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Eugene F. Kranz
Toledo Express Airport
Facility Requirements

RS&H

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CHAPTER 3

FACILITY REQUIREMENTS

3.1 INTRODUCTION

Airport facility requirements including type, size and quantity are based on the future aviation demand levels projected in the aviation demand forecast discussed in **Chapter 2 Aviation Demand Forecasts.** Upgrading, expanding, or even eliminating facilities can be driven by updates to regulatory standards adopted by the Federal Aviation Administration, adjustments in the airport's vision or a shift in passenger demand and airport use. Replacement of outdated and inefficient facilities that are cost prohibitive to maintain can also influence facility needs. These different considerations can have a significant impact on future development and are considered in this analysis for the 20-year planning horizon.

The Eugene F. Kranz Toledo Express Airport (TOL or the Airport) aviation demand forecast used the current FAA Terminal Area Forecast (TAF), socioeconomic data, and information gained from interviews with airport tenants and management to forecast commercial passenger enplanements and operations, general aviation operations, military operations, and number of based aircraft. The TAF is based on the federal fiscal year (October 1 – September 30), not calendar year. At the time this document was written, the 2022 TAF was utilized. **Table 3-1** below summarizes the forecast activity levels for enplaned passengers, aircraft operations, and based aircraft.

The forecast includes the activity levels for the base year of 2021 and outward years of 2026, 2031, and 2041. Although the forecast defines aviation activity milestones for the years 2026, 2031, and 2041, facility requirements are driven by levels of aircraft operations and passenger enplanement demands, which may or may not coincide with those specific years. Therefore, to eliminate associations between demand levels and specific years, the levels of demand which trigger facility improvements, referred to as a Planning Activity Level (PAL), are broken into three activity levels: PAL 1, PAL 2, and PAL 3 respectively. This chapter will focus on determining the facility requirements for each PAL.

TABLE 3-1 OVERALL SUMMARY OF AIRPORT PLANNING FORECAST

	Base Year	PAL 1	PAL 2	PAL 3
Air Carrier	46,034	77,764	85,252	91,204
Commuter	35,935	36,537	42,720	47,158
TOTAL ENPLANEMENTS	81,969	114,301	127,971	138,362
Itinerant				
Air Carrier	2,945	3,099	3,261	3,611
Air Taxi/Commuter	5,650	5,929	6,231	6,881
Total Commercial Operations	8,595	9,028	9,492	10,492
General aviation	15,398	16,624	16,750	17,005
Military	2,208	2,208	2,208	2,208
Local				
General aviation	5,554	6,806	6,832	6,884
Military	1,314	1,314	1,314	1,314
TOTAL OPERATIONS	**33,069**	**35,980**	**36,596**	**37,903**
Based Aircraft				
Single-Engine Piston	25	25	25	25
Multi-Engine Piston	8	8	8	8
Turboprop	5	5	5	5
Turbojet	15	17	19	24
Helicopter	3	3	3	3
Other	21	21	21	21
TOTAL	**77**	**79**	**81**	**87**

Source: RS&H Analysis 2023

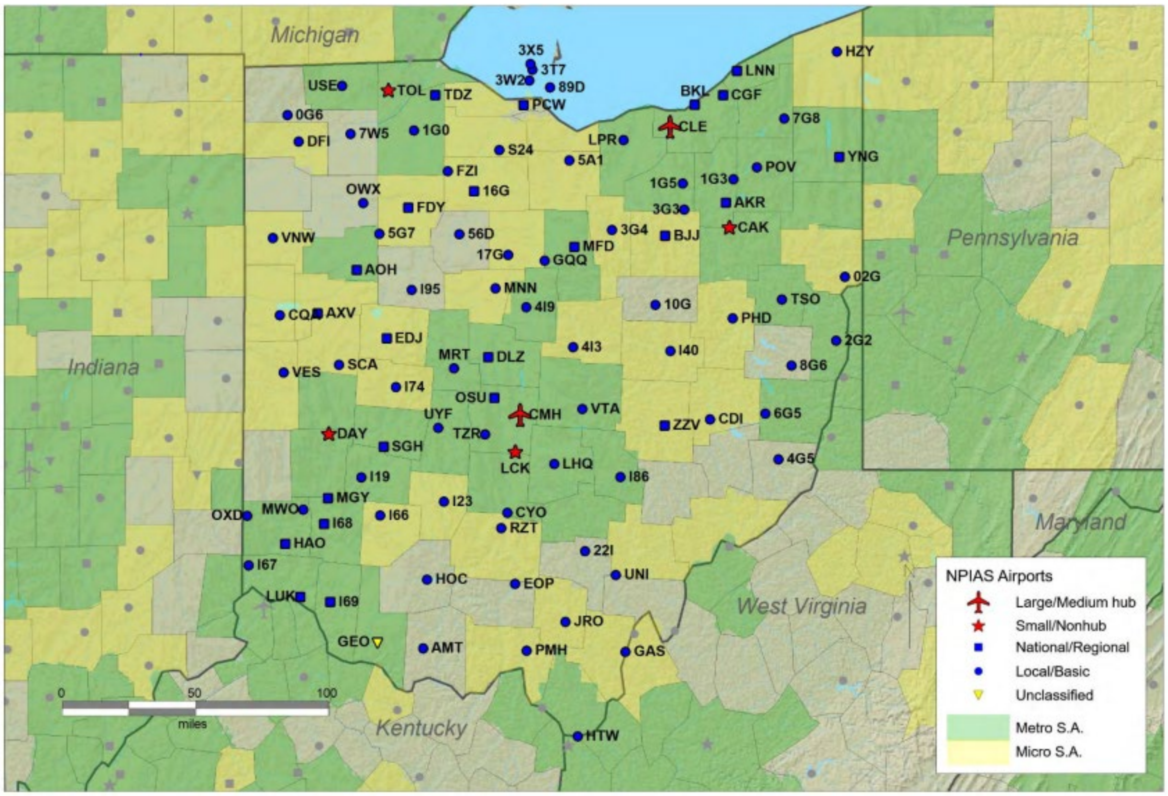
3.1.1 Airport Role and Service Level

Airports provide a critical role in the transportation system, from moving passengers and goods to medical supplies and emergency transport, military operations, flight training, et cetera. The FAA has identified public-use airports to meet the needs of civil aviation and national defense known as the National Plan of Integrated Airport Systems (NPIAS). These airports are considered necessary to provide a safe and efficient system of airports. Determination of an airport's classification within the NPIAS is a function of the FAA which establishes airport project funding levels. An airport must be included in the NPIAS to be eligible for Federal Funding. There are 3,287 airports currently identified in the NPIAS with $62.4 billion of eligible airport development between 2023-2027.[1]

[1] National Plan of Integrated Airport Systems (NPIAS) 2023-2027 Narrative

As a commercial service airport, TOL is currently listed in the NPIAS as a non-hub primary airport which accounts for less than 0.05 percent of the total passenger enplanements, but more than 10,000 annual enplanements provided by commercial aircraft service within the United States. **Figure 3-1** shows all NPIAS airports in the state of Ohio. Based on the anticipated activity levels, no changes to the NPIAS service level are anticipated within the planning period.

FIGURE 3-1 NPIAS AIRPORTS IN OHIO



Source: NPIAS FY 2023-2027 Appendices

Though TOL is classified within the NPIAS for its commercial service activity, it also serves its community with 3 other major categories of aviation activity: cargo, military, and general aviation. In 2021 TOL enplaned 81,969 passengers, saw 96,481 tons of cargo, had 3,522 military operations, and 20,952 general aviation operations. All current and forecasted aviation activity at TOL is used to analyze future facility needs.

3.1.2 Sustainability

Sustainability can have varying definitions, but Airports Council International-North America (ACI-NA) defines sustainability as "A holistic approach to managing an airport so as to ensure the integrity of the Economic viability, Operational efficiency, Natural Resource Conservation, and Social responsibility (EONS) of the Airport." This approach helps airports meet the needs of current day-to-day activities while ensuring the future needs of the airport are not compromised.

The facility requirements analysis begins with a review of the current FAA design standards, industry trends, emerging challenges, and innovations requiring consideration in facility planning.

While EONS considerations will be a critical part of the upcoming Alternatives analysis in Chapter 4, facility requirement determinations are more quantitative and objectively determined by way of modern industry guidance, best practices, and regulatory standards. Most of this chapter is devoted to assessments in each of the following topics and functional areas of TOL:

- Emerging Trends
- Meteorological Conditions
- Airfield Capacity
- Airfield Design
- Navigational Aids, Lighting and Airspace
- Commercial Passenger Terminal
- General Aviation Facilities
- Ohio Air National Guard
- Aviation Support Facilities
- Airport Access and Circulation
- Utilities
- Land Use

Future facility requirements detailed in the following sections are based on the ability of the existing airport configuration to accommodate the forecast demand levels in a way that meets the Toledo-Lucas County Port Authority's quality of service objectives.

3.2 EMERGING TRENDS

In planning for the future of the Airport, it is important to consider the emerging trends of both commercial passenger service and general aviation activity, especially those with significant and direct impacts to TOL. The aviation industry is always evolving, and history demonstrates that technological innovations often precede industry transformations. The rapid pace of development in aviation is anticipated to continue and airports will be expected to adapt quickly to demands created by the latest trends and innovations. There is substantial benefit in surveying the industry landscape to understand and project for probable changes among pilots, aircraft types, new technologies, and airport management policies.

From the commercial passenger service perspective, one of the most impactful trends among regional carriers involves the up-gauging of smaller regional jets having 50-seats or less, to larger aircraft with greater seat capacities and slightly higher load factors. Up-gauging aircraft increases the peak passenger demand of the Airport's terminal and landside facilities. This does not currently impact TOL as the only regional carrier operating out of TOL (American) discontinued service, but could affect passenger operations in PAL 1, PAL 2, and PAL 3.

From the general aviation recreational flyer and student pilot perspective, there has been, and will continue to be, a measurable change in pilot demographics. Over the past decade, a decline in the number of pilots in the 40 to 60-year-old range has occurred. Historically, this was an age group involved in recreational flying. Statistics show an ongoing decline in recreational flying for that age range. Simultaneously, there has been, up until the onset of the COVID-19 global pandemic, a sharp increase in the amount of flight training. This trend has been associated with both regulatory changes and a strong demand for commercial airline pilots. The COVID-19 pandemic has now cast uncertainty into both the future demand for commercial pilots and the willingness of students to pursue the field. As of October 2020, Boeing, publisher of the *Pilot and Technician Outlook 2020-2039*, has reduced employment forecast numbers for pilots by 5 percent, maintenance technicians by 3.9 percent, and cabin crew positions by 12 percent[2] [3]. While these numbers demonstrate less anticipated opportunity in the field, the report notes that "retirements and over vacancies should leave openings that need to be filled by furloughed and new aviators and that airplanes being brought out of storage will require thousands of labor hours to ensure proper maintenance."

From the general aviation-based aircraft perspective, the number of single engine piston aircraft is declining nationwide, and this is forecast to continue over the next 20-year. Flights by aircraft over 20 years old have declined over the past five years. New types of general aviation aircraft are being driven by a shift from recreational and leisure flying to more business flying. This shift is driving increases in business type aircraft such as Bombardier Challengers, Gulfstreams, and Cessna Citation jets. For TOL, piston aircraft are not following this trend as they are forecasted to remain constant, but trends do show an increase in jets.

Other high-level trends occurring in the aviation industry include:

- Demand for small aircraft is decreasing due to the decreasing number of people pursuing pilot certificates for recreational purposes.
- Instructional flying was increasing due to high demand for commercial pilots and changes in regulations that increased necessary flight hours for entry into sought after commercial pilot positions. The impact of the COVID-19 global pandemic on future commercial pilot employment opportunity has not yet resolved into a clear trend at this time, however, the near-term decline in student activity has begun to stabilize as of February 2021.[4]
- The cost of flying has sharply increased. This is especially true with relation to cost of retail aviation gasoline, which has more than quadrupled in the last 20 years.
- Operations by jets are increasing as a share of total operations, which results in greater demand for additional, stronger pavement and Jet A fuel availability at airports.
- Communities are establishing community resiliency plans related to disaster response and recovery, in which airports play a key role.

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[2] Boeing, *Pilot and Technician Outlook 2020-2039*, October 2020 update. Available here: https://www.boeing.com/resources/boeingdotcom/market/assets/downloads/2020_PTO_PDF_Download.pdf

[3] AOPA, *Boeing's 20-Year Job Predictions Lowered*, Retrieved April 12, 2021 from https://www.aopa.org/news-and-media/all-news/2020/october/15/boeings-20-year-job-predictions-lowered

[4] Pilot Career News, ***FlightLogger*** *Sees Pilot Training at Turning Point*, Retrieved April 12, 2021 from https://www.pilotcareernews.com/flightlogger-sees-pilot-training-at-turning-point/

Aviation trends like electric aircraft development, environmental stewardship, elimination of leaded aviation gasoline, and new aircraft designs will influence airport facility requirements. Electric aircraft have the potential to usurp traditional fossil fuel aircraft currently used in flight training and recreational flying. Electric aircraft engines, currently being tested for certification, would simultaneously reduce operational costs, noise, and carbon dioxide emissions, making small aircraft operations more affordable and environmentally friendly. This shift affects airport facilities by requiring improvements like electric charging ports and it could affect airport capacity and storage needs if small aircraft operations increase. Necessary upgrades or extension of electrical lines serving TOL should be considered as well as strategic locations for electric aircraft battery charging stations, timing to implement improvements, and adjustments to financial policies which recapture operating revenues lost by decreasing fuel sales.

One opportunity that can be leveraged by the TLCPA is the introduction of redundancy into the utility system through the implementation of sustainable energy generated from clean, renewable sources such as solar energy systems. Airports are beginning to integrate renewable energy systems into airport-wide microgrids to establish Airport energy independence, thereby promoting financial self-sufficiency and protecting the airport's central role in community resiliency during disaster recovery. A conceptual plan for a microgrid system at TOL will be discussed in the Alternatives chapter.

3.3 METEOROLOGICAL CONDITIONS

Weather plays a significant role in influencing airport facility needs and design requirements. Ambient temperature, precipitation, wind, visibility, cloud ceiling, and atmospheric pressure are all climate factors that affect operational parameters and future facility needs at TOL.

An analysis of monthly weather station data from the National Oceanographic and Atmospheric Administration (NOAA) showed that July was the warmest month at TOL with an average high temperature of 73.5 degrees Fahrenheit and an average max temperature of 82.5 degrees Fahrenheit. Comparatively, the coldest temperatures occur in the month of February with an average of 20.6 degrees Fahrenheit. The first annual freeze occurs in late October while the last freeze typically occurs in early April.

Most of the annual precipitation falls between the months of April-September, receiving an average of 19.2 inches of rainfall. The wettest month is May with an average of 3.6 inches of rain while January is the driest month receiving an average of 2.05 inches. The average seasonal snowfall for the Toledo area is 31.0 inches.[5] This data indicates that the meteorological conditions will not affect annual capacity over the planning period.

3.3.1 Runway Orientation and Wind Analysis

Runway wind coverage analysis was conducted using the FAA's ADIP Windrose Tool and considers 10 years of meteorological data (January 2011 through December 2020). Data for this tool is supplied by NOAA's Integrated Surface Database (ISD) through the weather reporting station located at TOL. The wind coverage analysis examines all-weather conditions and instrument meteorological conditions (IMC).

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[5] All recorded weather data collected by the National Oceanic and Atmospheric Association (NOAA), compiled by RS&H July 2022

The primary factor in determining runway orientation is the direction of prevailing winds. As stated in FAA AC 150/5300-13B, *Airport Design*, the primary runway should be orientated in the direction of the prevailing winds, barring other considerations. FAA runway design standards recommend an airport's runway system provide a minimum of 95 percent wind coverage. The 95 percent wind coverage is computed on the basis of the crosswind component not exceeding the set value based on the Runway Design Code (RDC). If a single runway cannot provide this coverage, then a crosswind runway is warranted. Runway 7-25 has a RDC D-IV with a crosswind component of 20 knots, which has wind coverage of over 99 percent. Wind conditions affect all aircraft, but smaller aircraft (A-I and B-I) are more susceptible to wind variations than larger aircraft and have a crosswind component of 10.5 knots. For these aircraft, Runway 7-25 is below 95 percent in Instrument Meteorological Conditions (IMC) conditions (ceiling less than 1,000' above ground level and/or visibility less than three miles) and therefore the crosswind Runway 16-34 is necessary in TOL's runway system. **Table 3-2** shows wind coverage percentages for all weather conditions and IMC conditions.

TABLE 3-2 RUNWAY WIND COVERAGE

ALL WEATHER WIND DATA				
RUNWAY	10.5 KNOTS	13 KNOTS	16 KNOTS	20 KNOTS
7-25	95.27%	97.82%	99.54%	99.93%
16-34	83.55%	89.60%	95.91%	98.73%
COMBINED	99.08%	99.81%	99.98%	100.00%
ALL WEATHER OBSERVATIONS: 128,184				
IMC WIND DATA				
RUNWAY	10.5 KNOTS	13 KNOTS	16 KNOTS	20 KNOTS
7-25	94.04%	96.85%	99.15%	99.83%
16-34	84.78%	90.22%	95.91%	98.68%
COMBINED	99.04%	99.78%	99.97%	99.99%
IFR OBSERVATIONS: 20,872				

Source: NOAA NATIONAL CLIMATIC DATA CENTER
STATION: 725360 TOLEDO EXPRESS AIRPORT - ASOS
DATA RANGE: 2011-2020
AIRPORT REFERENCE CODE (ARC): D-IV

3.4 AIRFIELD CAPACITY

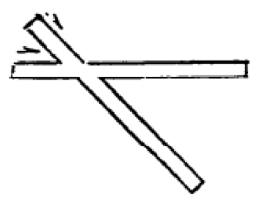
A high-level study of capacity was conducted by RS&H in March 2020 and is attached as **Appendix B**. The study indicated that based on the then current and forecasted operational counts through 2045 at TOL, the current two runway system is more than adequate to meet capacity needs. The following information is an additional analysis using current and forecasted numbers from the FAA 2022 TAF.

Airfield capacity calculations use a metric referred to as the mix index. The mix index is equivalent to the percent of medium-sized aircraft in the mix, such as the Airbus A320, plus three times the percent of large-sized aircraft in the mix, such as the Boeing 767-300ER.

