AC 150/5060-5, *Airport Capacity and Delay* outlines the computation for airfield capacity during airport planning and design. This evaluation helps to determine any capacity-related improvements or expansions that may be necessary to support flight activity levels. Based on FAA guidance, the simplified capacity analysis was applied at EVV. Furthermore, the Airport's estimated airfield capacity can be expressed in the following two measurements:

- ***Hourly Capacity:*** The maximum number of aircraft operations that an airfield can safely accommodate under continuous demand in a one-hour period. This expression accounts for Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) conditions and is used to identify any peak-period constraints on a given day.

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

4.3.1 Capacity Calculation Factors

Several key factors and assumptions specific to EVV were defined. Consistent with the guidance provided in AC 150/5060-5, those include:

- ***Aircraft Fleet Mix Index***: A ratio of the various classes of aircraft serving the Airport
- ***Runway-Use Configuration***: The number and orientation of the Airport's active runways
- ***Percentage of Aircraft Arrivals:*** The ratio of landing operations to total operations
- ***'Touch and Go' Factor***: The ratio of landings with an immediate takeoff to total operations
- ***Location of Exit Taxiways:*** The number of taxiways available to an aircraft within a given distance from the runways' landing thresholds
- ***Meteorological Conditions:*** The percentages of time an airfield experiences VFR, IFR, and Poor Visibility Conditions (PVC) conditions

AC 150/5060-5 provides estimated hourly airfield capacity for VFR and IFR operations, as well as the ASV based on runway configurations and the type of aircraft operating (or projected to operate) at an airport. The runway configuration and aircraft fleet mix, as they pertain to EVV, are further examined in the subsequent sections.

Aircraft Fleet Mix Index

The Airport's aircraft fleet mix index is determined by the size of typical aircraft and the frequency of their operations. To identify the aircraft mix index, AC 150/5060-5 establishes four categories in classifying an aircraft by its maximum takeoff weight (MTOW), as depicted in **Table 4-5.**

Table 4-5 – Aircraft Capacity Classifications

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

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

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

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

Although EVV can accommodate all four aircraft classes, the following operations percentages for aircraft categories C and D were gathered from a review of operations that occurred in the Base Year (2023):

- ***Class C:*** 16.5 percent of the Airport's operations
- ***Class D:*** 4.5 percent of the Airport's operations

As such, the Base Year mix index is 30.2, derived from the following formula [16.5 + 3(4.5) = 30.2], and displayed in the table below. A result of 30.2 which falls between the 21 and 50 mix index range, further shown in **Table 4-6**. Note, the numbers listed herein are rounded; however, the mix index calculation was completed using actual operations data, not rounded.

The projected operation percentages by aircraft class depicted in **Table 4-6** were utilized to project the future aircraft fleet mix index for each PAL.

Table 4-6 – Projected Operations by Aircraft Class (%)

Aircraft Class	Base (2023)	PAL 1 (2028)	PAL 2 (2033)	PAL 3 (2038)	PAL 4 (2043)
C	16.5%	24.9%	26.2%	27.7%	29.1%
D	4.5%	5.9%	6.8%	7.5%	8.2%
Mix Index	30.2	42.5	46.5	50.3	53.8

Source: FAA TFMSC, Bureau of Transportation Statistics (T-100 Data), CHA, 2024.

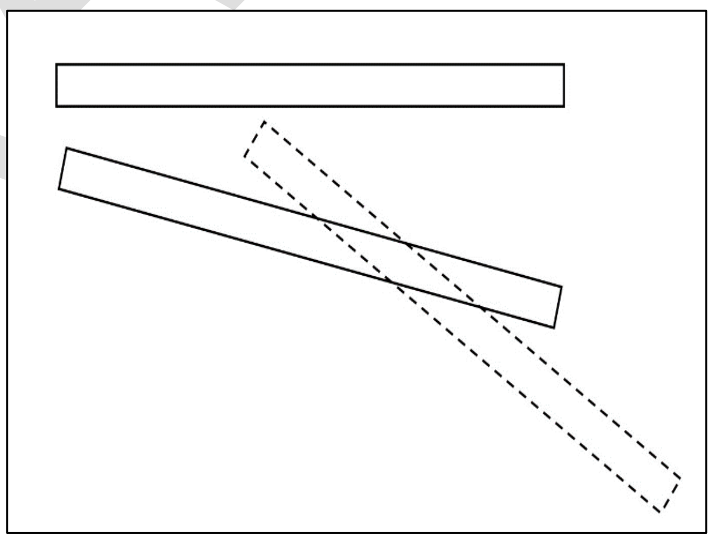
Based on the fleet mix changes described in **Chapter 3**, specifically related to commercial activity, the aircraft fleet mix index is anticipated to increase throughout the forecast period from 30.2 during the Base Year to 53.8 by PAL 4.

Runway Use Configuration

Once the fleet mix index is calculated for each planning period, the type of runway use configuration as outlined in AC 150/5060-5 is determined.

Runway use configuration number 15 (**Figure 4-2**) was selected based upon the converging runway layout of Runway 4-22 and Runway 18-36. Runway 9-27 was not included within this evaluation as that runway does not support regular use of C and D category aircraft. Configuration number 15 was selected due to the greater number of operations based on runway end designations; which is the Runway end 18 and Runway end 22.

Figure 4-2 – Runway Use Configuration #15



Source: AC 150/5060-5 Airport Capacity and Delay

Additionally, **Table 4-7** lists the various mix index ranges for runway use configuration 15.

Table 4-7 – Capacity & ASV for Long Range Planning

Mix Index % (C+3D)	Hourly Capacity		Annual Service Volume (Ops/Year)
	VFR	IFR	
0 to 20	132	59	260,000
21 to 50	99	57	220,000
51 to 80	82	56	215,000
81 to 120	77	59	225,000
121 to 180	73	60	265,000

Source: AC 150/5060-5 Airport Capacity and Delay *[Figure 2-1]*, CHA, 2024.

Table 4-8 depicts how the previously discussed aircraft mix index relates to the capacity and ASV for long range planning.

Table 4-8 – Capacity & ASV for Long Range Planning (EVV Aircraft Mix Index)

Mix Index % (C+3D)	Hourly Capacity		Annual Service Volume (Ops/Year)
	VFR	IFR	
0 to 20	132	59	260,000
21 to 50	99	57	220,000
51 to 80	82	56	215,000
81 to 120	77	59	225,000
121 to 180	73	60	265,000

Source: AC 150/5060-5 Airport Capacity and Delay *[Figure 2-1]*, CHA, 2024.

Hourly Capacity

As outlined in AC 150/5060-5, *Chapter 2: Capacity and Delay Calculations for Long Range Planning,* hourly capacity estimates were made under the following assumptions:

- Percent Arrivals: Arrival operations equal departure operations.
- Percent Touch and Goes: Percent of touch and goes is within the ranges shown in AC 150/5060-5, *Table 2-1*. Based on EVV's Aircraft Mix Index, the percent of touch and go operations were assumed between 0 to 40 percent through PAL 3 and between 0 and 20 percent in PAL 4.
- Taxiways: Full-length parallel taxiway and ample runway entrance/exit taxiways. These assumptions accurately represent the taxiway layout at EVV for Runway 4-22 and Runway 18-36.
- Airspace Limitations: There are no airspace limitations which would adversely impact flight operations or otherwise restrict aircraft which could operate at the Airport.
- Runway Instrumentation: The airport has at least one runway end equipped with an Instrument Landing System (ILS) and has the necessary Air Traffic Control (ATC) facilities and services to carry out operations in a radar environment. These assumptions are true for EVV, as Runways 4 and 22 are both equipped with an ILS, and the Airport has the necessary ATC facilities and services.

Based on the runway-way use configuration and aircraft mix index at EVV, and in accordance with FAA AC 150/5060-5, current and future hourly capacity (or operations per hour) through PAL 3 under VFR and IFR conditions are approximately 99 and 57 operations, respectively. In PAL 4, hourly capacity under VFR and IFR conditions is projected at approximately 82 and 56 operations, respectively. See **Table 4-9**.

Table 4-9 – Capacity & ASV for Long Range Planning (EVV Hourly Capacity)

Mix Index % (C+3D)	Hourly Capacity		Annual Service Volume (Ops/Year)
	VFR	IFR	
0 to 20	132	59	260,000
21 to 50	99	57	220,000
51 to 80	82	56	215,000
81 to 120	77	59	225,000
121 to 180	73	60	265,000

Source: AC 150/5060-5 Airport Capacity and Delay *[Figure 2-1]*, CHA, 2024.

When evaluating EVV's ability to accommodate hourly activity levels, average hourly activity and peak hour activity levels were independently examined. Per FAA TFMSC data, EVV averaged approximately 14 hourly operations during the peak month (June) in the Base Year (2023). Based on the hourly capacity parameters presented in **Table 4-9**, EVV is anticipated to accommodate average hourly operations and peak hourly operations throughout the forecast horizon.

Annual Service Volume

Annual Service Volume (ASV) is an expression of the total number of aircraft operations that an airfield can support per annum. As outlined in AC 150/5060-5, *Chapter 2: Capacity and Delay Calculations for Long Range Planning,* air service volume estimates were made under the following assumptions:

- VFR weather conditions occur roughly 10 percent of the time
- Runway-Use Configuration: Roughly 80 percent of the time the airport is operated with the runway-use configuration which produces the greatest capacity

Based on the runway-use configuration and mix index, and as shown in **Table 4-10**, annual air service volume at EVV is expected to remain at approximately 220,000 operations per year from the Base Year through PAL 3. In PAL 4, ASV is expected to be approximately 215,000 operations.

Table 4-10 – Capacity & ASV for Long Range Planning (EVV ASV)

Mix Index % (C+3D)	Hourly Capacity		Annual Service Volume (Ops/Year)
	VFR	IFR	
0 to 20	132	59	260,000
21 to 50	99	57	220,000
51 to 80	82	56	215,000
81 to 120	77	59	225,000
121 to 180	73	60	265,000

Source: AC 150/5060-5 Airport Capacity and Delay *[Figure 2-1]*, CHA, 2024.

As shown in **Table 4-11**, airfield capacity at EVV is expected to range from 16.5 percent in the Base Year to approximately 19.7 percent by PAL 4.

Table 4-11 – Annual Service Volume & Capacity

Factor	Base (2023)	PAL 1 (2028)	PAL 2 (2033)	PAL 3 (2038)	PAL 4 (2043)
Annual Operations	36,212	37,599	39,105	40,772	42,427
Annual Service Volume	220,000	220,000	220,000	220,000	215,000
Capacity Level	**16.5%**	**17.1%**	**17.8%**	**18.5%**	**19.7%**

Source: AC 150/5060-5 Airport Capacity and Delay, CHA, 2024.

4.3.1 Capacity Summary

If the annual aircraft operations exceed the ASV, an airport is likely to see significant delays; however, an airport can still experience delays before capacity is reached. In accordance with FAA Order 5090.5, activity levels that may trigger capacity planning and development include but are not limited to: exceeding the anticipated ASV percentages thus requiring mitigation to avoid delays, exceeding projected operations that require more fuel reserves or evaluating if any hotspots are present on the airfield, or based aircraft values peak and require movement and safety area boundaries to be expanded. These development markers and triggers may be further evaluated as part of the alternatives chapter, allowing the airport to make necessary improvements and avoid delays before they are anticipated to occur.

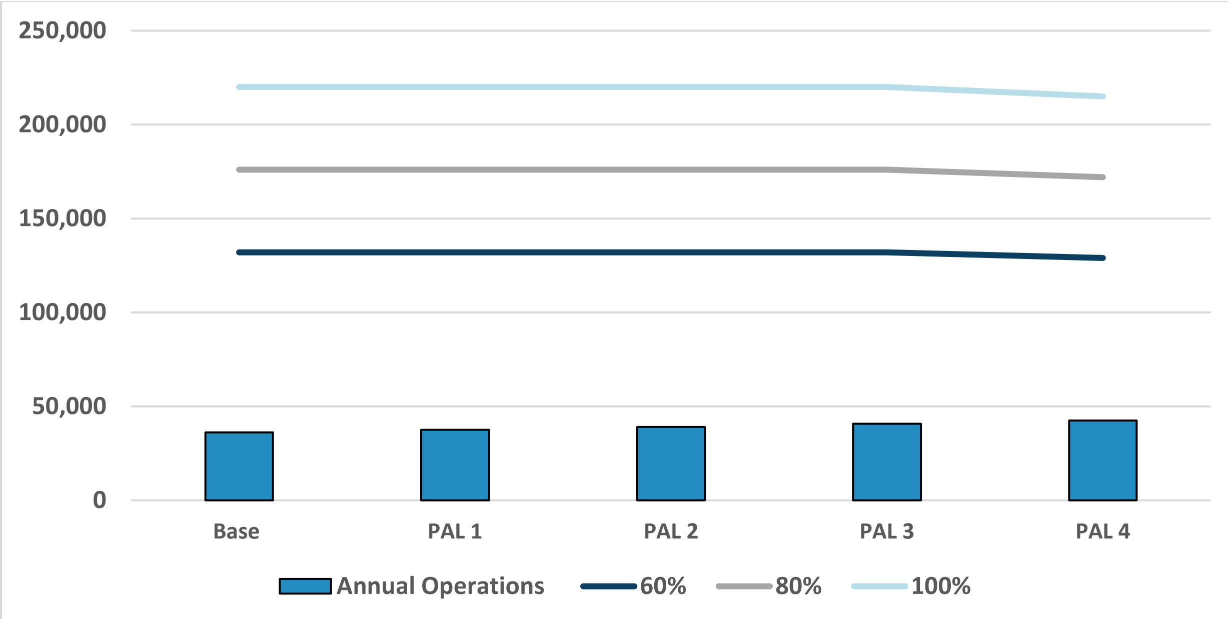
Per FAA Order 5090.5, 60 percent ASV is the trigger for planning a new runway or extended runway to increase hourly capacity and the trigger for development is being within five years of the ASV reaching 80 percent. The forecasted operational limits at specific capacity levels to trigger future planning for another runway at EVV are presented in **Table 4-12**. As shown, the current airfield capacity should be adequate to serve the Airport's activity well beyond the planning horizon. As activity at EVV is forecast to reach a maximum of approximately 19.7 percent capacity, improvements in airfield capacity are not necessary. Projected demand and capacity levels are further depicted in **Figure 4-3**.

Table 4-12 – Capacity Levels

Capacity Level	Base Year - PAL 3	PAL 4
60%	132,000	129,000
80%	176,000	172,000
100%	220,000	215,000

Source: CHA, 2024.

Figure 4-3 – Project Demand



Source: AC 150/5060-5 Airport Capacity and Delay, CHA, 2024.

4.4 RUNWAY REQUIREMENTS

The configuration of an airport's runway system is generally based upon a variety of factors including prevailing wind, terrain, nearby obstructions, on- and off-airport development, and available land. Airport planning helps to ensure that the existing and future airfield configuration, including the number of runways and their respective location/orientation, meets applicable FAA design standards.

To identify the design standards for which a runway must adhere, a RDC is established. The RDC consists of a three-component code including the AAC, ADG, and the runway's lowest instrument approach visibility minimum as expressed in Runway Visual Range (RVR) values typically 1,200 feet, 1,600 feet, 2,400 feet, 4,000 feet, and 5,000 feet. Runways without a published instrument approach procedure are identified as "VIS" to indicate a visual approach.

Table 4-13 lists the existing and future RDCs for each runway at EVV. Runway 18-36 RDC is anticipated to increase throughout the planning horizon. Therefore, requirements for Runway 18-36 were evaluated for both the existing and future RDC.

Table 4-13 – EVV Runway Design Codes

	Existing/Future	Existing	Future	Existing/Future
	Runway 4-22	Runway 18-36	Runway 18-36	Runway 9-27
Aircraft Approach Category (AAC)	D	B	C	A
Airplane Design Group (ADG)	III	II	II	I-Small
Approach Visibility	1,800 RVR	4,000 RVR	4,000 RVR	Visual Approaches
Runway Design Code	**D-III-1,800**	**B-II-4,000**	**C-II-4,000**	**A-I-Small-VIS**

Sources: FAA Form 5010-1; Airport Master Record-August 2024; FAA AC 150/5300-13B – *Change 1*; CHA, 2024.

Using the RDC for each runway, the following examines the FAA runway design standards with the existing runway configuration to identify deficiencies and need for future airfield improvement.

4.4.1 Wind Coverage

An airport's primary runway is generally orientated in the direction the prevailing wind. According to FAA AC 150-5300-13B, planning should consider the need for a crosswind runway when the primary runway provides less than 95 percent wind coverage for the critical aircraft's design group. The RDCs for Runways 4-22 (D-III) and 18-36 (future RDC of C-II) require 95 percent or greater wind coverage at 16 knots. As listed on **Table 4-14**, sufficient wind coverage is provided on both runways.

Table 4-14 – Runway 4-22 & Runway 18-36 Combined Wind Coverage

Windrose Observations	Runway	Crosswind Speed			
		10.5 Knots	13 Knots	16 Knots	20 Knots
All Weather (AW)	4 - 22	95.82%	97.96%	99.60%	99.93%
	18 - 36	95.43%	97.73%	99.44%	99.88%
	AW Combined*	**97.90%**	**99.23%**	**99.85%**	**99.78%**
Instrument Flight Rules (IFR)	4 - 22	*94.18%*	96.89%	99.20%	99.79%
	18 - 36	*94.75%*	97.26%	99.14%	99.72%
	IFR Combined*	**97.07%**	**98.82%**	**99.70%**	**99.92%**
Visual Flight Rules (VFR)	4 - 22	95.96%	98.07%	99.66%	99.95%
	18 - 36	95.41%	97.75%	99.48%	99.91%
	VFR Combined*	**97.97%**	**99.27%**	**99.87%**	**99.99%**

*Combined Runway 4-22 & 18-36 only. NOAA has released data with 2023 observations, but the results did not cause enough variance to require a new windrose.
Source: NOAA, National Climate Center; Station 724320 (2013-2022); CHA 2024.

Runway 9-27 Wind Coverage

Since the RDC for Runway 9-27 is projected to remain A-I Small-VIS, crosswind coverage for the runway is only evaluated at 10.5 knots. That is, larger approach category and design group aircraft that can withstand greater crosswind speeds are either less likely or unable to operate on runways designated with a smaller RDC.

As listed on **Table 4-15**, Runway 9-27 provides less than 95 percent crosswind coverage during all weather, IFR, and VFR operations. However, with the additional runways at EVV (e.g., Runways 4-22 and 18-36), sufficient combined wind coverage is provided at the Airport during each type of weather operation.

Table 4-15 – Runway 9-27 Wind Coverage

Windrose Observations	Runway	Crosswind Speed
		10.5 Knots
All Weather (AW)	9-27	*92.60%*
Instrument Flight Rules (IFR)		*93.36%*
Visual Flight Rules (VFR)		*92.30%*

Source: NOAA, National Climate Center; Station 724320 (2013-2022) CHA, 2024.

In summary, Runway 9-27 does not provide enhanced wind coverage to the overall EVV runway system.

4.4.2 Runway Designations

Due to the changes in the earth's magnetic declination over time, the compass heading of a runway and its associated runway end number designations can change. Current magnetic declination information was derived from the National Oceanic and Atmospheric Administration (NOAA). The current headings and declinations of the runway ends at EVV are as follows:

- Runway 4
  - Current headings: 041° magnetic (rounds and truncates to 4), 038° true
  - Declination: 3° 50' W ± 0° 22' changing by 0° 4' W per year
- Runway 22
  - Current headings: 221° magnetic (rounds and truncates to 22), 218° true
  - Declination: 3° 51' W ± 0° 22' changing by 0° 4' W per year
- Runway 18
  - Current headings: 184° magnetic (rounds and truncates to 18), 181° true
  - Declination: 3° 50' W ± 0° 22' changing by 0° 4' W per year
- Runway 36
  - Current headings: 004° magnetic (rounds and truncates to 0 and corresponding to 360 degrees on a compass for a runway designation of 36), 001° true
  - Declination: 3° 50' W ± 0° 22' changing by 0° 4' W per year
- Runway 9
  - Current headings: 094° magnetic (rounds and truncates to 9), 091° true
  - Declination: 3° 50' W ± 0° 22' changing by 0° 4' W per year
- Runway 27
  - Current headings: 274° magnetic (rounds and truncates to 27), 271° true
  - Declination: 3° 50' W ± 0° 22' changing by 0° 4' W per year

Currently, no changes in the runway designations of Runway 4-22 are needed; however, since magnetic declination changes slowly over time, the runway numbers may need to be reevaluated by PAL 4, at which time magnetic declination may have changed more significantly. In 15 years (or approximately around PAL 3), Runway 18-36 may be redesignated Runway 1-19, and Runway 9-27 may be redesignated as Runway 10-28.

4.4.3 Runway Width

Table 4-16 lists the required width for each runway at EVV. Each runway currently meets or exceeds the minimum runway width requirements per AC 150/5300-13B – *Change 1*.

Table 4-16 – EVV Runway Widths

Runway Width Concept	Existing/Future Runway 4-22	Existing Runway 18-36	Future Runway 18-36	Existing/Future Runway 9-27
Runway Width Standard	100 Feet	75 Feet	100 Feet	60 Feet
Current Runway Width	150 Feet	150 Feet	150 Feet	75 Feet
Runway Width Surplus/(Deficiency)	**+50 Feet**	**+75 Feet**	**+50 Feet**	**+15 Feet**

Sources: FAA Form 5010-1, Airport Master Record-May 2023, AC 150/5300-13B – *Change 1*; CHA, 2024.

Although the width of Runways 4-22 conforms to the standard minimum requirements, the runways are occasionally used by cargo and widebody aircraft with maximum certified takeoff weights of 150,000 pounds or greater. According to AC 150/5300-13B – *Change 1*, it is recommended that runways accommodating those aircraft maintain a width of 150 feet. Additionally, cargo and widebody are unable to taxi/utilize the entire portion of Taxiway C. As such, design plans are underway to upgrade connector Taxiway H to Taxiway Design Group 5 standards to accommodate larger aircraft taxing across Runway 18-36 and to the west apron area. Therefore, it is recommended that the current widths of Runways 4-22 be maintained with periodic examination of the aircraft fleet utilizing the runways and associated taxiway system.

Furthermore, although Runway 9-27 also exceeds minimum runway width requirements, the capital expense required to reduce the runway width would not likely prove cost efficient unless associated with other airfield improvements (i.e., updated taxiway geometry). Additionally, Runway 9-27 runway does not currently receive federal funds. Therefore, it recommended that the current Runway 9-27 width remain until runway reconstruction or decommissioning is warranted.

4.4.4 Runway Shoulders

Shoulders are areas adjacent to the defined edges of runways, taxiways, or aprons. According to FAA AC 150/5300-13B – *Change 1*,, shoulders are designed to:

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

Although paved shoulders are only required for runways accommodating ADG-IV aircraft and above, AC 150/5300-13B – *Change 1*, does recommend them for runways accommodating ADG-III aircraft. The EVV runway system does not currently have paved shoulders. Therefore, it is recommended that Runway 4-22 be equipped with 25-foot shoulders (**Table 4-17**) along each edge of runway pavement.

Table 4-17 – Runway Shoulder Design Standards

Design Concept	Runway 4-22
Shoulder Width Standard/Recommendation	20 Feet
Current Shoulder Width	None
Shoulder Width Recommendation*	**25 Feet**

Note: * Per AC 150/5300-13B – *Change 1*, for runways serving airplanes with maximum certificated takeoff weight greater than 150,000 pounds and the shoulder width is 25 feet.
Sources: FAA AC 150/5300-13B – *Change 1*; CHA, 2024.

4.4.5 Runway Safety Area

A Runway Safety Area (RSA) is a rectangular area bordering a runway that is intended to reduce the risk of damage to an aircraft in the event of an undershoot, overrun, or excursion from its associated runway. **Table 4-18** lists the standard RSA dimensions for the EVV runway system. Illustrated on **Figure 4-7** through **Figure 4-12** is the existing and future RSA's for Runway 18-36 as they are projected to change during the forecast horizon.

Table 4-18 – EVV Runway Safety Area Dimensions

RSA Concept	Existing/Future Runway 4-22	Existing Runway 18-36	Future Runway 18-36	Existing/Future Runway 9-27
Runway Safety Area Width	500 Feet	150 Feet	500 Feet	120 Feet
Runway Safety Area Length Beyond Runway End	1,000 Feet	300 Feet	1,000 Feet	240 Feet
Runway Safety Area Length Prior to Threshold	600 Feet	300 Feet	600 Feet	240 Feet

Sources: FAA AC 150/5300-13B – *Change 1;* CHA, 2024.

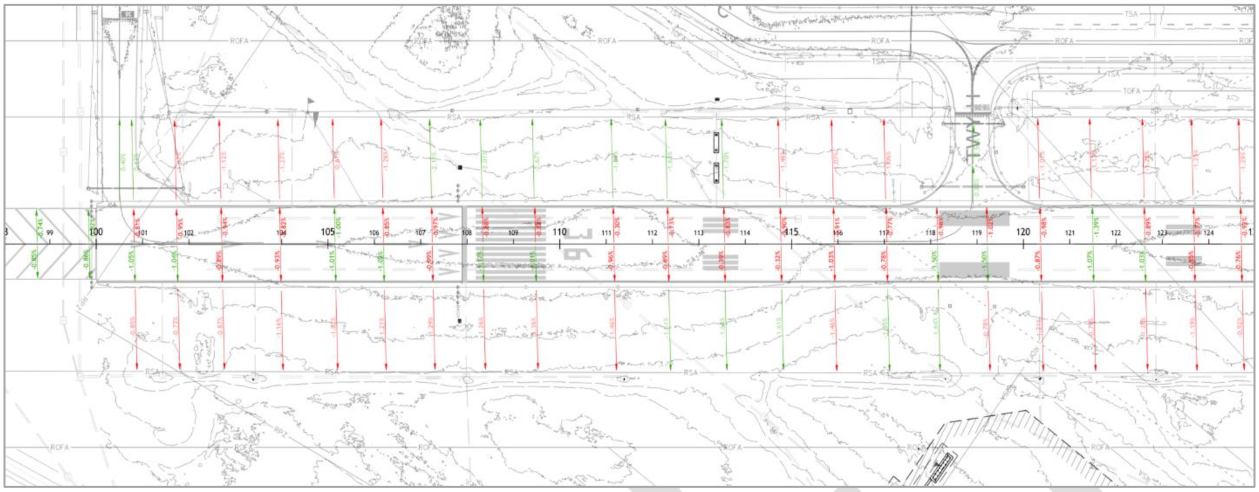
<u>Runway Safety Area Grading</u>

RSAs are required to be cleared and graded such that they are void of potentially hazardous ruts, depressions, or other surface variations. Additionally, RSAs must be drained by grading or via storm sewers to prevent water accumulation, they must be able to support snow removal and firefighting equipment, and they must be free of objects excepts those required because of their function.