The mix index is used to define the annual service volume (ASV) for an airfield. The mix index percentage can range between zero and 180, where smaller percentages reflect predominately small aircraft in the operational fleet mix and higher percentages represent a larger aircraft fleet mix. The FAA prescribed methodology to reflect the impacts of fleet mix on the ASV defines five ranges of mix index.

TOL is a two-runway system comparable to the No. 9 configuration depicted in AC 150/5060-5, shown in **Table 3-3**.

TABLE 3-3 TWO RUNWAY MIX INDEX AND ASV

Runway Configuration	Mix Index %(C+3D)	Hourly Capacity Ops/Hr		ASV
		VFR	IFR	
9. 	0 to 20	98	59	230,000
	21 to 50	77	57	200,000
	51 to 80	77	56	215,000
	81 to 120	76	59	225,000
	121 to 130	72	60	265,000

Source: FAA Advisory Circular 150/5060-5, Airport Capacity and Delay

The goal of this analysis is to determine the airfield capacity and the sufficiency of the runways to handle the capacity. The numbers developed are compared to the long-range forecasts for the Airport to determine whether any shortfalls exist. Based on the current and forecasted fleet mix at TOL, the mix index falls within the 21 to 50 range at 33 percent. The generally accepted industry benchmark to begin planning for additional airfield capacity is when demand reaches 60 percent (120,000 operations) of the ASV, and building needed upgrades when demand reached 80 percent (160,000 operations) of ASV. As shown in **Table 3-4** the ASV ratio for TOL does not reach 60 percent capacity in the planning horizon. This indicates the current runway system is adequate to accommodate the current and anticipated demand within the planning period.

TABLE 3-4 FORECAST OPERATIONS AND ANNUAL AIRFIELD CAPACITY

Existing 2 Runway System	Base Year 2021	PAL 1	PAL 2	PAL 3
Annual Service Volume	200,000	200,000	200,000	200,000
Annual Demand	33,069	36,379	36,991	38,290
ASV Demand/Capacity Ratio	17%	18%	18%	19%

Source: FAA AC 150/5060-5 Airport Capacity and Delay, RS&H Forecast Demand

3.5 AIRFIELD DESIGN

This section analyzes the various elements of the airfield and their ability to accommodate forecast demand.

3.5.1 Airfield Configuration

Eugene F Kranz Toledo Express Airport is comprised of two runways and four main taxiways. The runways are oriented with respect to the wind to provide appropriate wind coverage for users of the Airport. As discussed in **Section 3.3.1 Runway Orientation and Wind Analysis**, Runway 7-25 and Runway 16-34 meet the FAA standard for wind coverage as a system.

The taxiway system provides safe and efficient movement of aircraft to and from the ramps and runways. Due to some heavy modification of the airfield configuration approximately 20 years ago, the taxiway nomenclature does not follow the typical alphabetical progression. This nomenclature will be addressed in the Alternatives and corrected as a near-term future airfield project. Taxiway A provides east airfield hangar access to Runway 16 and Taxiways B and N. Taxiways B and D are full-length, parallel taxiways for Runway 7-25. Taxiway N is a parallel taxiway for Runway 16-34. All taxiways have multiple standard and non-standard connectors to allow for the efficient movement of aircraft. All non-standard conditions will be discussed further in this section. **Figure 3-2** illustrates the airfield layout at TOL.

FIGURE 3-2 AIRFIELD CONFIGURATION

Source: RS&H Analysis, 2022

3.5.2 Airport Design Criteria

Each runway at an airport has a design aircraft, which is the largest aircraft that regularly uses that runway. The airfield must be designed so that the most demanding, regularly operating aircraft (at least 500 annual operations) is able to use the runways, taxiways, and ramps. Airport design standards are established in FAA Advisory Circular150/5300-13B *Airport Design*. This AC outlines design criteria for all design groups depending on the Aircraft Approach Category (AAC), Airplane Design Group (ADG), and Taxiway Design Group (TDG).

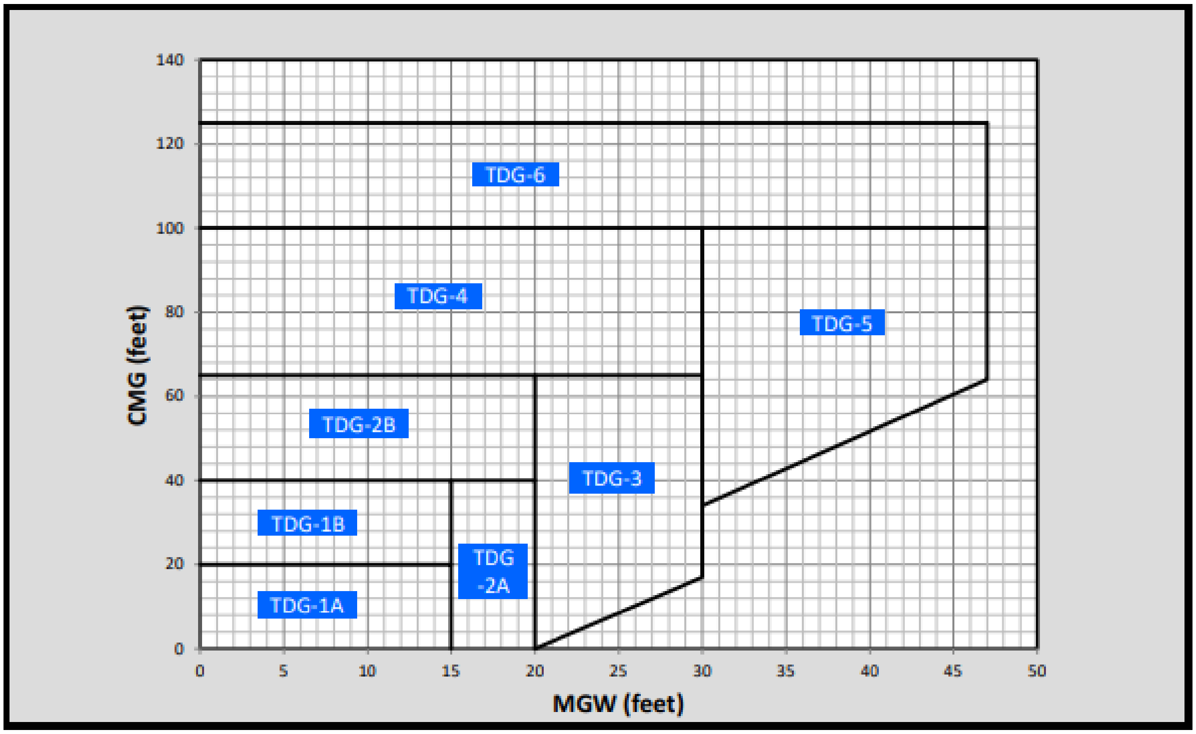
The Airport Reference Code (ARC) is a coding system used by the FAA to relate airport design criteria to the operational and physical characteristics of the aircraft intended to operate at an airport. The ARC is defined by a letter designating the aircraft approach category, which relates to the approach speed of an aircraft, and a Roman numeral designating the design group, which refers to the wingspan. The FAA's aircraft approach categories and airplane design groups are listed in **Table 3-5** and taxiway design group criteria in **Figure 3-3**.

TABLE 3-5 AIRCRAFT APPROACH CATEGORY AND AIRPLANE DESIGN GROUP

AAC	VREF/Approach Speed	
A	Approach speed less than 91 knots	
B	Approach speed 91 knots or more but less than 121 knots	
C	Approach speed 121 knots or more but less than 141 knots	
D	Approach speed 141 knots or more but less than 166 knots	
E	Approach speed 166 knots or more	
Group #	**Tail Height**	**Wingspan**
I	< 20 ft (< 6.1 m)	< 49ft (< 14.9m)
II	20 ft to < 30 ft (6.1 m to < 9.1m)	49 ft to < 79 ft (14.9 m to < 24.1 m)
III	30 ft to < 45 ft (9.1 m to < 13.7 m)	79 ft to < 118 ft (24.1 m to <36 m)
IV	45 ft to < 60 ft (13.7 m to < 18.3 m)	118 ft to < 171 ft (36 m to <52 m)
V	60 ft to < 66 ft (18.3 m to < 20.1 m)	171 ft to < 214 ft (52 m to <65 m)
VI	66 ft to < 80 ft (20.1 m to < 24.4 m)	214 ft to <262 ft (65 m to <80m)

Source: FAA Advisory Circular 150/5300-13 B Airport Design

FIGURE 3-3 TAXIWAY DESIGN GROUP



Note: Values in the graph are rounded to the nearest foot. 1 foot = 0.305 meters.

Source: FAA Advisor Circular 150/5300-13B Airport Design

Note: CMG – Cockpit to main gear; MGW – Main gear width; TDG – Taxiway Design Group

3.5.2.1 Runway 7-25 Critical Aircraft

The largest aircraft currently conducting more than 500 annual operations on Runway 7-25 identified in **Chapter 2 Aviation Activity Forecasts** at TOL is a Boeing 737-800 which is runway design group D-III; however, the future critical aircraft is projected to be the Boeing 767-300ER w/winglets (D-IV) due to increasing cargo operations. Therefore, in this Master Plan, facility requirements for Runway 7-25 will be based on criteria for a D-IV, TDG 5 aircraft. Engineering airfield surfaces to this ARC and TDG is critical to maintaining an airfield environment which can safely accommodate the Airport's critical aircraft. Only those pavement surfaces required to accommodate the design aircraft need be designed to that standard. Runway and taxiway surfaces that only serve small general aviation aircraft can be designed in an efficient and targeted way which serves the appropriate type of aircraft.

3.5.2.2 Runway 16-34 Critical Aircraft

Based on FAA Offload data and consideration from ATCT staff, it was determined the most demanding aircraft conducting 500 annual operations or more on Runway 16-34 has a RDC A-I-IA, similar to the Cessna 172 Skyhawk. Based on this data and on airport input, the future critical aircraft was identified as a B-II-2, like the Beechcraft Super King Air. Planning Runway 16-34 and associated pavement for the future critical aircraft will allow flexibility in operators utilizing TOL especially in crosswind conditions. Currently, Runway 16-34 is constructed to accommodate D-IV aircraft, thus overbuilt. Based on the lifecycle of the facility and the timing of future funded AIP projects, the eligibility to appropriately size the runway will be evaluated in the Alternatives Chapter and identified as future capital improvement projects within the planning period. Facility requirements for Runway 16-34 in this Master Plan will be analyzed based on B-II-2 criteria.

The following sections discuss runway design requirements. Taxiway design requirements are discussed subsequently in **Section 3.5.5, Taxiway Design** of this chapter.

3.5.3 Runway Requirements

Analysis of the runways addresses the geometric ability of the runways to meet FAA design standards based on the critical aircraft for current and forecast demand. Elements examined in this section include runway orientation and designation, length, width, runway protections zones, geometric standards, pavement strength, and an analysis of the need for a third runway.

3.5.3.1 Runway Designation

Runway designations provided on each runway indicate the runway orientation according to the magnetic compass bearing. Runway designations can change due to the slow drift of the magnetic poles on the Earth's surface, which over time change the runway's magnetic bearing. Magnetic declination relates to the degree of magnetic drift that must be accounted for. It is recommended that airports coordinate with FAA if the designation is more than a five-degree difference from the runway's established designated runway heading.

As of October 2022, the magnetic declination at TOL is 6° 52′ W and changing annually by 0° 1′ W. As illustrated in **Table 3-6**, all runway designations are anticipated to remain the same throughout the planning period.

TABLE 3-6 MAGNETIC DECLINATION

			Existing		Future (2041)		
Runway Designation	True Alignment	True Bearing	Magnetic Bearing	Runway Heading	Magnetic Bearing	Runway Heading	Runway Designation
7	067°	67° 09' 38.88"	74° 1' 38.88"	074°	74° 20' 38.88"	074°	7
25	247°	247° 11' 04.20"	254° 3' 04.20"	254°	254° 22' 04.20'	254°	25
16	157°	157 °10' 50.52"	164° 2' 50.52"	164°	164° 21' 50.52"	164°	16
34	337°	337° 11' 09.24"	344° 3' 09.24"	344°	344° 22' 09.24"	344°	34

Source: RS&H Analysis 2022

3.5.3.2 Runway Length Analysis

Runway length is determined by the greater requirement of the takeoff or landing performance characteristics of the existing and future critical aircraft. In the case of TOL, the Boeing 737-800 and Boeing 767-300ER with winglets will be analyzed to determine appropriate runway length. Amazon Air, the primary air cargo operator at TOL, has established the critical aircraft for the main Runway 7-25, thus providing sufficient runway length to accommodate their longest routes and payload is key. The A320 operated by Allegiant Air, as well as the ERJ-175 operated by American Airlines (forecasted to return in PAL 1), are also analyzed. Two guidance documents are available with methodology for determining an airport's recommended runway lengths:

Guidance A **FAA Recommended Runway Length:** General runway length guidance based on FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, performance graphs for composite aircraft groups, as adjusted for TOL mean maximum temperature (82.5°F) field elevation (638 feet above mean sea level), difference in runway centerline elevations (17.6 ft for Runway 7-25 and 9.5 ft for Runway 16-34) and aircraft flight range of greater than 1,400 nautical miles.

Guidance B **Current and Forecast Critical Aircraft Planning Manuals:** Determines runway length for specific aircraft models and engines based on data from the aircraft manufacturer, as adjusted for TOL to the extent possible based on aircraft operating (payload) weights, flight range, non-standard temperatures, and field elevation.

The above guidance stated sufficient information to recommend no additional runway length is needed throughout the planning period for Runway 7-25. This is based on the 10,600-foot length, the forecast of aircraft operations, and the expected aircraft stage lengths of both current and future critical aircraft, and most frequent passenger aircraft operating at TOL. Runway 16-34 is not sufficient for the A320, 737-800, or 767-300ER with a current length of 5,599 in both takeoff and landing. This runway, however, is not used for air carrier or cargo service and is sufficient in length for smaller aircraft like the Beechcraft Super King Air. **Table 3-7** provides the FAA recommended runway length requirement. Though the analysis concluded the runway length is sufficient today, a future extension for Runway 7-25 may be desired to allow greater stage lengths and/or larger aircraft.

TABLE 3-7 RUNWAY LENGTH REQUIREMENTS

Aircraft	Airbus A320	Boeing 737-800	Boeing 767-300ER	Embraer ERJ - 175	Beechcraft Super King Air
Time Period	Existing	Existing	Future	Future	Existing/Future
Furthest Destination	AZA - 1,412 nm	AFW - 825 nm	AFW - 825 nm	ORD - 186 nm	N/A
Take Off					
Existing Runway 7-25 Length	**10,600'**	**10,600'**	**10,600'**	**10,600'**	**10,600’**
Length Required 7-25	6,100	5,900	6,100	4,200	3,200’
Length Required for 7-25 (MTOW)	8,100	8,700	10,200	8,200	3,200’
Existing Runway 16-34 Length	**5,599'**	**5,599'**	**5,599'**	**5,599'**	**5,599’**
Length Required 16-34	N/A	N/A	N/A	4,100	3,200’
Length Required for 16-34 (MTOW)	N/A	N/A	N/A	8,100	3,200’
Landing					
Landing Length Required (both runways)	5,800	6,800	6,700	5,400	3,200’

Source: RS&H Analysis, 2022

Note: MTOW=Max Takeoff Weight

3.5.3.3 Runway Width and Blast Pad Analysis

Runway 7-25 and Runway 16-34 are currently 150′ wide, satisfying D-IV and B-II criteria. The existing width for Runway 7-25 should be maintained through the planning period. Based on B-II standards moving forward, Runway 16-34 is overbuilt (the B-II standard for runway width is 75′) and project eligibility for federal funding support will be determined by the proposed project scope and FAA coordination.

Runways should also have shoulders to accommodate their associated design aircraft that will help protect against soil erosion from jet blast. Runway 7-25 meets FAA standard with 35′ paved shoulders while Runway 16-34 does not have shoulders. Runways with design aircraft of ADG-II are recommended to have 10′ of stabilized shoulders which can consist of turf or stabilizing soil treatments. Given Runway 16-34 is 75′ wider than standard, the additional pavement acts as the recommended shoulder width. For future runway rehabilitation or reconstruction projects, 10′ of that additional width would be maintained to act as stabilized shoulders, with the remaining pavement removed or no longer maintained.

Similar to runway shoulders, blast pads are added to the end of runways to provide erosion protection control during aircraft takeoff operations. Based on the design aircraft for each runway, all four runway ends should have a blast pad. Runway 7-25 meets the blast pad length standard however falls short in width. Runway 16-34 does not have a blast pad at either end. FAA standard blast pads for D-IV aircraft are recommended at Runway 7 and for B-II aircraft at Runway 16 and Runway 34. A summary of the runway widths and blast pad dimensions are shown in **Table 3-8.**

TABLE 3-8 RUNWAY WIDTH AND BLAST PAD STANDARD

	D-IV Standard	Runway 7	Meets Standard (✓)	Runway 25	Meets Standard (✓)	B-II Standard	Runway 16-34	Meets Standard (✓)
Runway Pavement Width	150'	150'	✓	150'	✓	75'	150'	✓
Paved Shoulder Width	25'	35'	✓	35'	✓	10'	None	✓
Runway Blast Pad Width	200'	150'	X	150'	X	95'	None	X
Runway Blast Pad Length	200'	200'	✓	1,000'	✓	150'	None	X

Source: FAA Advisory Circular 150/5300 13-B Airport Design, RS&H Analysis, 2022

3.5.3.4 Runway Protection Zones

For the protection of people and property on the ground, the FAA standards identify a trapezoidal area of land located off each runway end as the Runway Protection Zone (RPZ). The size of RPZs vary according to the design aircraft's Aircraft Approach Category (AAC), Airplane Design Group (ADG), and the visibility minimums defined for each runway. **Table 3-9** presents the RPZ dimensions for the runways at TOL by runway end.

TABLE 3-9 RUNWAY PROTECTION ZONES

Runway	Runway End 7	Runway End 25	Runway End 16	Runway End 34
TOL Runway Reference Code	D-IV	D-IV	B-II	B-II
TOL Visibility Minimum	1/2 Mile	1/2 Mile	1 Mile	1 Mile
Approach RPZ				
Standard Length	2,500	2,500	1000'	1000'
Standard Inner Width	1,000'	1,000'	500'	500'
Standard Outer Width	1,750'	1,750'	700'	700'
Departure RPZ				
Standard Length	1,700'	1,700'	1000'	1,000'
Standard Inner Width	500'	500'	500'	500'
Standard Outer Width	1,010'	1,010'	700'	700'

Source: RS&H Analysis, 2022; FAA Advisory Circular 150/5300-13B Airport Design

According to the FAA Advisory Circular 150/5300-13B, *Airport Design*, the FAA recommends having all areas within the RPZ cleared and owned by the Airport. When this is impractical, airport owners should maintain the RPZ clear of all facilities supporting incompatible activities.