Additionally, within the RSA boundary the first 200 feet beyond the runway ends must have a longitudinal grade between zero and three percent, and beyond 200 feet the grade must not penetrate any approach surface. The RSA must not have a negative grade more than five percent and/or a longitudinal grade change of two percent (±) per 100 feet. The Runway 18/36 RSA is known to have non-standard transverse RSA grades, and designs have been produced to correct those issues.

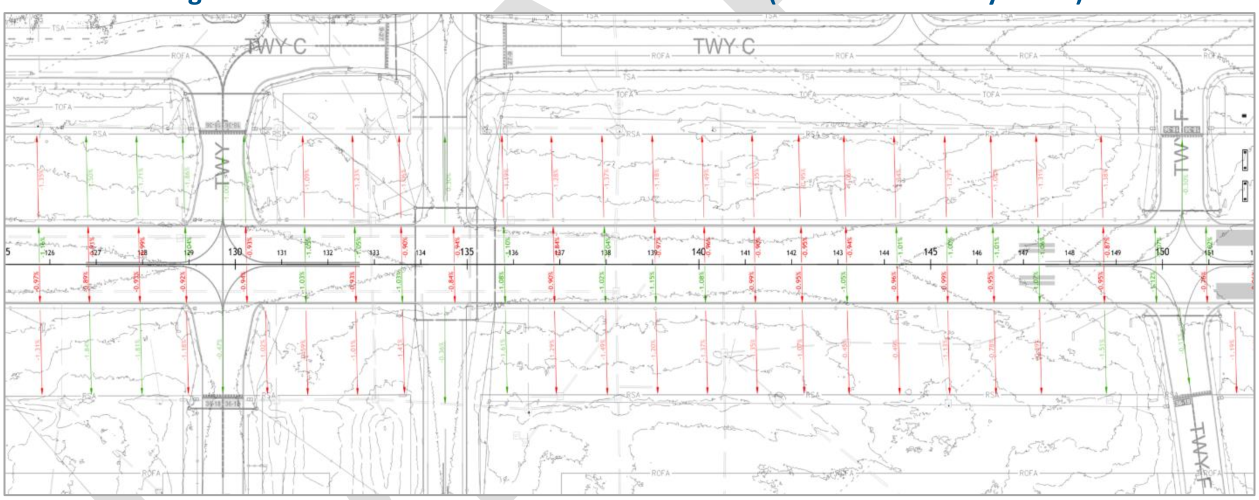
Figure 4-4 through **Figure 4-6** present the Runway 18/36 RSA grades, as they relate to C-II standards. The B-II RSA width is 150 feet, therefore only red, non-standard grades within the bounds of the runway's pavement are non-compliant. However, those figures present the RSA's width required for a future upgrade to C-II standards.

Figure 4-4 – Non-Standard RSA Transverse Grade (Runway 36 Approach End)



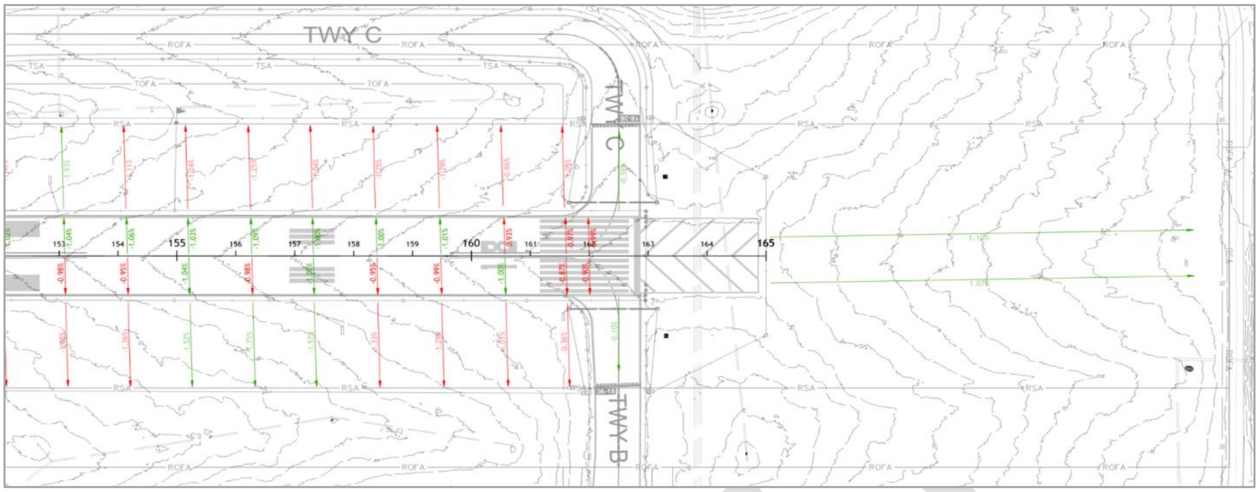
Note: Areas with red delineation are non-standard, areas of green are within FAA standards.
Source: CHA, 2024.

Figure 4-5 – Non-Standard RSA Transverse Grade (Middle of Runway 18-36)



Note: Areas with red delineation are non-standard, areas of green are within FAA standards.
Source: CHA, 2024.

Figure 4-6 – Non-Standard RSA Transverse Grade (Runway 18 Approach End)



Note: Areas with red delineation are non-standard, areas of green are within FAA standards.
Source: CHA, 2024.

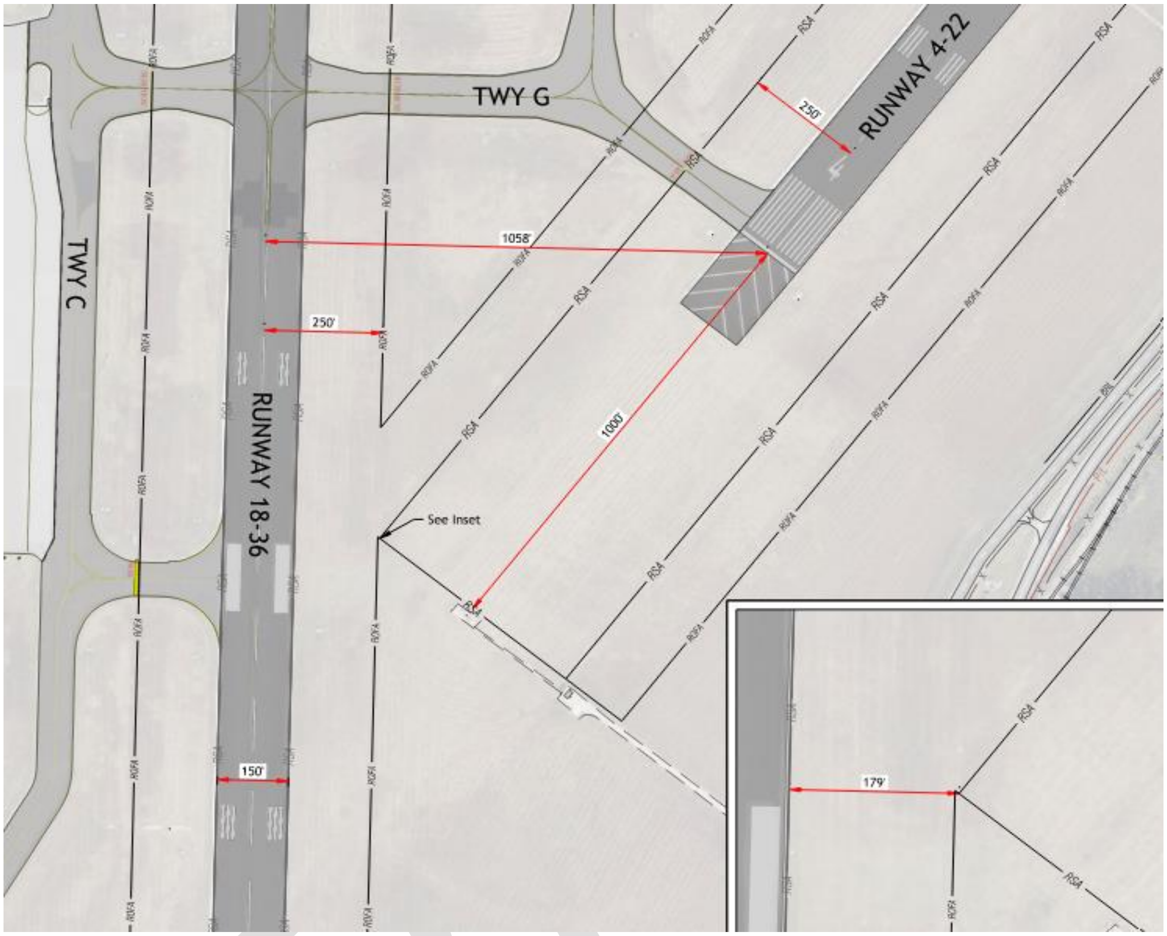
Overlapping Runway Safety Areas

Overlapping RSAs can occur when two or more runways converge but do not intersect, such as the configuration of Runway 4-22 and Runway 18-36. According to AC 150/5300-13B – *Change 1*, overlapping RSAs introduce safety risks and potential operational limitations, may create conditions resulting in holding positions on taxiways that do not lead directly to a runway, and can present an elevated risk for wrong runway departures when an aligned taxiway is present. With converging runway configurations, runway ends should be designed such that:

- Runway ends, taxiways, and holding positions allow taxiing and holding aircraft to remain clear of all RSAs.
- Runway ends facilitate holding positions so that aircraft hold perpendicular to the runway centerline.

Although Runways 4-22 and 18-36 converge, but do not intersect, the location of the Runway 4 approach end is located approximately 1,058 feet east of the Runway 18-36 centerline. Therefore, the respective RSAs for each runway do not overlap and remain independent. As such, the nearest holding position located at the intersection of Runway 4 and Taxiway G ensure that aircraft hold perpendicular to Runway 4 and remain clear of the RSA. **Figure 4-7** depicts the RSA beyond the Runway 4 approach end in relation to the Runway 18-36 RSA.

Figure 4-7 – Overlapping RSA's



Sources: CHA, 2024.

Runway 18 Safety Area

Due to the location of St. George Road, the Runway 36 threshold is displaced by 798 feet to provide 1,000 feet of RSA length beyond the Runway 18 end, as seen in **Figure 4-8**. Resultantly, the following declared distances are published for Runway 18-36 (**Table 4-19**). The declared distances coincide with the RSA requirements of a C-II runway, as seen in **Figure 4-9**. Therefore, the Airport should maintain these conditions since Runway 18-36 RDC is projected to increase to C-II during the planning horizon.

Table 4-19 – Runway 18-36 Declared Distances

Terminology	Runway 18	Runway 36
Takeoff Run Available (TORA)	5,497 Feet	6,286 Feet
Takeoff Distance Available (TODA)	5,497 Feet	6,286 Feet
Accelerate Stop Distance Available (ASDA)	5,497 Feet	6,286 Feet
Landing Distance Available (LDA)	5,497 Feet	5,497 Feet

Sources: FAA Form 5010-1, Airport Master Record, 2024.

Figure 4-8 – Existing RSA/ROFA (Runway 36 Approach End)

Sources: CHA, 2024.

Figure 4-9 – Future RSA/ROFA (Runway 36 Approach End)

Sources: CHA, 2024.

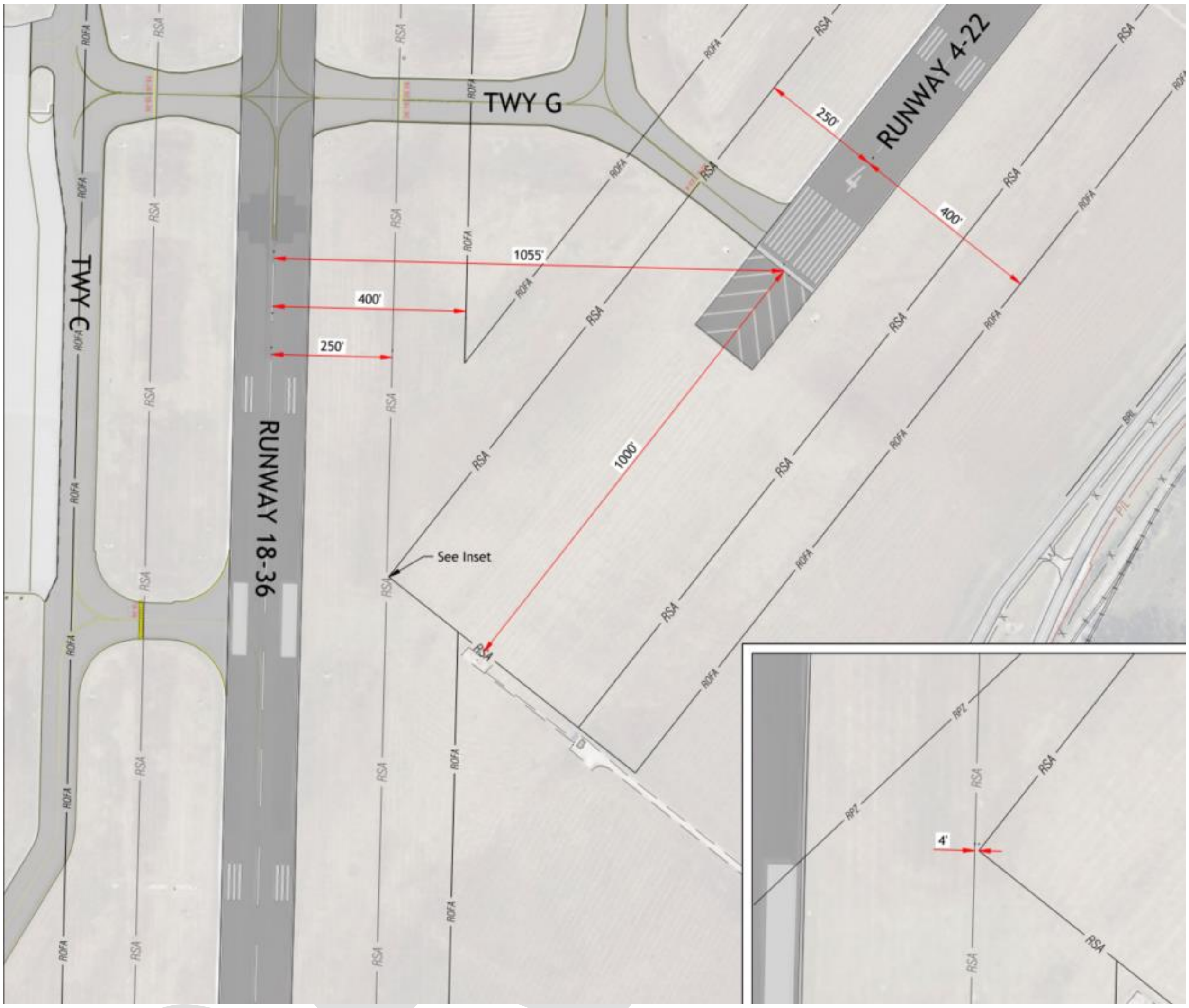
Figure 4-10 – Existing RSA/ROFA (Runway 18 Approach End)

Sources: CHA, 2024.

Figure 4-11 – Future RSA/ROFA (Runway 18 Approach End)

Sources: CHA, 2024.

Figure 4-12 – Converging Areas via Future RSA & ROFA (Runway 36 Approach End)



Sources: CHA, 2024.

4.4.6 Runway Object Free Area

A Runway Object Free Area (ROFA) is a rectangular area bordering a runway that is intended to provide enhanced safety for aircraft operations by ensuring the area remains clear of parked aircraft or other equipment not required to support air navigation or the ground maneuvering of aircraft. **Table 4-20** lists the standard ROFA dimensions for the EVV runway system. Illustrated previously on **Figure 4-7** through **Figure 4-12** is the existing and future ROFA's for Runway 18-36 as they are projected to change during the forecast horizon.

Table 4-20 – EVV Runway Object Free Area Dimensions

ROFA Concept	Existing/Future Runway 4-22	Existing Runway 18-36	Future Runway 18-36	Existing/Future Runway 9-27
Runway Object Free Area Width	800 Feet	500 Feet	800 Feet	250 Feet
Runway Object Free Area Length Beyond Runway End	1,000 Feet	300 Feet	1,000 Feet	240 Feet
Runway Object Free Area Length Prior to Threshold	600 Feet	300 Feet	600 Feet	240 Feet

Sources: FAA AC 150/5300-13B – *Change 1;* CHA, 2024.

Similar to the RSAs, there are no vertical objects, other than those permitted due to their function, located within the bounds of the ROFAs at EVV.

Additionally, the same concept regarding the Runway 18-36 declared distances and associated Runway 36 displaced threshold are applicable to the future ROFA as both the RSA and ROFA lengths beyond the runway end and prior to the threshold are 600 feet.

4.4.7 Runway Obstacle Free Zone

A Runway Obstacle Free Zone (ROFZ) is a volume of airspace centered above a runway that is required to be clear of all objects, except for frangible navigational aids that are fixed-by-function during aircraft operations. **Table 4-21** lists the dimensions of the ROFZs at EVV. **Figure 4-13** displays the ROFZ for Runway 22 Approach End.

Table 4-21 – EVV Runway Obstacle Free Zone Dimensions

ROFZ Concept	Existing/Future	Existing/Future	Existing/Future
	Runway 4-22	Runway 18-36	Runway 9-27
Runway Obstacle Free Zone Width	400 Feet	400 Feet	250 Feet
Runway Obstacle Free Zone Length Beyond Runway End	200 Feet	200 Feet	200 Feet

Sources: FAA AC 150/5300-13B – *Change* 1; CHA, 2024.

Figure 4-13 – Runway 22 Approach End's ROFZs

Source: CHA, 2024.

A review of the OFZs adjacent to each runway indicated that there are no objects, other than those that are fixed-by-function, located within the areas.

Additionally, as the Runway 22 end is equipped with an approach lighting system and has published landing minimums of ½ mile visibility, there are three additional OFZ components applicable to the Runway 22 end. These components include the:

- ***Inner-Approach Obstacle Free Zone:*** Begins 200 feet from the runway threshold and extends 200 feet beyond the last light of the approach lighting system. Its width is the same as the ROFZ and rises at a 50:1 slope.
- ***Inner-Transitional Obstacle Free Zone:*** Located along the sides of the OFZ and inner-approach OFZ and rising at a 6:1 slope to 150 feet above the airport elevation.
- ***Precision Obstacle Free Zone:*** Begins at the threshold and extends along the extended runway centerline beyond the runway end for 200 feet a width of 800 feet.

A review of the Runway 22 end indicated that the volume of airspace facilitating the additional OFZs remain clear of all incompatible objects. It is recommended that airspace protection is maintained to safeguard the volume of airspace within each OFZ.

4.4.8 Runway Protection Zones

The Runway Protection Zone (RPZ) is a land use control that is primarily meant to enhance the protection of people and property on the ground through airport control. Such control includes clearing of RPZ areas of incompatible objects and activities.

RPZ Dimensions

Runways may have two types of RPZs, the Approach RPZ and Departure RPZ, which have varying dimensions based on the design aircraft's AAC and ADG, as well as the runways' visibility minimums. The RPZ is a trapezoidal area located 200 feet beyond the runway end and centered on the extended runway centerline. Departure RPZs are used if and when a runway displaced threshold is in place. Currently the following three runways have a displaced threshold, Runway 36 at 789 feet, Runway 9 at 529 feet, and Runway 27 at 218 feet. Approach and departure RPZ dimensions for all three runways are presented in **Table 4-22**.

Incompatible Land Use Within the RPZs

Incompatible land uses consist of homes, or any other development that contains a concentration of people such as occupied buildings of any type. Incompatible land uses can also consist of physical obstructions, visual distractions, or wildlife attractants which can threaten the safety of aircraft operations. According to AC 150/5190-4B, *Airport Land Use Compatibility Planning,* compatible land uses consist of "those that can coexist with a nearby airport without constraining the safe and efficient operation of the airport or exposing people living and/or working nearby to significant environmental impacts." The primary characteristics that are typically considered when determining land use compatibility include:

- Noise
- Airspace
- Development Density
- Visual/Atmospheric Interference
- Wildlife
- Protection of People and Property

Figure 4-14 through **Figure 4-20** depicts the Airport's approach and departure RPZs and highlight areas such as public roads, railroads, or non-airport owned, private property that are considered incompatible with the FAA's recommended land usage within an RPZ.

Table 4-22 – EVV Runway Protection Zone Dimensions

Description		Runway			
		Existing/Future 4/22	Existing 18/36	Future 18/36	Existing 9/27
Approach RPZ	Length	1,700' / 2,500'	1,700' / 1,700'	1,700' / 1,700'	1,000' / 1,000'
	Inner Width	1,000' / 1,000'	1,000' / 1,000'	1,000' / 1,000'	250' / 250'
	Outer Width	1,510' / 1,750'	1,510' / 1,510'	1,510' / 1,510'	450' / 450'
Departure RPZ	Length	1,700' / 1,700'	1,000' / 1,000'	1,700' / 1,700'	1,000' / 1,000'
	Inner Width	500' / 500'	500' / 500'	500' / 500'	250' / 250'
	Outer Width	1,010' / 1,010'	700' / 700'	1,010' / 1,010'	450' / 450'

Sources: FAA AC 150/5300-13B – *Change 1;* CHA, 2024.

Runway 27 RPZs

The Runway 27 Approach and Departure RPZs begin 200 feet from the end of the usable runway and 200 feet from the displaced threshold, respectively. Both RPZs are located within the EVV property boundary and have compatible land uses within. (See **Figure 4-14**).

Runway 9 RPZs

The Runway 9 Approach and Departure RPZs begin 200 feet from the end of the useable runway and 200 feet from the displaced threshold, respectively. Both RPZs are located within the EVV property boundary except for a section of U.S. Highway 41 which traverses through portions of both RPZs. Additionally, the western half of the Approach RPZ is located over a section of gold course located on the property owned by EVV. (See **Figure 4-15**).

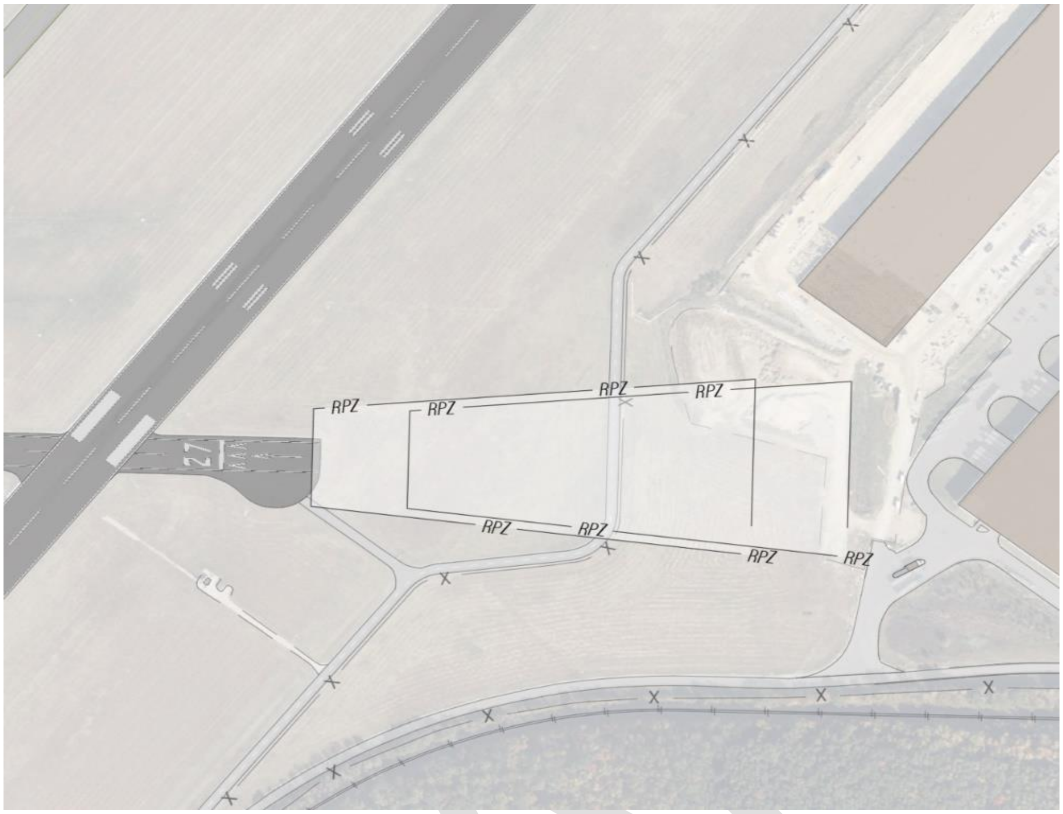
Runway 4 Approach & Runway 22 Departure RPZs

The Runway 4 Approach and Runway 22 Departure RPZs are entirely contained within the Airport's property boundary. There are no vertical objects, other than runway/taxiway lighting and navigational aids that are fixed-by-function, within the RPZs. (See **Figure 4-16**).

Runway 22 Approach & Runway 4 Departure RPZs

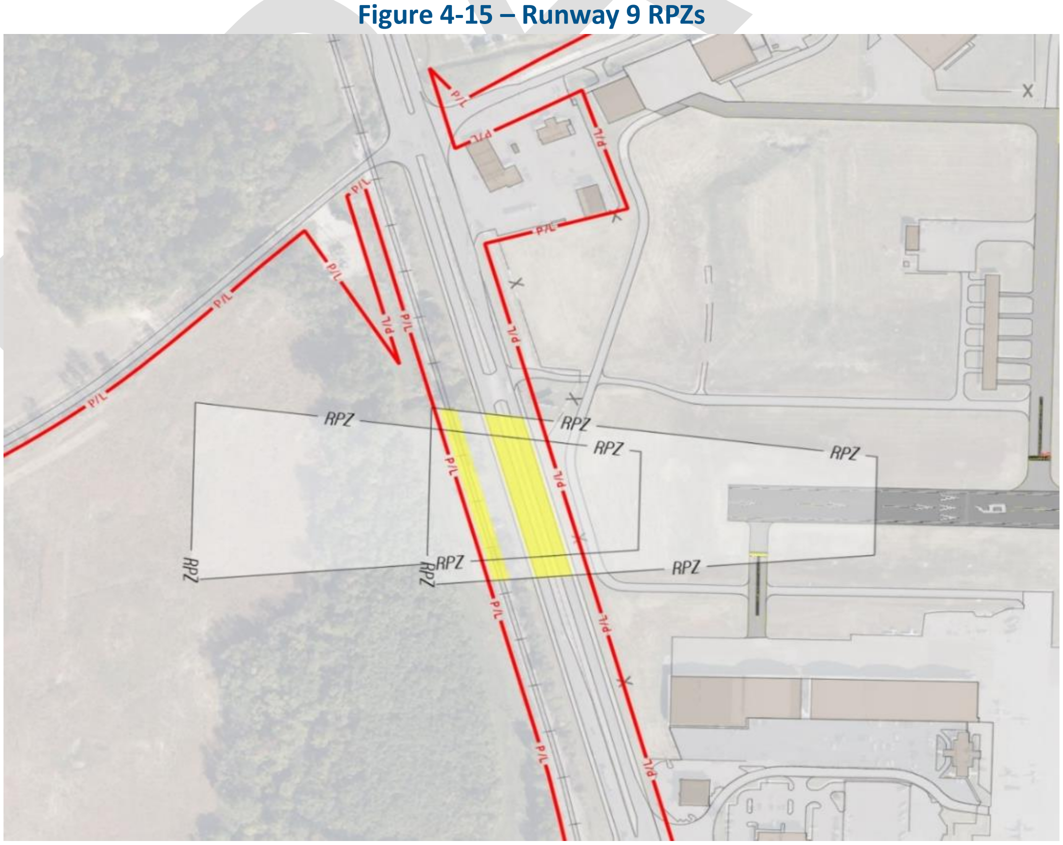
The Runway 22 Approach and Runway 4 Departure RPZs encompass the largest area due to Runway 22's precision instrument approach ½ mile visibility minimum. Property acquisition in conjunction with the runway's shift/extension ensured that those RPZs were entirely contained within the Airport's property boundary. It is important to note that a section of Oak Hill Rd is contained within the eastern section of Runway 22's Approach RPZ. Runway 4's Departure RPZ remains clear of that roadway, however a CSX railroad line bisects both the Runway 22 Approach and Runway 4 Departure RPZs. (See **Figure 4-17**).

Figure 4-14 – Runway 27 RPZs



Sources: FAA AC 150/5300-13B – *Change 1;* CHA, 2024.

Figure 4-15 – Runway 9 RPZs

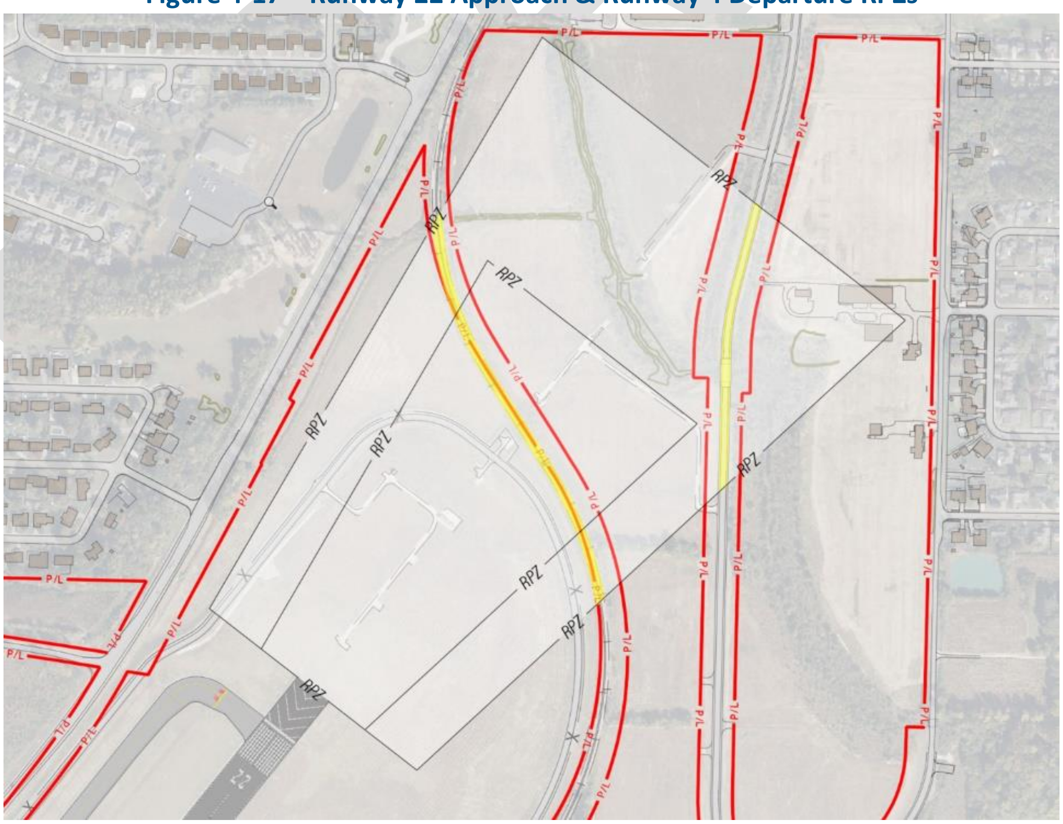


Sources: FAA AC 150/5300-13B – *Change 1;* CHA, 2024.

Figure 4-16 – Runway 4 Approach & Runway 22 Departure RPZs

Sources: FAA AC 150/5300-13B – *Change 1;* CHA, 2024.

Figure 4-17 – Runway 22 Approach & Runway 4 Departure RPZs

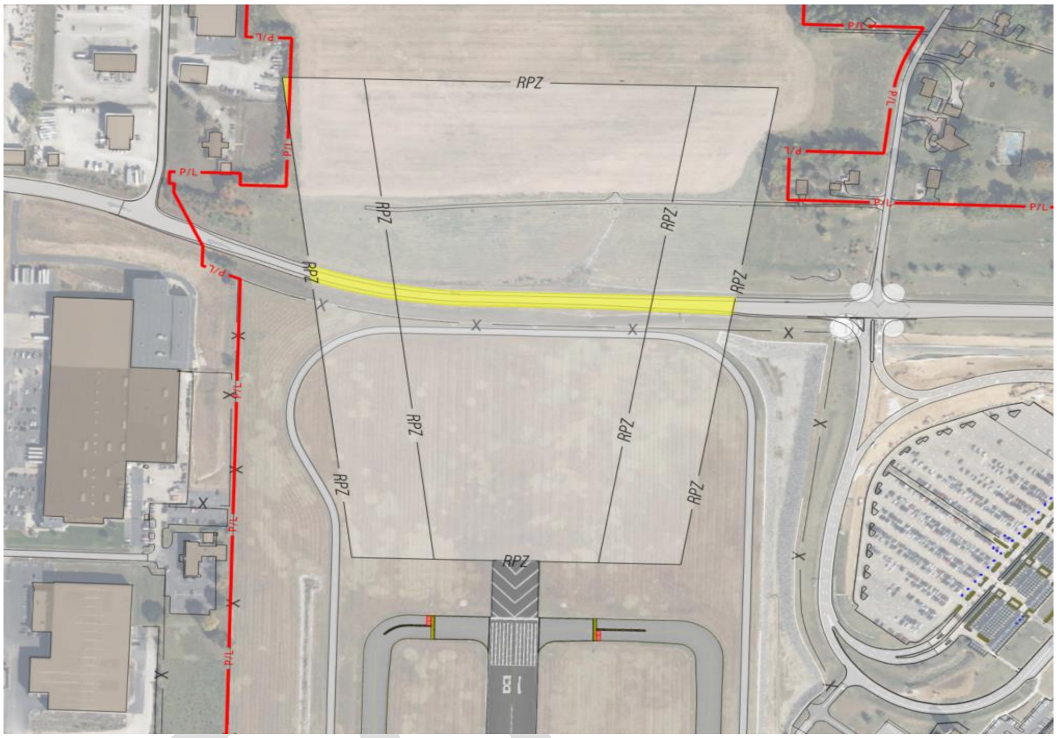


Sources: FAA AC 150/5300-13B – *Change 1;* CHA, 2024.

Future Runway 18 Approach and Runway 36 Departure RPZs

Runway 36's Departure RPZ is entirely on airport property, and Runway 18's Approach RPZ has just a small area at its northwestern corner that extends beyond airport property. However, State Route 57 bisects both RPZs. (See **Figure 4-18**).

Figure 4-18 – Runway 18 Approach & Runway 36 Departure RPZs



Sources: FAA AC 150/5300-13B – *Change 1;* CHA, 2024.

Future Runway 36 Approach and Runway 18 Departure RPZs

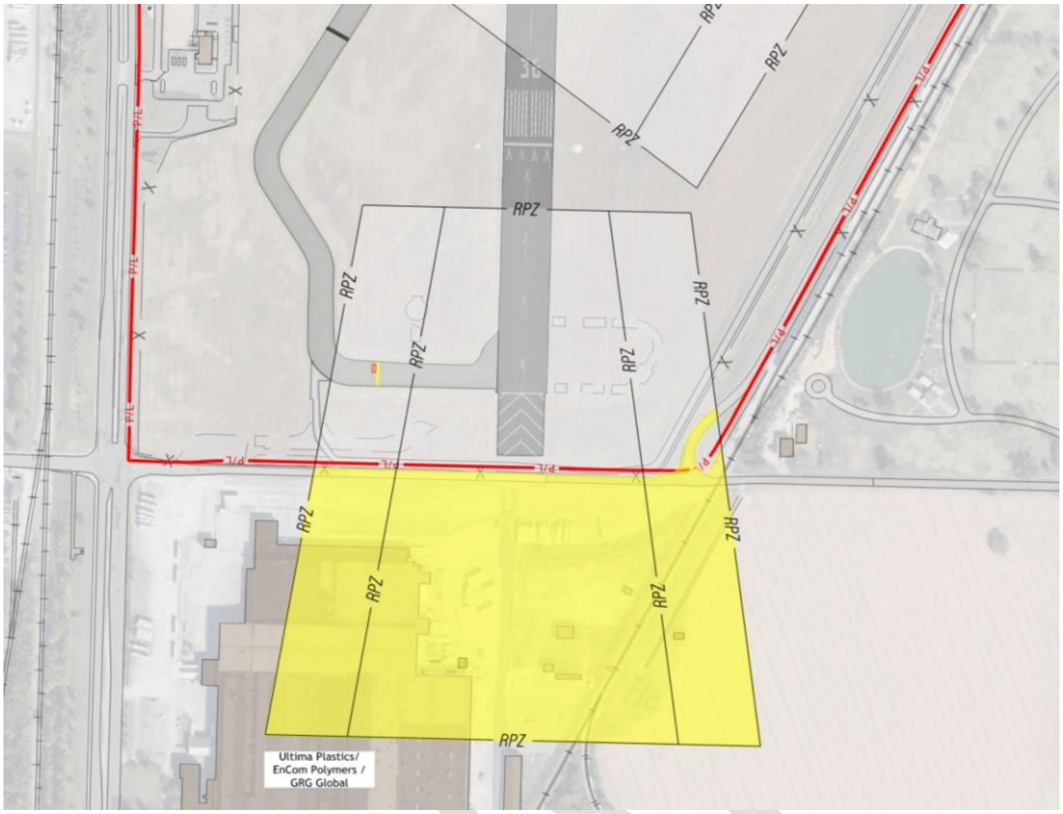
Runway 36 threshold is displaced, the Approach RPZ begins 200 from the displaced threshold. For displaced threshold runways without published declared distances, the Departure RPZ begins 200 feet from the end of usable runway. However, since declared distances are published for Runway 18-36, the Runway 18 Departure RPZ starts 200 feet from the end of Runway 18's Takeoff Run Available (TORA), which is coincident with the start of the Runway 36 Approach RPZ.

Runway 18's Approach and Runway 36's Departure RPZs' northern portions are located within airport property. St. George Road and Ossenberg Lane are located within the Runway 36 Approach RPZ. St. George Road also bisects the Runway 18 Departure RPZ. A large factory is also located within the Runway 36 Approach RPZ. (See **Figure 4-19**).

Runway 9 Approach and Runway 27 Departure RPZs

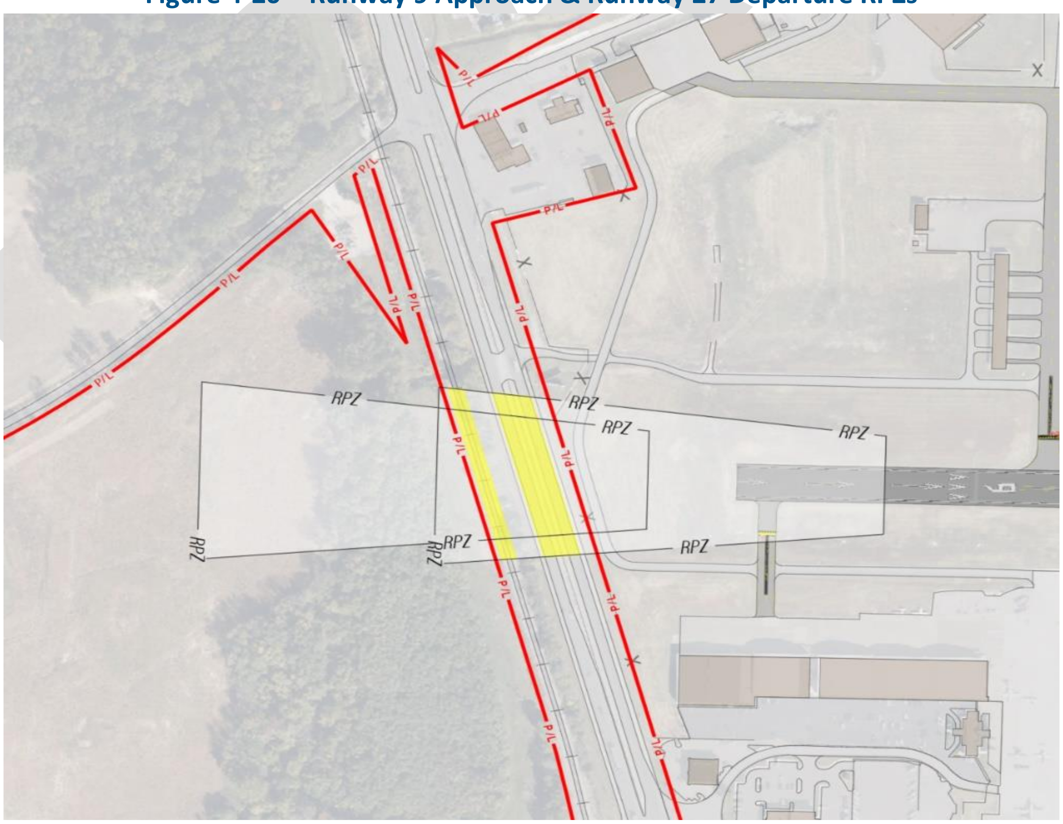
The Runway 9 Approach and Departure RPZs begin 200 feet from the end of the usable runway and 200 feet from the displaced threshold, respectively. Both RPZs are located within the EVV property boundary except for a section of U.S. Highway 41 which traverses through portions of both RPZs. Additionally, the western half of the Approach RPZ is located over a section of a golf course located on property owned by EVV. Additionally, a CSX railroad bisects both the Runway 22 Approach and Runway 4 Departure RPZs. (See **Figure 4-20***)*.

Figure 4-19 – Runway 36 Approach & Runway 18 Departure RPZs



Sources: FAA AC 150/5300-13B – *Change 1;* CHA, 2024.

Figure 4-20 – Runway 9 Approach & Runway 27 Departure RPZs



Sources: FAA AC 150/5300-13B – *Change 1;* CHA, 2024.

4.4.9 Runway Visibility Zone

A Runway Visibility Zone (RVZ) is an area formed by imaginary lines connecting two physically intersecting runways' line-of-sight points. The purpose of an RVZ is to provide a visual field of view enhancing pilot situational awareness to avoid conflict with aircraft operating on an intersecting runway.

For planning purposes, it is recommended that aircraft aprons are designed such that no aircraft is parked within the RVZ. Additionally, for airports with part-time air traffic control operations, such as EVV, it is recommended that any point five feet above the runway centerline within the RVZ is mutually visible with any other point five feet above the centerline of the crossing runway.

Since Runway 9-27 intersects both Runway 4-22 and Runway 18-36, there are effectively two RVZs at EVV. **Figure 4-21** depicts each RVZ.

As shown, the current RVZs at EVV remain clear of all aircraft parking areas. Additionally, a review of airport elevations indicated that all points five feet above the runway within the RVZs are mutually visible with any other point five feet above the centerline of the crossing runway.

Figure 4-21– Runway Visibility Zones

Sources: CHA, 2024.

Converging Non-Intersecting Runways

As mentioned, an RVZ is formed by two physically intersecting runways. In the event that Runway 9-27 is decommissioned, the current RVZ standards would no longer apply as Runway 4-22 and Runway 18-36 do not intersect. However, FAA AC 150/5300-13B – *Change 1*, recommends that runways which converge, but do not intersect, evaluate the same RVZ criteria based upon a modified RVZ.

As such, **Figure 4-22** depicts a modified RVZ based on converging non-intersecting runway criteria for Runway 4-22 and Runway 18-36 only. Similar to the existing RVZs, the modified RVZ does not contain aircraft parking and is mutually visible with any other point five feet above the centerline of the converging runway.

Figure 4-22 – Converging Non-Intersecting Runway Visibility Zone

Sources: CHA, 2024.

4.4.10 Runway Blast Pads

Like runway shoulders, blast pads are intended to provide erosion from jet blast at the runway ends. FAA AC 150/5300-13B – *Change 1*, requires blast pads at the ends of all runways accommodating ADG-IV aircraft and higher and recommends blast pads for runways accommodating ADG-III aircraft. Currently the Runway 4-22 and Runway 18-36 ends are each equipped with a blast pad. However, given that Runway 18-36 is not anticipated to accommodate ADG-III aircraft based on the RDC, the blast pads are adequate.

Table 4-23 lists the dimensional RDC design standards for blast pads along with the dimensions of the existing blast pads at EVV.

Table 4-23 – Runway Blast Pad Design Standards

	Runway 4-22	Runway 18-36
Blast Pad Width x Length Standard*	200 x 200 Feet	N/A
Existing Blast Pad Width x Length	150 x 200 Feet	140 x 200 Feet

Note: * Per AC 150/5300-13B – *Change 1*, for runways serving airplanes with maximum certificated takeoff weight greater than 150,000 pounds, and the blast pad width is 200 feet.
Sources: FAA AC 150/5300-13B – *Change 1;* CHA, 2024.

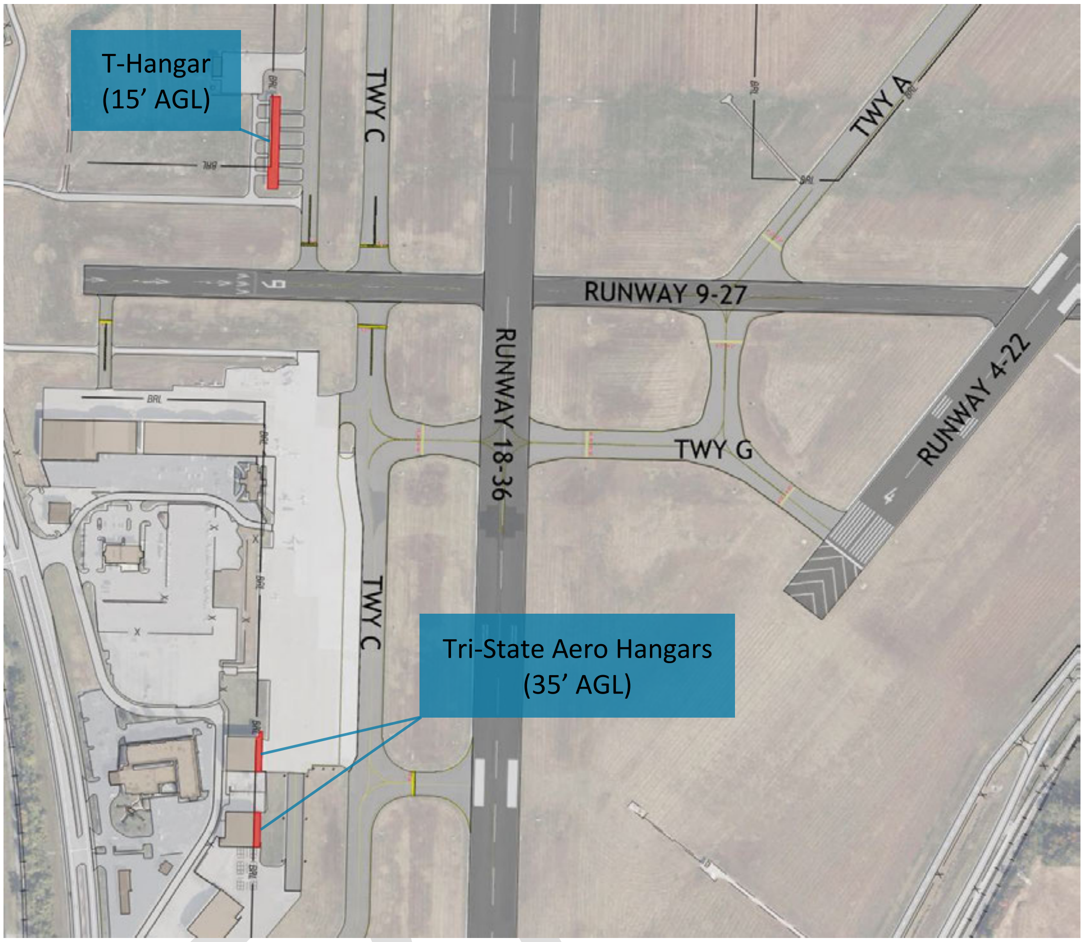
Currently the blast pads for Runway 4-22 are smaller than the FAA required dimensions given that the runway has an ADG of III and serves aircraft with a MTOW greater than 150,000 lbs., as shown on **Table 4-23**. It is recommended that the Runway 4-22 blast pad width be increased to 200 feet during the next reconstruction project given that EVV needs to accommodate B737-800 aircraft with a MTOW greater than 150,000 lbs., for commercial service operations.

4.4.11 Building Restriction Line

Although not a specific FAA design standard, the Building Restriction Line (BRL) is a line of reference to provide generalized guidance for building location and height restriction as well as protection of safety areas, navigation aid critical areas, and airspace surfaces. The BRL is measured as a setback distance from a runway centerline, generally using 35 feet for planning purposes. The BRL is based upon the FAR Part 77 transitional surface (i.e., 7:1 slope) and is, therefore, often evaluated for a variety of heights when siting potential locations for buildings/objects.

There are currently three hangars located west of Runway 18-36 with portions located within the 35-foot BRL at EVV. The BRL boundary is labeled and located in conjunction with the red designators for the hangar facilities, as depicted within **Figure 4-23**; moreover, each hangar is appropriately sited based on its respective height and does not interfere with the Part 77 transitional surface. Future development should evaluate the BRL to ensure continued airspace protection.

Figure 4-23 – Building Restriction Line



Sources: CHA, 2024.

4.4.12 Transverse & Longitudinal Runway Grading

Transverse gradient standards are intended to ensure that a runway provides positive lateral drainage from runway pavement surfaces. A runway's general standard transverse grade configuration is a center crown, with equal, constant downward grades on either side. The transverse runway gradient design standards vary based on the AAC for a specific runway. Three portions of the transverse grades within the EVV runway system were analyzed: the pavement slopes, the RSA side slope, and the ROFA side slope.

Runway 18-36

Runway 18-36 was found to have approximately a one percent slope from centerline to edge of pavement. Although a one percent slope is generally acceptable for a pavement slope, to promote drainage it was determined that future design slope of the pavement would be 1.25 percent. To increase the design slope by 0.25 percent, the centerline requires an increase by approximately 2.25 inches (assuming edge of pavement height remains consistent). In addition, the longitudinal gradient, pavement cross slope, and traverse RSA grading for Runway 18-36 was found to be deficient given FAA design standards. It's recommended that the area's identified be corrected during the next runway rehabilitation given the probable cost to correct these deficiencies.

Runway 4-22

Runway 4-22 was reconstructed in 2015. Design and construction ensured that the runway met all FAA grading standards. As such, no known transverse or longitudinal grading issues are present.

Runway 9-27

Per AC 150/5300-13B – *Change 1*, the standards for A-I Runways include a pavement grade between -1.0 percent to -2.0 percent, an RSA side slope grade of -1.5 percent to -5.0 percent, and an OFA side slope grade of less than zero percent, unless adequate wingtip clearance is provided which allows for a positive slope of up to 8:1. During the analysis it was found that the pavement ranged from -3.8 percent to 0.8 percent, the RSA side slope ranged from -3.9 percent to three percent, and the ROFA side slope was generally negative with a maximum positive slope of 1.6 percent. The area between the intersection of Runway 4-22 and Runway 18-36 experienced the most non-standard condition grading, including the intersections themselves. Often the transverse grades were non-standard at taxiway intersections. The RSA side slope was frequently positive, which can result in water ponding. As noted above, most of the non-standard grading is on or near runway-to-runway intersections. Per the AC 150/5300-13B – *Change 1*, both Runway 4-22 and Runway 18-36 have a higher precedence over Runway 9-27. However, it should be known that this requires positive drainage and a transverse slope of no less than 0.5 percent. It is recommended that these identified areas be corrected during the next runway pavement rehab/reconstruction or safety area improvement project.

Additionally, AC 150/5300-13B – *Change 1*, states that the maximum longitudinal grade is ±2.0 percent. This is exceeded at the intersection of Runway 9-27 and Runway 4-22. The maximum grade change is also ±2.0 percent. There are two spots on Runway 9-27 where this is exceeded: at the intersection of Runway 18-36 and at the Intersection of Runway 4-22. The minimum allowable distance between points of intersection does not exceed 250 feet per percent change between points of intersection or 300 feet per percent change of the vertical curve as required at points near or on the intersections with Runway 4-22 and Runway 18-36. It is recommended that these identified areas be corrected during the next runway pavement rehab/reconstruction or safety area improvement project.

4.4.13 Runway to Parallel Taxiway Centerline Separation

Runway to parallel taxiway centerline separation is a significant operational safety design standard. The minimum separation distance uses aircraft design grouping and assumes the same critical aircraft for both the runway and taxiway. The following discusses each runway and its respective the minimum runway to taxiway separation standard.

Runway 4-22

Runway 4-22 requires a 400-foot runway to taxiway separation. There is currently 400 feet of separation between the northern end of parallel Taxiway A and the Runway 22 end. This separation increases to 790 feet within the southern two-thirds of Taxiway A near the Terminal Apron connectors. The portion of Taxiway A between the Runway 27 end and Taxiway G angles toward the Runway 4 end with approximately 550 feet of separation at the intersection of Taxiway A and Taxiway G.

Sufficient separation is currently provided between Runway 4-22 and Taxiway A.