In FAA RPZ guidance, transportation facilities not limited to, but including public roads/highways were identified as examples of land uses in an RPZ that are incompatible. This guidance is to address the introduction of new or modified land uses, meaning that while the uses are defined as incompatible, mitigation is not immediately required for existing infrastructure. However, FAA does not support expansion of incompatible uses with the RPZs.

All land within the RPZs is under airport control, however three of the four RPZs overlay one or more public roadways. The Airport should continue to regularly assess overall risk presented by the roads and maintain communication with the FAA Regional Office and Airports District Office (ADO). See **Figure 3-4** for a graphical representation of airport RPZs.

FIGURE 3-4 AIRPORT RPZ EVALUATION

Source: RS&H Analysis 2022

3.5.3.5 Runway Visibility Zone

The Runway Visibility Zone (RVZ), which applies to airfields with intersecting runways, is formed by imaginary lines connecting two physically intersecting runway's line of sight (LOS) points.[6] It helps prevent potential hazards and/or collisions by enhancing situational awareness for pilots and ground operation vehicles. As shown in **Figure 3-5**, there are portions of the cargo ramp and OANG ramp that are within the RVZ at TOL, as well as the ASOS. Structures as well as aircraft that are parked in these areas can create a potential LOS conflict. In addition, a large group of trees between Runway 7 and Runway 34 are also within the RVZ. Since TOL has a 24-hour ATCT, a clear RVZ is not a requirement, but is recommended as a supplemental safety measure. The TLCPA intends to continue clearing efforts and coordination with other airport tenants to maintain a clear RVZ to the best of their ability. In the event of Runway 7-25 extension, further analysis would need to be conducted to identify potential obstacles within the RVZ.

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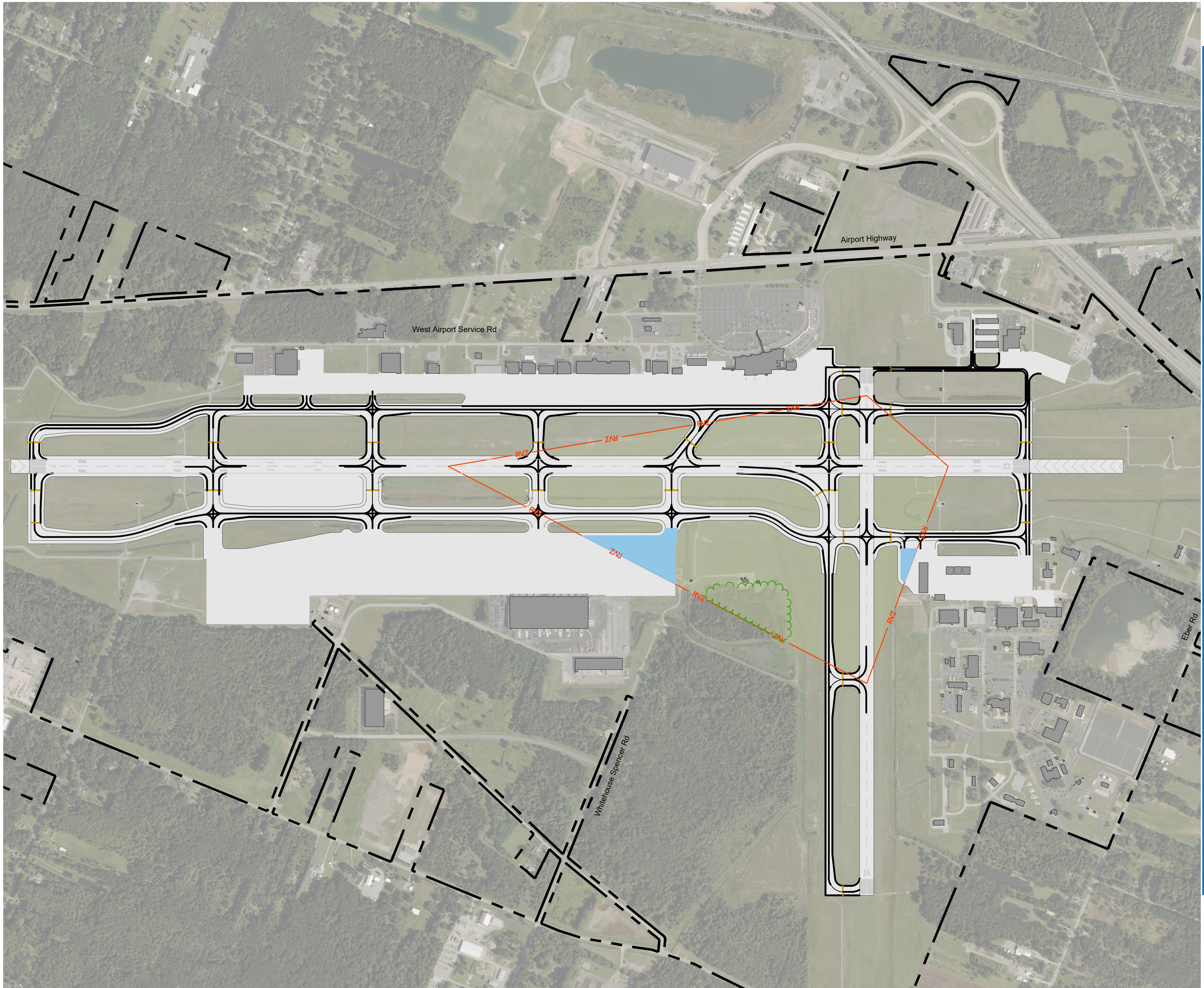
[6] AC 150/5300-13B Section 3.8.2

Runway Visibility Zone Conflicts



3.5.3.6 Runway Geometric and Separation Standards

The existing runway geometric and separation distances have been analyzed against current FAA dimensional standards for each runway. Compliance with geometric and separation standards ensures a safe airfield environment. Nonstandard conditions should be mitigated to the fullest extent possible before requesting modification to standards.

Table 3-10 compares FAA airport design standards to existing conditions for Runways 7-25 and 16-34. There are no known object or grading issues within the safety areas and runway separations meet FAA standards.

TABLE 3-10 RUNWAY DESIGN STANDARDS

Airfield Components	D-IV Standard	Existing Condition	Existing/Future Condition Met (✓)	B-II Standard	Existing Condition	Existing/Future Condition Met (✓)
Runway Separation						
Runway Centeline to:						
Holding Position *	256'	256'-260'	✓	206'	256'-259'	✓
Parallel Taxiway/Taxilane Centerline	400'	400'-600'	✓	240'	400'	✓
Aircraft Parking Area	400'	+400'	✓	250'	+250'	✓
Helicopter Parking	400'	+400'	✓	250'	-	✓
Safety Areas						
Runway Safety Area (RSA)						
Length Beyond Departure End	1,000'	1,000'	✓	300'	1,000'	✓
Length Prior to Threshold	600'	600'	✓	300'	600'	✓
Width	500'	500'	✓	150'	500'	✓
Runway Object Free Area (ROFA)						
Length Beyond Runway End	1,000'	1,000'	✓	300'	1,000'	✓
Length Prior to Threshold	600'	600'	✓	300'	600'	✓
Width	800'	800'	✓	500'	800'	✓
Runway Obstacle Free Zone (ROFZ)						
Length	200'	200'	✓	200'	200'	✓
Width	400'	400'	✓	250'	400'	✓
Precision Obstacle Free Zone (POFZ)						
Length	200'	200'	✓	N/A	N/A	N/A
Width	800'	800'	✓	N/A	N/A	N/A

Note: * One foot is added for every 100' above sea level. TOL is over 600' above sea level so 6' is added.

3.5.3.7 Runway Pavement Strength

Pavement strength is an important criterion in determining the usability of the runways. Both Runway 7-25 and Runway 16-34 have bearing capacities designed for aircraft weighing between 12,500 to 300,000 pounds depending on gear configuration. As shown in **Table 3-11**, certain current and future critical aircraft (in particular, the Boeing 767-300ER, a future critical aircraft) exceed the existing bearing capacity of Runway 7-25; however, these aircraft do not operate out of TOL in a high frequency. If operations of the 767-300ER or similar aircraft continue to operate near the same recorded frequency as they do today, the existing pavement bearing capacity would be adequate to accommodate these operations without accelerated deterioration anticipated. However, if operations were to increase for these aircraft exceeding the runway bearing capacity, the pavement condition would require close monitoring as accelerated deterioration will be expected.

According to the FAA's Airport Improvement Program (AIP) Handbook (Order 5100.38D), varying scopes of pavement restoration are expected to perform for similarly varying time periods or useful life. Pavement construction/reconstruction is expected to last at least 20 years, pavement rehabilitation a minimum of 10 years, and maintenance repair project such as seal coating and crack sealing are expected to achieve at least 3 years of use prior to a subsequent repair project. The last rehabilitation project was performed on Runway 7-25 in 2013 and on Runway 16-34 in 2011 with the useful life for projects having been achieved at the time of this writing. Analysis of the existing pavement condition of both runways is expected to prompt a repair project in the near-term, PAL 1 time period. In the event increased operational frequency of aircraft exceeding the bearing capacity of the existing runway pavement is expected to occur, an engineering analysis would need to be performed to properly gauge the repair method necessary to support these and forecasted operations.

It is also important to note that the OANG operates military aircraft that, while not based at TOL, do operate there under infrequent exercises (such as the KC-135 and C-130). These aircraft greatly exceed the existing pavement bearing capacity. Given the OANG aircraft operations are more demanding, they will produce advanced deterioration of the pavement than the civilian fleet mix. While FAA funding covers pavement rehabilitation for civilian activity, it does not cover funding for military activity as that is separately funded by the Department of Defense. As a result, coordination between the Airport and OANG is critical and regularly updating the Airport's Pavement Management Program (PMP) as described in FAA AC 150/5380-7B.

TABLE 3-11 TYPICAL AIRCRAFT MAXIMUM TAKE-OFF WEIGHTS

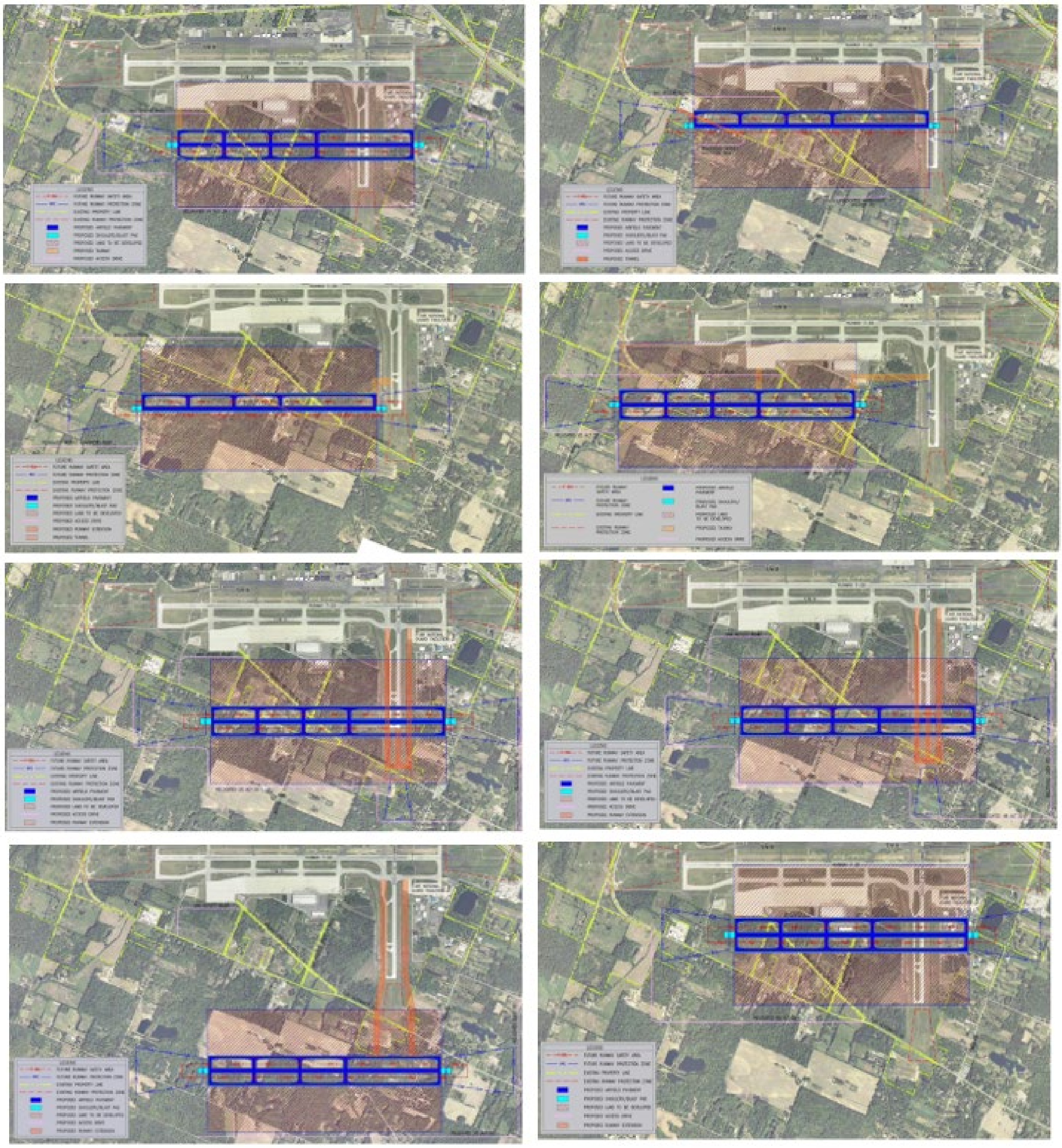
Aircraft	Aircraft Size (Passengers)	ARC	Gear Type	Maximum Takeoff Weight	Runway 7-25 (✓)	Runway 16-34 (✓)
General Aviation Aircraft						
Light/Small Business Jet	4-6 Passengers	B-I to B-II	Single - Wheel	8,000 to 20,000 lbs.	✓	✓
Medium Business Jet	6 to 10 Passengers	B-II to C-II	Dual-Wheel	20,000 to 50,000 lbs	✓	✓
Large Business Jet	10 to 16 Passengers	C-II to D-III	Dual-Wheel	45,000 to 95,000 lbs.	✓	✓
Air Carrier/Air Taxi Aircraft						
Turboprop	19-40 Passengers	B-II to A-III	Dual-Wheel	26,000 to 65,000 lbs.	✓	✓
Regional Jet	50 to 90 Passengers	C-II	Dual-Wheel	53,000 to 85,000 lbs.	✓	✓
Airbus 319/320	up to 180 Passengers	C-III	Dual-Wheel	up to 172,000 lbs.	✓	✓
Boeing 747-400	up to 524 Passengers	D-V	Dual-Tandem Wheel	up to 900,000 lbs.	X	X
Military						
KC-135 Stratotanker	up to 83,000 lbs cargo	C-IV	Dual-Tandem Wheel	up to 322,500 lbs.	X	X
F- 16	Fighter Jet	D-I	Single-Wheel	up to 37,500 lbs.	✓	✓
Runway 7-25 Current/Future Critical Aircraft						
Boeing 737-800 (C)	up to 162 Passengers	D-III	Dual-Wheel	up to 174,200 lbs.	X	X
Boeing 767 - 300ER (F)	up to 350 Passengers	D-IV	Dual-Tandem Wheel	up to 412,000 lbs.	X	X
Runway 16-34 Current/Future Critical Aircraft						
Cessna 172 Skyhawk (C)	up to 4 passengers	A-I	Single - Wheel	up to 2,550 lbs	✓	✓
Beechcraft Super King Air (F)	up to 8 passengers	B-II	Single - Wheel	up to 12,500 lbs	✓	✓

Source: FAA Aircraft Characteristics Database 2018, RS&H Analysis 2022

3.5.3.8 Third Runway Analysis

As part of the Airport's previous Master Plan completed in 2008, alternatives were considered for a potential third runway be added to the runway system (see **Figure 3-6**). The driving force for this evaluation was attributed to a peak in air traffic by air cargo operations from BAX Global, which averaged approximately 20 flights per night out of TOL. With BAX Global no longer operating at TOL and the current cargo operator (Amazon Air) only operating 2 flights a day, an airfield capacity analysis, further detailed in **Section 3.4**, was conducted with a forecasted annual demand reaching only 19% of ASV through PAL 3. While an increase in cargo activity is anticipated with further development of the former BAX Global campus, the capacity is still not anticipated to catalyze a third runway. Given the lack of justification based on capacity or safety, it is unlikely the FAA would consider funding a third runway. Furthermore, aside from impacts to the surrounding community, this space can best be utilized to allow for additional expansion of the future cargo and industrial campus, in both aeronautical and non-aeronautical uses. Based on the capacity analysis and forecast, and the runway length analysis in **Section 3.5.3.2**, this Master Plan will not protect for a third runway and will recommend new land uses for this area.

FIGURE 3-6 THIRD RUNWAY ALTERNATIVES



Source: RS&H Analysis 2008

3.5.4 Taxiway Requirements

The taxiway analysis addresses specific requirements relative to the ability of the existing taxiways to accommodate the current and projected demand. At a minimum, taxiways must provide efficient circulation and must have the proper strength and meet recommended FAA design standards to safely accommodate the design aircraft. Airport runways should be supported by a system of taxiways that provides an access interface between the runways and the aircraft parking and hangar areas.

Taxiways are classified as either:

- **Parallel** – these taxiways facilitate the movement of aircraft to and from the runway.
- **Apron Taxiways or Connector**– these taxiways provide primary aircraft access in an aircraft parking apron.
- **Apron Taxilanes** – these taxilanes provide access to individual aircraft parking positions and/or hangar areas.
- **Exits** – these taxiways provide a means of entering and exiting the runway (does not include those taxiways designated as connector, parallel, or apron edge taxiway).

The major taxiways in TOL's taxiway system are defined in **Table 3-12**.