Runway 9-27

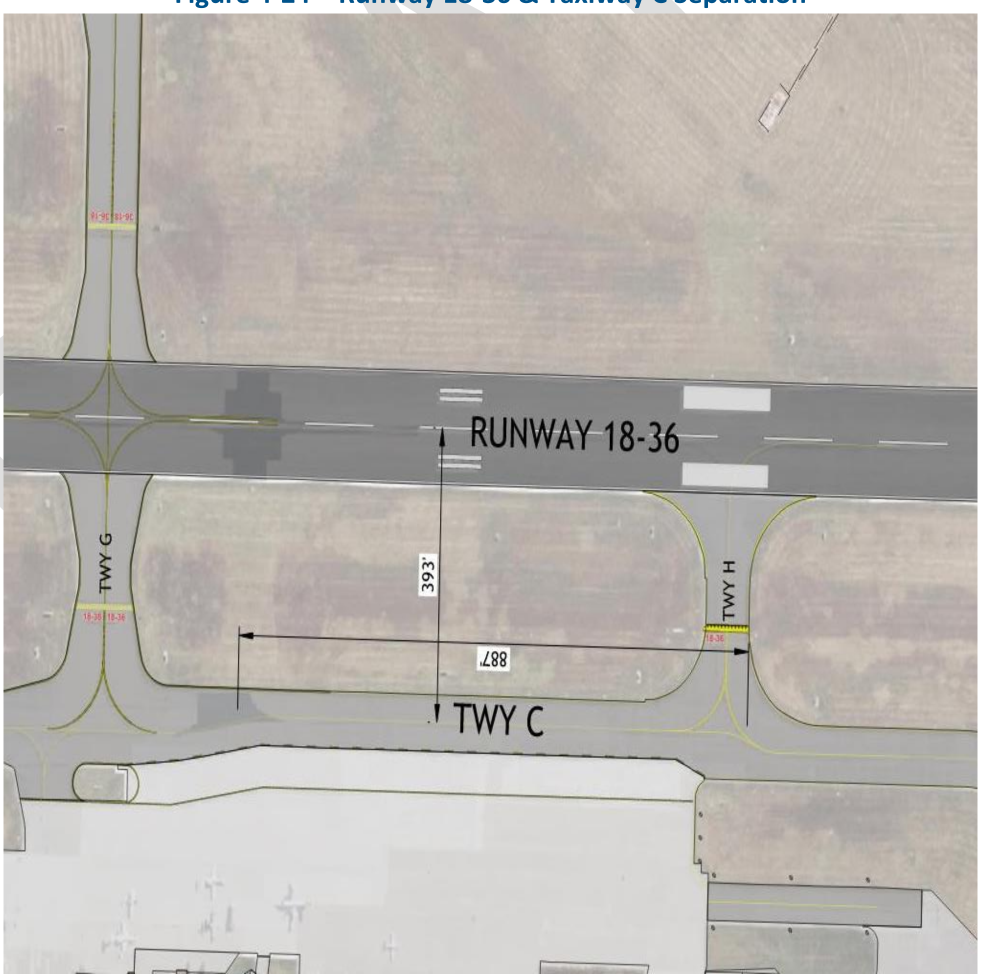
Runway 9-27 does not have a full-length parallel taxiway; however, portions of Taxiway G are located 475 feet south of the runway and the northern portion of the west GA apron is located approximately 345 feet south of the runway. Sufficient separation is currently provided between Runway 9-27 and all adjacent taxiways.

Runway 18-36

Runway 18-36 requires a 300-foot runway to taxiway separation for an RDC of C-II. EVV may want to maintain a runway to taxiway separation of 400-feet for Runway 18-36 in case the RDC ADG increases to III to coincide with Runway 4-22. At least 420 feet of separation is provided between Runway 18-36 and parallel Taxiway C, except for the middle portion of the taxiway where the separation decreases to 393 feet. The portion of Taxiway C south of Taxiway H veers away from the runway before connecting to the Runway 36 end.

Figure 4-24 depicts the portion of Taxiway C that provides less than the 400-foot separation to Runway 18-36. Design is currently underway to address the non-standard separation and is discussed within later sections of this report.

Figure 4-24 – Runway 18-36 & Taxiway C Separation



Sources: CHA, 2024.

4.4.14 Runway Length Requirements

Inadequate runway length can limit the operational capability of an airport, including the aircraft types that can operate and the destinations that the airport serves. Runway lengths can place restrictions on the allowable takeoff weight of the aircraft, which then reduces the amount of fuel, passengers, or cargo that can be carried. To ensure that EVV can support existing and anticipated aircraft and airline operational demands, a runway length analysis was performed based on specific aircraft performance characteristics as documented in the manufacturer's Aircraft Planning Manuals (APMs). 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 EVV:

Aircraft Specifics

- ***Payload/Load Factor:*** Represents the carrying capacity of the aircraft, including passengers, baggage, and cargo. As discussed within **Chapter 2**, an 82.4 percent load factor was chosen as the payload for planning purposes.[1]
- ***Estimated Takeoff Weight***: The estimated takeoff weight, which includes the payload and the fuel required to reach the intended destination (with reserve fuel). The estimated takeoff weight varies by aircraft, payload, and destination.
- ***Model & Engine Type:*** The aircraft version and engine type.

Airport Specifics

- ***Temperature:*** The atmospheric temperature at the airport. Per NOAA, warmer air requires longer runway lengths because the air is less dense, thus generating less lift on the aircraft. The average temperature (88.6°F) of the hottest month (July) at EVV 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 EVV is established at 421.9 feet mean sea level (MSL).
- ***Runway Gradient:*** The average slope of the runway, expressed as a percentage. The elevation between the Runway 4 and 22 ends is 39.8 feet for an effective 0.5 percent.
- ***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 aircraft weight and runway length requirements.
- No obstacles impacting departure climb were not included, since this factor is not accounted for in the APMs.

The A319-100, A320-200, B737-800, and ERJ-145 were selected as the most demanding aircraft currently operating and/or forecasted to operate at EVV and were used for to determine runway length requirements at the Airport. Additionally, Orlando-Sanford International Airport (SFB)

[1] It should be noted that fuel burn was not accounted for within the evaluations; therefore, the calculations presented herein would need reassessed to include fuel burn prior to any runway reconstruction.

currently represents the greatest stage length destination at approximately 640 nautical miles from EVV. Based upon this information, the EVV runway infrastructure currently provides sufficient length for the listed aircraft to reach SFB (**Table 4-24**).

Table 4-24 – Minimum Takeoff Length Required (82.4% Payload)

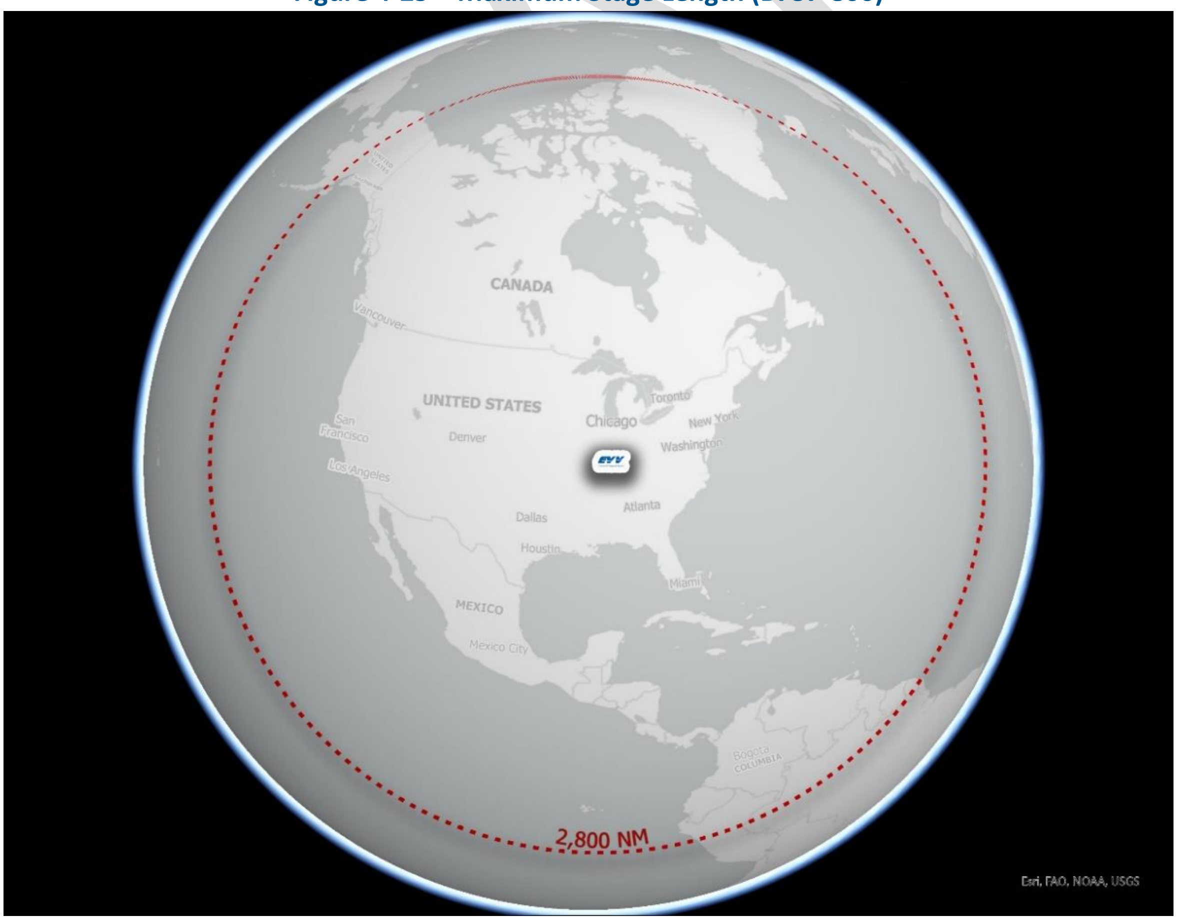
Aircraft Model	Destination	Estimated Takeoff Weight (lbs.)	Estimated Takeoff Length to Destination (ft)
Airbus 319-100	Orlando Sanford International Airport (SFB)	134,508	5,400
Airbus 320-200		149,750	6,079
Boeing 737-800		143,229	5,826
Embraer RJ-145		44,867	6,056

Sources: Airbus, Boeing, & Embraer Aircraft Planning Manuals, CHA, 2024.

An additional analysis was conducted to determine the maximum possible stage length based upon the longest runway length at EVV (8,021 feet) and the forecasted load factor of 82.4 percent. For this analysis, the B737-800 was chosen as the most demanding aircraft. The analysis determined a B737-800 could depart from Runway 4-22 on the hottest day of year with an 82.4 percent load factor and travel approximately 2,800 nautical miles before refueling. Note that increased load factors reduced the maximum stage length.

Figure 4-25 depicts the maximum stage length in relation to EVV.

Figure 4-25 – Maximum Stage Length (B737-800)



Sources: CHA, 2024.

4.5 TAXIWAY REQUIREMENTS

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

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

Larger aircraft operating at EVV, including commercial service aircraft, exclusively use Runway 4-22 and Runway 18-36. As such, the taxiway system providing connectivity to each of these runway ends must accommodate the same aircraft grouping. Due to its size, Runway 9-27 only accommodates single- and light twin-engine aircraft and taxiways associated with that runway do not require the same design standard requirements as Runways 4-22 and 18-36.

The following section outlines the taxiway system at EVV, including safety area and pavement geometry standards, to identify deficiencies and areas for recommended improvement.

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.

4.5.1 Taxiway Width

Taxiway widths requirements are based upon the taxiway's designated design group (TDG). **Table 4-25** lists each taxiway at EVV along its respective TDG and width. As listed, each taxiway and taxilane at EVV currently meets or exceeds the minimum width requirements.

Taxilane E serves the GA and T-Hangar area and is 10 feet wider than the minimum requirement. It is recommended this width be maintained until such time the taxilane is rehabilitated.

Taxiways T1 and T2 serve as connector taxiways providing access from Taxiway A to the terminal apron. Similar to Taxilane E, it is recommended that the Taxiway T1 and T2 widths be maintained until such time they are rehabilitated.

Table 4-25 – Taxiway Width Requirements

Taxiway/Taxilane	Taxiway Design Group (TDG)	Width (feet)	FAA Standard Met
A	5	75	Yes
B	3	75	Yes
C	3	75	Yes

Taxiway/Taxilane	Taxiway Design Group (TDG)	Width (feet)	FAA Standard Met
D (Taxilane)	2B	35	Yes
D1 (Taxilane)	2B	35	Yes
E (Taxilane)	2B	45	Yes
F	3	75	Yes
G	5	75	Yes
H	3	75	Yes
T1	3	100	Yes
T2	3	100	Yes

Source: FAA AC 150/5300-13B – *Change 1;* CHA 2024.

4.5.2 Taxiway Shoulders

The taxiway system at EVV is not currently equipped with taxiway shoulders. According to AC 150/5300-13B – *Change 1*, taxiway shoulders are recommended when the taxiway or apron accommodates ADG-IV and larger aircraft. As discussed within **Chapter 2**, Taxiway A and Taxiway G both accommodate AGD-IV aircraft. Therefore, it is recommended that shoulders are provided along each edge of Taxiway A and Taxiway G.

Additionally, AC 150/5300-13B – *Change 1*, further recommends that taxiways accommodating aircraft up to ADG-III are equipped with stabilized shoulders (e.g., turf shoulder or stabilized soil treatment). As such, it is recommended that all other taxiways at EVV, except for Taxiways D, D1, and E, are equipped with stabilized shoulders (turf or soil).

4.5.3 Taxiway Safety Area & Object Free Area

The Taxiway Safety Areas (TSA) is designed to support the occasional passage of aircraft, as well as ARFF equipment while the Taxiway Object Free Area (TOFA) is the area adjacent to the TSA that must remain free of objects not fixed-by-function to provide a vertical and horizontal wingtip clearance.

Based on the critical aircraft grouping (ADG-III), the taxiway safety area (TSA) and taxiway object-free area (TOFA) width requirements are listed within **Table 4-26**.

Table 4-26 – Taxiway Safety Area Requirements

Taxiway/ Taxilane	Airplane Design Group (ADG)	Taxiway Safety Area (TSA)	Taxiway Object Free Area (TOFA)
A	IV	171	243
B	III	118	171
C	III	118	171
D (Taxilane)	II	79	110
D1 (Taxilane)	II	79	110
E (Taxilane)	II	79	110
F	III	118	171
G	IV	171	243
H	III	118	171
T1	IV	171	243
T2	IV	171	243

Source: FAA AC 150/5300-13B – *Change 1;* CHA 2024.

4.5.4 Taxiway Geometry

An assessment of the EVV taxiway system was conducted to evaluate its compliance with current FAA taxiway geometry standards. **Table 4-27** lists the widths, ADG, and TDG of each taxiway as well as if the taxiway meets current FAA geometry standards. **Figure 4-26** depicts the recommend taxiway geometry configuration. As shown, some taxiways do not meet the standards of a TDG-3, as mentioned in **Chapter 2**.

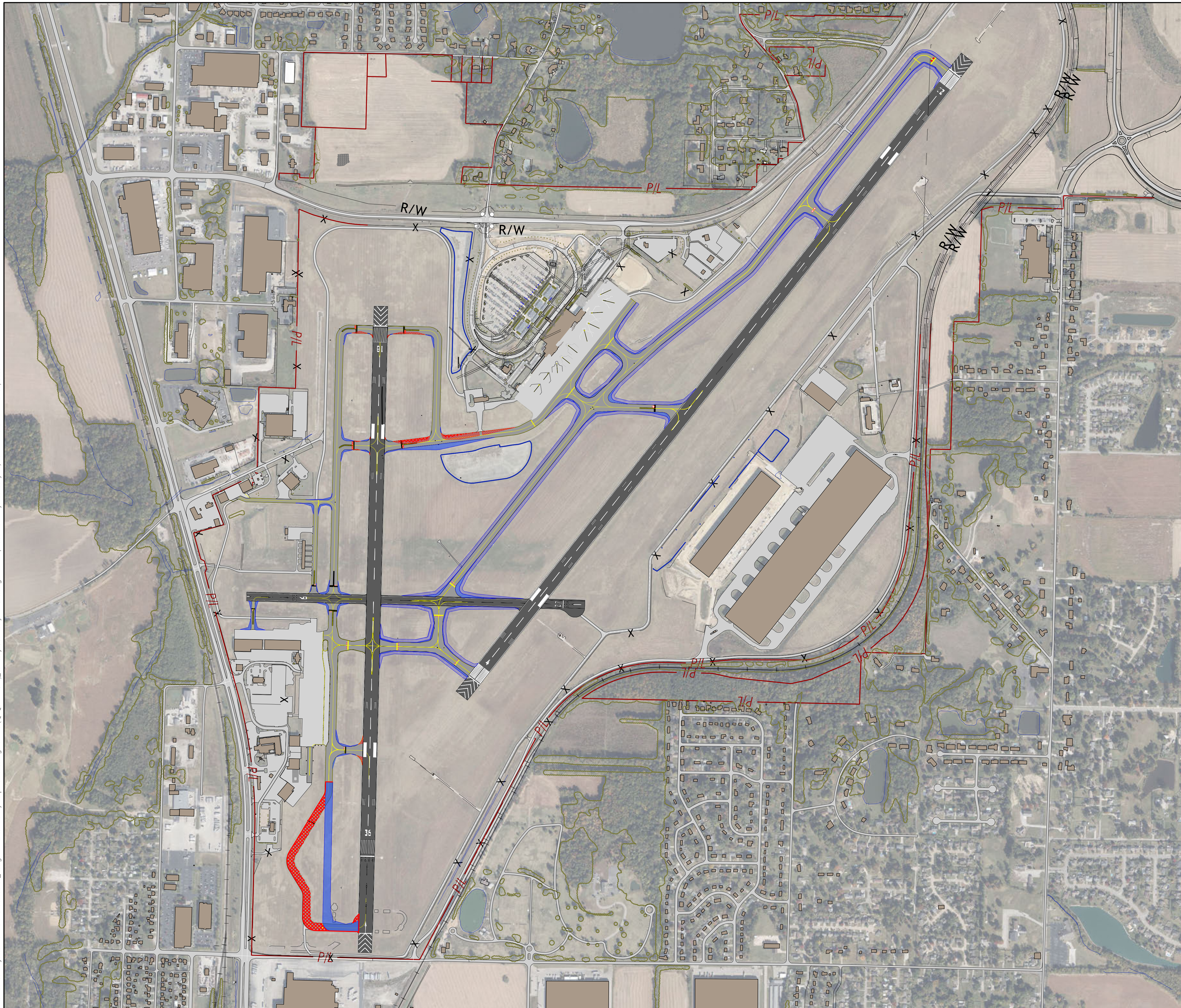
For taxiway turns onto runways, aprons, or additional taxiways, there are FAA design standards for the geometry of the paved fillets, based on the angle of the turn. Additionally, the FAA also recommends that exit taxiways are perpendicular to runways. Currently, all taxiways at EVV do not comply with these standard fillet dimensions. It is recommended that the additional pavement necessary to bring fillets up to standard be applied with the next airfield rehabilitation or reconstruction project. Standard fillet geometry will be evaluated in the alternative analysis.

Figure 4-26 Taxiway Geometry Deficiencies outlines the correct geometry needed to bring each of the taxiway to current standards noted in the AC 150/5300-13B – *Change 1*.

Table 4-27 – EVV's Taxiway Geometry Compliance with FAA Standards

Taxiway & Taxilane	Location	Existing Width (feet)	Airplane Design Group (ADG)	Taxiway Design Group (TDG)	Meets Geometry Standard (Y/N)	Meets FAA Taxiway Width Standards (Y/N)
A	Parallel to RWY 04-22	75	IV	5	N	Y
A1	Connector to end of RWY-22	75	III	5	N	Y
A2	Connector to middle of RWY-22	75	III	5	N	Y
A3	Connector from TWY T2 to mid-RWY 04-22.	75	III	5	N	Y
B	Provides access to RWY 18-36 and connects to TWY F.	75	III	3	N	Y
C	Provides access to the West Ramp And RWY 18-36.	75	III	3	N	Y
D (Taxilane)	Provides access to the Evansville Wartime Museum and GA Hangars Connects to TWY C and TWY E	35	II	2B	N	Y
D1 (Taxilane)	Used as an exit/entrance on to RWY 09-27.	35	II	2B	N	Y
E (Taxilane)	Provides access to the T-hangars and connects to Runway 09-27 and TWY D.	45	II	2B	N	Y
F	Connects to the terminal apron and TWY B. Provides a TWY crossing through RWY 18-36.	75	III	3	N	Y
G	Provides a TWY crossing through RWY 18-36 and RWY 09-27. Also provides access to RWY 04-22.	75	IV	5	N	Y
H	Used as an exit from RWY 18-36 on to TWY C.	75	III	3	N	Y
T1	Connector from TWY A to Terminal Apron.	75	III	3	N	Y
T2	Connector from TWY A to Terminal Apron.	75	III	3	N	Y

Source: FAA Form 5010; FAA AC 150/5300-13B – *Change 1;* CHA, 2024.



PROPOSED TAXIWAY/TAXILANE PAVEMENT
PROPOSED TAXIWAY/TAXILANE SHOULDER
PROPOSED TAXIWAY/TAXILANE PAVEMENT REMOVAL

GRAPHIC SCALE (FEET)
0 250 500 1,000

Evansville Regional Airport

PRIMARY:
CHA
201 N. Illinois Street, Suite 800
Indianapolis, IN 46204
317.786.0461 . www.chacompanies.com

SUB:

Designed By:	Drawn By:	Checked By:
Issue Date: 1/25/2024	Project No: 76738	Scale: AS SHOWN

REV	BY	DESCRIPTION	DATE
-	-	-	-

PROJECT: EVANSVILLE REGIONAL AIRPORT AIRPORT MASTER PLAN

TITLE: Taxiway Geometry Deficiencies

CERTIFICATION:

DRAWING NO.
4 - 26

File Name: V:\Projects\ANY\K6\076738.000\09_Design\Exhibits\Facility Requirements\Figure 4-13 (QAQC - TDG4s)_Taxiway Geometry Exhibit.dwg - 17x11 | Modified / By: January 25, 2024 1:14:18 PM / Blanco, Jose

4.6 AIRFIELD LIGHTING AND NAVIGATIONAL AIDS REQUIREMENTS

Airfield lighting allows for the safe operation of aircraft during nighttime hours and low visibility conditions. Airfield lighting typically includes runway and taxiway edge and centerline lighting, Visual Glide Slope Indicator (VGSI; also known as Precision Approach Path Indicator or 'PAPI'), Runway End Identifier Lights (REILs), runway threshold lighting, runway guard lights, touchdown zone lights (TDZLs), apron lighting, and airport rotating beacon. An overview of these devices are described below in *italics*.

Rotating Beacon
The Airport's rotating beacon is located adjacent to the airport equipment storage building. According to the Airport, the existing rotating beacon does not achieve FAA standards and has reached the end of its useful life. Design for the relocation and replacement of the rotating beacon which will meet FAA standards is currently underway.

Precision Approach Path Indicator (PAPI) Lights
A PAPI is a system of lights on the side of a runway threshold and provides visual descent guidance information during pilots' final approach to landing. Runway ends 4, 18, and 36 are equipped with PAPI-4 (four-light unit) systems, each providing a three-degree glide path to the runway thresholds. The current PAPI systems are adequate for the EVV infrastructure.

Runway Threshold Lighting
Runway threshold lights provide a visual indicator for pilots of the beginning of the usable runway if green and the end of the usable runway if red. Each runway end at EVV is currently equipped with sufficient threshold lighting.

Runway Edge Lighting
Runway edge lighting systems are classified according to their intensity (brightness); High-Intensity Runway Light (HIRL), Medium Intensity Runway Light (MIRL), and Low-Intensity Runway Light (LIRL). Runway 4-22 and Runway 18-36 are equipped with HIRLs, while Runway 9-27 is equipped with MIRLs. The current runway edge lighting systems at EVV are adequate.

REILs
The primary function of a REIL system is to provide rapid and positive identification of a runway's end to pilots on final approach to landing. Runways 4, 18, and 36 are each equipped with REILs. The current REILs are adequate to serve EVV operational environment.

Runway Centerline Lighting
Runway centerline lights are required for Category (CAT) II and III precision approach runways, as well as CAT I approaches, where the Runway Visual Range (RVR) is less than 2,400 feet. The FAA also recommends runway centerline lighting when a taxiway contains a high-speed exit.

Currently, the precision approach runways (Runway 4 and 22) do not offer an RVR less than 2,400 feet. Additionally, the EVV taxiway system does not contain a high-speed exit. Therefore, runway centerline lighting is not required nor is it recommended as part of this study.

Taxiway Edge Lighting

Similar to runway edge lighting, taxiway lighting delineates the taxiway's edge and provides guidance to pilots during periods of low visibility and at night. The Airport's taxiways are each equipped with Medium Intensity Taxiway Lighting (MITLs) systems except for Taxilane E, which is equipped with blue reflectors. The current taxiway edge lighting systems at EVV are adequate.

4.6.1 Approach Procedures and Navigational Aids Requirements

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

Based on current FAA classifications, there are three types of approach categories: visual, non-precision, and precision.

- **Visual (V)** – Approaches performed under visual flight rules only when meteorological conditions include a cloud ceiling height of 1,000 feet or greater and visibility greater than or equal to 3 miles.
- **Non-Precision Approach (NPA)** – A non-precision instrument approach provides lateral or both lateral and vertical guidance to the runway. Non-precision approaches do not meet the same criteria as precision approaches and are therefore classified as "non-precision". Examples of non-precision approaches include VOR, NDB, and RNAV (GPS) approaches.
- **Precision Approach (PA)** – A precision instrument approach provides aircraft with both vertical and lateral guidance to the runway using an instrument landing system (ILS) or precision approach path radar (PAR). Landing visibility minimums for precision approaches are generally lower than other types of instrument approach procedures but require use of ground-based equipment (e.g., glideslope, localizer, approach lighting system).

Runways 4 and 22 are each equipped with precision approaches using an ILS and Runways 18 and 36 are each equipped with non-precision approaches. **Table 4-28** lists the current instrument approach procedure information.

En-Route NAVAIDs

En-Route NAVAIDs assist pilots during navigation between airports. These facilities are usually ground-based and electronically emit signals that are received by aircraft on a specific radio frequency. The Airport has a VOR and VORTAC that is available for use during flight. It is recommended to refer to IAP 'VOR RWY 4,' when following an approach that is for Runway 4-22. A VOD, which relies upon Very High Frequency (VHF) Omni Directional Range (VOR) with Distance Measuring Equipment (DME) systems, are ground based En-Route NAVAIDs.

Table 4-28 – EVV's Instrument Approach Procedure Summary

Runway	Approach Category	NAVAIDs	Lighting	Minimum Ceiling (AGL)/ Visibility	IAP Types
04	Precision	ILS, GPS	HIEL, REIL, PAPI-4	200 ft. / 3/4 mile	ILS/LOC, VOR/DME, RNAV (GPS)
22	Precision	ILS, GPS	HIEL, MALSR, PAPI-4	200 ft. / 1/2 mile	ILS or LOC
09	Visual	N/A	MIRL	Visual	N/A
27	Visual	N/A	MIRL	Visual	N/A
18	Non-Precision	GPS	HIEL, PAPI-4, REIL,	200 ft. / 3/4 mile	RNAV (GPS)
36	Non-Precision	GPS	HIEL, PAPI-4, REIL	300 ft. / 3/4 mile	RNAV (GPS)

Source: FAA Airport Master Record (Form 5010), Accessed 2023. 8; CHA 2024.