TABLE 3-12 AIRPORT TAXIWAYS

Taxiway Designator	Width	Type
A	40'	Hangar access to RWY 16 and TWY B, TWY N
B	75'	Parallel for RWY 7-25
D	75'	Parallel for RWY 7-25
N	75'	Parallel for RWY 16-34

Source: Airport Data Collection, Prepared by RS&H, 2022

The goal of an effective taxiway system is to maintain traffic flow using taxi routing with a minimum number of points requiring a change in the airplane's taxiing speed. At TOL, there are a total of 19 taxiways, including taxiway connectors. Taxiway A serves as access from GA hangars to Runway 16 and Taxiways B and N. Taxiway B serves as a parallel taxiway for Runway 7-25 and has six exit taxiways from Runway 7-25 to the north ramp area that services GA and Commercial traffic. Taxiway D is also a parallel taxiway to Runway 7-25 and has six exit taxiways to the south, serving the cargo ramp and the OANG ramp. Taxiway N serves as a parallel taxiway for Runway 16-34 and has three exit taxiways from Runway 16-34. See **Figure 3-2** for TOL taxiway layout. It is important to note that at the eastern GA/FBO ramp, Taxiway A transitions between movement and non-movement areas of the apron. While this is not an explicit deficiency, this is not considered preferential by the FAA.

The Airport's design aircraft determines taxiway design standards and dimensional criteria. Taxiway pavement width is determined by the Taxiway Design Group (TDG) of the design aircraft. Separation standards are determined by the ADG of the design aircraft. Depending on the demand, portions of the airfield may be designed for one aircraft type and other portions for a different aircraft type.

To accommodate the Airport's design aircraft, it is recommended that taxiways serving Runway 7-25 be designed and built to ADG IV/TDG 5 standards; whereas taxiways associated with Runway 16-34 be set to ADG II/TDG2 standards.

The existing taxiways and associated connectors were compared to the design standards set forth in Advisory Circular 150/5300-13B, *Airport Design*, to identify deficiencies. Based on the two different design aircraft identified for TOL, portions of the airfield should be designed differently. These divisions of airfield design are dependent upon the role each facility plays at the Airport. The intent behind this FAA guidance is to avoid over-design and under-design of airport facilities. The FAA recommended design standards for ADG IV/TDG 5 and ADG II/TDG 2 taxiways are provided in **Table 3-13**.

TABLE 3-13 TAXIWAY DESIGN STANDARDS

Taxiway Components	Taxiway Width	Taxiway Shoulder Width	Taxiway Object Free Area Width	Taxiway Safety Area Width	Centerline to Parallel Taxiway	Taxiway Centerline to Fixed or Moveable Object	Taxiway Fillet Design
ADG IV (TDG 5) Standard	**75'**	**30'**	**243'**	**171'**	**207'**	**112'**	**(1)**
TWY B	✓	25'-30'	✓	✓	✓	✓	X
TWY D	✓	✓	✓	✓	N/A	✓	X
ADG II (TDG 2) Standard	**35'**	**15'**	**124'**	**79'**	**101.5'**	**55'**	
TWY A	✓	X	✓	✓	✓	✓	X
TWY N (2)	✓	X	✓	✓	N/A	✓	X

(1) See FAA Advisory Circular 150/5300-13B Appendix J for fillet design dimensions
(2) Taxiway N has shoulders between Runway 7-25 and Taxiway D

Taxiway N serves Runway 16-34 that has a future design aircraft of B-II/TDG 2. Prior to this identification, Taxiway N was designed and constructed to accommodate D-IV/TDG 5 aircraft and therefore currently exceeds minimum requirements for TDG 2. Future rehabilitation and/or reconstruction projects for Taxiway N will only be eligible for federal funding up to TDG 2 standards.

3.5.4.1 Taxiway Deficiencies

Analysis of the taxiways was conducted to determine if airfield deficiencies existed compared to current FAA design standards in Advisory Circular 150/5300-13B. Identified deficiencies are explained below and shown in **Figure 3-7**.

3.5.4.1.1 Taxiway Shoulders

FAA design standards require that all taxiways that serve ADG IV/TDG 5 aircraft should have paved shoulders, and taxiways that serve ADG II/TDG 2 should have stabilized shoulders. Stabilized shoulders can either consist of turf or made from stabilizing soil treatments per standards in Advisory Circular 150/5370-10.[7] Taxiway A does not have any shoulders and Taxiway N has shoulders between Runway 7-25 and Taxiway D, which is a portion used by larger aircraft. In addition, Taxiway B and its associated connectors do not consistently meet FAA standards. See **Table 3-14** below that identifies Taxiway B shoulder deficiencies.

[7] Advisory Circular 150/5300-13B Airport Design

TABLE 3-14 TAXIWAY B SHOULDER STANDARDS

Taxiway Component	Taxiway Shoulder Width	Meets Standard (✓)
ADG IV (TDG 5) Standard	**30'**	
TWY B (EAST OF RWY 16-34)	30'	✓
TWY B B/W RWY 16-34 AND TWY N	25' NORTH/30' SOUTH	X
TWY B (WEST OF TWY N)	30'	✓
TWY B1 (NORTH OF TWY B)	NONE	X
TWY B1 (SOUTH OF TWY B)	25' WEST/ 30' EAST	X
TWY B6	25' WEST/22'EAST	X
TWY B9	NONE	X
TWY B11	NONE	X
TWY B13	NONE	X
TWY B14	25'	X

Source: RS&H analysis, 2023

3.5.4.1.2 Direct Access

Taxiways that provide direct access from the apron to the runway can increase the risk of a runway incursion occurring due to the loss of situational awareness for pilots and vehicle operators. Per FAA design standards it is recommended that either the apron or runway entrance should be offset so pilots must make a series of turns before entering the runway from the apron. Taxiways B1, B6, B9, B11, D1, D6, D9, D11, D13, and N3 all provide direct access from the apron.

3.5.4.1.3 Middle Third Runway Crossing

FAA design standards suggests Runway crossings should be kept to the outer thirds of a runway, as the middle third is considered a "high energy" zone where pilots can least maneuver to avoid a collision. Taxiways B6, D6, B9, D9, B11, and D11 are crossing Runway 7-25 within the middle third of the runway.

3.5.4.1.4 Taxiway Fillet Geometry

In 2012, the FAA revised the criteria for taxiway design dimensions and appropriate pavement fillet design. The previous standard used the ADG, which is based on the aircraft wingspan and tail height, to determine appropriate taxiway dimensions and fillet design. Current standards now require the taxiway dimensions be designed to meet newly established TDGs, which are based upon the undercarriage dimensions, specifically the Main Gear Width (MGW) and the Cockpit to Main Gear (CMG) dimensions. As taxiway fillet geometry was revised in 2012, the fillet geometry for taxiways which have not been reconstructed since are not to current standards. These design issues should be evaluated and addressed as practical over time as pavement surface maintenance is performed.

3.5.4.1.5 Non-Standard Angle

Taxiway B6 is a non-standard acute angle taxiway. AC 150/5300-13B recommends runway/taxiway intersections be designed at right-angles unless a high-speed exit is necessary due to capacity. High-speed exits are designed to assist aircraft exit a runway more efficiently to allow for more operations on the runway.

Right-Angle taxiways provide the best visual perspective to a pilot approaching an intersection and optimum orientation of the runway holding position signs[8]. As described in Section 3.4 Airfield Capacity, the number of operations in and out of TOL does not necessitate a high-speed exit.

3.5.4.1.6 Drainage

There is concrete riprap within the TOFA at Taxiways D6, D9, D11, and D13.

In summary, most of the items identified are not deficiencies requiring immediate action due to any critical safety risk. Rather, many are the result of FAA design guidance updates occurring after the development of certain areas of the airfield. The following chapter, **Identification and Evaluation of Alternatives**, will address the design recommendations for future airfield projects. The above-listed deficiencies are shown graphically in **Figure 3-7**.

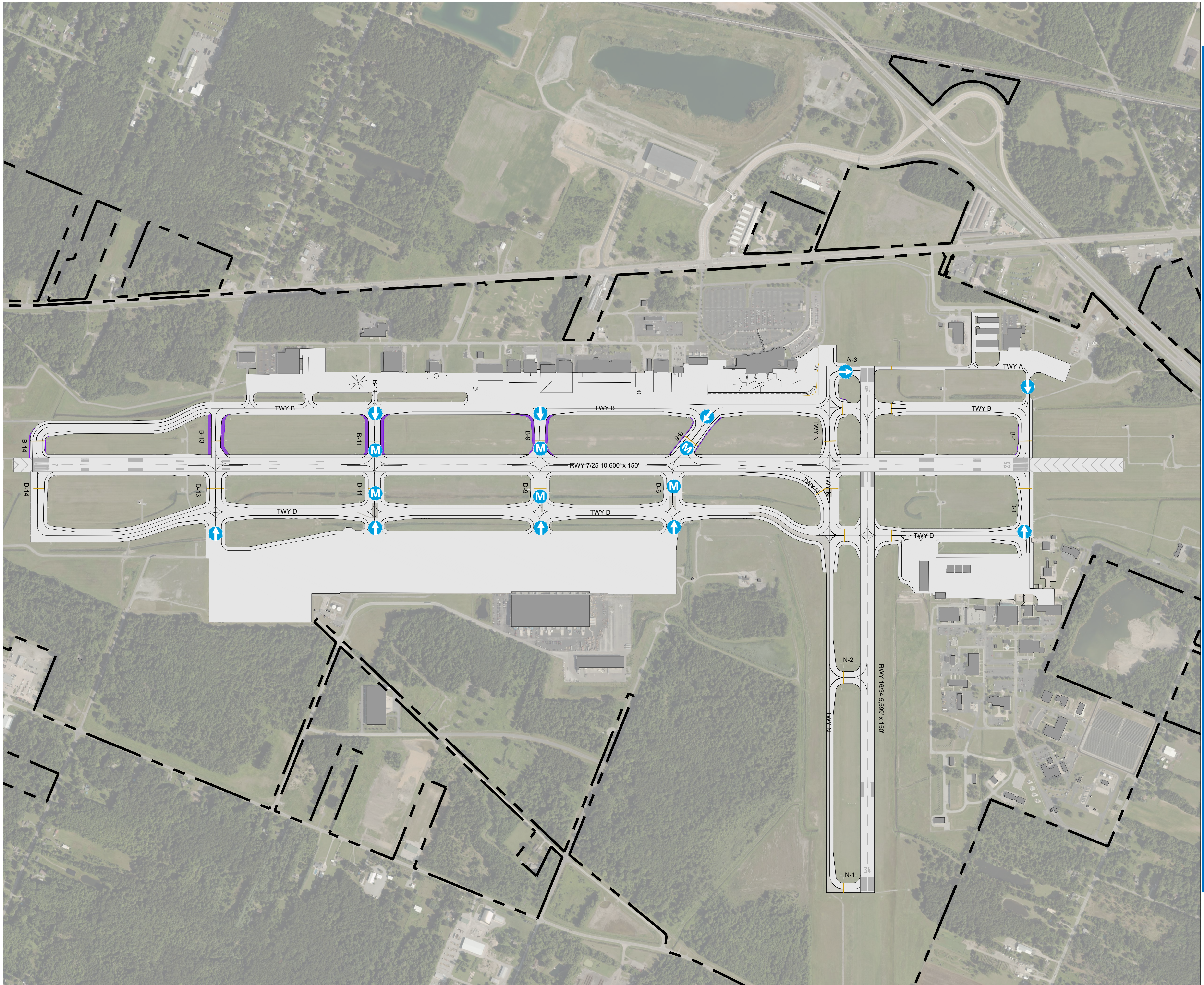
3.1 NAVIGATIONAL AIDS, LIGHTING AND AIRSPACE REQUIREMENTS

Navigational aids, often referred to as NAVAIDS, and airfield lighting consist of equipment to help pilots locate the Airport. NAVAIDS can provide information to pilots about the aircraft's horizontal alignment, height above the ground, location of airport facilities, and the aircraft's position on the airfield. TOL features all three types of navigational aids (visual, electronic, and meteorological). The following narrative describes the three types of NAVAIDS as well as any deficiencies that currently exist at TOL.

3.1.1 Visual and Electronic Aids

Visual aids at TOL include those specific to each runway and those that serve the entire airport. Electronic aids include devices and equipment used for aircraft instrument approaches. The Ohio Air National Guard (OANG) operations require a unique location and landing assist equipment that is proprietary to and maintained by the OANG. Runway 7-25 is the only runway at TOL that supports this equipment, and this is the only runway that can accommodate military operations. Visual and electronic aids at TOL are listed in **Table 3-15**.

[8] AC 150/5300-13B Airport Design



Taxiway Deficiencies

Design

Direct runway access

Middle third crossing

Shoulders to be added

Deficiencies not depicted

1. Fillet geometry
   -All taxiway fillet designs deficient per AC 150/5300 13B

2. Concrete Riprap in the TOFA
   -D11, D13

3. Taxiway B-6 is a non-standard angle

TABLE 3-15 VISUAL AND ELECTRONIC NAVIGATIONAL AIDS

NAVAID	Primary Runway 7	Primary Runway 25	Crosswind Runway 16	Crosswind Runway 34	Adequate (✓) Deficient (X)
Visual Aids					
Approach Lighting	ALSF-2	MALSR	REIL	REIL	✓
Lighting System	HIRL	MIRL	MIRL	MIRL	✓
Runway Markings	Precision	Precision	Non Precision	Non-Precision	✓
Runway Windcone	Yes	Yes	Yes	No	✓
Touchdown Zone Lightin	Yes	No	No	No	✓
Visual Slope Indicator	No	PAPI (P4L)	PAPI (P4L)	PAPI(P4L)	✓
Rotating Beacon*	Yes				✓
Segmented Circle*	No				✓
Electronic Aids					
Glideslope	Yes	Yes	No	No	✓
LOC	Yes	Yes	No	No	✓
DME	No	Yes	No	No	✓
RNAV (GPS)	Yes	Yes	Yes	Yes	✓
VOR	Yes	Yes	Yes	Yes	✓
Military Aids					
TACAN	Yes	Yes	No	No	N/A
BAK -12	Yes	Yes	No	No	N/A

Source: FAA Chart Supplements, FAA 5010 Form, RS&H Analysis, 2022

Note * is used by all runways

Abbreviations: PAPI =Precision Approach path Indicator; P4L=PAPI 4 Light;
MALSR=Medium Approach Light System with Runway Alignment Indicator Lights
HIRL=High Intensity Runway Lights; MIRL=Medium Intensity Runway Lights;
REIL=Runway End Identifier Lights

In addition to the above noted, there is also a compass rose marking on the western side of the GA apron, and an additional one planned for the MRO apron on the far east general aviation ramp. Analysis of the existing navigational aids at TOL found the following discrepancies.

- Runway 7 is without a Visual Slope Indicator. A Precision Approach Path Indicator (PAPI) is not required but is recommended for Runway 7 as a safety enhancement.
- Runway 34 does not have a wind cone. A wind cone provides surface wind direction for pilots. For each runway available for air carrier use, a supplemental wind cone must be installed at the end of the runway or at least at one point visible to the pilot while on final approach and prior to takeoff.[9] Runway 34 is not used by air carriers therefore a wind cone is not required but is recommended.

[9] eCFR :: 14 CFR 139.323 -- Traffic and wind direction indicators. (FAR 139.323)

- The wind cone(s) feature no segmented circle. A segmented circle assists pilots in locating an airport and provides a centralized location for other indicators such as wind direction or traffic pattern. According to 14 CFR Part 139.323 *Traffic and Wind Direction Indicators*, a segmented circle is required at an airport with a right-hand traffic pattern that has either no operational air traffic control tower (ATCT) or one that closes for a period of time. Since the ATCT at TOL is operated 24/7, a segmented circle is not required, but is recommended.
- No Touchdown Zone Lights (TDZL) on Runway 25. TDLZ systems are normally installed on precision approach runways to indicate the touchdown zone when landing. It is recommended that a TDLZ system be installed on Runway 25 to support the precision instrument approach.
- No Distance Measuring Equipment (DME) on Runway 7. Pilots utilizing the ILS on Runway 7 currently rely on the Locater Outer Marker (LOM) which helps pilots establish distance along an established route. The LOM is not monitored at TOL therefore a DME is recommended for Runway 7.

All of the existing runways at TOL have appropriate required navigational aids that are properly sited and in working condition, with the exception of the above-listed recommendations.

Both ends of Runway 7-25 have an instrument landing system (ILS) that utilize a glide slope, localizer, and approach lighting system. Both systems meet Category I (CAT I) landing requirements, which require ceilings above 200 feet and visibility greater than ½ statute mile. The current cargo operator at TOL, Amazon, has indicated a desire for the development and installation of CAT II or CAT III ILS to achieve lower approach minimums for Runway 7-25. The evaluation of a CAT II. SA CATII, or CAT III ILS has been conducted separately, but in parallel to this Master Plan update. Detailed results of this study can be found in the **Approach Upgrades Feasibility Study** report. The study indicated upgrades are feasible with the current equipment at TOL to ultimately enable lower operating minimums at the airport. These facility upgrades will be evaluated as part of the Alternatives Chapter.