DME – Distance Measuring Equipment
GPS – Global Positioning System
HIRL – High Intensity Runway Lights
ILS – Instrument Landing System
MALSR – Medium-Intensity Approach Lighting System with Runway Alignment Indicator
MIRL – Medium-Intensity Runway Lighting
PAPI-4 – Four-Box Precision Approach Path Indicator
REIL – Runway End Identifier Lights
RNAV – Area Navigation
LOC – Localizer
IAP – Instrument Approach Procedure

Precision Approach – ILS

The Runway 22 ILS consists of three components: a localizer (LOC), a glideslope (GS), and the approach lighting system (ALS). Runway 4 has a Runway Visual Range (RVR) rollout and Runway 22 has a RVR touchdown. RVR is a critical component in determining what the ILS minimums will be for each landing category. Specifically, operations in reduced visibility weather conditions, RVR system measurements are used by air traffic controllers to establish airport operating categories; and the ILS minimums will include RVR operation components and limitations. The Runway 4 ILS system at EVV consists of a localizer and a glideslope with no approach lighting system.

A localizer is situated approximately 1,000 feet past the departure-end of each runway approach and provides lateral positioning guidance to pilots. The system uses radio frequencies (RF) to transmit signals to aircraft by focusing the RF beam down the centerline of the runway toward the approach end of the runway for approximately 10 miles, focused within 35 degrees to the left or right of the runway centerline. The Airport is currently examining upgrading the Runway 4 localizer to a larger array.

The glide slope is located near the runway approach end (each near the touchdown zone of Runway 4 and 22) at a distance from the threshold to provide optimum crossing height. The glide slopes transmit a signal for approximately 10 nautical miles, with a horizontal coverage of eight degrees on each side of the localizer course, measured from the origin of the glide slope beam.

The ALS provides a lighted approach path along the extended centerline of the runway to provide a visual alignment, height perception, roll guidance, and horizontal reference for the pilot. At EVV, the ALS consists of a Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) for Runway 22. The MALSR at EVV adheres to FAA design standards.

Non-Precision Approaches – RNAV (GPS)

The Global Positioning System (GPS) based technology on Runway 4, 18, and 36 enables vertically guided approach procedures with approach capabilities similar to ILS approaches, without the need for the traditional ground-based ILS NAVAID components. The RNAV (GPS) systems follow FAA standards.

4.7 PASSENGER TERMINAL FACILITY BUILDING AND GATE REQUIREMENTS

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

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

BHS = Baggage Handling System

CBIS = Check Baggage Inspection System

CBRA = Checked Baggage Resolution Area

EQA = Equivalent Aircraft

FT = Feet / Foot

SF = Square Feet

SSCP = Security Screening Checkpoint

LF = Linear Feet

MAP = Million Annual Passengers

NO. = Number of, Number

NBEG = Narrow-body Equivalent Gate

NA = Not Applicable

OSR = On-Screen Resolution

PM = Peak Month

PMAD = Peak Month, Average Day

USF = Usable Square Feet

% = Percent

& = And

-- = Not Provided

PAX = Passenger

Table 4-29 – Terminal Facility Needs Summary

Area/Processor Area/Number	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
Gates					
Preferred Gate Demand Summary – *NO*	7	7	7	9	10
Narrow-body Equivalent Gates (NBEG) – *NO*	6.1	6.7	7.0	8.7	10.0
Equivalent Aircraft Gates (EQA) – *NO*	4.2	4.4	5.0	5.9	7.0
Concourse Hold Rooms					
Single NBEG Hold Room Area – *SF*	2,620	2,641	2,660	2,679	2,697
Total Holdroom Space Required – *SF*	18,206	17,698	18,620	23,304	26,972
Airline – Check-In and Checked Bag Drop					
Total Passenger Check-in Stations – *EA*[2]	22	14	17	20	21
Total PAX Check-In Hall Area – *SF*	7,462	4,292	5,052	5,525	5,510
Passenger Security Screening Checkpoint (SSCP) Processors					
Security Screening Area Required (10-Minute Queue Wait Used)					
Number of Lanes Required – *NO*[3]	2	2	2	3	3
Security Screening Area (Screening and Queuing) – *SF*	4,257	3,870	3,870	5,805	5,805
Circulation – Exit Lane Area – *SF*	497	1,161	1,161	1,742	1,742
Total Security Screening Area – SF	4,754	5,031	5,031	7,547	7,547
Baggage – CBIS, Outbound, and Inbound					
Outbound Baggage Screening (CBIS) – *SF*	2,974	1,740	1,740	2,580	2,580
Outbound/Inbound Bag Make-up (BHS) – *SF*	13,608	9,200	10,500	12,400	14,700
Inbound Baggage Claim Frontage – *LF*	200	123	155	175	195
Inbound Baggage Claim – *SF*	8,915	4,696	5,259	5,618	5,983

Note: Numbers in **RED** represent a deficiency in space based on existing conditions. Enplanements represent the high-growth forecast scenario. Enp. = Enplanements
Source: CHA, 2024.
Footnotes:
[1] Denotes existing conditions in the terminal building for comparison to forecasted PAL facility needs.
[2] Includes self-service kiosk in ticketing counter and service agent positions at ticketing counter.
[3] 10 minute queuing

4.7.1 Passenger Activity Variables

The following data indicated in **Table 4-30** represents the different passenger activity variables used to evaluate and determine the processor and other function group needs throughout the planning horizons.

Table 4-30 – Passenger Activity Variables

Areas	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
Load Factors - %	77.1%	77.9%	78.6%	79.3%	80.0%
Annual Enplaned PAX – *NO.*	165,933	306,839	384,561	434,219	484,596
Peak-hour Enplaned PAX [1] - *NO.*	163	301	377	426	475
Peak hour origination PAX [2] - *NO.*	158	292	366	413	461
Peak 30-minute enplaned PAX [3] – *NO.*	82	151	189	213	238
Peak 30-minute originating PAX [4] – *NO.*	80	146	183	207	231
Peak 20-minute enplaned PAX [5] – *NO.*	80	146	183	207	231
Annual Deplaned PAX – *NO.*	165,933	306,839	384,561	434,219	484,596
Peak-hour deplaned PAX – *NO.*	163	301	377	426	475
Peak-hour terminating PAX [6] – *NO.*	158	292	366	413	461
Peak 30-Min deplaned PAX [7] – *NO.*	82	151	189	213	238
Peak 30-Min terminating PAX [8] – *NO.*	80	146	183	207	231

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

4.7.2 Processor Areas Evaluated

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

- Aircraft Gate Demand
- Concourse Hold Rooms
- Check-in, Ticketing, and Baggage Drop Lobby (Ticket Lobby)
- Passenger Security Screening Checkpoint (SSCP) and Queuing
- Checked Baggage Inspection and Security (CBIS) Outbound Baggage Screening
- Outbound (Inbound) Baggage Make-Up
- Inbound Baggage Claim

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

- Annual and peak hour passenger enplanement data
- Peak hour passenger deplanement data
- Annual and peak month, peak day aircraft operations data
- Fleet mix changes through the planning activity levels
- Load factor changes though the planning activity levels
- International Air Transport Association (IATA) Level of Service (LOS) Standards

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

- Airport Cooperative Research Program (ACRP) Synthesis 84, *Transportation Network Companies: Challenges and Opportunities for Airport Operators*
- ACRP, *Report 25 – Airport Passenger Terminal Planning and Design, Volume 2: Spreadsheet Models and User's Guide*
- IATA, Airport Development Reference Manual (ADRM), *12th Edition*

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

By comparing the programmatic spatial requirements for each PAL to the Base Year (2023, or existing conditions), the recommended terminal needs and requirements needed to accommodate the projected passenger activity levels were identified. The forecasted passenger demand throughout the planning period shows a steady increase. It is important to understand that the projected enplanement growth does not predetermine equal or proportional expansion across all passenger processor areas. Decisions pertaining to expanding or decreasing space considered several factors aside from enplanements, passenger behavior, and industry trends. For example, aviation industry trends show passengers are becoming more self-reliant and are using self-service functions, especially as a by-product of COVID. In addition, airlines at EVV are transitioning their fleet to include larger regional and narrow-body aircraft.

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

For the purposes of determining spatial needs of the terminal areas throughout the PALs, the analyses were each conducted as a "free-body-analysis". Thus, area determinations did not strongly consider the existing layout, size, and configuration as a variable in determining spatial needs.

Gate Demand Summary

The following data presented in **Table 4-31** indicates the gate demands used to evaluate and determine the processor, and other function groups, needs throughout the planning horizons.

Table 4-31 – Preferred Gate Demand Summary

Preferred Gate Demand Summary					
Areas	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
Gate Demand Analysis					
Gate Forecast Demand – *NO.*	7	7	7	9	10
Narrow-body Equivalent Gates (NBEG) – *NO*	6.1	6.7	7.0	8.7	10.0
Equivalent Aircraft Gates (EQA) – *NO*	***4.2***	4.4	5.0	5.9	7.0

Note: Numbers in **RED** represent a deficiency in space based on existing conditions
Source: CHA, 2024.

4.7.3 Level of Service (LOS)

As shown in **Table 4-32**, IATA's Airport *Development Reference Manual, 12th Edition* provides established level of service grades, which was utilized to judge the adequacy of terminal features at EVV. For this MPU, the intended LOS goal was 'C', or 'Good'. LOS C is typically used as a baseline performance criterion target for most airport terminals and is recommended by IATA as the minimum design standard as it denotes "good level of service".

Table 4-32 – IATA Level of Service Grades

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

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

4.7.4 Aircraft Gate Demand Analysis

The current terminal gate configuration has seven (7) contact gates (A1, A3, A4, B1, B3, B4, and B5). Contact gates were determined in which a holdroom corresponds to a single aircraft parking position. Therefore, unutilized parking positions without a PBB such as A2, A5, and B2 were not considered in the baseline analysis to determine future gate requirements. Each gate utilized has approximately 2.60± departures per peak month/peak average day. Therefore, the existing conditions or base year takes into consideration the seven (7) leased contact gates to establish the baseline gate activity for departures/enplanements.

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

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

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

Gate demand of more than 3.50 daily departures was not accounted for, unless otherwise indicated and explained. It must be noted that examined norms do not typically exceed this figure but maximized gate structures may allow for a such a number to come to fruition. This would affect the total number of gates available at EVV. Attracting new air service, particularly with a new airline, is a difficult feat without additional slotting capacity within the context of the current number of gates and terminal frontage on the apron to park aircraft.

Boise Airport (BOI) and Norfolk International Airport (ORF) were benchmarked meeting the equal to, or less than 3.0 departures per gate, per day. Reno-Tahoe International Airport (RNO) has less than 3.75-departures per gate, per day. Reno-Tahoe International Airport gate planning utilizes to their benefit preferential gate status at the airport and assumes the ultra-low-cost carriers (i.e., Allegiant, JetBlue, Breeze, Spirit, Sun Country, Volaris, etc.) use a single gate on a per-turn basis and do not have a dedicated gate.

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

A straight-line, annualized enplaned passengers per gate forecast is presented in **Table 4-33**. This table does not depict a peak month enplaned passenger per gate forecast. See **Table 4-34** for peak month enplaned passenger per gate forecast.

Peak month enplaned passenger per gate forecast is depicted in **Table 4-34**.

Table 4-33 – Annual Average Enplaned Passenger per Gate Forecast Approach

Year	Annual Enplanements	Annual Commercial Ops	Annual Departures[1]	# of Gates	Enplaned Annual Pax/ Gate	Enplaned Annual Pax per Departure
Base	165,933	5,973	2,987	7	23,705	56
PAL 1	306,839	7,158	3,579	8	36,577	86
PAL 2	384,561	8,459	4,230	10	38,792	91
PAL 3	434,219	9,905	4,953	12	37,407	88
PAL 4	484,596	11,325	5,663	13	36,512	86

Footnotes: [1] Assumes Total Annual Commercial Operation ÷ 2 = Annual Commercial Departures.
Note: Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: Airport Cooperative Research Program (ACRP) Report 25 – Airport Passenger Terminal Planning and Design Guidebook, CHA, 2024.

Table 4-34 – Peak Month Enplaned Passenger per Gate Forecast Approach

Year	PM Enplanements	PM Ops	PM Departures[1]	# of Gates	Enplaned PM Pax/Gate	Enplaned PM Pax per Departure
Base	16,415	565	283	7	2,345	58
PAL 1	21,097	677	339	8	2,543	63
PAL 2	25,779	800	400	10	2,704	67
PAL 3	30,461	937	469	11	2,825	70
PAL 4	35,143	1,071	536	12	2,906	72

Footnotes:[1] Assumes Total Peak Month Operations ÷ 2 = Peak Month Departures.
Note: Numbers in **RED** represent a deficiency in space based on existing conditions
Sources: Airport Cooperative Research Program (ACRP) Report 25 – Airport Passenger Terminal Planning and Design Guidebook, CHA, 2024.

A straight-line, annualized daily departure per gate forecast is presented in **Table 4-35**. This table does not depict a peak month, average day departures per gate forecast. Daily departures and annual departures per gate are both controlled at baseline figures.

Table 4-35 – Daily Average Departures per Gate Forecast Approach

Year	Annual Enplanements	Annual Commercial Ops[1]	Annual Departures	# of Gates	Annual Departures/ Gate	Daily Departures Per Gate
Base	165,933	5,973	2,987	7	427	1.17
PAL 1	306,839	7,158	3,579	4	913	2.5
PAL 2	384,561	8,459	4,230	5	913	2.5
PAL 3	434,219	9,905	4,953	5	913	2.5
PAL 4	484,596	11,325	5,663	6	913	2.5

Footnotes: [1] Assumes Average Day Operations ÷ 2 = Average Day Departures.
Note: Numbers in **RED** represent a deficiency in space based on existing conditions
Source: Airport Cooperative Research Program (ACRP) Report 25 – Airport Passenger Terminal Planning and Design Guidebook, CHA, 2024.

The peak month departures per gate forecast is presented in **Table 4-36**. This table illustrates the calculated gates needed to maintain the standard departures for both Peak Month Average Turns per gate and Peak Month Average Day Turns per gate.

A summary of the calculated number of gates needed across given approaches is provided in **Table 4-37**.

Table 4-36 – Peak Month Departures per Gate Forecast Approach

Year	PM Enplanements	PM Ops	PM Departures[1]	# of Gates	PM Departures/ Gate	PMAD Departures Per Gate
Base	16,415	565	283	7	40.4	2.6
PAL 1	21,097	677	339	6	54.9	3.5
PAL 2	25,779	800	400	7	54.9	3.5
PAL 3	30,461	937	469	9	54.9	3.5
PAL 4	35,143	1,071	536	10	54.9	3.5

Footnotes: [1] Assumes Total Peak Month Operation ÷ 2 = Peak Month Departures.
Note: Numbers in **RED** represent a deficiency in space based on existing conditions.
Source: Airport Cooperative Research Program (ACRP) Report 25 – Airport Passenger Terminal Planning and Design Guidebook, CHA, 2024.

Table 4-37 – Gate Forecast Demand

Demand Concept	Table	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
Annual Enplaned Passenger/ Gate Approach	**4-33**	7	8	10	12	13
Peak Month Enplaned Passenger/ Gate Approach	**4-34**	7	8	10	11	12
Daily Departures per Gate Forecast Approach	**4-35**	7	4	5	5	6
Peak Month, Average Day Departures / Gate Forecast Approach	**4-36**	7	6	7	9	10
Contingency Factor = NO	--	*(NA)*	*(NA)*	*(NA)*	*(NA)*	*(NA)*
RECOMMENDATION FOR GATES	**--**	**7**	**7**	**7**	**9**	**10**

Note: Numbers in **RED** represent a deficiency in space based on existing conditions. Enp. = Enplanements.
Source: CHA, 2024.

Narrow-Body Equivalent Gates and Equivalent Aircraft Gate Analysis

As previously discussed in **Section 4.2**, the "design aircraft" or "design aircraft family" represent the most demanding aircraft or grouping of aircraft with similar characteristics (relative to AAC, ADG, TDG) that are currently using EVV. After a review of operations, the Boeing 737-800 (ADG D-III, TDG of 3) is the most demanding passenger aircraft operating at EVV throughout the forecast period.

The current and projected design aircraft family, as presented, is used as the basis for normalizing the terminal gates at the Airport and for conducting the gate equivalencies analyses. Gate equivalency analyses were useful in determining hold room spatial requirements, as well as determining other processor evaluations and aircraft ramp frontage requirements at the terminal concourses. The results of the analyses are summarized in **Table 4-29**.

It is important to note that the definition of the term "gate" refers only to a parking position assigned to a scheduled aircraft for enplanement and department of passengers. The term is applied as a number without consideration of the size of the aircraft. To standardize the definition of gates when determining processor sizing requirements, two metrics were developed: *Narrow-body Equivalent Gates* (NBEG), specifically for sizing hold rooms and *Equivalent Aircraft* (EQA) to size other processor areas. **Table 4-38** sets froth the determination for Narrow-body Equivalent Gates and Equivalent Aircraft.

Table 4-38 – Gate Equivalencies

Design Group	Class and Aircraft	Existing # Of Gates	NBEG		EQA	
			Maximum Wingspan (Feet)	Index	Typical Seats Average	Index
BASE Gate Equivalencies						
I	Small Regional (Metro, B99, J31)	0	49	0.4	25	0.2
II	**Medium Regionals (C-II)**	**3**	**79**	**0.7**	**50**	**0.4**
III	**Large Regionals (C-III)**	**2**	**118**	**1**	**75**	**0.5**
III	**Narrow-body (C-III, D-III)**	**2**	**118**	**1**	**145**	**1**
IIIa	B757 (B757, B757 w/Winglets)	0	49	0.4	25	0.2
IV	Wide-body (B767)	(0)	214	1.4	280	1.9
V	Jumbo (B747, B777, A330, A340)	(0)	262	1.8	400	2.8
VI	Super Jumbo (A380, B747-8)	(0)	49	2.2	525	3.6
BASE (Existing) Totals		**(7)**	**NBEG**	**6.1**	**EQA**	**4.2**
PAL 1 Gate Equivalencies						
I	Small Regional (Metro, B99, J31)	0	49	0.4	25	0.2
II	**Medium Regionals (C-II)**	**1**	**79**	**0.7**	**50**	**0.4**
III	**Large Regionals (C-III)**	**4**	**118**	**1**	**75**	**0.5**
III	**Narrow-body (C-III, D-III)**	**2**	**118**	**1**	**145**	**1**
IIIa	B757 (B757, B757 w/Winglets)	0	135	1.1	185	1.3
IV	Wide-body (B767)	(0)	171	1.4	280	1.9
V	Jumbo (B747, B777, A330, A340)	(0)	214	1.8	400	2.8
VI	A380 (A380, B747-8)	(0)	262	2.2	525	3.6
PAL 1 Totals		**7**	**NBEG**	**6.7**	**EQA**	**4.4**
PAL 2 Gate Equivalencies						
I	Small Regional (Metro, B99, J31)	0	49	0.4	25	0.2
II	**Medium Regionals (C-II)**	**0**	**79**	**0.7**	**50**	**0.4**
III	**Large Regionals (C-III)**	**4**	**118**	**1**	**75**	**0.5**
III	**Narrow-body (C-III, D-III)**	**3**	**118**	**1**	**145**	**1**
IIIa	B757 (B757, B757 w/Winglets)	0	135	1.1	185	1.3
IV	Wide-body (B767)	(0)	171	1.4	280	1.9
V	Jumbo (B747, B777, A330, A340)	(0)	214	1.8	400	2.8
VI	A380 (A380, B747-8)	(0)	262	2.2	525	3.6
PAL 2 Totals		**7**	**NBEG**	**7.0**	**EQA**	**5**
PAL 3 Gate Equivalencies						
I	Small Regional (Metro, B99, J31)	0	49	0.4	25	0.2
II	Medium Regionals (C-II)	0	79	0.7	50	0.4
III	**Large Regionals (C-III)**	**6**	**118**	**1**	**75**	**0.5**
III	**Narrow-body (C-III, D-III)**	**4**	**118**	**1**	**145**	**1**
IIIa	B757 (B757, B757 w/Winglets)	(0)	135	1.1	185	1.3
IV	Wide-body (B767)	(0)	171	1.4	280	1.9
V	Jumbo (B747, B777, A330, A340)	(0)	214	1.8	400	2.8

Design Group	Class and Aircraft	Existing # Of Gates	NBEG		EQA	
			Maximum Wingspan (Feet)	Index	Typical Seats Average	Index
VI	A380 (A380, B747-8)	(0)	262	2.2	525	3.6
PAL 3 Totals		**9**	**NBEG**	**8.7**	**EQA**	**5.9**
PAL 4 Gate Equivalencies						
I	Small Regional (Metro, B99, J31)	0	49	0.4	25	0.2
II	Medium Regionals (C-II)	0	79	0.7	50	0.4
III	**Large Regionals (C-III)**	**6**	**118**	**1**	**75**	**0.5**
III	**Narrow-body (C-III, D-III)**	**4**	**118**	**1**	**145**	**1**
IIIa	B757 (B757, B757 w/Winglets)	0	135	1.1	185	1.3
IV	Wide-body (B767)	(0)	171	1.4	280	1.9
V	Jumbo (B747, B777, A330, A340)	(0)	214	1.8	400	2.8
VI	A380 (A380, B747-8)	(0)	262	2.2	525	3.6
PAL 4 Totals		**10**	**NBEG**	**10.0**	**EQA**	**7.0**

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

4.7.5 Concourse Hold Rooms

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

The calculations made for hold room area across the planning horizon are depicted in **Table 4-40**. Most importantly, the seat number on the design aircraft is assumed at 177. This number represents Allegiant seats on an A320 and captures the seating capacities for a B737-800 aircraft as well. In addition, evaluations conducted were based on a LOS B/C which mandates 15-square feet for seated passengers and 10 square feet for standing passengers. In comparison, LOS A would allot 17-square feet for seated passengers and 12-square feet for standing passengers.

Table 4-40 follows, which indicates inclusive hold room space requirements as calculated in this study throughout the planning horizon (represented by given PALs).

Table 4-39 – Inclusive Hold Room Space Requirements

Function	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
NBEG Factor - *No.*	6	7	7	9	10
Each Hold Room Area - *SF*	2,620	2,641	2,660	2,679	2,697
Total Hold Room Area - SF	**15,984**	**17,698**	**18,620**	**23,304**	**26,972**
Existing Hold Room Area - SF	18,206 SF				
Surplus/ (Deficiency)	**2,222**	**508**	**(414)**	**(5,098)**	**(8,766)**

Note: Numbers in **RED** represent a deficiency in space based on existing conditions. Enp. = Enplanements
Source: CHA, 2024.

Table 4-40 – Single NBEG Hold Room Area Evaluation

Single NBEG Hold Room Evaluation										
Evaluation Concepts	**Base (Existing)**		**PAL 1 (2028)**		**PAL 2 (2033)**		**PAL 3 (2038)**		**PAL 4 (2043)**	
			Input	**Out**	**Input**	**Out**	**Input**	**Out**	**Input**	**Out**
Seats on Design Aircraft – *NO.*	177		177		177		177		177	
Load Factors (%)	77.1%		77.9%		78.6%		79.3%		80.0%	
# of Design Passengers	**136**		**138**		**139**		**140**		**142**	
% PAX Seated	80%	109	80%	110	80%	111	80%	112	80%	113
% PAX Standing	20%	27	20%	28	20%	28	20%	28	20%	28
Seated PAX Area - SF	15	1638	15	1655	15	1669	15	1684	15	1699
Standing PAX Area - SF	10	273	10	276	10	278	10	281	10	283
Seated & Standing Area - SF		1911		1930		1948		1965		1982
% Increase for Amenities	10%	191	10%	193	10%	195	10%	197	10%	198
% Increase for High Utilization	0%	0	0%	0	0%	0	0%	0	0%	0
Hold Room Share Factor -(Decrease)	-3%	-57	-3%	-58	-3%	-58	-3%	-59	-3%	-59
Adj. Seated/Standing Area (SF)	**2,044**		**2,065**		**2,084**		**2,103**		**2,121**	
Podium Width /Position - FT	4		4		4		4		4	
Depth of Podium to Back Wall - FT	8		8		8		8		8	
Podium Queue Depth - FT	15		15		15		15		15	
Area / Podium Position - SF		92		92		92		92		92
Podium Positions – NO.	2		2		2		2		2	
Total Podium & Queue - SF		184		184		184		184		184
Boarding/Exit Corridor Width - FT	6		6		6		6		6	
Depth of Hold Room - FT	25		25		25		25		25	
Boarding/Egress per Bridge - SF		150		150		150		150		150
Bridges/Gate – NO.	1		1		1		1		1	
Boarding Corridor Area - SF		150		150		150		150		150
NBEG Hold Room Area (SF)	**2,620**		**2,641**		**2,660**		**2,679**		**2,697**	

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

4.7.6 Check-In, Ticketing, and Baggage Drop Lobby (Ticket Lobby)

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

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

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

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

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

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

Check-in functionalities found at airports are summarized below:

- Automatic Check-in – An example of automatic check-in is if a passenger holds an elite status with airline, the airline will automatically check the passenger in for the passenger's flight 36 hours in advance, putting this passenger ahead of other passengers for boarding preferences and upgrades. In addition, many airlines have apps available that will automatically check-in a passenger without prompting.
- Baggage Drop Positions – Airline staff or agents accept bags from passengers who check-in via internet PC/mobile device or at a kiosk for a two-step process.

- Bypass (Internet browser/PC/Mobile Device) Check-in – Passengers who do not check bags and are able to check-in remotely, prior to arriving to the terminal and do not use terminal check-in processors.
- Curbside Check-in Processors – Typically, curbside check-in facilities are equipped with conveyor belts located at the check-in podiums for direct input of bags into the outbound baggage system. At smaller airports (or for airlines who do not wish to pay for conveyors) checked bags may be placed on carts and taken into the check-in lobby to be transferred to the ticket counter baggage conveyor.
- Full Service (Agent) Check-in – Airline staff or agents may assist passengers with boarding passes, rebooking, and where check-in bags are accepted.
- Passenger Self-Service Baggage Tag and Baggage Drop – Without the assistance of an airline agent, passengers can complete the checked baggage processes.
- Self-Service Kiosk Check-in – Stand-alone kiosks can be located at the ticket counter, remote from the ticket counter or throughout the terminal. Kiosks can print boarding passes and bag tags. When kiosks are located at the ticket counter, they are typically configured in pairs with a bag well, which often includes a baggage scale between the kiosks.

The LOS assumptions for passenger check-in behaviors at EVV through the planning horizon are shown in **Table 4-41** and **Table 4-42**.