3.1.2 Meteorological Aids

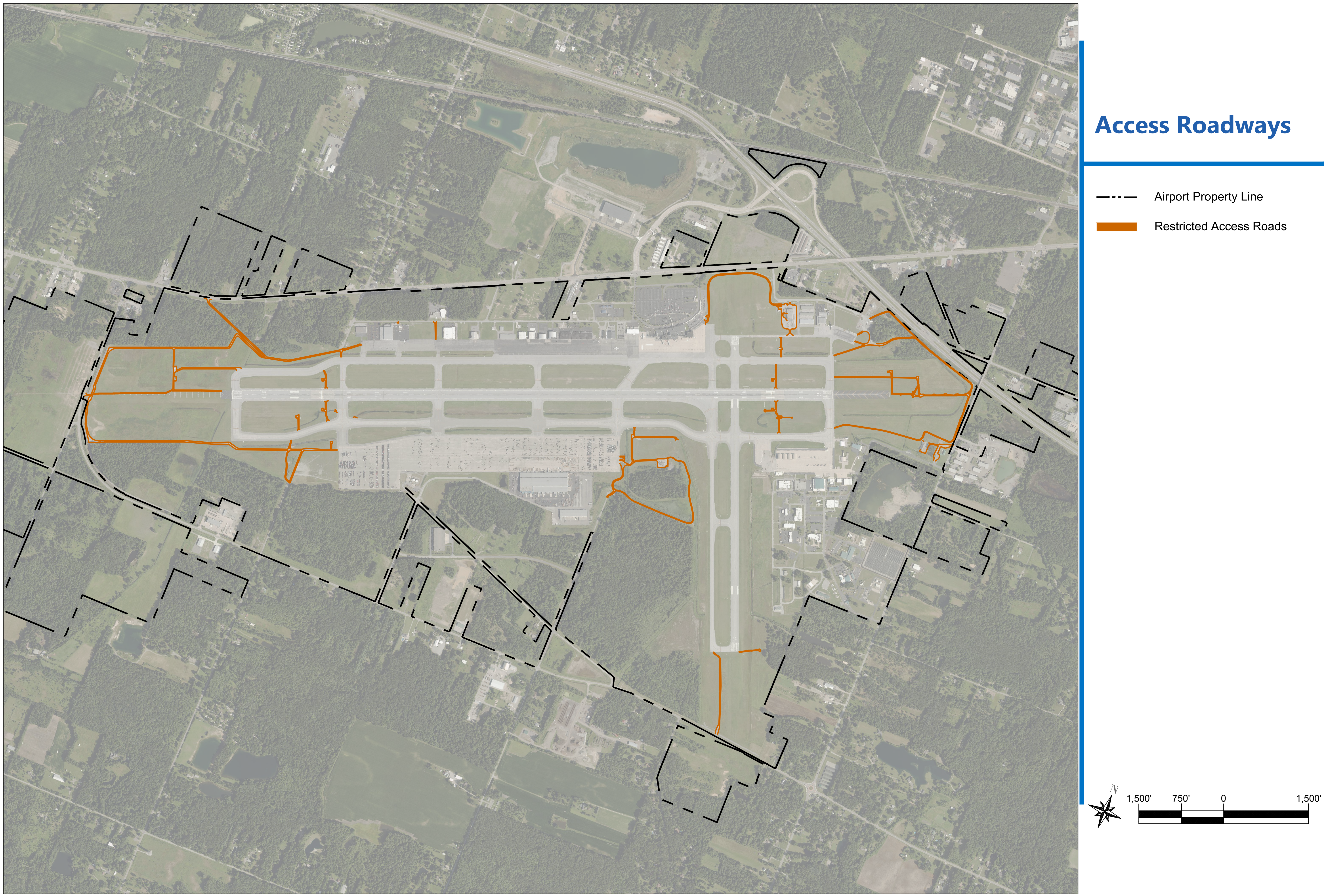
Meteorological aids consist of equipment that reports weather conditions to users and tenants at an airport. TOL has an Automated Surface Observing System (ASOS) which provides real time weather conditions to air traffic control personnel and pilots. Analysis of the existing equipment and the needs of the airport indicate that there are no deficiencies and that all meteorological aids are adequate through the planning period.

3.1.3 Airspace

The NAS consists of various classifications of airspace that are regulated by the FAA. Airspace classification is necessary to ensure the safety of all aircraft utilizing the facilities especially during periods of inclement weather and above populated areas. The airspace immediately surrounding TOL is Class C; the inner four nautical miles of Class C airspace extends from the surface up to, but not including, 4,700 feet mean sea level (MSL). The outer portion of Class C airspace extends from 2,000 feet MSL up to, but not including 4,700 feet above MSL. This airspace classification is adequate for the existing and future operational requirements expected at the Airport.

3.1.4 On-Airfield Access Road

At TOL, vehicle service road (VSR) provides restricted access for Airport operational use (refer to **Figure 3-8**). While it currently provides access to most airside facilities, much of the southeastern quadrant of the airfield, particularly the Runway 34 end, OANG base, and ARFF, are not connected. While the OANG base is a separately maintained and operated facility, it is recommended that a perimeter road provide vehicular access to all Airport-controlled facilities. Furthermore, certain segments of pavement are in poor condition, or unpaved altogether. Consequently, it is impassable to many vehicles such as Aircraft Rescue and Firefighting (ARFF) equipment, Airport Maintenance and security vehicles, and fueling trucks, requiring them to cross airside pavement to access all parts of the airfield. It is recommended that the road be fully paved throughout. Additionally, certain portions of the existing VSR impede the RSA and ROFA. If this access is not mitigated, proper procedure signage is needed in these areas.



Access Roadways
Airport Property Line
Restricted Access Roads
N
1,500'
750'
0
1,500'

3.2 COMMERCIAL PASSENGER TERMINAL FACILITY REQUIREMENTS

The commercial passenger facilities consist of the passenger terminal building, terminal gates, terminal curb front and vehicle parking. In 1955, the existing passenger terminal opened with a 137,000 SF steel construction, two-level, two-concourse terminal facility with administration offices and an air traffic control tower. It has had several expansions and renovations with the most recent occurring in 2006. With a decrease in passenger traffic and the number of airlines operating from TOL, much of the space is underutilized. In addition, much of the infrastructure and building systems are nearing the end of their lifespan. With the forecasted growth in commercial passengers along with a return of multiple commercial airlines, the issues related to the commercial passenger terminal facilities should be addressed.

As part of the TOL Airport Master Plan Update, a Terminal Area Plan was completed to analyze options for a new or renovated terminal that will serve commercial passenger operations. This section includes narrative and tabulated summaries from that plan, which describe the requirements determined for a new or renovated terminal. For detailed information, reference **Appendix C, TOL Passenger Terminal Area Plan**, which comprehensively documents the planning analyses and conclusions that resulted from that portion of the master plan study.

3.2.1 Design Activity Level

Determining the peak hour passenger demand is the traditional method for comparing terminal facility capacity with current and forecast demand. This is done by calculating the amount of enplaning and deplaning passengers processed through the terminal during the busiest hour of the average busy day of the year's peak month. Peak hour demand helps identify terminal facility accommodations needed to provide the optimal level of service for passengers.

The Master Plan forecast establishes four passenger enplanement forecast scenarios: Low, Base Case, Medium, and High scenarios with a base year of 2021 and a horizon year of 2041. To determine the necessary future passenger terminal needs, only the base case and high forecast scenarios were evaluated for the 2026 and 2041 analysis years. The 2041 horizon year was analyzed to project terminal needs out for the full range of the passenger forecast. The 2026 horizon year corresponds to the forecast assumption that legacy airline activity would return to TOL by 2026. **Table 3-16** describes each activity level and the aircraft associated with the peak hour passenger demand.

TABLE 3-16 DESIGN ACTIVITY LEVEL SUMMARY

Scenario	Aircraft Type	Passenger Seats	Peak Enplaning Passengers	Peak Deplaning Passengers
Base 2026	Airbus A320	186	140	160
High 2026	Airbus A320 Embraer 175 Mitsubishi CRJ-900	186 76 76	210	220
Base 2041	Airbus A320	186	140	160
High 2041	Airbus A320neo Boeing 737 MAX 8 Mitsubishi CRJ-900	182 189 76	290	390

Source: RS&H Analysis, 2022

3.2.2 Terminal Area Programming Requirements

Industry guidelines were used to assess the existing capacity and future requirements for different functional areas in the terminal corresponding with proposed annual enplanement growth in the planning periods. To simplify each analysis, the terminal building was broken down into functional areas that delineate types of space by use. For the planning period, the projected enplanement/deplanement levels were used to determine the space required to accommodate operations.

The terminal building programmatic requirements were calculated based upon airport terminal planning best practices and recommended methodologies which can be credited to the following industry resources.

- Airport Passenger Terminal Planning and Design – Airport Cooperative Research Program Report 25, 2010, Volumes 1 and 2
- IATA Airport Development Reference Manual, 11th Edition, 2019
- Checkpoint Design Guide, Revision 6.1, Transportation Security Administration (TSA), 2016
- TSA Planning Guidelines and Design Standards for Checked Baggage Inspection Systems, Version 4.1, 2011
- Federal Aviation Administration (FAA) Advisory Circular, AC No: 150/5360-13A, Planning and Design Guidelines for Airport Terminal Facilities, July 2018
- Federal Aviation Administration (FAA) Advisory Circular, AC No: 150/5360-14A, Access to Airports by Individuals with Disabilities, 2017
- Ailevon Pacific – Toledo Express Airport Master Plan Forecast, Draft, April 2022

The programmatic requirements for this terminal building were determined based on the peak activity identified in the scenario analysis combined with planning parameters tailored to meet a desired level of service. Level of service (LOS) is a qualitative and quantitative measure of passenger flows, level of delay, and level of passenger comfort. Two reputable industry resources have researched and developed rating systems that discuss methodologies and recommendations for determining LOS. These organizations are the International Air Transportation Association (IATA) and the Airport Cooperative Research Program (ACRP).

To determine the size and area volumes for a passenger terminal that will adequately support airline operations at TOL, the 2026 and 2041 base and high scenarios were used. These scenarios were chosen to develop a range of sizing that, on the lower end, accommodates near-term single-gate ULCC flight operations and on the upper end, provides enough space to serve forecasted future demand levels with multiple overlapping flights. The terminal sizing is based upon the standards required to provide an optimum level of service to passengers and includes correctly sized processing functions.

Table 3-17 outlines the terminal size requirement for each scenario broken out by space. These spaces include:

- **Airline Space:** The areas of the terminal used for ticketing/check-in, active and queuing spaces, as well as airline ticketing offices.
- **Airport Space:** The terminal areas used by the airport administration for offices, storage, and operations functions.
- **Baggage Service:** The areas of the terminal used to handle inbound and outbound baggage, including facilities necessary to perform baggage sorting, offloading, and retrieval.
- **Building Systems**: The areas of the terminal are reserved for mechanical, electrical, telecom, and other services that provide the utilities to operate the terminal.
- **Concessions:** The areas of the terminal that are leasable to third-party vendors, including food and beverage, retail, and banks/ATMs.
- **Ground Transportation:** The areas of the terminal used for car rental, taxi, bus, and ride-sharing counter space, queuing, and offices.
- **Holdrooms:** The areas of the terminal where passengers wait to board an aircraft, including airline customer service counters, boarding queues, and other amenities.
- **Public Space:** The areas of the terminal used by the public for circulation and associated functions, including waiting areas for meeters/greeters, restrooms, and baggage claim retrieval.
- **Transportation Security Administration (TSA):** The areas of the terminal operated by the TSA, including the security screening checkpoint (SSCP), offices, and baggage screening rooms.

This analysis determined that a total of approximately 58,900 sq ft is needed to accommodate the base 2026 and 80,800 sf ft would be sufficient to accommodate the high 2041 forecast. Evaluation of building new or renovating the existing terminal will be discussed in the Alternatives Chapter of this Master Plan.

TABLE 3-17 TERMINAL SCENARIO SIZING

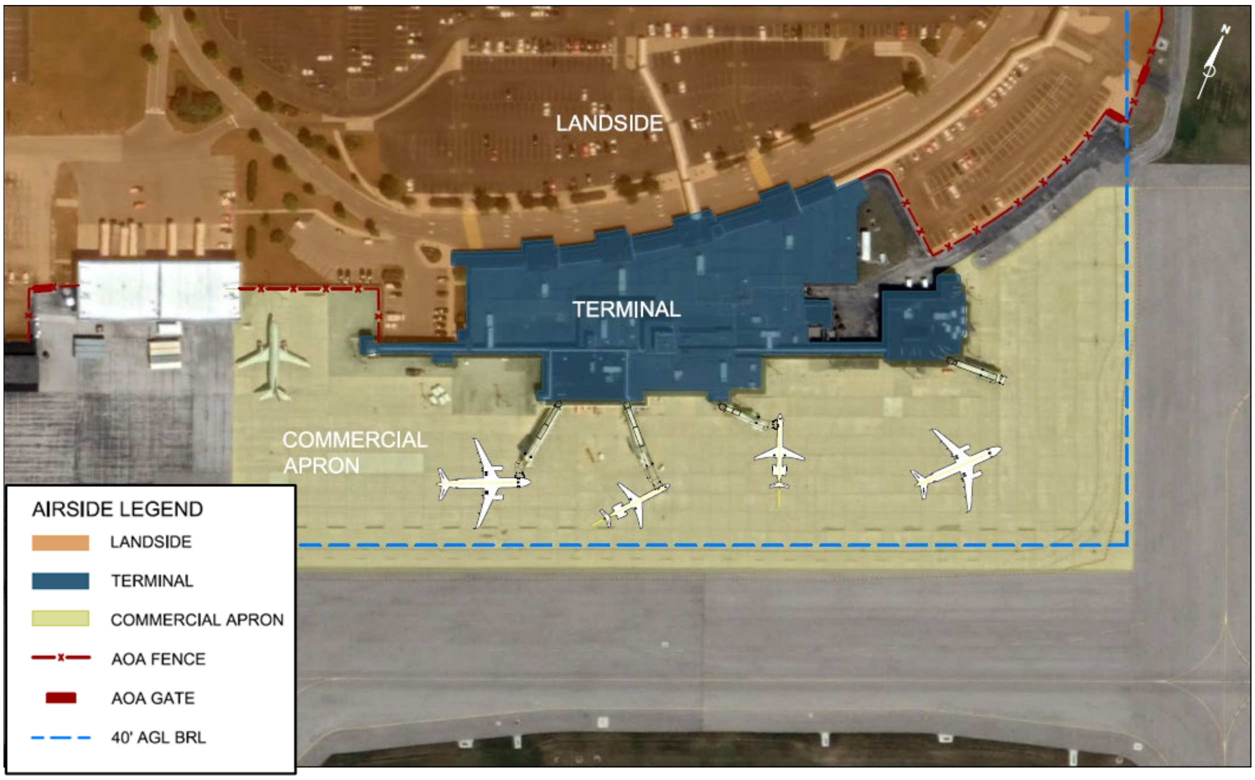
TERMINAL FACILITIES COMPONENTS	Existing		Baseline Forecast								Surplus/(Deficiency)							
	2021		Base 2026		High 2026		Base 2041		High 2041		Base 2026		High 2026		Base 2041		High 2041	
TOTAL TERMINAL PROGRAM AREA	**137,700**	**sf**	**58,900**	**sf**	**74,500**	**sf**	**67,600**	**sf**	**80,800**	**sf**	**78,900**	**sf**	**63,200**	**sf**	**70,400**	**sf**	**57,000**	**sf**
Airline Space	9,100	sf	2,000	sf	2,600	sf	2,000	sf	3,500	sf	**7,200**	**sf**	**6,500**	**sf**	**7,200**	**sf**	**5,600**	**sf**
Airport Space	26,100	sf	26,100	sf	26,100	sf	26,100	sf	26,100	sf	**0**	**sf**	**0**	**sf**	**0**	**sf**	**0**	**sf**
Baggage Service	19,900	sf	9,500	sf	14,100	sf	13,500	sf	19,400	sf	**10,400**	**sf**	**5,800**	**sf**	**6,400**	**sf**	**500**	**sf**
Building Systems	7,300	sf	2,800	sf	3,600	sf	3,200	sf	3,900	sf	**4,500**	**sf**	**3,700**	**sf**	**4,100**	**sf**	**3,400**	**sf**
Concessions	4,500	sf	1,000	sf	2,500	sf	1,400	sf	3,700	sf	**3,500**	**sf**	**2,000**	**sf**	**3,100**	**sf**	**800**	**sf**
Ground Transportation	2,700	sf	600	sf	1,500	sf	900	sf	2,300	sf	**2,100**	**sf**	**1,200**	**sf**	**1,900**	**sf**	**500**	**sf**
Holdrooms/Gates	24,400	sf	3,300	sf	10,700	sf	10,100	sf	7,200	sf	**21,100**	**sf**	**13,700**	**sf**	**14,400**	**sf**	**17,200**	**sf**
Public Space	38,600	sf	10,600	sf	9,000	sf	7,400	sf	10,200	sf	**28,000**	**sf**	**29,600**	**sf**	**31,200**	**sf**	**28,400**	**sf**
Transportation Security Administration (TSA)	5,100	sf	3,000	sf	4,400	sf	3,000	sf	4,500	sf	**2,100**	**sf**	**700**	**sf**	**2,100**	**sf**	**600**	**sf**

Source: RS&H Analysis 2022

3.2.2.1 Terminal Apron and Aircraft Gates

The analysis for total apron space began with the requirements necessary to provide four aircraft gate positions large enough for the Boeing B737-900ER and Airbus A321neo aircraft (which are all Aircraft Design Group (ADG) III aircraft). While these aircraft are not specifically in the flight schedules, it is appropriate to plan for the most significant aircraft type for the ADG. **Figure 3-9** illustrates that the airside apron is more than adequate to accommodate the planning levels discussed earlier in this section.

FIGURE 3-9 AIRCRAFT APRON AREA



Source: RS&H Analysis 2022

TOL currently has four passenger boarding bridges (PBB). However, only three are operational. Due to the non-overlapping of the commercial aircraft operations in both the Base 2026 and Low 2041 scenarios, only one PBB is immediately necessary. As legacy airlines return and the ULCC introduces additional frequency and new destinations, there will be overlapping flights which could require up to four PBBs by 2041. **Table 3-18** illustrates the forecasted demand and the number of passenger boarding gates necessary for the planning horizon.

TABLE 3-18 PASSENGER DEMAND AND PASSENGER BOARDING BRIDGES NECESSARY

ANNUAL AND PEAK-HOUR PASSENGERS	Existing 2021	Baseline Forecast			
		Base 2026	High 2026	Base 2041	High 2041
Annual Enplaned Passengers	79,300	63,100	163,300	90,100	245,800
Total Peak Hour Enplaned Passengers	120	140	210	140	290
Total Peak Hour Deplaned Passengers	160	160	220	160	390
Total Combined Peak Hour Passengers	270	280	340	280	610
Total Passenger Boarding Bridges	**4**	**1**	**3**	**1**	**4**

Source: RS&H Analysis 2022

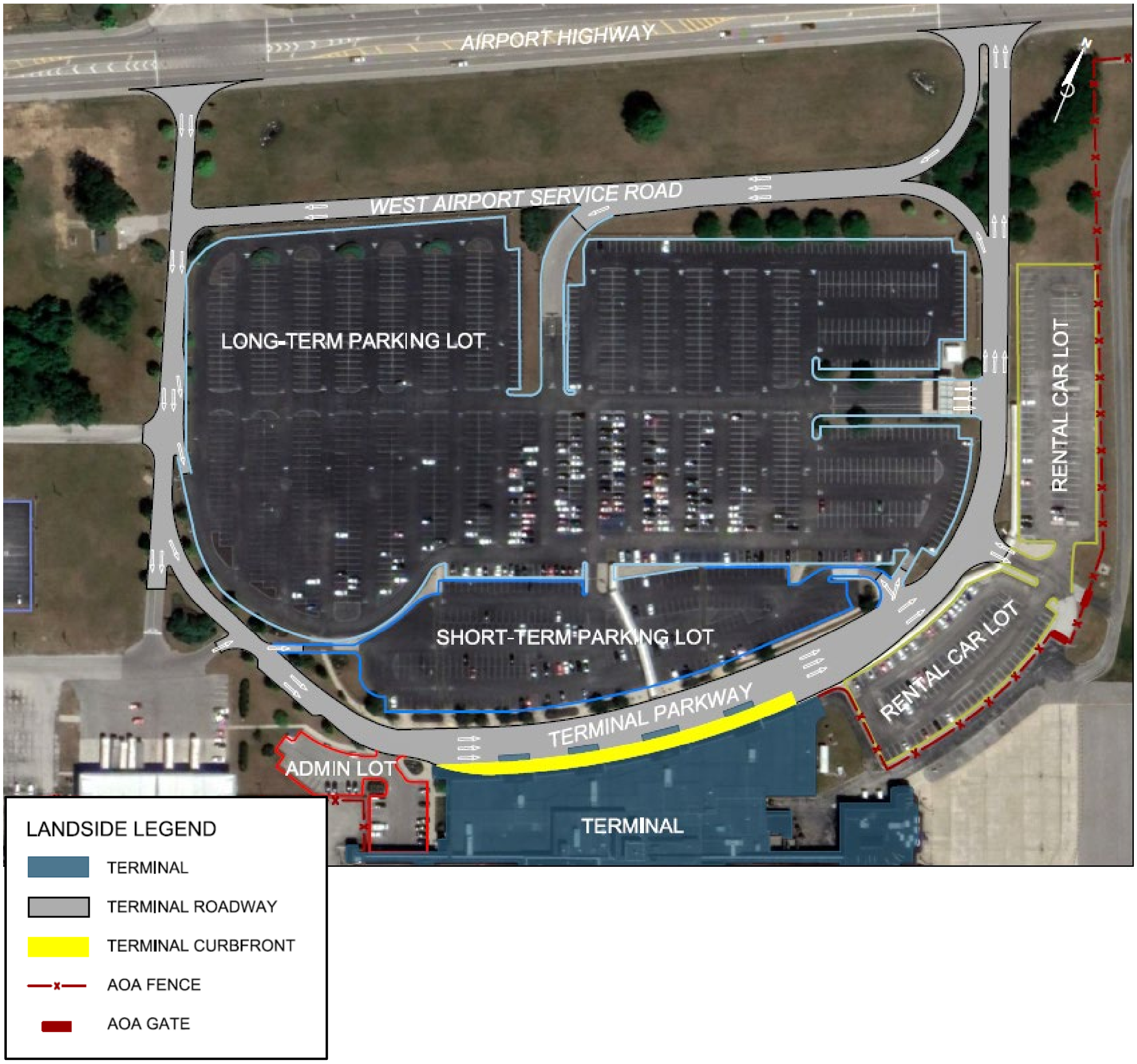
3.2.2.2 Passenger Terminal Curbfront and Vehicle Parking

Landside components of the passenger terminal include the terminal roadway loop, terminal curb, and vehicle parking areas. The sizing of the terminal curb and parking areas are based on various planning parameters and needs specific to a region's passenger characteristics. The terminal roadway must be sized appropriately to accommodate vehicle parking and the terminal curb. As illustrated in **Figure 3-9** the landside components at TOL are considered adequate for the existing and future passenger demand, and the study will continue to focus primarily on the passenger terminal facility. However, as part of the design phase, the following items should be considered:

- Consideration of raised crosswalks and ramped curbs.
- Ensure that parking and front drive are configured to allow traffic flow during an elevated threat level (300' setback).

The sizing of the terminal curb and parking areas are based on various planning parameters and needs specific to a region's passenger characteristics. The terminal curbfront is approximately 500 feet in length, deemed adequate to accommodate vehicle parking and the terminal curb. The terminal curbfront is covered by a roof, with covered walkways providing shelter between the terminal facility and parking lots opposite Terminal Parkway. As illustrated in **Figure 3-10** the landside components at TOL are considered adequate for the existing and future passenger demand. **Table 3-19** breaks down parking spaces available per lot. The current amount of parking will accommodate the demand through PAL 3. Further analysis of commercial passenger parking requirements is discussed in **Section 3.11.3**.

FIGURE 3-10 LANDSIDE FACILITIES AT TOL



Source: RS&H Analysis 2022

TABLE 3-19 VEHICLE PARKING AT TOL

Parking Lot	Total Spaces
Public Parking	
Short-Term	237
Long-Term	1,412
Private Parking	
Rental Cars	106
Administration	31
Total	**1,786**

Source: RS&H Analysis, 2022

3.3 GENERAL AVIATION FACILITIES

This section outlines the requirements during the planning period for the general aviation (GA) facilities used for aircraft parking and storage. The GA facilities evaluated in this section include aircraft hangars and apron. The analysis divides aircraft storage needs between based and transient aircraft.

3.3.1 Based Aircraft Parking and Storage

The quantity and type of hangar space is driven by many different factors including total number of based aircraft, fleet mix, local weather conditions, airport security, user preference, and other various market forces. This section outlines requirements for T-hangars, and conventional hangars. These hangar types are general terms used to describe different hangar sizes with somewhat different uses. The following outlines broad definitions for how each hangar space is programmed within the context of this Master Plan:

» T-hangars – Small hangars typically arranged so small aircraft are "nested" next to each other in alternating directions. Smaller single-engine aircraft and light multi-engine aircraft are generally stored in t-hangar units.

» Conventional hangars – Hangars larger than a T-hangar and potentially housing multiple smaller aircraft. A conventional (or box) hangar itself can range from 5,000 – 30,000 square feet. Additional space is required for apron frontage needs, landside/parking, buffers and safety area offsets, and other various site development elements.

The prepared aviation activity forecast shows a small amount of growth that will require additional storage through the planning period. Of the five aircraft types, a moderate increase in the number of jets is forecasted with a small increase in turboprops by PAL 3. At PAL 3, an additional 12 aircraft above existing 2021 levels are projected to require storage accommodation, as shown in **Table 3-20**. Aside from the quantitative aircraft storage space projected from the forecast, it is important to note that demand for hangars may materialize differently throughout the planning period. This includes not just based aircraft counts, but also types of aircraft, particularly with regard to new and emerging industry trends.

Furthermore, there has been ongoing discussion of the potential ultimate closure of Toledo Executive Airport (TDZ) within the planning period. This airport, classified as General Aviation/Regional in the 2023 NPIAS, serves a predominantly single-engine fleet mix of based aircraft. As a result, the facilities at TOL serve a large mix of multi-engine and jet-based aircraft traffic. If the closure of TDZ were to ultimately occur, much of this based aircraft activity would be relocated to TOL or other neighboring airports. While this will need further study beyond the timeframe of this Master Plan, additional ultimate based aircraft storage space should be considered for beyond the planning period and depicted on the Airport Layout Plan (ALP). It is crucial to note that studying the potential closure of this airport is still in the very early stages and the likelihood of its closure is unknown at this point.

TABLE 3-20 BASED AIRCRAFT FORECAST

Aircraft Type	Base Year (2021)	PAL 1 (2026)	PAL 2 (2031)	PAL 3 (2041)
Single Engine (Piston	25	25	25	25
Multi-Engine (Piston)	5	5	5	5
Turboprop	5	5	5	6
Jet	16	18	21	27
Helicopter	3	3	3	3
Totals	**54**	**56**	**59**	**66**

Source: RS&H Aviation Forecast, 2022

Note: 21 F-16s were removed from the based aircraft forecast total as they are assumed to be stored by the OANG

To determine the hangar requirements for the planning period at TOL, the following assumptions were made based on conversations with the airport and observations made during the inventory portion of the Master Plan:

- **Based Aircraft**
  - 100% will be stored in a hangar
  - All single engine aircraft will be stored in a T-Hangar
- **Itinerant Aircraft**
  - Single and Multi-engine – 95 percent will be parked on the apron and 5 percent will be stored in a hangar
  - Turboprop/Jet (ADG I/II/III) – 100 percent will be stored in a hangar
  - Fleet Mix - Fleet mix was determined based on FAA OPSNET data from the past 10 years. Aircraft type breakdown for TOL is as follows:
    - Single Engine – 65 percent
    - Multi Engine – 17 percent
    - Turboprop – 10 percent
    - Small Jet (ADG I/II) – 7 percent
    - Large Jet (ADG III) – 1 percent

3.3.1.1 T-Hangars

TOL currently has a total of 17 T-Hangar units, but only six are known to be in a condition to house aircraft. Based on the above assumptions, there is a need for 19 additional T-Hangar units now and throughout the planning period. See **Table 3-21.**

TABLE 3-21 T-HANGAR REQUIREMENTS

Aircraft Type	Existing Units	Hangar Demand (Units)		
		PAL 1	PAL 2	PAL 3
Single Engine	-	25	25	25
Multi Engine	-	0	0	0
Turboprop	-	0	0	0
Small Jet (ADG I/II)	-	0	0	0
Large Jet (ADG III)		0	0	0
Helicopter	-	0	0	0
Total T-Hangar Units	6	25	25	25
Surplus / (Deficit)	-	(19)	(19)	(19)

Source: RS&H Analysis, 2022

3.3.1.2 Conventional/Box Hangars

To develop the required conventional hangar space, an average hangar area square footage was calculated based on length and width of representative aircraft for ADG I/II/III. Clearance was added to each aircraft for operational safety. The average square footage was then multiplied by how many aircraft per aircraft type would be stored in a hangar which was determined by the assumptions in **Section 3.3.1**. See **Table 3-22** for conventional hangar space needed throughout the planning period.

TABLE 3-22 CONVENTIONAL HANGAR REQUIREMENTS

Aircraft Type	Existing Space	Hangar Demand		
		PAL 1	PAL 2	PAL 3
Single/Multi Engine Aircraft Count	-	6	6	6
Single/Multi Engine Aircraft Area (SF)		4,440	4,440	4,440
Turboprop/Small Jet Aircraft Count	-	23	26	33
Turboprop/ Small Jet Aircraft Area (SF)		45,617	51,567	65,450
Large Jet Aircraft Count	-	5	5	5
Large Jet Aircraft Area (SF)	-	29,800	29,800	29,800
Helicopter Count		3	3	3
Helicopter Area (SF)	-	2,700	2,700	2,700
Total Conventional Hangar Area (SF)	307,655	82,557	88,507	102,390
Surplus / (Deficit)	-	225,098	219,148	205,265

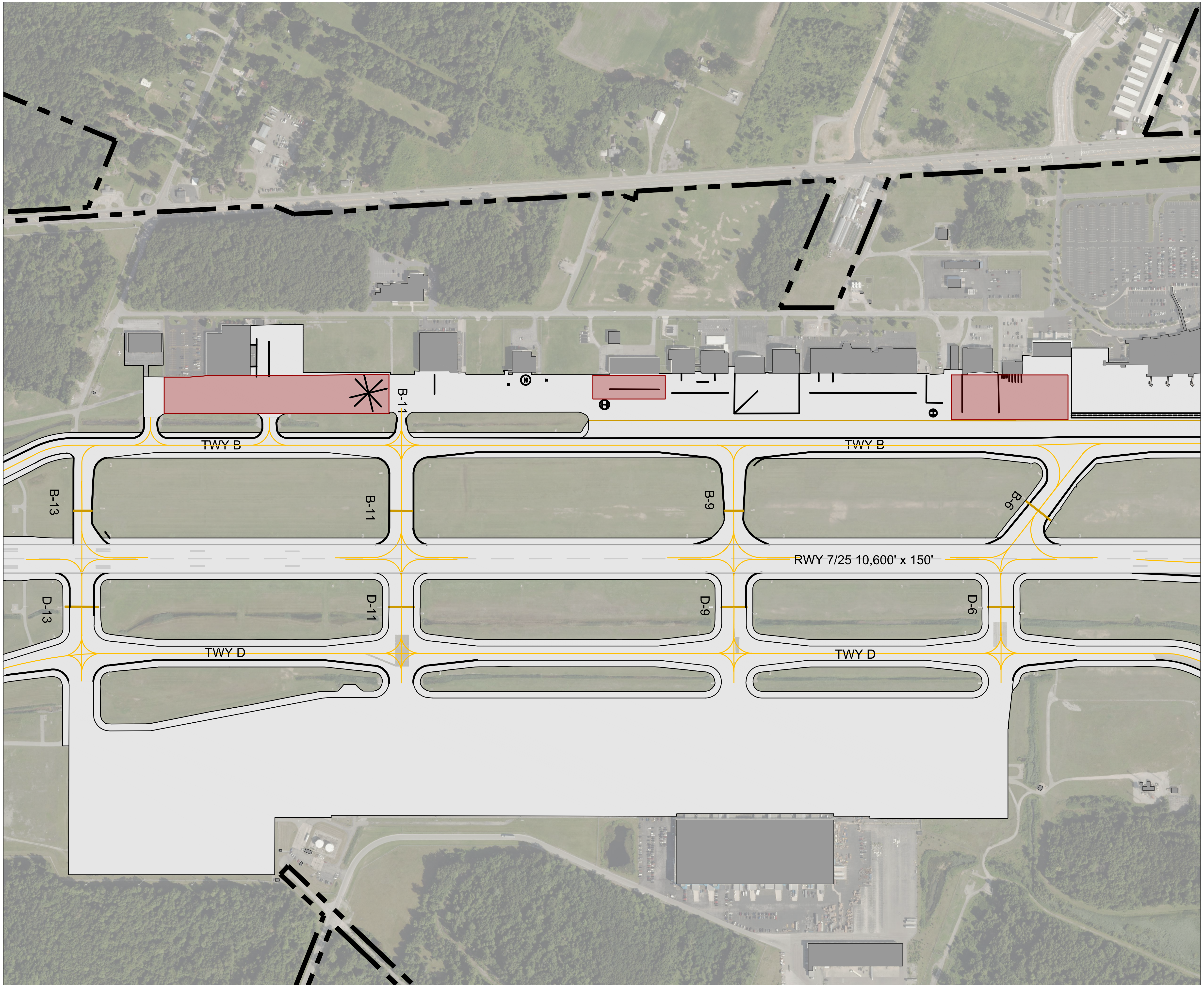
Source: RS&H Analysis, 2022

The numbers from this analysis indicate more than sufficient conventional/box hangar space already existing at TOL to satisfy the demand; however, the airport has indicated that multiple tenants have expressed interest in either expanding or relocating their facilities to accommodate growing operational needs. It is important to note that most of the hangars at TOL are privately owned. Some tenants own multiple or larger aircraft that cannot be comfortably stored in their hangar and some tenants have less. This will be further discussed in the Alternatives chapter of this Master Plan.

3.3.2 Transient Aircraft Parking Apron

Transient (itinerant) aircraft are those aircraft not based at TOL. Apron requirements were determined based on the assumptions in **Section 3.3.1**. See **Figure 3-11** for existing transient parking areas at TOL and **Table 3-23** for transient apron parking requirements.

Transient Aircraft



Airport Property Line

Transient Parking Apron

TABLE 3-23 APRON REQUIREMENTS

Aircraft Type	Existing Space	Apron Demand		
		PAL 1	PAL 2	PAL 3
Transient Aircraft				
Single/Multi Engine Aircraft Count		22	22	23
Single/Multi Engine Aircraft Area (SF)	-	16,280	16,280	17,020
Total Parking Area (SF)		16,280	16,280	17,020
Apron Circulation Area (SF)		6,500	6,500	6,800
Total Apron Area (SF)	414,000	22,780	22,780	23,820
Surplus / (Deficit)	-	391,220	391,220	390,180

Source: RS&H Analysis, 2022

Note: A circulation area factor of 40 percent was assumed; east GA/MRO apron was not factored into existing itinerant aircraft storage space

TOL has enough apron space to satisfy the demand throughout the planning period; however, there are not any designated tie-downs. Due to the location of TOL being known for high chances for extreme weather, it is recommended tie-downs be added for additional safety for the aircraft.

3.4 OHIO AIR NATIONAL GUARD

At the time of this writing, the OANG is also conducting an update to the master plan for the 180th Fighter Wing based at TOL. While the OANG generally operates independent of airport operations, short of runway use within the bases' property boundary, Airport input was included in the OANG's master plan update to ensure future compatibility with airfield and planning requirements for TOL. The scope and purpose of this Master Plan focuses solely on TLCPA-operated facilities, thus planning and development within the confines of OANG facilities is independent of development elsewhere on Airport property.

3.5 AVIATION SUPPORT FACILITIES

Support facilities at an airport encompass a broad set of functions that exist to ensure the airport can fulfill its primary role and mission in a safe and operationally efficient manner. The following sections outline the requirements for various supporting facilities at the Airport.

3.5.1 Air Traffic Control Tower

The Airport's Air Traffic Control Tower (ATCT) is located on top of the passenger terminal, in operation 24 hours per day, seven days a week, maintaining all air to ground communications and visual signaling within five nautical miles of the airport. The location of the ATCT presently has line-of-sight issues associated with the Runway 16 and Runway 34 thresholds. The current facility was constructed in 1952; given its age and the line-of-sight issues, the need for replacement ATCT at TOL has been identified in previous studies along with several potentially viable options for a future tower. The Terminal Radar Approach Control (TRACON) for TOL is also located within the ATCT facility itself at the airport. Like the tower and rest of the terminal facility, the TRACON facility is outdated and requires periodic maintenance to continue proper operation.