Table 4-41 – IATA Level of Wait Time Standard for Check-In (Minutes)

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

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

Table 4-42 – IATA Level of Service Space Standard for Check-In (sq. ft. per PAX)

Type of Service	A	B	C	D	E	F
Few carts and few PAX with check-in baggage	18.3	15.0	12.9	11.8	9.6	<9.6
Few carts and 1 or 2 pieces of baggage per PAX	19.4	16.1	14.0	12.9	11.8	<11.8
High percentage of PAX using baggage carts	24.8	20.5	18.3	17.2	16.1	<16.1
"Heavy aircraft" flights with 2 or more items per PAX and a high rate of PAX using baggage carts	28.0	24.8	21.5	20.5	19.4	<19.4

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

For planning purposes this Study, and in reference to IATA, it is assumed 70 percent of all originating passengers check baggage through to their destination at the actual "ticketing" lobby, with an additional 10 percent checking baggage through at the departure gate. When combined, this comes to a total of 80 percent of all passengers checking a bag with an agent. Without curbside check-in and remote baggage drop locations, it was assumed at EVV that 70 percent of the originating passengers drop baggage off in the check-in processor area. This percentage of baggage drop utilization was assumed to remain constant throughout the planning horizon.

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

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

Note, passengers who are checking bags to their destination are more likely to check-in at the airport as part of the baggage drop and screening process. In addition, without self-bag tagging and self-drop of baggage, each passenger checking baggage through will need an interface with an agent.

The assumptions for passenger check-in behaviors at EVV through the planning horizon are shown in **Table 4-43**.

Table 4-43 – Enplaned Passenger Check-in Utilizations

Check-in and Checked Bag Drop	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
Passenger Check-in by Methodology					
Traditional Ticketing Counter & Bag Drop Function - Agent Assist [1]	--	30%	27%	14%	10%
Terminal Kiosk Check-in Only	--	5%	3%	3%	3%
Terminal Kiosk Check-in & Bag Drop Function – Agent Assist	--	18%	15%	8%	5%
Remote/Automatic Check-in & Bag Drop Function – Agent Assist	--	36%	31%	30%	20%
Curbside Check-in Processors	--	0%	0%	0%	0%
By-Pass Remote Check-in (Browser or Mobile App)	--	11%	19%	10%	7%
Automated Check-in	--	0%	0%	15%	20%
Remote/Automatic Check-in & PAX Self-Service Bag Tag & Drop	--	0%	5%	8%	18%
Terminal Kiosk Check-in & PAX Self-Service Bag Tag & Drop	--	0%	0%	12%	17%
Total PAX Utilization	**--**	**100%**	**100%**	**100%**	**100%**
Baggage Check and Drop Locations Utilization					
Terminal Building – Location	(100%)	100%	100%	100%	100%
Terminal Building – PAX Utilization	(70%)	70%	70%	70%	70%
Curbside – Location	(0%)	0%	0%	0%	0%
Curbside – PAX Utilization	(0%)	0%	0%	0%	0%
Off-Airport Location – Location	(0%)	0%	0%	0%	0%
Off-Airport Location – PAX Utilization	(0%)	0%	0%	0%	0%

Footnote: [1] Accounts for high PAX utilization with Allegiant, and the likelihood of ultra-low-cost airline carriers will provide new air services at EVV.
Note: Those numbers depicted in parentheses indicate existing conditions. Enp. = Enplanements
Source: CHA, 2024.

The above analysis assumed that passengers will gravitate away from traditional ticket counters to kiosks and finally to self-service baggage drop functions as the Airport approaches the end of the planning horizon. If the adoption of self-service check-in/baggage drop functions were to advance at a quicker rate, the demand to provide area within the terminal for these check-in processor functions may be reduced.

Assumptions

Additional assumptions included:

- Transaction time for checking in at a kiosk is 2.5 minutes.
  - Maximum desired queue time: 2.5 minutes +/-
  - Maximum average queue time: 1.5 minutes +/-
- Transaction time for agent assistance is 5.0 minutes.
  - Maximum desired queue time: 10 minutes +/-
  - Maximum average queue time: 6 minutes +/-

- Transaction time for checking a bag (baggage drop and self-service bag drop) is 1.7 minutes.
  - Maximum desired queue time: 10 minutes +/-
  - Maximum average queue time: 6 minutes +/-
- Ticketing check-in and bag drop counters area assumes 6 linear feet per position (includes baggage scale), 12-foot depth from back wall to face of counter, 8-foot circulation easement from face of counter to queuing line.
- Kiosk area, assuming free standing kiosks not integral to counter, are 6 square feet per kiosk with 25 square feet of circulation, and 72 square feet of queuing space.
- 70 percent of passengers check baggage in the traditional ticket lobby throughout the planning horizon.

Throughout the planning period:

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

Table 4-44 – Passenger Check-in and Bag Drop Stations Required

Check-in Modes	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
Traditional Ticketing Counter & Bag Drop (Agent Assist) – *NO*	*(17)*	5	5	4	3
Curbside Check-In and Remote Check-In (Mobile App) – NO.	*(0)*	**2**	**3**	**5**	**6**
Terminal Kiosk Check-In and Baggage Drop Positions (Agent Assist) – NO	*(5)*	**7**	**8**	**7**	5
PAX Self-Service Bag Drops - *NO*	*(0)*	0	**1**	**4**	**7**
Totals	***(22)***	14	17	20	21

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

Table 4-45 indicates the area requirements for each type of passenger check-in mode based on the station required in **Table 4-44**.

Table 4-45 – Passenger Check-in Area Requirements

Size & Areas	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
Traditional TIX Counter Processor Functions – Agent Assist					
Effective Length (6 feet per TIX Position)– *LF*	94	28	28	22	17
PAX Queue Depth (20 ft) - *FT*	20	20	20	20	20
Agent Area (12 ft) – Front of Counter to Wall) - *SF*	1,122	330	330	264	198
Front Circulation Area (8 ft - Counter to Queue) - *SF*	748	220	220	176	132
Queuing Area - *SF*	1,870	550	550	440	330
Subtotal – Traditional TIX Counter	3,740	1,100	1,100	880	660
Curbside, Remote, and Automated Check-In – NO.					
Effective Length (5 feet) - LF	0	11	16.5	27.5	33
Queue Depth (13 feet) - FT	13	13	13	13	13
Area (34 SF) - SF	0	68	102	170	204
Queuing - SF	0	143	215	358	429
Subtotal – Curbside and Remote	0	211	317	528	633
Terminal Kiosk Check-In and Baggage Drop Positions (Agent Assist)					
Effective Length (6 feet per DROP Position) – *LF*	28	39	44	39	28
Queue Depth (20 feet) - *FT*	20	20	20	20	20
Agent Area (12 feet - Front of Kiosks) - *SF*	330	462	528	462	330
Front Circulation Area (8 ft - Counter to Queue) - *SF*	220	308	352	308	220
Queuing Area - *SF*	560	780	890	780	560
Subtotal – Bag Drop Stations (Agent Assist.) - *SF*	1,110	1,550	1,770	1,550	1,110
PAX Self-Service Bag Drop Stations					
Effective Length (6 feet per DROP Position) – *LF*	0	0	5.5	22	38.5
Queue Depth (20 feet) - *FT*	20	20	20	20	20
Agent Area (5 feet - Front of Kiosks) - *SF*	0	0	27.5	110	192.5
Front Circulation Area (8 feet - Counter to Queue) - *SF*	0	0	44	176	308
Queuing - SF	0	0	110	440	770
Subtotal – Bag Drop (PAX Self-Service) - SF	**0**	**0**	**182**	**726**	**1,271**
TOTAL	**4,850**	**2,861**	**3,368**	**3,684**	**3,674**
Circulation					
Circulation Factor of 0.50 [1] - *SF*	2,425	1,431	1,684	1,842	1,837
Total Passenger Check-in Hall Area - SF	7,275	4,292	5,052	5,525	5,510
Existing Passenger Checking Area - SF			7,462		
Surplus/(Deficiency)	187	3,171	2,410	1,937	1,952

Footnotes: [1] A generally acceptable circulation factor is 0.30 times the *Area* for passenger "ticket" lobby area requirements. This analysis concluded that a more practicable circulation factor is 0.50 to address any errant airline operational policies and/or procedures, non-common equipment and facilities use.
Note: Numbers in **RED** represent a deficiency in space based on existing conditions. Enp. = Enplanements
Source: CHA, 2024.

The check-in stations at EVV are served with the majority being traditional ticket counters with the assistance of ticketing agents. The check-in lobby is anticipated to be adequate to serve existing and future passenger demand throughout the planning period. Although, passenger activity is forecasted to increase, as the industry and passengers increase the use of kiosk and self-serve check-in methods, the required square footage required will decreased.

4.7.7 Passenger Security Screening Checkpoint (SSCP) and Queuing

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

EVV operates one (1) distinct centralized security screening check point, with two (2) security screening checkpoint queue lanes.

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

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

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

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

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

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

IATA's standards in gauging space needed for passengers waiting in a single queue to be screened are depicted in **Table 4-46**.

Table 4-46 – IATA Level of Service Standards for Security Screening Checkpoints

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

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

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

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

TSA issued *Checkpoint Design Guideline* (CDG), recommends that airports and local TSA authorities collaborate to establish acceptable goals for terminal-specific wait times and screening lane processing rates to be used for planning purposes.

Extended queue depths and areas have a dimensional effect on a pair of checkpoint lanes, as depicted in **Figure 4-27**. In addition, dimensions can be impacted by processing rates and wait time variables, which later inform queue area totals.

The basis of determining screening lane requirements was held constant at LOS C, 150 passengers per hour, per lane (0.40 MIN/PAX). This is coupled with a square feet of queue area that corresponds to wait times per lane of about 10.00 minutes, 8.00 minutes, and 4.00 minutes, as indicated in **Figure 4-27**.

Figure 4-27 – Wait Time Calculation

$$\text{Wait Time/Lane (MIN)} = \frac{\text{Total Queue Area (SF)}}{\text{LOS (SF/PAX)}} \times \text{Screening Lane Throughput (MIN/PAX)}$$

Therefore

$$\text{10.00 Wait Time/Lane MIN} = \frac{\text{270 SF}}{\text{10.8 (SF/PAX)}} \times \text{0.40 Screening Lane Throughput (MIN/PAX)}$$

$$\text{8.00 Wait Time/Lane MIN} = \frac{\text{220 SF}}{\text{10.8 (SF/PAX)}} \times \text{0.40 Screening Lane Throughput (MIN/PAX)}$$

$$\text{4.00 Wait Time/Lane MIN} = \frac{\text{110 SF}}{\text{10.8 (SF/PAX)}} \times \text{0.40 Screening Lane Throughput (MIN/PAX)}$$

Table 4-47 – Passenger Security Screening Checkpoint Lane Demand

Demand Concept	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
Peak Hour Enplaned - *NO.*	163	301	377	426	475
Peak 30-Min Originating PAX – *NO.*	82	151	189	213	238
Additional Traffic – *NO.* [1 2]	13	23	29	32	36
Total Peak 30-Min.	95	174	218	245	274
# of Passengers Processed/minute per lane	1.6	2.9	3.6	4.1	4.6
Throughput Rate	175	175	175	175	175
Max Wait Time in Queue (min.)	6.7	6.7	6.7	6.7	6.7
Existing No. of Security Lanes – *NO.*	**2**				
4-Minute Queue Wait – No. of Lanes Required *(315 SF Queue Area / Lane & LOS 10.8 SF / PAX in Queuing Area)*					
Demand[3] **- *NO.*** (# of lanes)	**1**	**2**	**3**	**3**	**3**
8-Minute Queue Wait – No. of Lanes Required *(315 SF Queue Area / Lane & LOS 10.8 SF / PAX in Queuing Area)*					
Demand[3] **- *NO.*** (# of lanes)	**1**	**2**	**2**	**3**	**3**
10-Minute Queue Wait – No. of Lanes Required *(315 SF Queue Area / Lane & LOS 10.8 SF / PAX in Queuing Area)*					
Demand[3] **- *NO.*** (# of lanes)	**1**	**2**	**2**	**3**	**3**

Footnotes: [1] 15-percent of peak 30-minute originating PAX
[2] Non-passenger, employees, crew, etc. 0.3
[3] Normalized to 0.40 minutes per passenger process rate, or 150 PAX per lane, per hour
Note: Numbers in **RED** represent a deficiency in space based on existing conditions. Enp. = Enplanements
Source: ACRP Report 25, *Airport Passenger Terminal Planning and Design*, CHA, 2024.

Although PAL 2 through PAL 4 identify a deficit in kiosk availability during when demand is high, it should be noted that this demand is mostly present with surges in operations from ultra-low cost carrier activity and recreational travelers.

Shifts in the LOS offered, the processor rate per lane, and accepted wait times for the queuing area will result in fluctuations of the forecasted number of screening lanes required throughout the planning horizon. To visualize the layout of a generic pair of TSA security checkpoint lanes, refer to **Figure 4-28**. This helps provide background in calculating SSCP processor areas.

Utilizing the assumptions, the dimensional guideline for a checkpoint lane pair with AIT and magnetometer was approximately 3,870 square feet as depicted in **Figure 4-28**, and consisted of:

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

- Stanchions for ADA-accessible and family queue lanes

The total security screening checkpoint (SSCP) areas needed at EVV are tabulated in **Table 4-49.** For consistency across all study modules, a 0.30 circulation factor was applied to the SSCP total area. This accounts for SSCP exit lanes from the secure airside concourse to the non-secured public area.

Figure 4-28 – Standard TSA Security Screening Checkpoint Lane

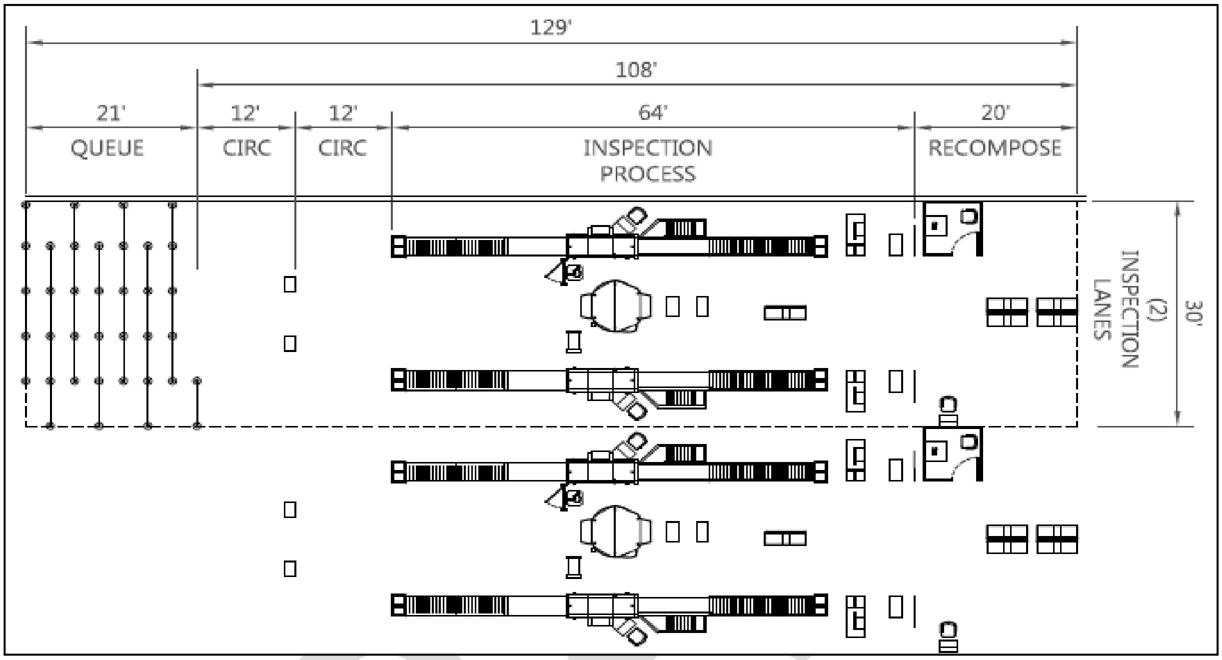


Table 4-48 – Passenger Screening Checkpoint Lane Demand

Lane Demand Concept	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
Peak Hour Enplaned - *NO.*	163	301	377	426	475
Peak 30-Min Originating PAX – *NO.*	82	151	189	213	238
Additional Traffic – *NO.*	13	23	29	32	36
Total Peak 30-Min.	95	174	218	245	274
# of Passengers Processed/minute per lane	1.6	2.9	3.6	4.1	4.6
Throughput Rate	175	175	175	175	175
Max Wait Time in Queue (min.)	6.7	6.7	6.7	6.7	6.7
Existing No. of Security Lanes – *NO.*	**2**				
4-Minute Queue Wait – No. of Lanes Required *(315 SF Queue Area / Lane & LOS 10.8 SF / PAX in Queuing Area)*					
Demand[4] - *NO.* (# of lanes)	1	2	3	3	3
8-Minute Queue Wait – No. of Lanes Required *(315 SF Queue Area / Lane & LOS 10.8 SF / PAX in Queuing Area)*					
Demand[4] - *NO.* (# of lanes)	1	2	2	3	3
10-Minute Queue Wait – No. of Lanes Required *(315 SF Queue Area / Lane & LOS 10.8 SF / PAX in Queuing Area)*					
Demand[4] - *NO.* (# of lanes)	1	2	2	3	3

Source: IATA, CHA, 2024.

Table 4-49 – Passenger Security Screening Checkpoint (SSCP) Area Requirements

Security Screening Space Requirement	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
4-Minute Queue Wait – No. of Lanes Required *(315 SF Queue Area / Lane & LOS 10.8 SF / PAX in Queuing Area)*					
Security Queue Area (SF)	315	630	945	945	945
Checkpoint Area (Tables, Equip., and Search)	1,620	3,240	4,860	4,860	4,860
Total Security Screening Area (SF)	**1,935**	**3,870**	**5,805**	**5,805**	**5,805**
Public Circulation for Exit Lane (SF)	581	1,161	1,742	1,742	1,742
Overall Security Screening Area (SF)	**2,516**	**5,031**	**7,547**	**7,547**	**7,547**
Existing SSCP Area - SF	**4,754**				
Surplus/(Deficiency)	**2,239**	(277)	(2,793)	(2,793)	(2,793)
8-Minute Queue Wait – No. of Lanes Required *(315 SF Queue Area / Lane & LOS 10.8 SF / PAX in Queuing Area)*					
Security Screening Space Requirement	**Base (Existing)[1] 165,933 Enp.**	**PAL 1 (2028) 306,839 Enp.**	**PAL 2 (2033) 384,561 Enp.**	**PAL 3 (2038) 434,219 Enp.**	**PAL 4 (2043) 484,596 Enp.**
Security Queue Area (SF)	315	630	630	945	945
Total Checkpoint Area (Tables, Equip., and Search)	1,620	3,240	3,240	4,860	4,860
Total Security Screening Area (SF)	**1,935**	**3,870**	**3,870**	**5,805**	**5,805**
Public Circulation for Exit Lane (SF)	581	1,161	1,161	1,742	1,742
Overall Security Screening Area (SF)	**2,516**	**5,031**	**5,031**	**7,547**	**7,547**
Existing SSCP Area - SF	**4,754**				
Surplus/(Deficiency)	**2,239**	(277)	(277)	(2,793)	(2,793)
10-Minute Queue Wait – No. of Lanes Required *(315 SF Queue Area / Lane & LOS 10.8 SF / PAX in Queuing Area)*					
Security Screening Space Requirement	**Base (Existing)[1] 165,933 Enp.**	**PAL 1 (2028) 306,839 Enp.**	**PAL 2 (2033) 384,561 Enp.**	**PAL 3 (2038) 434,219 Enp.**	**PAL 4 (2043) 484,596 Enp.**
Security Queue Area (SF)	315	630	630	945	945
Total Checkpoint Area (Tables, Equip., and Search)	1,620	3,240	3,240	4,860	4,860
Total Security Screening Area (SF)	**1,935**	**3,870**	**3,870**	**5,805**	**5,805**
Public Circulation for Exit Lane (SF)	581	1,161	1,161	1,742	1,742
Overall Security Screening Area (SF)	**2,516**	**5,031**	**5,031**	**7,547**	**7,547**
Existing SSCP Area - SF	**4,754**				
Surplus/(Deficiency)	**2,239**	(277)	(277)	(2,793)	(2,793)
Total Security Screening Area (SF)					
	Base (Existing)[1] 165,933 Enp.	**PAL 1 (2028) 306,839 Enp.**	**PAL 2 (2033) 384,561 Enp.**	**PAL 3 (2038) 434,219 Enp.**	**PAL 4 (2043) 484,596 Enp.**
Existing SSCP Area	4,754				
4-Minute Queue Wait	2,516	5,031	7,547	7,547	7,547
4-Minute Surplus/(Deficiency)	**2,239**	**(277)**	**(2,793)**	**(2,793)**	**(2,793)**
8-Minute Queue Wait	2,516	5,031	5,031	7,547	7,547
8-Minute Surplus/(Deficiency)	**2,239**	**(277)**	**(277)**	**(2,793)**	**(2,793)**
10-Minute Queue Wait	2,516	5,031	5,031	7,547	7,547
10-Minute Surplus/(Deficiency)	**2,239**	**(277)**	**(277)**	**(2,793)**	**(2,793)**

Footnote:

[1] Number of lanes required indicated in **Table 4-47**, multiplied by (3,870 SF ÷ 2) + (Queueing Area by Minutes) = Area Requirements
[2] A factor of 0.30 was applied to the total SSCP area to determine the SSCP circulation and Exit Lane needs
Note: Numbers in **RED** represent a deficiency in space based on existing conditions. Enp. = Enplanements
Source: CHA, 2024.

4.7.8 Outbound (Inbound) Baggage Make-Up

It is assumed that baggage make-up processor areas contain baggage make-up rooms, a baggage sortation device or system, and baggage carts/ tug circulation and staging areas. The analysis performed is for enclosed baggage make up areas only and is shown in **Table 4-50.**

Table 4-50 – Outbound (Inbound) Baggage Make-Up

Baggage Factor	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
EQA	4	4	5	6	7
Expected # of departures per Gate (within 2-4 hour staging period)	1.8	1.8	1.8	1.8	1.8
Staged carts/containers per EQA	2	2	2	2	2
Area required per cart/container (SF)	600	600	600	600	600
Make Up Area - SF	8,800	9,200	10,500	12,400	14,700
Existing Make Up Area - SF	13,608				
Surplus/(Deficiency)	**4,808**	**4,408**	**3,108**	**1,208**	**(1,092)**

Notes: Numbers may not add up due to rounding.
Numbers in **RED** represent a deficiency in space based on existing conditions. Enp. = Enplanements
Source: ACRP Report 25, *Airport Passenger Terminal Planning and Design*, CHA, 2024.

4.7.9 Inbound Baggage Claim

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

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

- Percent of passengers checking bags: *80 percent* (70 percent ticketing lobby (TIX), 10 percent at the gate)
- Average number of bags per passenger checking bags: *1.6*
- Average traveling party size: *1.3*
- Percent additional passengers at claim: *30 percent*
- Claim frontage per person: *1.5 linear feet*
- Area per person in active retrieval area: *18 square feet (LOS C)*

For planning purpose and added accuracy, calculations were also conducted to estimate the number of bags that may need to be retrieved from the carousels. Data generated was made in agreement with fleet mix and load factors within the PMAD. The analysis was used to determine projected linear feet required for the baggage claim to accommodate the projected number of bags and the total baggage claim area required to serve the baggage claim devices and circulation as shown in **Table 4-51**.

Table 4-51 – Terminating PAX Baggage Claim Space Requirements

Baggage Claim Concepts	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
Peak Hour Terminating PAX	163	301	377	426	475
% Terminating PAX	97%	97%	97%	97%	97%
% Termination PAX in Peak 20-minutes	47%	47%	47%	47%	47%
Peak 20-min. Terminating PAX – NO.	74	137	172	194	217
70% PAX Bags Check at TIX – NO.	52	96	120	136	152
10% PAX Check Bags at Gate – NO.	7	14	17	19	22
Total PAX Checking Bags - NO.	44	82	103	116	130
Average Travel Party Size – NO.	1.3	1.3	1.3	1.3	1.3
Number of Parties – NO.	34	63	79	90	100
Additional Persons at Bag Claim	30%	30%	30%	30%	30%
Total Persons at Carousel – NO.	44	82	103	116	130
Claim Frontage Required – 1.5 LF/PAX	**67**	**123**	**155**	**175**	**195**
Existing Claim Frontage - SF			**200**		
Claim Frontage Surplus/(Deficiency)	**133**	**77**	**45**	**25**	**5**
Area / Person in Active Retrieval - SF	18	18	18	18	18
Total Area for Active Retrieval - SF	801	1481	1856	2095	2339
Baggage Service Offices (BSO) - SF	1500	1500	1500	1500	1500
Oversize Baggage Claim - SF	150	150	150	150	150
Subtotals Bag Claim Area - SF	**2,451**	**3,131**	**3,506**	**3,745**	**3,989**
Circulation (1.50 x Factor)[1]	1,225	1,565	1,753	1,873	1,994
Total Bag Claim Processor Area - SF	**3,676**	**4,696**	**5,259**	**5,618**	**5,983**
Existing Baggage Claim - SF			**8,915**		
Bag Claim Area Surplus/(Deficiency)	**5,239**	**4,219**	**3,656**	**3,297**	**2,932**

Footnotes:[1] Generally acceptable circulation factor is 0.30 times the *Subtotal* for baggage claim area requirements. This analysis concluded that a more practicable circulation factor is 0.50 to address any errant airline operational policies and/or procedures, non-common equipment and facilities use.
Notes: Numbers may not add up due to rounding.
Numbers in **RED** represent a deficiency in space based on existing conditions. Enp. = Enplanements
Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook*, CHA, 2024.

4.7.10 CBIS Outbound Baggage Screening

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

Forecasted data indicates an increase in EVV passenger activity across planning horizons, which generates more demand for additional baggage screening equipment. This trend is tabulated in **Table 4-52**.