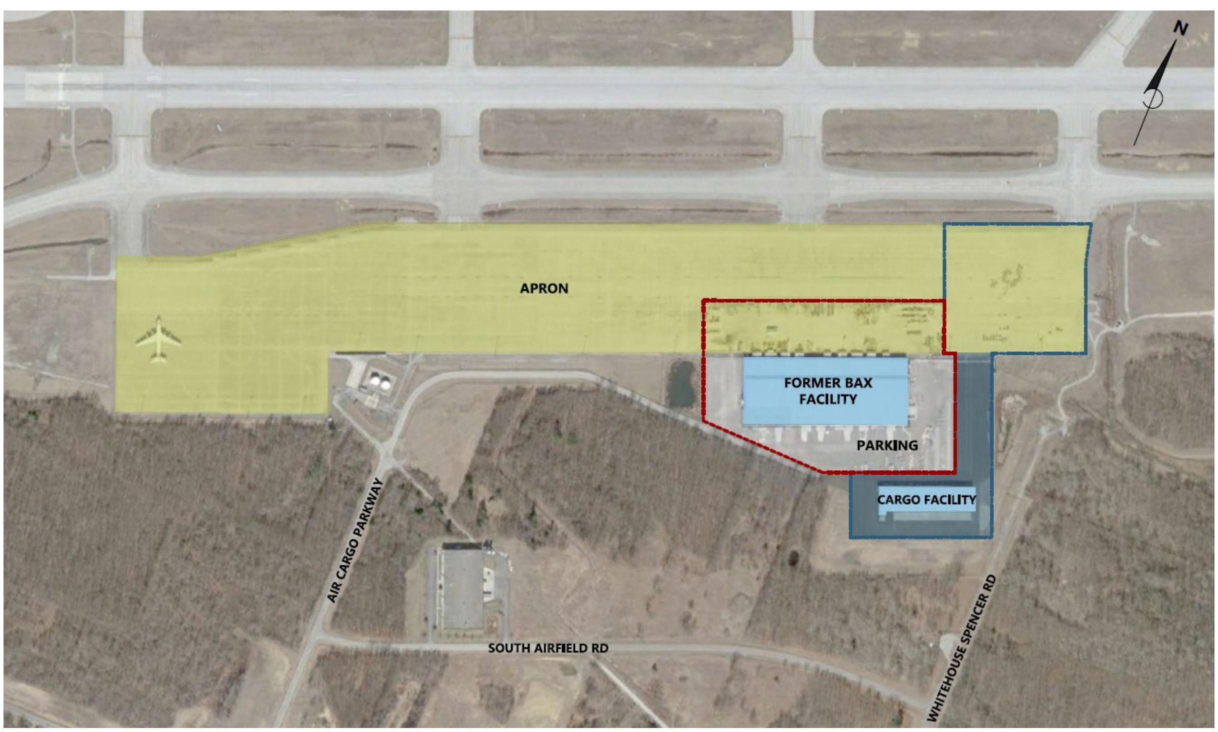
Additionally, the facilities being a part of the Passenger Terminal create access issues, for both staff accessing the ATCT/TRACON, and for passengers and staff accessing the SSCP.

The FAA completed an FAA Order 6480.4B, Airport Traffic Control Tower Siting Process siting study in 2008, and as such this master plan study will carry forward their preferred site. Airport Police and Operations Security and law enforcement at TOL is maintained by airport police stationed in a facility west of the main terminal that provides both direct landside and airside access. While the present facility meets basic demands and satisfies federal guidance, it is an aging building. Consideration will be given to a new facility at a similar location within the planning period and further discussed in the Implementation Plan.

3.5.2 Intermodal and Cargo facilities

As discussed in previous sections, cargo has historically been a significant factor at TOL, with activity occurring at the facilities to at the south side of the airfield, at a 75-acre apron and large intermodal facility (see **Figure 3-12**). Currently, Amazon Air operates cargo activity at this facility, with Tronair, Inc. leasing space for non-aeronautical operations support (no airside access) Since the departure of BAX Global, there has been a decline in these operations, however a recovery is anticipated within the near-term planning period. As a result, planning for the growth of these facilities is key. The Forecast analyzed cargo volumes in landed weight by tons, with the preferred scenario anticipating a compound annual growth rate of 4.15 percent t in the planning period, more than doubling existing volumes. While the apron itself is sufficiently sized, allowing for expansion of the sorting and cargo support facilities will be key in the planning period. The goal is to continue to facilitate a major intermodal cargo campus, with a mix of aeronautical and non-aeronautical uses. This will be further detailed in the **Alternatives** section.

FIGURE 3-12 EXISTING CARGO FACILITIES



Source: RS&H Analysis, July 2022

3.5.3 Airport Maintenance Equipment

The maintenance and Snow Removal Equipment (SRE) storage facility is a 22,500 sq ft, heated facility north of Taxiway A. The facility is aging and is unable to properly store all airport maintenance and snow removal equipment needed to keep up with TOL's operational needs. Some equipment is stored in the old ARFF facility, but still does not provide the space needed, and as a result some equipment is stored outdoors. See **Table 3-24** for the Airport's current SRE inventory and **Table 3-25** for the breakdown of deficit space over the planning period.

In addition to inadequate space, the current facility is reaching the end of its useful life after being originally constructed in the 1960's, is inefficient, and not optimally located on the airfield. AC 150/5220-18A recommends an equipment service area of a maintenance facility should maintain a 40-degree temperature while the maintenance and office area should maintain a 60-degree temperature unless a local code exists that specifies otherwise. The Alternative chapter will identify and evaluate a preferred solution to address the aging facility and space required within the planning period.

TABLE 3-24 TOL SRE INVENTORY LIST

Year	Equipment
Heavy Snow Removal Equipment	
2003	OshKosh Snowplow Truck w/18' Wausau Blade
2003	OshKosh Snowplow Truck w/18' Wausau Blade
2010	Oshkosh w/18' Oshkosh Blade
1993	International Dump Truck w/14' Blade
1993	International Dump Truck w/14' Blade
1997	Ford 8000 Dump Truck/Spreader
1993	International Dump Truck w/14' Blade
Ice Equipment	
1992	Ford L8000 with Batts Spray Equipment
1968	Ford 750 with Spray Equipment
Snowbrooms & Snowblowers	
1991	Oshkosh 20' Runway Broom
1991	Oshkosh 20' Runway Broom
1996	Oshkosh 20' Runway Broom
2010	Oshkosh 20' Runway Broom
1991	Oshkosh Rotary Snow Blower
2005	Oshkosh Rotary Snow Blower
1992	Case 821-B Loader
1996	Case 921-B Loader w/blade and blower attachments

Source: Airport Snow and Ice Control Plan, Prepared by RS&H, 2023

TABLE 3-25 MAINTENANCE/SNOW REMOVAL EQUIPMENT STORAGE AT TOL

	Existing	PAL 1	PAL 2	PAL 3
Total Area (sf)	22,500	24,900	25,600	26,350
Surplus (Deficit) (sf)		(2,400)	(3,100)	(3,850)

TOL also plans to purchase two pieces of multifunction SRE in accordance with the airport's Snow and Ice Control Plan (SICP) that will be factored into the analysis of the proposed maintenance facility expansion and/or relocation.

3.5.4 Deicing Application, Collection and Treatment Facilities

The commercial apron is equipped with an aircraft deice catchment system but has not been in service for years due to the lack of need. Likewise, the south cargo apron is also equipped for deicing, but has not been in service since the departure of BAX global in 2012. When applicable, GA aircraft deice near their own and/or the FBO hangar facilities. Conversations with the airport indicate there has not been stormwater benchmark exceedances due to glycol, but it is recommended that the airport keep up the maintenance on the existing stormwater infrastructure facilities to protect stormwater discharge into nearby water basins. The existing and anticipated glycol storage capacity is depicted in **Table 3-26**.

TABLE 3-26 GLYCOL STORAGE AT TOL

	Existing	PAL 1	PAL 2	PAL 3
Total Storage Area (sf)	3,000	3,200	3,200	3,300
Total Storage Area Surplus (Deficit) (sf)	-	(200)	(200)	(300)

Source: RS&H Analysis, 2023

3.5.5 Aircraft Rescue and Firefighting

The TOL Aircraft Rescue and Firefighting (ARFF) facility is rated as an Index B facility as determined in Title 14 Code of Federal Regulations (CFR) Part 139.315, but is able to accommodate Index C status upon request/prior notice due to the OANG's surplus of military equipment. The index is determined based on the number of commercial passenger aircraft departures and length of the air carrier aircraft. An Index B airport allows the airport to serve commercial aircraft that are at least 90 feet but less than 126 feet in length, while an Index C classification allows commercial aircraft that are at least 126 feet but less than 159 feet in length. Based on the forecast, it is anticipated that the Airport will remain Index B throughout the planning period, however they are equipped to provide Index C status upon request.

The ARFF facility currently meets the requirements mandated by Federal Aviation Regulation Part 139 for the minimum vehicle response times and required number of vehicles. All firefighting operations at TOL are managed by the Ohio Air National Guard who maintains the ARFF facility and operations (housed on the OANG base) in accordance with all FAA and military requirements. Initial correspondence between the OANG and airport staff indicate that the current ARFF building is undersized, in accordance with military requirements, and that the OANG has begun planning for future expansion/redevelopment.

Under Part 139.317, Index B requires the airport operator to have certain equipment and agents ready to respond. This includes the amount of dry chemical, water capacity and certain discharge rates. Index B requires one of the following scenarios:

- Two vehicles.
  - One vehicle carrying 500 pounds of sodium-based dry chemical, halon 1211, or clean agent; or 450 pounds of potassium-based dry chemical and water with a commensurate quantity of aqueous film forming foam agent (AFFF) to total 100 gallons for simultaneous dry chemical and AFFF application; and
  - One vehicle carrying an amount of water and the commensurate quantity of AFFF so the total quantity of water for foam production carried by both vehicles is at least 1,500 gallons.
- One vehicle.
  - One vehicle carrying at least 500 pounds of sodium-based dry chemical, halon 1211, or clean agent and 1,500 gallons of water and the commensurate quantity of AFFF for foam production.

When the Airport is upgraded to Index C, it would require one of the following scenarios:

- Three vehicles.
  - One vehicle carrying 500 pounds of sodium-based dry chemical, halon 1211, or clean agent; or 450 pounds of potassium-based dry chemical and water with a commensurate quantity of AFFF to total 100 gallons for simultaneous dry chemical and AFFF application.
  - Two vehicles carrying an amount of water and the commensurate quantity of AFFF so the total quantity of water for foam production carried by all three vehicles is at least 3,000 gallons.
- Two vehicles.
  - One vehicle carrying 500 pounds of sodium based dry chemical, halon 1211, or clean agent and 1,500 gallons of water and the commensurate quantity of AFFF for foam production.
  - One vehicle carrying water and the commensurate quantity of AFFF so the total quantity of water for foam production carried by both vehicles is at least 3,000 gallons.

The current ARFF vehicles at TOL are listed in **Table 3-27**.

TABLE 3-27 TOL ARFF VEHICLES

ARFF Equipment	Make/Year	Ownership	Water Capacity/Rate	Chemical	Capacity/Rate
ARFF 81 W	KME 2014	OHANG	1400/210 GPM	AFFF	57/3%
ARFF 81X	Oshkosh 2011	OHANG	1500/750 GPM	AFFF and Dry/N_2	210/3%
ARFF 81Y	Pierce 2011	OHANG	1400/210 GPM	AFFF	56/3%
Rescue 1	Ford F550 2005	Airport	-	-	-
Rescue 2	Oshkosh 2018	Airport	1500/700 GPM	AFFF and Dry/N_2	210/3%

Source: Airport Data Collection, 2022

The life expectancy of ARFF equipment varies by manufacturer, model and level of activity, but Advisory Circular 150/5220-10E, *Guide Specification for ARFF Vehicles* estimates a 10-12 year service life for most ARFF vehicles. Lightly used ARFF vehicles can remain in service longer, but once repair parts become scarce or the annual operating cost exceeds 75 percent or the current estimated value, replacement should occur. It is recommended that TOL plan to replace Rescue 1, within PAL X.

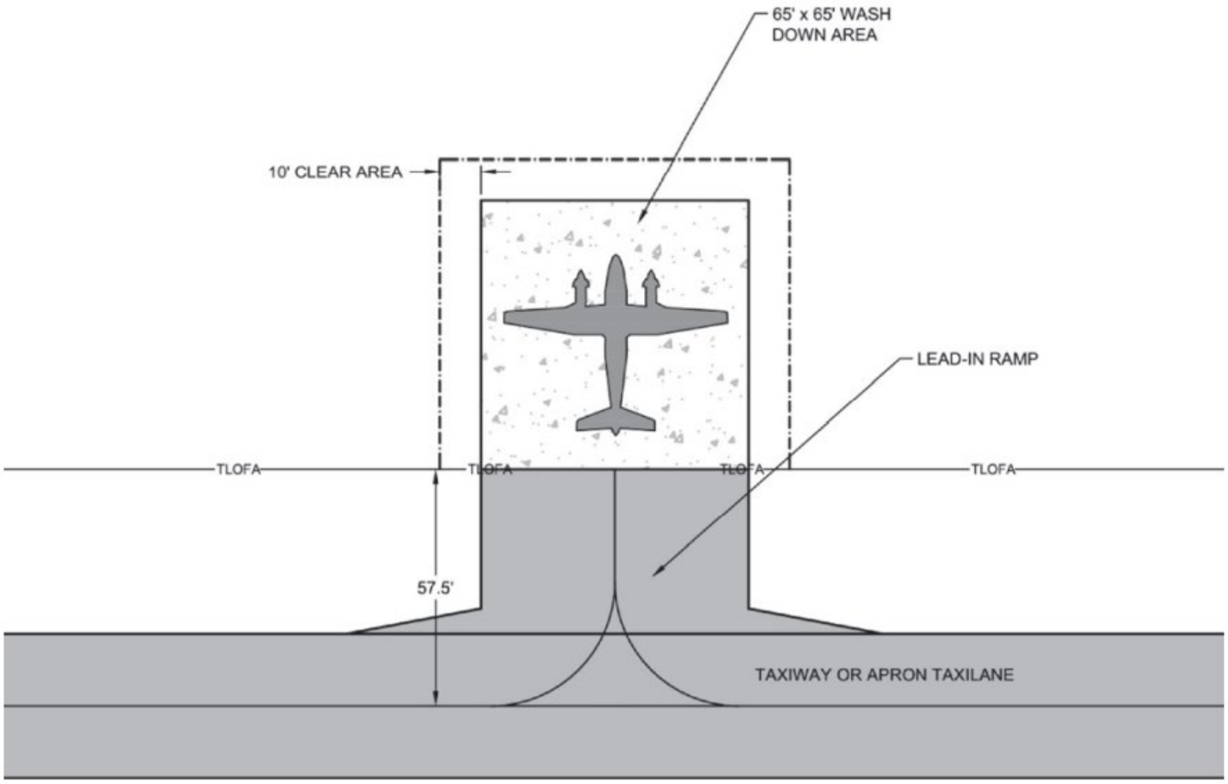
3.5.6 Aircraft Wash Facilities

TOL does not currently have an aircraft wash rack facility, but this type of facility is generally desirable to small general aviation aircraft which makes up the majority of based aircraft at TOL. Aircraft wash facilities can be financed/operated by the Airport, private investors, or a combination of both.

There are different styles of aircraft wash facilities possible at TOL. Wash facilities can be open air, covered, or completely enclosed. When considering local environmental requirements, and cost, either an open air or covered facility are logical choices for the Airport.
Open air has the advantage of size flexibility and cost savings, however, a covered structure benefits from reduced infiltration of precipitation into the drain and less runoff of grease and soaps around the pad. A covered facility also protects people and equipment from the sun and is relatively inexpensive to construct, although more expensive than an open-air concept. A covered facility does, however, lack the ability to accommodate aircraft larger than the size of structure.

It is recommended the facility be built to accommodate aircraft up to the size of a Beechcraft King Air 200. Using the dimensions of this aircraft will allow the majority of the based aircraft at TOL to utilize the wash facility. A wash facility is best located in proximity to small aircraft storage locations and near connections to water, sanitary sewer, and electricity utilities. To easily collect fees for this service, a communication line would be required to serve a transaction system that accommodates credit cards or other forms of payment. The facility needs to be equipped with multiple hose bibs, as well as grease, oil, and sand separators to prevent discharge from entering the sanitary sewer drainage system. Additionally, the facility must be located outside of all taxilane object free areas, in a location that will not penetrate Part 77 surfaces, and away from all areas that may experience prop wash or jet blast. **Figure 3-13** shows an example of an aircraft wash facility. .

FIGURE 3-13 AIRCRAFT WASH FACILITY EXAMPLE



Source: ACRP Report 113, Guidebook on General Aviation Facility Planning; Delta Airport Consultants, Inc, 2014

3.5.7 Aircraft Fuel Storage

All of the general aviation, cargo, and commercial aircraft fueling at TOL is provided via FBOs through truck service. The Ohio Air National Guard handles all of their own fueling independently through the use of their own trucks and fuel farm. The airport does not currently provide any self-fueling alternatives. Fuel storage at the airport is handled through a combination of above ground and underground storage tanks. The existing and anticipated storage capacities by type (Jet-A and 100LL Avgas) are presented in **Table 3-28** and **Table 3-29**, respectively.

TABLE 3-28 JET-A CAPACITY

	Existing	PAL 1	PAL 2	PAL 3
ADPM JetA Operations	-	378	397	417
Use Ratio (Gallons/Operation)	-	228	228	228
Average Day Peak Month Demand (Gallons)	-	87,000	91,000	95,000
Total JetA Fuel Capacity (Days)	-	7	7	7
Total JetA Storage Required for 5 Days (Gallons)	620,000	435,000	455,000	475,000
Total JetA Storage Surplus (Deficit) (Gallons)	-	185,000	165,000	145,000

Source: RS&H Analysis, 2023

TABLE 3-29 100LL AVGAS CAPACITY

	Existing	PAL 1	PAL 2	PAL 3
ADPM Avgas Operations	-	95	98	103
Use Ratio (Gallons/Operation)	-	5	5	5
Average Day Peak Month Demand (Gallons)	-	470	490	510
Total Avgas Fuel Capacity (Days)	-	94	90	86
Total Avgas Storage Required for 5 Days (Gallons)	44,000	2,350	2,450	2,550
Total Avgas Storage Surplus (Deficit) (Gallons)	-	41,650	41,550	41,450

Source: RS&H Analysis, 2023

The Airport is anticipated to have adequate fuel storage capacity with a 5-day reserve throughout the planning period. While 100-octane low-lead (100LL) Avgas is currently the most commonly used fuel for piston-engine aircraft, the FAA is currently working towards a path to eliminate leaded aviation fuels altogether. This initiative, known as Eliminate Aviation Gasoline Lead Emissions (EAGLE), intends to accelerate government and industry actions to establish policies to permit both new and existing general aviation aircraft to operate lead-free, without compromising aviation safety and the economic and broader public benefits of general aviation.