Table 4-52 – Checked Baggage Inspection System Requirements (CBIS)

	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
Design Hour Baggage Load					
Peak Hour Originating PAX Checking In[1] – *NO*	163	301	377	426	475
PAX Checking Bags at TIX– *NO*	158	292	366	413	461
Average # of Bags per PAX – *NO*	70%	70%	70%	70%	70%
Bags to Process in Peak Hour – *NO*	1.5	1.5	1.5	1.5	1.5
10 Minute Baggage Flow Rate – *NO*	166	306	384	433	484
TSA Surge Factor (Based on a 10 Minute Baggage Flow Rate)	28	51	64	72	81
Equivalent Baggage Surge Rate	1.38	1.28	1.25	1.24	1.22
% of Bags That are Over-sized & Too Big For EDS	229	392	480	535	591
NO. of Over-sized Bags Requiring ETD Inspections	3%	3%	3%	3%	3%
Bags to Process Through Level 1 EDS Units – *NO.*	7	12	14	16	18
EDS/ETD Equipment Requirements					
Level 1 EDS Screening – Process Rate (bags/hour) – *NO*	250	250	250	250	250
Level 1 EDS Units Required – *NO*	1	2	2	**3**	**3**
% of Scanned Bags Requiring Level 2 Screen **(Alarm Rate)**	25%	25%	25%	25%	25%
Bags Requiring Level 2 OSR – *NO*	55	95	116	130	143
Level 2 OSR Rate (Bags/Hour per Operator) - *NO*	120	120	120	120	120
Level 2 OSR Stations Required (1 Operator/Station) – *NO*	1	1	1	2	2
% of Resolved OSR Bag reviews **(Clear Rate)**	80%	80%	80%	80%	80%
Bags Needing Level 3 Screening in Peak Hour – *NO.*	18	31	38	43	47
Level 3 ETD Screening - Process (Bags/Hour/Screener)	24	24	24	24	24
Level 3 ETD Units Required (2 Screeners/Unit) – *NO*	1	1	1	1	1
Baggage Screening Requirements					
Level 1 Area Per EDS Screening Unit - *SF*	800	800	800	800	800
Required EDS Units – *NO*	**1**	**2**	**2**	**3**	**3**
Level 2 Area per OSR Station - *SF*	40	40	40	40	40
OSR Stations Required – *NO*	**1**	**1**	**1**	**2**	**2**
Area per ETD Screening Units - *SF*	100	100	100	100	100
Required ETD Units – *NO*	**1**	**1**	**1**	**1**	**1**
Total Area Requirements for CBIS - *SF*	**940**	**1,740**	**1,740**	**2,580**	**2,580**
Existing CBIS Area - SF	2,974				
Surplus/(Deficiency)	***2,034***	***1,234***	***1,234***	***394***	***394***

Footnotes: [1] 97% originating PAX with pre-applied surge factor
Note: Numbers in **RED** represent a deficiency in space based on existing conditions. Enp. = Enplanements
Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook*, CHA, 2024.

4.7.11 Terminal Apron

The terminal apron requirement is driven by the terminal frontage requirement which is based on the narrowbody equivalent gate (NBEG) for the airport throughout the planning horizon. The NBEG is derived from evaluating the class of aircraft anticipated to use each gate to determine the wingspan requirement. For EVV, three class of aircraft are anticipated to utilize the gates which include medium regional jets (79 ft. wingspan), large regional jets (118 ft. wingspan), and narrowbody aircraft (118 ft. wingspan). As the Airport transitions from smaller aircraft to larger aircraft, the number of gates required to serve larger aircraft contributes to a higher terminal frontage requirement. For this analysis, a wingtip clearance of 25 feet was used in between parking positions as a conservative approach to capture varying airline clearance requirements. Presented below in **Table 4-53** is the terminal frontage requirement over the planning horizon which shows a deficiency of 115 feet in PAL 1 up to 583 feet in PAL 4.

Table 4-53 – Terminating Apron Frontage Requirement

Aircraft Class	Base (Existing)[1] 165,933 Enp.	PAL 1 (2028) 306,839 Enp.	PAL 2 (2033) 384,561 Enp.	PAL 3 (2038) 434,219 Enp.	PAL 4 (2043) 484,596 Enp.
Gate Requirement					
Medium Regional (79 FT)	3	1	0	1	0
Large Regional (118 FT)	2	4	4	5	6
Narrow-Body (118 FT)	2	2	3	3	4
Total Gates	**7**	**7**	**7**	**9**	**10**
Total Wingspan Requirement					
Medium Regional (79 FT)	237	79	0	79	0
Large Regional (118 FT)	236	472	472	590	708
Narrow-Body (118 FT)	236	236	354	354	472
Total Wingspan Clearance Req.	**709**	**787**	**826**	**1,023**	**1,180**
Wingtip Clearance Requirement - 25 FT Per Position					
Total Wingtip Clearance Req.	**175**	**175**	**175**	**225**	**250**
Total Apron Frontage Requirement					
Total Frontage Req.	**884**	**962**	**1,001**	**1,248**	**1,430**
Existing Terminal Frontage - LF	847				
Surplus/(Deficiency)	**(37)**	**(115)**	**(154)**	**(401)**	**(583)**

Notes: Numbers may not add up due to rounding.
Numbers in **RED** represent a deficiency in space based on existing conditions. Enp. = Enplanements
Wingspan requirements represent 79 feet for medium regional jets and 118 feet for large regional jets and narrowbody aircraft.
Source: Airport Cooperative Research Program (ACRP) *Report 25 – Airport Passenger Terminal Planning and Design Guidebook*, CHA, 2024.

4.8 SUPPORT FACILITY REQUIREMENTS

Support facilities provide vital functions related to the overall operation of the Airport and include facilities related to general aviation operations, cargo, aircraft fueling and deicing, Aircraft Rescue and Firefighting (ARFF), Airport maintenance, and Air Traffic Control Tower (ATCT). As airport operations increase, the use of these facilities and infrastructures increases, creating greater demand and less available capacity to meet this demand over the 20-year planning horizon. The following sections detail the current capacity and projected demand for the previously mentioned facilities.

4.8.1 General Aviation Facility Requirements

GA facilities accommodate the airport with additional pilot lounges, maintenance storage, or revenue producing services like aircraft storage that contribute to the operation and business at the Airport. Aircraft storage hangar requirements are generally a function of the number and type of based aircraft, owner preferences, hangar rental costs and area climate. Due to various weather conditions, hangars are a valuable commodity in the Southern Indiana region where rain, high wind, frost, and an occurrence of snowstorms can cause damage to parked aircraft, which is extremely disruptive to aircraft operations. Additionally, during the warmer months, heat and sun exposure can damage avionics and fade paint.

General Aviation Hangar Facilities

The majority of the Airport's GA hangar space is located along the westside of the airfield, to the southwest of the Terminal Apron. Tenant interviews revealed an overall desire for additional hangar space; and many recommended a more consolidated approach to hangar space where each tenant's hangars would be in proximity to each other or their specific business. As this Study progresses, an analysis of potential expansion for additional hangar locations will be analyzed in an Alternatives Development chapter.

Existing Hangar Storage Space

The Airport's FBO Tri-State Aero provide a majority of the hangar space at EVV. The hangar storage areas, which are mostly subleased to various aircraft owners, consist of different types of hangars that vary in size, from approximately 9,000 square feet to over 15,000 square feet. Locally based operators and private owners at EVV employ use of hangar space. These hangars are fully enclosed and secured providing protection to aircraft from outside elements. **Table 4-54** lists each storage hangar at the Airport, as well as the approximate storage capacity.

Table 4-54 – Aircraft Hangar Units

Building	Year Built	Approximate Area (SF)
Tri-State Hangar 1	1960	12,000
Tri-State Hangar 2	1965	12,000
Tri-State Hangar 3	1970	12,000
Tri-State Hangar 4	1980	12,000
Tri-State Hangar 5	1984	17,500
Tri-State Hangar 6	2015	12,880
Tri-State Hangar 7	2007	12,880
Tri-State Hangar 8	N/A	11,800
T-Hangars	1960	9,344
New Tri-State Hangar	2024	15,800
Petersburg Road Box Hangar 1	1997	8,500
Petersburg Road Box Hangar 2	1999	11,500
TOTAL		**148,204**

Source: Evansville Regional Airport (EVV), CHA, 2024.

Projected Hangar Storage Space

During the forecast period, the Airport is projected to experience an increase in based aircraft, consisting predominately of single-engine aircraft as shown on **Table 4-55**. To develop a projection of required hangar space, assumptions were made based on average square feet of space required to store each type of aircraft, and the forecasted fleet mix of based GA aircraft in the planning period. The primary oversight for the GA hangar location for maintenance and repair services is handled by the Airports FBO Tri-State Aero.

Table 4-55 – Additional Based Aircraft Projection

Aircraft Type	Base Year	PAL 1	PAL 2	PAL 3	PAL 4
Current & Projected Based Aircraft					
Single	38	40	42	43	44
Multi	8	9	9	9	10
Turboprop	0	0	0	0	0
Jet Aircraft	6	7	8	9	10
Helicopter	1	1	1	1	1
Total	**53**	**57**	**60**	**62**	**65**
Additional Based Aircraft To Be Accommodated Each Planning Period					
Single	-	2	2	1	1
Multi	-	1	-	-	1
Turboprop	-	-	-	-	-
Jet Aircraft	-	1	1	1	1
Helicopter	-	-	-	-	-
Total	**-**	**4**	**3**	**2**	**3**

Source: CHA 2024.

Table 4-56 provides an overview of anticipated hangar space requirements based on type of aircraft which follow industry planning recommendations.

Table 4-56 – Recommended Aircraft Storage Space

Required by Aircraft Type	Recommended Space (SF)
Single	1,100
Multi	3,000
Turboprop	3,600
Jet	7,200
Helicopters	900

Source: CHA 2024.

Based on these assumptions and projections for based aircraft noted above, EVV is expected to need approximately 12,400 SF of additional hangar space by PAL 1 as shown on **Table 4-57.** Hangar storage space requirements are projected to increase through the planning horizon to a total requirement of approximately 41,400 SF by PAL 4.

Table 4-57 –Additional Hangar Storage Requirement

Aircraft Type	Base Year	PAL 1	PAL 2	PAL 3	PAL 4
Additional Hangar Storage Required (SF)					
Single	-	2,200	2,200	1,100	1,100
Multi	-	3,000	-	-	3,000
Turboprop	-	-	-	-	-
Jet Aircraft	-	7,200	7,200	7,200	7,200
Helicopter	-	-	-	-	-
Total	**-**	**12,400**	**9,400**	**8,300**	**11,300**
Total Additional Hangar Space Through PAL 4		**41,400**			
Total Requirement	**-**	**160,604**	**170,004**	**178,304**	**189,604**
Existing Hangar Space					**148,204**
Total Requirement					**41,400**
Number of Hangars Required (60'x60')					**12**

Source: CHA 2024.

General Aviation Apron Requirement

The GA apron located on the West Ramp which runs parallel to Taxiway C and Runway 18-36 is operated by Tri-State Aero. GA Apron requirements are a factor of projected total GA operations which is further broken down into peak month operations and then peak month average day (PMAD) operations. When evaluating the extent of projected itinerant activity, activity for the busiest day was assumed to be 10 percent more than the peak-month average day itinerant activity. Furthermore, arrivals were assumed at 50 percent of the itinerant operations, with approximately 80 percent of itinerant arrivals parking at either a tie-down location or on an itinerant apron area as shown on **Table 4-58.**

Table 4-58 – Projected Itinerant GA Aircraft Activity

Year	Total Itinerant Ops	Peak Month	PMAD	Busiest Day (Assume 10% > PMAD)	Itinerant Arrivals on Busiest Day (Assume 50%)	Itinerant Aircraft on Ground (Assume 80%)
Base	16,720	1,542	50	55	28	14
PAL 1	16,817	1,551	50	55	28	14
PAL 2	16,914	1,560	50	55	28	14
PAL 3	17,016	1,569	51	56	28	14
PAL 4	28,629	4,503	150	76	38	30

Note: Numbers may not add up due to rounding.

Source: EVV, FAA Operations Network (OPSNET), FAA Traffic Flow Management System Counts (TFMSC), FAA Airport Data and Information Portal (Form 5010), Bureau of Transportation Statistics (BTS) T-100 data, U.S. DOT T-100 data, CHA, 2024.

To estimate the aircraft mix, it was assumed that itinerant aircraft would retain the fleet mix breakout from the Base Year, which consisted of approximately 11 percent Group I, 46 percent Group II, and 12 percent Group III aircraft as shown on **Table 4-59**.

Table 4-59 – Projected Itinerant Aircraft Parked on Ground

Year	Tie-Down Spaces Required				Tie-Down Apron Space Requirements (SY)			
	Group I	Group II	Group III	Total	Group I	Group II	Group III	Total
Base	5	5	4	14	1,800	2,450	78,400	82,650
PAL 1	5	5	4	14	1,800	2,450	78,400	82,650
PAL 2	5	5	4	14	1,800	2,450	78,400	82,650
PAL 3	5	5	4	14	1,800	2,450	78,400	82,650
PAL 4	5	5	4	14	1,800	2,450	78,400	82,650

Source: EVV, FAA Operations Network (OPSNET), FAA Traffic Flow Management System Counts (TFMSC), FAA Airport Data and Information Portal (Form 5010), Bureau of Transportation Statistics (BTS) T-100 data, U.S. DOT T-100 data, CHA, 2024.

After projecting the number of aircraft anticipated to need to be accommodated, it was necessary to project how much apron space would be required to accommodate these aircraft. Using apron space requirements set forth in FAA AC 150/5300-13B – *Change 1*, assuming no taxilane, projected Group I aircraft on the ground are assumed to require 360 SY each for parking, while Group II would each require 490 SY of apron space. To accommodate projected Group III aircraft on the ground, approximately 11,000 SY of apron space would be required for each aircraft which assumes a large Group III aircraft such as the Gulfstream 6 as a conservative approach. Based on these assumptions, a total of 90,915 SY of apron space is recommended by PAL 4 for future itinerant aircraft use as shown on **Table 4-60**.

Table 4-60 – Projected Itinerant Apron Space Demand

Year	Tie-Down Spaces Required [Surplus / (Deficit)]				Tie-Down Apron Space Requirements (SY) [Surplus / (Deficit)]			
	Group I	Group II	Group III	Total	Group I	Group II	Group III	Total
Base	(5)	(5)	(4)	(14)	(1,980)	(2,695)	(86,240)	(90,915)
PAL 1	(5)	(5)	(4)	(14)	(1,980)	(2,695)	(86,240)	(90,915)
PAL 2	(5)	(5)	(4)	(14)	(1,980)	(2,695)	(86,240)	(90,915)
PAL 3	(5)	(5)	(4)	(14)	(1,980)	(2,695)	(86,240)	(90,915)
PAL 4	(5)	(5)	(4)	(14)	(1,980)	(2,695)	(86,240)	(90,915)

Source: EVV, FAA Operations Network (OPSNET), FAA Traffic Flow Management System Counts (TFMSC), FAA Airport Data and Information Portal (Form 5010), Bureau of Transportation Statistics (BTS) T-100 data, U.S. DOT T-100 data, CHA, 2023.

The GA apron is approximately 36,000 SY, which includes the area dedicated to aircraft movement and aviation activity. Of the existing apron area, no space is dedicated to tie-down parking. A need has been identified for up to approximately 90,915 SY of apron parking to be dedicated for the use of itinerant aircraft parking, assuming that up to 50 percent of itinerant aircraft arrivals require accommodations. In the Base Year, the hangar facilities at EVV were at capacity, with Tri State Aero indicating that there is a current wait list for aircraft accommodations, thus the hangars are not capable of supporting itinerant traffic. An additional

90,915 SY of apron space to accommodate itinerant aircraft is anticipated to meet demand through the forecast horizon.

4.8.2 Cargo Facilities

FedEx at EVV currently provides regional scheduled air cargo services several times a week via Cessna Caravan's to Indianapolis. In addition, just in time cargo operations for the delivery of automotive parts is performed by GA aircraft using the GA apron. Given EVV's proximity to large cargo hubs such as Indianapolis, it is not anticipated that EVV would need to accommodate larger cargo aircraft and/or freight forwarding activity in the future. As such, smaller regional air cargo carriers such as FedEx currently or unscheduled cargo charters, known as 'feeders,' would be the more likely type of cargo operator to utilize the Airport. The forecast projects cargo operations and freight growth to be 2.9 percent a year growing from 245 operations to 437 operations in PAL 4 (2042). As such, if such a cargo operator desires to establish a presence at the Airport, given the availability of land, potential alternative areas that could support such activity will be identified in the Alternatives chapter.

4.8.3 Aviation Fueling Facilities

Tri-State Aero is responsible for operating the Airport's fuel storage and dispensing facilities. As stated in **Chapter 2**, the fuel farm consists of the following:

- Two underground 20,000-gallon Jet-A tanks
- Two underground 10,000-gallon 100LL AvGas tanks
- One above ground 2,000-gallon waste oil tank

For the purpose of this Study, the fuel analysis was focused on Jet-A and AvGas fuel storage. This analysis required having a baseline of information, which included reviewing fuel history from 2023, OPSNET Data, and to separate commercial operations from general aviation operations. Industry and regulation practices recommend an airport like EVV maintains a recommended minimum of at least a five-day fuel reserve.

The existing fuel storage capacity for Jet-A provides up to 5.8 days of fuel reserve, which is within the industry standard. An analysis was conducted to project the number of 20,000-gallon Jet-A storage tanks required to accommodate projected demand while maintaining a three-day and five-day fuel reserve. An additional analysis was performed to identify how many tanks would be required if wanting to maintain up to a seven-day reserve for Jet-A fuel. As shown in Table x-x, to maintain a five-day fuel reserve, one additional 20,000-gallon Jet-A fuel tank would be required by PAL 4.As previously discussed, the Airport cannot currently support a seven-day reserve of Jet-A fuel; however, installation of one 20,000-gallon tank would support a seven-day reserve throughout the planning horizon, while also meeting the demand for a five-day reserve in PAL 4.

Moreover, **Table 4-62** displays the AvGas storage capacity, which projects that seven-days of fuel storage can be adequately met by the Airport's current storage tanks; however, as the Airport continues to expand its GA services, it recommended that AvGas storage needs and fuel reserve continue to be evaluated.

Table 4-61 – JetA Fuel Storage Capacity: Current and Projected

EVV Baseline Data & Information	Base	PAL 1	PAL 2	PAL 3	PAL 4
Total Operations (Annually)	33,382	34,752	36,242	37,891	39,529
Operations (Daily Average)	88	91	95	100	104
Approximate Annual Fuel Usage (in Gallons)	2,622,173	2,729,787	2,846,827	2,976,357	3,105,023
Approximate Fuel Usage Per Operation (in Gallons)	79	79	79	79	79
Approximate Daily Fuel Usage (in Gallons)	6,900	7,183	7,491	7,832	8,170
Total Storage Capacity (in Gallons)	40,000	40,000	40,000	40,000	40,000
Approximate Days Fuel Reserve at Current Capacity	5.8	5.6	5.3	5.1	4.9
3-Day Reserve					
Fuel Storage Capacity Required (in gallons): 3-Day Reserve	20,699	21,549	22,473	23,495	24,511
Fuel Storage Capacity Surplus/(Deficit) (in gallons): 3-Day Reserve	19,301	18,451	17,527	16,505	15,489
Recommended Additional Tanks (At 20,000 gallons each): 3-Day Reserve	-	-	-	-	-
5-Day Reserve					
Fuel Storage Capacity Required (in gallons): 5-Day Reserve	34,499	35,914	37,454	39,158	40,851
Fuel Storage Capacity Surplus/(Deficit) (in gallons): 5-Day Reserve	5,501	4,086	2,546	842	(851)
Recommended Additional Tanks (At 20,000 gallons each): 5-Day Reserve	-	-	-	-	1
7-Day Reserve					
Fuel Storage Capacity Required (in gallons): 7-Day Reserve	48,298	50,280	52,436	54,822	57,192
Fuel Storage Capacity Surplus/(Deficit) (in gallons): 7-Day Reserve	(8,298)	(10,280)	(12,436)	(14,822)	(17,192)
Recommended Additional Tanks (At 20,000 gallons each): 7-Day Reserve	1	1	1	1	1

Source: FAA OPSNET, 2023; EVV, 2022; CHA, 2024.

Table 4-62 – AvGas Fuel Storage Capacity: Current and Projected

AvGAS	Base	PAL 1	PAL 2	PAL 3	PAL 4
Total Operations (Annually)	2,830	2,847	2,863	2,881	2,898
Operations (Daily Average)	8	8	8	8	9
Approximate Annual Fuel Usage (in Gallons)	76,133	76,590	77,021	77,505	77,962
Approximate Fuel Usage Per Operation (in Gallons)	27	27	27	27	27
Approximate Daily Fuel Usage (in Gallons)	224	225	227	228	229
Total Storage Capacity (in Gallons)	20,000	20,000	20,000	20,000	20,000
Approximate Days Fuel Reserve at Current Capacity	89.3	88.7	88.2	87.7	87.2
3-Day Reserve					
Fuel Storage Capacity Required (in gallons): 3-Day Reserve	672	676	680	684	688
Fuel Storage Capacity Surplus/(Deficit) (in gallons): 3-Day Reserve	19,328	19,324	19,320	19,316	19,312
Recommended Additional Tanks (At 10,000 gallons each): 3-Day Reserve	-	-	-	-	-
5-Day Reserve					
Fuel Storage Capacity Required (in gallons): 5-Day Reserve	1,120	1,127	1,133	1,140	1,147
Fuel Storage Capacity Surplus/(Deficit) (in gallons): 5-Day Reserve	18,880	18,873	18,867	18,860	18,853
Recommended Additional Tanks (At 10,000 gallons each): 5-Day Reserve	-	-	-	-	-
7-Day Reserve					
Fuel Storage Capacity Required (in gallons): 7-Day Reserve	1,568	1,578	1,587	1,597	1,606
Fuel Storage Capacity Surplus/(Deficit) (in gallons): 7-Day Reserve	18,432	18,422	18,413	18,403	18,394
Recommended Additional Tanks (At 10,000 gallons each): 7-Day Reserve	-	-	-	-	-

Source: FAA OPSNET, 2023; EVV, 2022; CHA, 2024.

4.8.4 Aircraft Rescue and Firefighting Facilities (ARFF)

ARFF Building

EVV's Aircraft Rescue and Firefighting (ARFF) facility is approximately 4,500 (sq. ft.) and located less than 200 yards from the terminal ramp. This facility was constructed in 1991 in accordance with building design requirements found in AC 150/5210-15A, *Aircraft Rescue and Firefighting (ARFF) Station Building Design.* Per the FAA Airport Improvement Program (AIP) Handbook, the useful life of a building is 40 years, the ARFF station is expected to surpass its useful life in 2031 during the planning horizon. Presently, the ARFF facility is adequately sized for the ARFF equipment and operations. However, the Airport should work with the FAA to evaluate the need for replacement, expansion, and/or renovation of the facility given its age and ability to accommodate future Airport operations.

ARFF Equipment

EVV currently operates with an ARFF 'Index B' with 'Index D' capabilities based on the Airport's aircraft operations and equipment. The equipment at the Airport for ARFF services are currently up to FAA standard for the size of this facility. The standard equipment needed by an Index B facility can be found in **Chapter 2**. As planning and expansion progresses at EVV, Index C resources could be warranted and will continue to meet FAA standards for the foreseeable planning activity levels.

4.8.5 EVAAD Maintenance Facilities

The Evansville-Vanderburgh Airport Authority District (EVAAD) presently owns and operates four buildings that house the maintenance activities and airport equipment storage. Most equipment that is needed for a peak day are presently stored underneath the terminal for ease of access and transport of persons, employees, and luggage. In addition, the Airport has just completed the construction of a new Snow Removal Equipment Storage (SRE) and Maintenance Facility located to the northeast of the terminal which will be approximately 43,000 square feet. This SRE and Maintenance Facility is expected to satisfy the Airport's needs during the duration of the planning horizon. Therefore, no additional maintenance and/or equipment storage facilities are anticipated.

4.8.6 Air Traffic Control Facilities

The ATCT is operated year-round, from 06:00 through 23:00 daily, located to the south adjacent to the terminal building. The future relocation or replacement of the ATCT may be warranted given its proximity to the terminal which could impede development, line-of-sight issues to the end of Runway 22, and/or due to its age (50 years old). The Airport is currently in the beginning stages with coordination efforts with the FAA to evaluate a potential relocation or replacement of the ATCT. No timeline is available for when or if a replacement ATCT will occur, therefore the existing ATCT location will be carried forward unless future terminal development calls for its relocation.

4.9 SURFACE TRANSPORTATION AND PARKING REQUIREMENTS

4.9.1 Access Roadways and Circulation

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

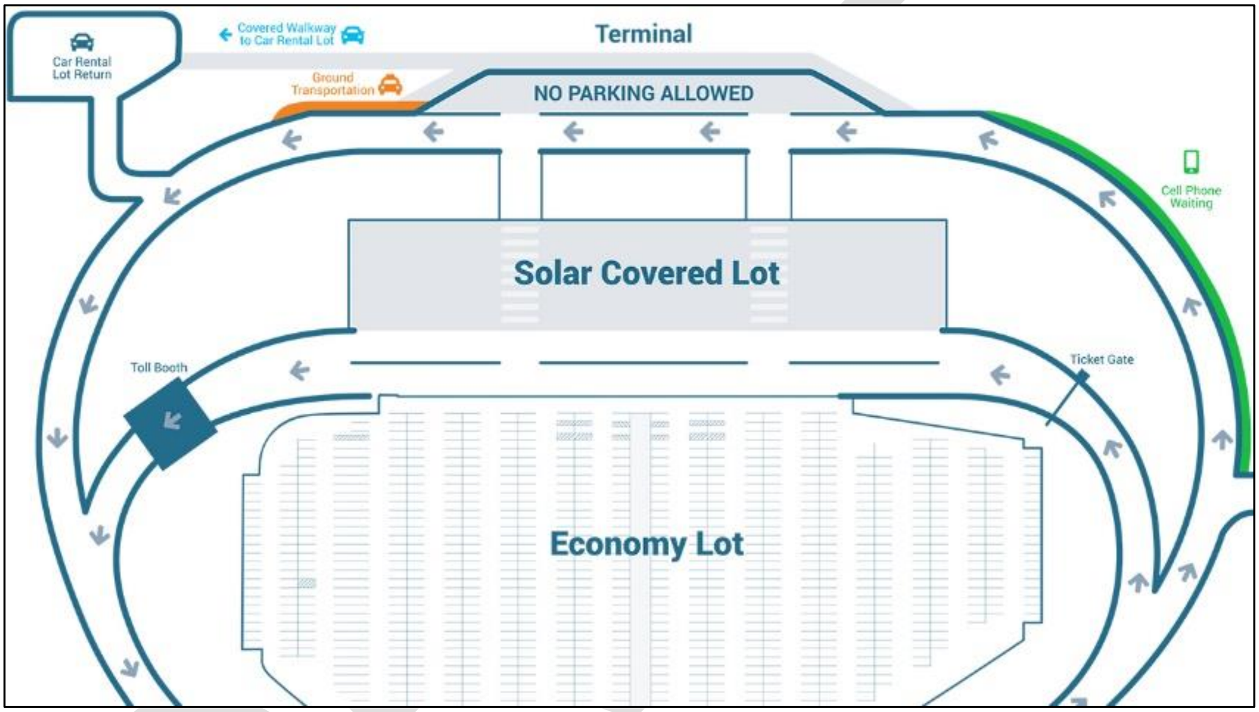
- **Access Roadways** – These roadways link the local/regional roadway network with the airport terminal. Access roadways provide free flow of traffic and typically have a limited number of decision points.
- **Curbside Roadways** – These roadways are one-way thoroughfares located immediately in front of the terminal building for the loading and unloading of passengers and baggage.

Curbside roadways typically consist of one inner lane, an adjacent maneuvering lane, and one or more through or bypass lanes.

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

For the purposes of this Study, the traffic analysis focused on the operations of the curbside roadways, circulation roadways, and parking roadways as shown below in **Figure 4-29**.

Figure 4-29 – Access Roads and Circulation



Source: EVV, 2023.

Regional Transportation System

The Airport is served with access roads and connections to US Highway 41 and State Road 57 along the west and northern property boundary. The Airport's grounds via Bussing Drive provide public access to the terminal as well as access to parking facilities. The regional access system is anticipated to have adequate capacity to accommodate an increase in enplanements. However, as enplanements increase and more vehicles are traveling to the Airport from the regional roadway system, consideration should be given in the long term to improve the access to and from the east on I-69. Given the distance from I-69, coordination with the state/county/local transportation agencies will be required as modifications will likely be required to other roadway systems.

4.9.2 Level of Service (LOS)

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

Terminal Curbside Roadway and Curb Front Level of Service

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

The level of service designation for the curbside and curbside roadway are determined based on the performance measures output by QATAR. **Table 4-63** summarizes the LOS grades for curbsides and curbside roadways based on the appropriate performance measure for each facility. The LOS criteria used for the terminal curbside analysis are based on the 2010 ACRP Report 40, *Airport Curbside and Terminal Area Roadway Operations* published by the TRB.

Table 4-63 – LOS for Curbside

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

Source: ACRP Report 40, CHA, 2024.

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

As discussed previously, multiple factors influence a curb front LOS including the mode of transportation used by passengers arriving and departing the airport, the design hour volume, dwell time by mode, and the curb front geometrics. The evaluation performed on each curbside considered the typical mode split at EVV. **Table 4-64** identifies the percentage split and dwell time for each transportation mode currently in use at the airport. The dwell times shown in this table and used for analysis are based on the ACRP Report 25, *Airport Passenger Terminal Planning and Design*.

In addition to these input parameters, information related to the number of passengers which utilize the various parking facilities at the airport was used. It is estimated that approximately 40 percent of passengers will park at the airport, indicating that approximately 60 percent of passengers will arrive by one of the identified modes of transportation and utilize the curb front. The results of the curbside utilization influence the roadway capacity. As seen in **Figure 4-30**, taken from ACRP Report 40, the roadway capacity decreases significantly as curbside utilization increases past 100%.

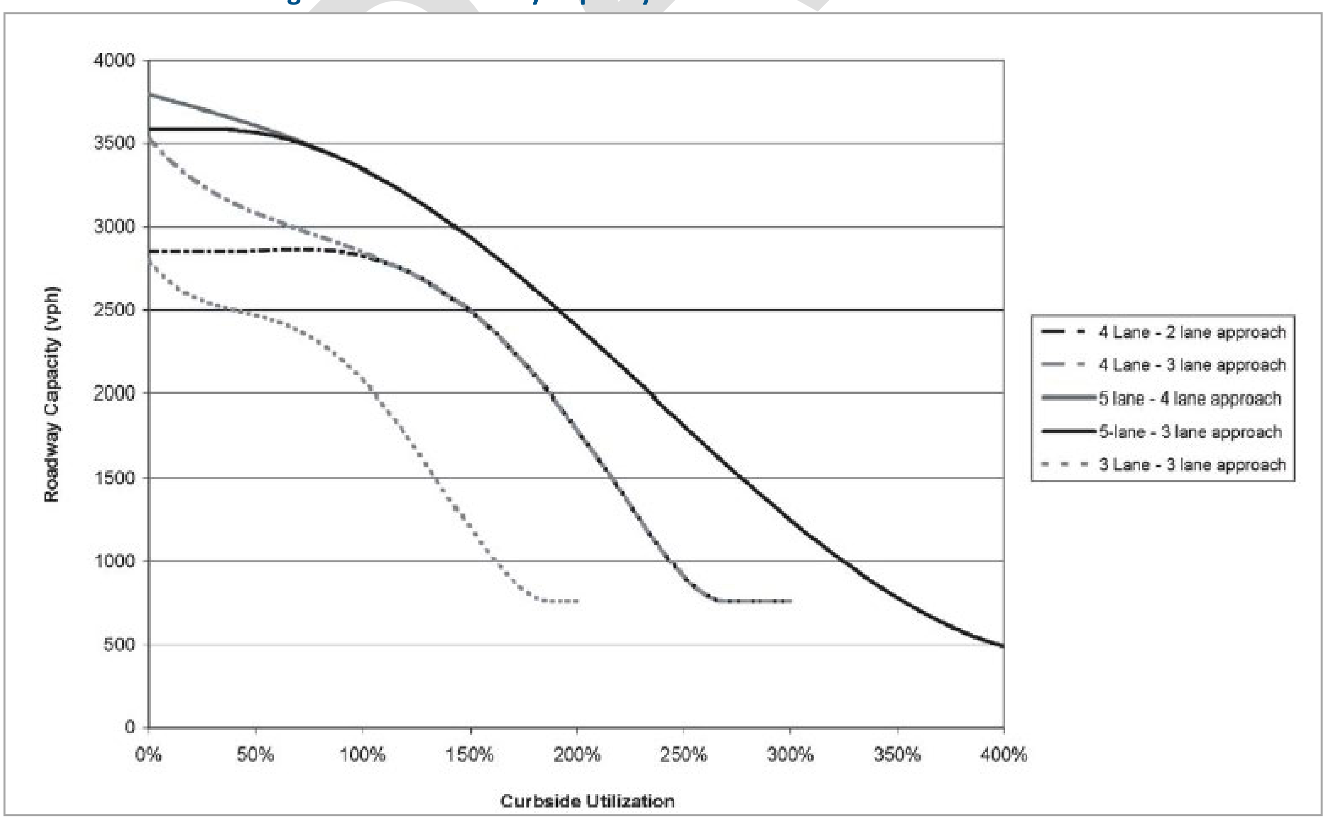
It is important to note, the average dwell time for Private Auto, the highest percent of users, is between 2-4 minutes.

Table 4-64 – Curb Front Mode of Transportation

Mode	Percentage	Dwell Time (Minutes)	Average Vehicle Length
Private Auto	70%	2 – 4	25 feet
Taxis	10%	1 – 3	25 feet
Limousines	0%	1 – 3	30 feet
Courtesy Vehicles	7.5%	2 – 4	30 feet
Shuttle Vans	7.5%	2 – 4	30 feet
Buses	5%	2 – 4	50 feet

Source: ACRP Report 25, CHA, 2024.

Figure 4-30 – Roadway Capacity versus Curbside Utilization



Source: ACRP Report 40, CHA, 2024.

4.9.3 Terminal Curbside

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

Non-hub airports typically aim for LOS C at new and existing curbside roadways. Curbside roadways work most efficiently if the lanes are divided to serve different vehicle types (e.g., passenger vehicles separated from commercial). Due to the nature of airport curbside facilities, the capacity is greatly reduced compared to typical roadway facilities with the same number of lanes due to the prevalence of parking maneuvers. More often at commercial service airports, there is a need to provide additional curbside lanes to have enough capacity to handle peak volumes even if a through lane is blocked due to double/triple parking and maneuvering.

EVV is a non-hub airport that has a ground level roadway leading to the terminal building with Departures and Arrivals on one level with 1 lane at the curb. The LOS results for the terminal curb will be described in this section.

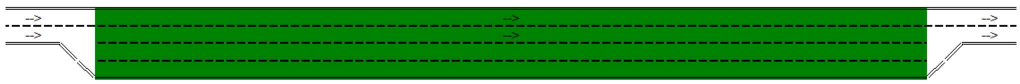
Departures and Arrival Curb

Industry guidelines for dwell times cover a wide range from 1 to 5 minutes (dependent on vehicle type) and frontages should not be designed for high dwell times. As such, frequency distribution was utilized to provide assumptions and inputs to the terminal curb evaluation. This resulted in evaluating the curb front with a dwell time of 5-minutes to provide a conversative approach since traffic counts was not included in the analysis.

The terminal curbside roadway provides a total of four (4) lanes: one (1) curb front, (1) maneuvering, and (2) through lanes. The innermost portion of the inner lane (closest to the terminal building) functions as a parking area for vehicles that are stopping to drop-off or pick-up passengers at the curb. The maneuvering lane can be used for drop-off or pick-up as well if the inner lane is occupied. The length of this curbside measures approximately 630 feet and has markings designating it as an unloading zone only. The outermost two lanes are used strictly for through traffic. The resulting LOS given by QATAR for the base year through PAL 4 is shown in **Figure 4-31** through **Figure 4-35**. In its current and future condition, the terminal curbside and roadway are adequate representing a LOS A till PAL 3 and 4 in which the curb drops to a LOS C .

Figure 4-31 – Base Conditions Terminal Curbside (5-min Dwell Time)

Airport	EVV
Roadway location	Terminal Curb
Scenario	Baseline
Level / type of roadway	Mixed
Total lanes / approach lanes	4 / 2
Number of curbside zones	1



Zone ID	Zone 1
Name/description	
Curb length (feet)	630
Zone type	active
Roadway volume (vph)	133
Roadway capacity (vph)	2,720
Roadway V/C ratio	0.049
Roadway LOS	A
Curb demand (# in sys 95% of time)	15.0
Curb capacity per lane (vehicles)	23.0
Curb utilization ratio	0.652
Curb LOS	A

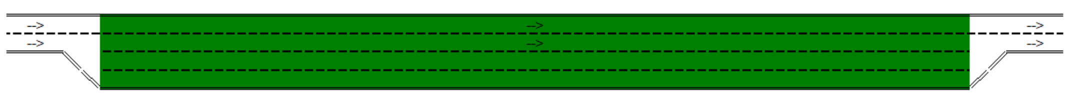
Level-of-service (LOS) key:

A
B
C
D
E
F

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

Figure 4-32 – Terminal Curbside PAL 1 (5-min Dwell Time)

Airport	EVV
Roadway location	Terminal Curb
Scenario	Baseline
Level / type of roadway	Mixed
Total lanes / approach lanes	4 / 2
Number of curbside zones	1



Zone ID	Zone 1
Name/description	
Curb length (feet)	630
Zone type	active
Roadway volume (vph)	171
Roadway capacity (vph)	2,716
Roadway V/C ratio	0.063
Roadway LOS	A
Curb demand (# in sys 95% of time)	19.0
Curb capacity per lane (vehicles)	23.0
Curb utilization ratio	0.826
Curb LOS	A

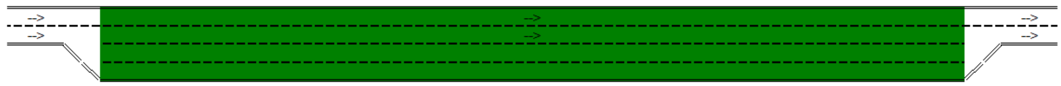
Level-of-service (LOS) key:

A
B
C
D
E
F

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

Figure 4-33 – Terminal Curbside PAL 2 (5-min Dwell Time)

Airport	EVV
Roadway location	Terminal Curb
Scenario	Baseline
Level / type of roadway	Mixed
Total lanes / approach lanes	4 / 2
Number of curbside zones	1



Zone ID	Zone 1
Name/description	
Curb length (feet)	630
Zone type	active
Roadway volume (vph)	209
Roadway capacity (vph)	2,695
Roadway V/C ratio	0.078
Roadway LOS	A
Curb demand (# in sys 95% of time)	22.0
Curb capacity per lane (vehicles)	23.0
Curb utilization ratio	0.957
Curb LOS	A

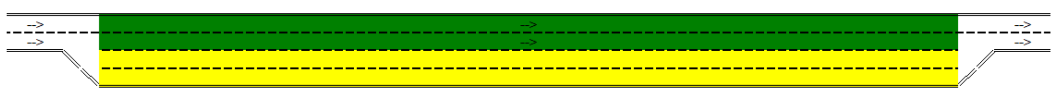
Level-of-service (LOS) key:

A
B
C
D
E
F

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

Figure 4-34 – Terminal Curbside PAL 3 (5-min Dwell Time)

Airport	EVV
Roadway location	Terminal Curb
Scenario	Baseline
Level / type of roadway	Mixed
Total lanes / approach lanes	4 / 2
Number of curbside zones	1



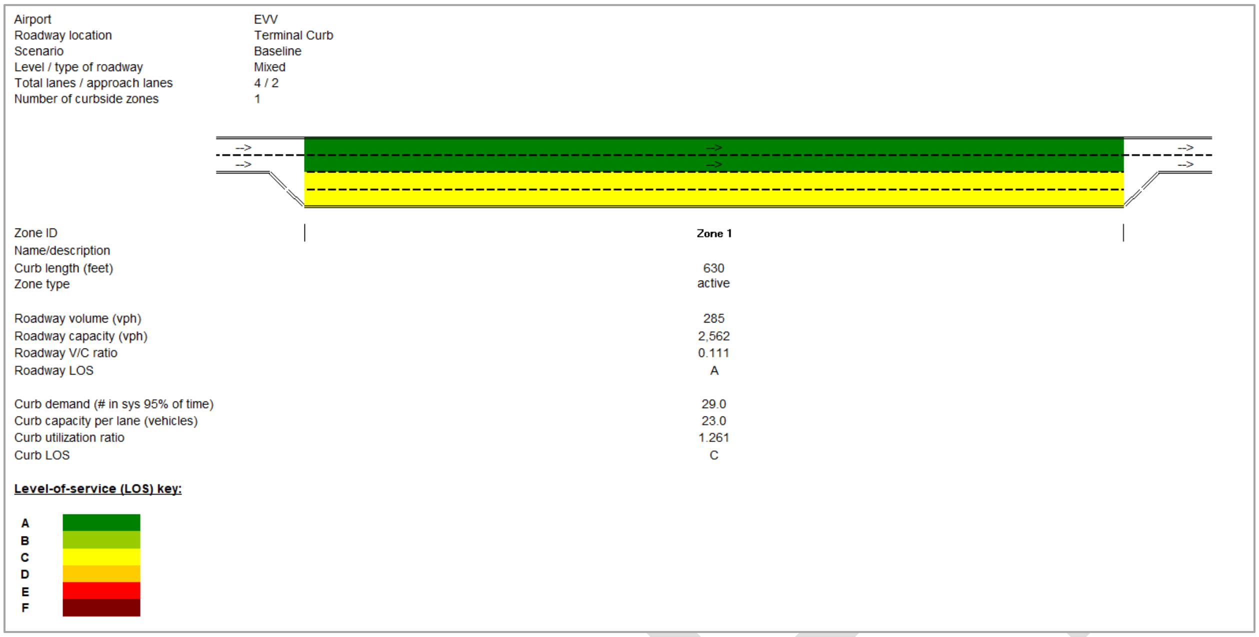
Zone ID	Zone 1
Name/description	
Curb length (feet)	630
Zone type	active
Roadway volume (vph)	247
Roadway capacity (vph)	2,634
Roadway V/C ratio	0.094
Roadway LOS	A
Curb demand (# in sys 95% of time)	26.0
Curb capacity per lane (vehicles)	23.0
Curb utilization ratio	1.130
Curb LOS	C

Level-of-service (LOS) key:

A
B
C
D
E
F

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

Figure 4-35 – Terminal Curbside PAL 4 (5-min Dwell Time)



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

Terminal Curbside Summary

As shown in the analysis above, planning should begin to improve the terminal roadway in PAL 3 to avoid a decrease in the LOS of the terminal curbside beyond the planning horizon. Options to mitigate the projected curbside congestion will be evaluated in **Chapter 5** in lockstep with the terminal development concepts. However, dwell time reductions would significantly impact the LOS of the Terminal curb. As such, it is recommended to implement a program or process to monitor the terminal curb and reduce dwell times to increase capacity of the curbside.

4.9.4 Parking

The number of required parking spaces at EVV is directly related to annual enplaned passenger traffic levels. The Airport currently has two public parking lots (solar covered lot and economy lot) that are accessible to the south via Bussing Drive. The Solar Covered Lot is adjacent to the terminal, while the Economy lot is farther west of the terminal but adjacent to Solar Covered Lot. Although each lot has two designated entrances, they share three exit lanes at a conjoined cashier plaza.

In total, the Airport has 1,493 parking spaces, with 202 spaces in the Solar Covered Lot (all for public use) and 1,291 spaces in the Economy Lot. Although there are 1,493 parking spaces, it is important to account for contingencies including vacancies resulting from improperly parked vehicles, maintenance work, and parking spaces for circulating traffic; therefore, it is assumed that only 90 percent of the actual supply is available for public use.

Public parking demand is the number of spaces required during peak parking periods. A Parking Study was completed in 2019 which evaluated the future parking demand at EVV based on 2019 enplanements, which was the highest activity recorded at the Airport in 20 years. For the purposes of this MPU, results from the Parking Study were utilized which showed June as the peak month (like the forecast developed for this MPU) for parking activity. In 2019 when the

Parking Study was completed, the Airport processed 235,082 enplaned passengers. Based on the Airport parking demand of 1,132 spaces in the peak hour (2:00 pm to 4:00 pm, or 14:00 to 16:00), the parking demand ratio is approximately 4.82 spaces per thousand (1,000) annual enplanements.

Table 4-65 presents the results of the parking demand analysis based on the FAA Recommended Forecast, the Medium-High Growth Scenario, and the High-Growth enplanement forecasts. Based on this approach and when comparing the parking demand to the effective supply (90 percent of total spaces based on contingencies, or 1,344 spaces), the Airport has adequate parking capacity. However, the Airport will exceed maximum parking capacity in PAL 3 if actual Airport activity follows the FAA Recommended Forecast or in PAL 1 if actual activity mirrors the Medium-High or High growth scenarios. As shown in the table, additional parking spaces needed will range from 369 in the FAA Recommended Forecast scenario to 992 spaces in the High growth scenario. It's recommended that the Airport continually monitor actual enplanement growth and begin planning for additional parking capacity as the Airport approaches 225,000 in enplanements.

Table 4-65 – Future Parking Demand

Public Parking						
Recommended Forecast						
Year	**Enplanements**	**Actual Supply**	**Effective Supply** (90 Percent)	**Parking Demand**[1]	**Surplus/ (Deficit)**	**Percent Capacity**
Base (2023)	165,933	1,493	1,344	800	544	60%
PAL 1 (2028)	213,263	1,493	1,344	1,028	316	76%
PAL 2 (2033)	260,593	1,493	1,344	1,256	88	93%
PAL 3 (2038)	307,923	1,493	1,344	1,484	**(140)**	110%
PAL 4 (2043)	355,244	1,493	1,344	1,712	**(369)**	127%
High Growth Forecast						
Year	**Enplanements**	**Actual Supply**	**Effective Supply** (90 Percent)	**Parking Demand**[1]	**Surplus/ (Deficit)**	**Percent Capacity**
Base (2023)	165,933	1,493	1,344	800	544	60%
PAL 1 (2028)	306,839	1,493	1,344	1,479	**(135)**	110%
PAL 2 (2033)	384,561	1,493	1,344	1,854	**(510)**	138%
PAL 3 (2038)	434,219	1,493	1,344	2,093	**(749)**	156%
PAL 4 (2043)	484,596	1,493	1,344	2,336	**(992)**	174%

Note: [1]Parking demand is calculated based on 4.82 spaces per 1,000 annual enplanements.
Source: EVV Terminal Parking Study, 2019; CHA, 2024.

4.9.5 Rental Cars

Rental Car Counters and Ready/Return Parking

Five rental car companies operate within the terminal building adjacent to the baggage claim area. Each of the five rental car companies have a dedicated counter used to process customers with a consolidated covered return/ready lot adjacent to the terminal. The Airport has ear marked areas adjacent to the existing return/ready lot for future expansion which is anticipated to be adequate to serve the rental car operation through the planning horizon. The Alternatives chapter will illustrate potential expansions to the ready/return lot.

In the absence of criteria to determine metrics for planning, this analysis assumed a planning factor of 925 square feet per rental car company module. The rental car company module accounted for 20 linear feet of counters, 12-foot-deep offices, 10-foot depth from the public face of the transaction counter to the back wall, and 15 feet for queuing with a 1.25 circulation factor. In PAL 3, requirements were increased to account for a new rental car operator establishing itself at EVV to aid in future terminal planning efforts.

Table 4-66 – Rental Car Concessions (PALs)

BASE			PAL 1			PAL 2			PAL 3			PAL 4		
No.	LF	SF	No.	LF	SF	No.	LF	SF	No.	LF	SF	No.	LF	SF
5	100	4,625	5	100	4,625	5	100	4,625	6	120	5,550	6	120	5,550

No. = Number of rental car companies on-site
LF = Linear feet of customer counter frontage
SF = Total square feet required for all rental car companies
Note: The existing customer counter is 110 LF and encompasses 3,518 SQ FT.
[1] Includes passenger queuing area, miscellaneous storage area and circulation.
Source: CHA, 2024.

Rental Car Vehicle Storage and Maintenance Facilities

Quick Turn Around (QTA) areas which include cleaning, fueling, light maintenance, and storage is performed at four separate parking lots to the north of the terminal. The QTA areas were found to be adequate given the existing and future rental car requirements. If a new rental car operator were to begin to operate at the airport, dedicated space is available adjacent to the exiting QTA lots for expansion.

Future Considerations

An interview with Enterprise was conducted as part of this MPU in which they mentioned the existing facilities (counter, lot space, car wash, and maintenance) were adequate given their existing operation. However, Enterprise is presently evaluating the infrastructure requirement needed to integrate electric vehicles (EV)'s into their existing fleet and operation. Given the continued and future adoption of EV's, EV chargers capable of charging an EV quickly (Level 3 charger) will be eventually needed in the future. The location of EV chargers and the power requirement is outside the scope of this Study. However, its recommended that the Airport work with the rental car operators in determining the best location of EV chargers and the necessary power requirement to support the fastest chargers. Industry wide, rental car companies were early to adopt EV's within their fleet if the required infrastructure was in place. Nevertheless, in recent news, companies have begun offloading EV's due to cost of maintenance/repair and lack of customer adoption. As the automotive industry continues to adopt EV's to pursue a more sustainable future, continued monitoring and adoption of industry requirements will need to be considered.

4.10 SUMMARY OF FACILITY REQUIREMENTS

This chapter identified the Airport's capacity and development needs for existing and anticipated activity levels. The recommendations determined in this chapter were primarily based on the aviation activity forecasts presented in **Chapter 3** and will form the basis of the development concepts presented in **Chapter 5**. The following summarizes the recommendations presented in this chapter.

4.10.1 FAA Airfield Design Standards

- Maintain RDC D-III-1800 for Runway 4-22, RDC C-II-4000 for Runway 18-36, and RDC A-I Small-Visual for Runway 9/27.
- Given the results of the wind analysis which shows that Runway 9-27 is not required for wind coverage, evaluate alternatives to determine the future need for Runway 9-27 and the feasibility to convert it to a taxiway to provide more developable space.
- The EVV runway system does not currently have paved shoulders. Therefore, it is recommended that Runway 4-22 be equipped with 25-foot shoulders.
- Acquire avigation easements or property for incompatible land uses within the RPZ's of Runway 18, 22, 27, and 36 which include public roads, railway, and buildings. An alternative method to control incompatible land uses can also be pursued with an airport overlay district.
- Increase the blast pad width for Runway 4-22 to 200 feet during the next reconstruction project given that this runway serves aircraft with a MTOW greater than 150,000 lbs.
- Correct Runway 18-36 longitudinal gradient, pavement cross slope, and transverse RSA grading deficiencies to meet FAA standards during the next reconstruction project. During the next Runway 18-36 rehabilitation, correct the cross slope to improve drainage in the area.
- If Runway 9-27 is determined to remain in place, correct transverse and longitudinal grading deficiencies during the next runway pavement rehab/reconstruction or safety area improvement project.
- Make available paved shoulders for Taxiway A and Taxiway G to meet FAA design standard recommendations for taxiways which accommodate ADG-IV or larger aircraft.
- Correct taxiway geometry deficiencies throughout the airfield to coincide with the latest FAA design standards during future taxiway rehabilitation projects.

4.10.2 Terminal Requirements

- Forecast gate demand is expected to require additional positions beyond the existing 7 gates. Starting in PAL 3, a total of 9 gates will be needed, increasing to a total of 10 gates required in PAL 4 by the end of the planning period.
- Additional holdroom area will be required as the Airport adds additional gate capacity beginning in PAL 3. Approximately 5,000 SF in additional holdroom area is needed in PAL 3 to support 9 total gates, increasing to 8,700 SF in additional holdroom space to support 10 gates in PAL 4.
- The Airport should consider the addition of 1 SSCP lane in PAL 3 to maintain a 10-minute queue as passenger activity increases through the planning horizon.

- The existing security screening checkpoint area was found to be deficient requiring additional space for passenger queuing and circulation. A deficiency of approximately 277 SF is present till PAL 2 to support the existing 2 SSCP lanes, this requirement increases to approximately 2,800 SF to support 3 SSCP lanes in PAL 3.

4.10.3 Aircraft Storage and Parking Apron Requirements

- The terminal apron is expected to need 4 additional aircraft parking gates within the planning period. Such gates are expected to require an additional 703 linear feet of terminal frontage.
- The GA aprons are expected to need an additional 90,915 square yards of pavement by the end of the planning period to support itinerant aircraft parking.
- The based aircraft aviation activity forecast signaled an increase in based aircraft at EVV. Therefore, the Airport will need a total of 189,604 square feet of hangar space during the planning horizon which equates to a deficiency of 41,400 square feet. The Airport should consider additional hangar storage to accommodate future based aircraft users.

4.10.4 Cargo Requirements

- Cargo demand was forecasted to remain relatively consistent with a slight increase during the planning horizon. As such, additional cargo facilities are not expected to be needed within the planning period. However, parcels which could serve a feeder cargo carrier will be identified in the event such an operator desires to conduct regular, scheduled service at the Airport.

4.10.5 Support Facility Requirements

- Install an additional 20,000-gallon fuel tank for Jet-A storage. If wanting to meet a seven-day day fuel reserve, the installation would be required immediately. If wanting to only maintain a five-day reserve, the tank is not anticipated to be needed until PAL 4.
- Continue to coordinate with the FAA regarding the potential relocation of the ATCT and ensure future relocation does not deter future development of the Airport.

4.10.6 Parking and Access Requirements

- Create a long-term plan as the Airport continues to grow working with the state/county/local transportation agencies regarding the possibility of connectivity to I-69.
- As the Airport approaches PAL 3 with a terminal curb LOS of C, begin planning for a terminal curb expansion alongside any future terminal expansion.
- Increase the Airport's parking capacity by approximately 135 to 992 parking spaces to accommodate anticipated parking demand during the planning horizon.
- Continue to reserve dedicated space west of the exiting QTA lots for future rental car expansion or to accommodate a new rental car operator.

- ✈ Stay vigilant of the future use of EV's by passengers and rental car operators and ensure the Airport has adequate power grid capacity.