3.6 AIRPORT ACCESS AND CIRCULATION REQUIREMENTS

This section describes the recommended and required improvements for access roadways and alternative modes of transportation (e.g. transit, bicycle lanes, pedestrian walkways) servicing the passenger terminal area. **Figure 3-14** depicts the current roadway and access configuration serving TOL.

3.6.1 Airport Access Roadways

Airport Highway (State Route 2) is a four-lane divided roadway, located immediately north of West Airport Service Road and Terminal Parkway, providing local access to the passenger terminal and the general aviation facilities located on the north side of the airport. It is directly connected via interchange to Interstate 80 (Ohio Turnpike/I-80). The intersection of this Ohio Turnpike access route and State Route 2 serves as the entry point to the terminal and north side airport facilities, where the airport access loop roadway provides access to the passenger terminal.

This airport access is provided via a controlled-access ramp spurring from the Ohio Turnpike, and segment of State Route 2 which is a major arterial roadway. As a result, level of service (LoS) for traffic volumes on these routes is satisfactory. While this could change with typical increases in traffic volumes, no major access upgrades are anticipated within the planning period.

3.6.2 On-Airport Circulation

Within the Airport itself, access is divided between the north side (which includes the passenger terminal and associated facilities, and most general aviation facilities), and the south side (which includes cargo and intermodal facilities). Additionally, the eastern side maintains the ARFF and Ohio Air National Guard facilities. Circulation on the OANG campus was not analyzed for the purpose of this study.

3.6.2.1 North Side Circulation

Access to the commercial passenger terminal and parking lots is provided via the Terminal Parkway roadway circulation loop that connects to and is located south of Airport Highway. From the intersection of Airport Highway and Terminal Parkway, two one-way south bound lanes provide access to the Airport. The east lane is used to access the long-term parking lot, and then further south, the short-term parking lot. The west lane is used to access the general aviation facilities. Both roadway circulation loop lanes continue south to connect to the passenger terminal curbfront, where two additional lanes are provided. Immediately following the west end of the passenger terminal curbfront, the southernmost lane provides access to the rental car ready/return lot and the northernmost lane merges with the exit lane from the short-term parking lot. These three lanes continue eastward and then northward, where they then merge with the exit lane from the long-term parking lot. The westernmost roadway circulation loop lane then splits to provide one-way westward travel along a 400-foot-long roadway that is located approximately seventy-five feet south and parallel to Airport Highway. This one-way westbound road connects to the northern end of the roadway circulation loop. The remaining two northbound roadway circulation loop lanes continue north and intersect with Airport Highway.

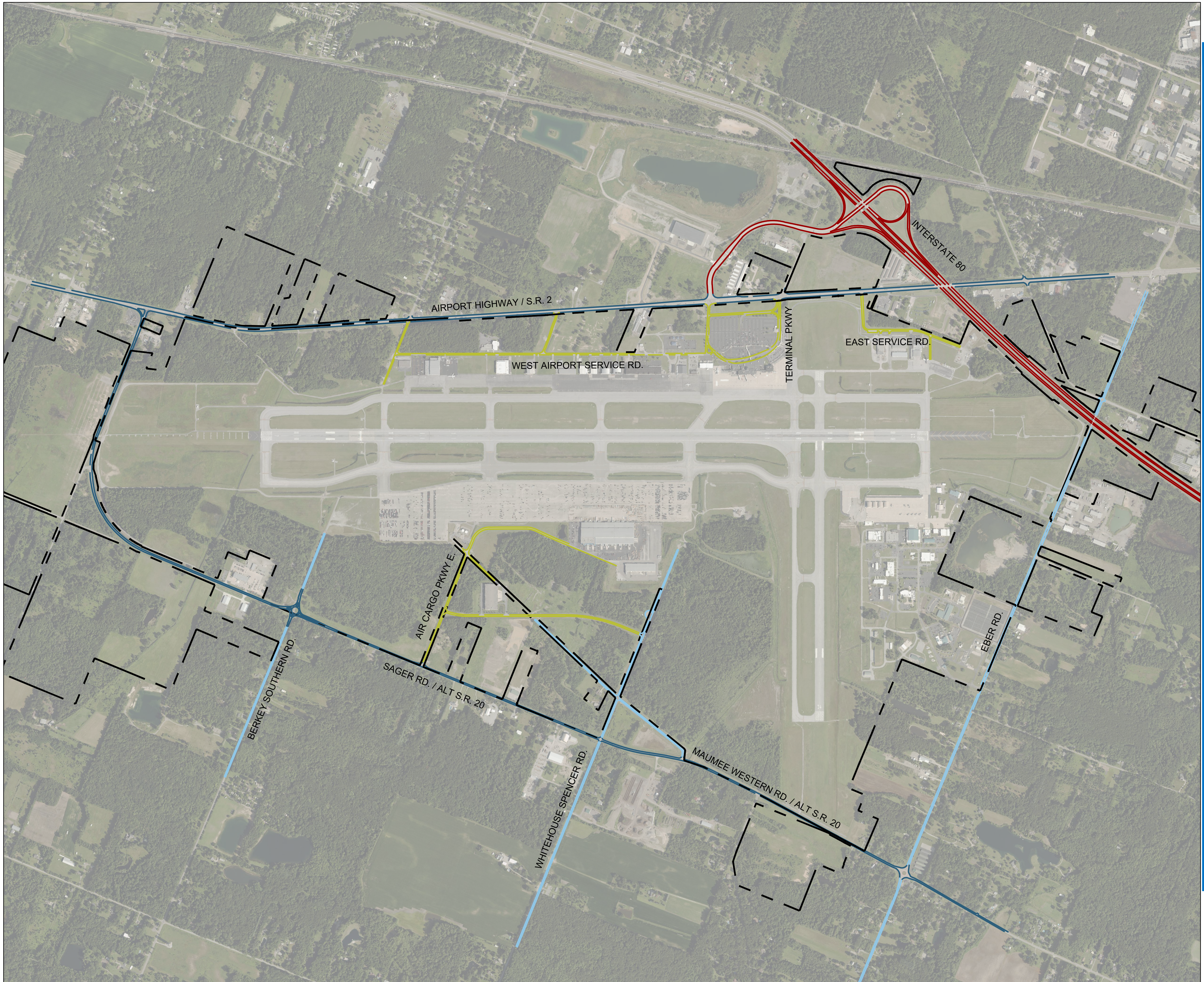
In addition to the passenger terminal and associated parking lots, the loop road provides access to West Airport Service Road. This road, in turn, provides direct access to the Airport's general aviation/FBO facilities, rental car QTA facilities, and airport operations facilities (such as fuel storage, customs/FIS, police, and operations). No LOS issues, such as traffic congestion, have been identified with any of these roadways and this is anticipated to remain the case throughout the planning period.

3.6.2.2 South Side Circulation

Access from Airport Highway to facilities on the southern side of the Airport is provided by State Route 295 to the west, and Eber Road to the east. Eber Road also provides access to the Ohio Air National Guard facilities on the eastern portion of the airfield.

Alternate US-20/State Route 295 (referred to as State Route 295 hereon) provides access to Air Cargo Parkway, which in turn, connects to the intermodal and cargo facilities on the southern side of the Airport. Air Cargo Parkway, accessed via State Route 295, provides access to the intermodal and cargo facilities and the south fuel farm. It is presently a two-lane road with a wide turning radius off of State Route 295, allowing large vehicles and trucks to access these facilities. Given the current limited development and activity on the Airport's south side facilities, LOS for these access roads is presently satisfactory. However, as the Airport intends to expand activity in these facilities and further expand them into the planning period, attention should be given to providing access for an increasing number of large trucks and commercial vehicles. ODOT has recently installed roundabouts along State Route 295 at two intersections, Berkely Southern Road and Whitehouse Spencer Road (which provides indirect access to the cargo apron), east and west of Air Cargo Parkway respectively. Continued coordination between ODOT and the TLCPA will ensure that these critical roadways will be able to handle the anticipated increase in traffic capacity demand.

Access Roadways



- Regional Access
- State Highway
- Local Roadway
- Airport Roadway- Public
- Airport Property Line

3.6.3 Commercial Passenger Vehicle Parking

Providing enough parking for airline passengers and Airport users is based on a quality-of-service standard, which is defined by the difficulty of finding a space in the peak hours of parking demand. For surface lots used for long-term parking, it is typically assumed that when the lot is 90 percent occupied, the difficulty of tracking down an available space suggests that the lot is "effectively full".

Parking requirements increase as annual demand increases. To determine parking requirements for the Airport's planning period, a ratio of annual enplanements to parking spots was used based on current demand levels. Conversations with airport staff and observations during the completion of the inventory chapter of this master plan, the long-term parking lot reaches 25% capacity during peak month. The public parking requirements are shown in **Table 3-30**. The existing vehicle parking available at TOL meets the demand through the planning period.

TABLE 3-30 COMMERCIAL PASSENGER PARKING REQUIREMENTS

Terminal Area Parking	Existing 2021	Base 2026	High 2026	Base 2041	High 2041
Enplanements	79,300	63,100	163,300	90,100	245,800
Total Spaces	1,412	1,412	1,412	1,412	1,412
Effective Capacity	1,271	1,271	1,271	1,271	1,271
Required Spaces	251	200	517	285	778
Surplus/Deficiency	1,161	1,212	895	1,127	634

Source: RS&H Analysis, 2022

Short-term parking areas enhance the level of service for passengers and meeter-and-greeters. The general assumption for short-term parking requirements is 15-20 percent of the number of long-term spaces. Based on the number of current short-term spaces available listed in **Table 3-19**, TOL has adequate parking capacity to meet the anticipated demand within the planning period.

3.6.3.1 Electric Vehicle Charging Stations

More electric vehicles (EVs) have come to market in recent years and their popularity among consumers has grown. Electric vehicles require charging stations to keep batteries charged, and more public and private facilities have begun to install these charging stations to accommodate electric vehicles. TOL currently has no regulations for electric vehicle charging stations in site development. Standards for allocating dedicated electric vehicles charging stations are still in their infancy, but effective 2017, California developed a Green Building Standards Code (Title 24, Part 11). In this code, nonresidential mandatory EV space allocations are dependent upon total required parking spaces and are set at a rate ranging from 4 to 6 percent of total parking. An industry excepted assumption for planning EV space requirements at TOL would be 1 percent of total allocated spaces should provide charging stations by end of planning period, which is approximately 18 spaces based on the total parking accommodations shown in **Table 3-30**.

3.7 UTILITY CAPACITY AND REQUIREMENTS

Availability of utilities at an airport is imperative to the day-to-day operations, as the Airport completed a Utility Master Plan in 2015. The following sections discuss the location and future need of utilities at TOL during the planning period. **Figure 3-15** shows the existing main lines for water, sanitary sewer, natural gas, electricity, and telephone servicing TOL.

3.7.1 Water and Sanitary Sewer

Water and sanitary sewer services are provided by Lucas County. The sanitary sewer lines for the terminal building extend under the short-term parking lot which then flows west via gravity to the sanitary lift station on the west side of the long-term parking lot. The sanitary lift station discharges the effluent to the sanitary sewer that runs parallel to Airport Highway.

The terminal and general aviation facilities on the north side of the airport are supplied by a water line near the main airport entrance and Airport Highway/S.R.2 and runs parallel to West Airport Service Road. The south airfield is supplied by a water line beginning at the intersection of Air Cargo Parkway and Sager Road/U.S Alt Route 20 and runs east paralleling Taxiway D. Both water and sanitary sewer service are adequate for the planning period.

3.7.2 Natural Gas

Natural gas is supplied by the Ohio Gas Company. The natural gas line is located on the far east wall of the terminal building. It crosses the airport entrance road and heads west. The south airfield is supplied by a line running along Whitehouse Spencer Rd and the OANG base is supplied by a gas line originating at Eber Rd. The natural gas service is adequate for the planning period at TOL.

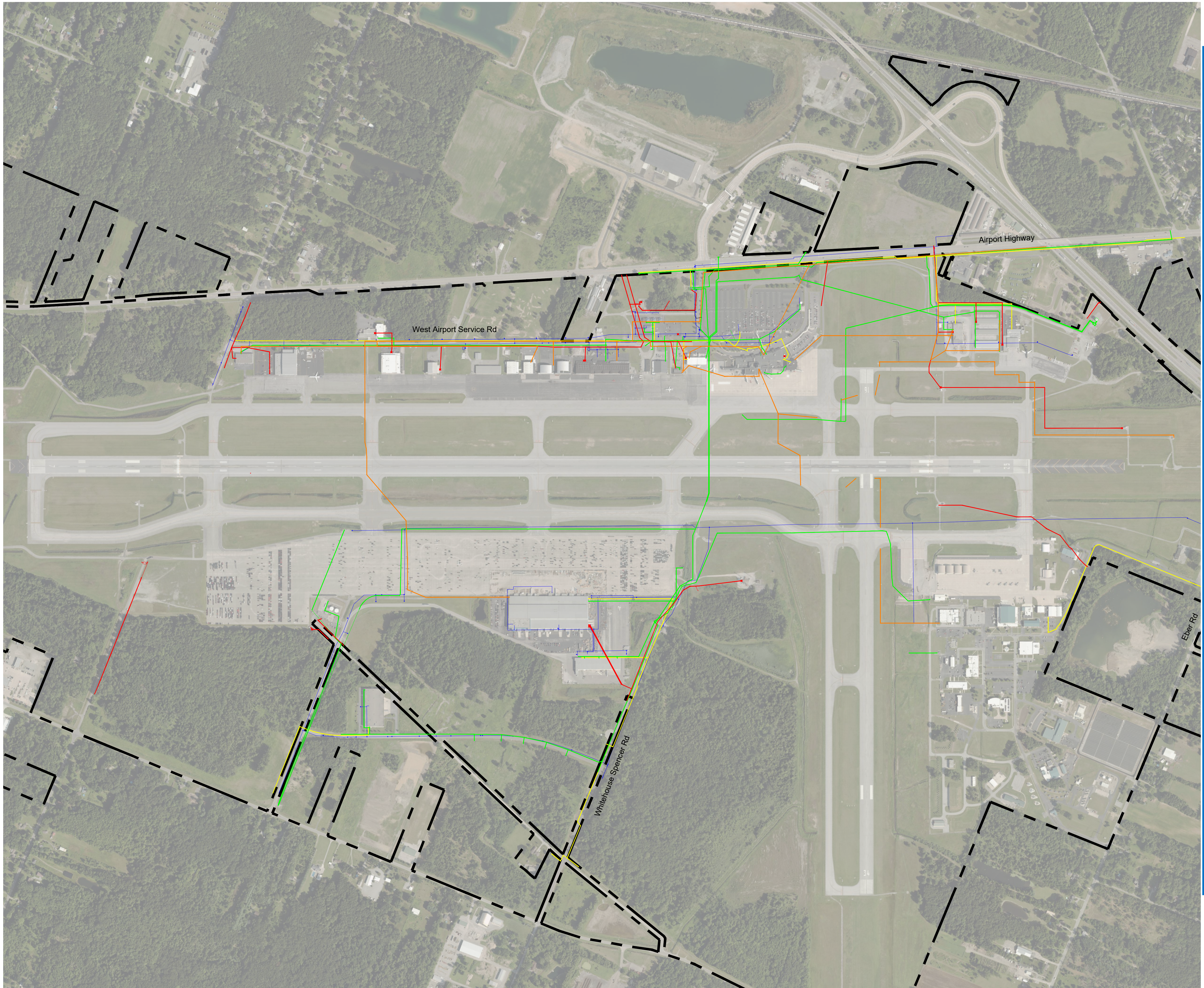
3.7.3 Electricity

Electricity for TOL is provided by Toledo Edison Power Company. All terminal and airfield power is controlled in the airfield electrical vault. Separate power runs to the general aviation tenants, maintenance facility, southside electrical vault, FAA and OANG base. Toledo Edison purchases their power from the open market and sources vary from coal, solar, wind etc. Discussions with the power company identified they would be able to accommodate the future growth of TOL, however the Airport could help ensure this by looking into other sources of sustainable power. Furthermore, while capacity is currently sufficient, there have been power outage/"brownout" issues at the Airport in recent history. Given this, as well as emerging trends, consideration should be given to increasing demand for electricity consumption in advance of emerging trends such as Advanced Air Mobility (AAM) and Unmanned Aerial Vehicles (UAV). These types of aircraft are powered electrically, as opposed to conventional fossil fuels and their operations are already anticipated in the near term at comparable airports. As discussed earlier, the introduction of redundancy into the utility system through the implementation of sustainable energy generated from clean, renewable sources such as solar energy systems would also support this. Airports are beginning to integrate renewable energy systems into airport-wide microgrids to establish Airport energy independence, thereby promoting financial self-sufficiency and protecting the airport's central role in community resiliency during disaster recovery. It has become common for airports to utilize undeveloped land to implement a source of renewable energy, such as solar.

To assist with the growing trend, the FAA has prepared guidance on solar energy systems on airport property (*Technical Guidance for Evaluating Selected Solar Technologies on Airports*). Solar energy displays a dedication to environmental responsibility and is a way to reduce airport operating costs.

3.7.4 Telephone/Communications

Telephone service is provided by AT&T. A line runs parallel to Airport Highway before entering the Airport then proceeds west parallel to West Airport Service Road. From the terminal building the telephone line also heads east to service the maintenance facility. The south side of the airport is serviced from a line that extends under the airfield at B11 and between Taxiway N and B6. The telephone and communication service is adequate for the planning period at TOL.



TOL Utilities

- Gas Line
- Water Line
- Electrical Line
- Sanitary Sewer Line
- Telephone Line
- Airport Property Line

1,000' 500' 0 1,000'

3.7.5 Utilities Summary

Aside from concerns with future and ultimate electrical capacity, there are no other concerns with utilities presently. However, utility infrastructure is aging and should be monitored and improved as expansions and renovations occur. Depending on whether the Terminal Building is relocated or renovated, infrastructure requirements including utilities, roadways and site drainage for the facility need to be considered. Utilities required at the terminal include water, electrical, natural gas, sewer and telecommunication. The final determined size of the building will dictate the capacity of various utilities that will be required. Advanced planning should be conducted regarding existing connections, capacities available, and means of distribution to a possible future site.

Future general aviation facility planning should also consider the infrastructure, utilities and space necessary for electric aircraft charging stations. Such facilities may begin to show demand over the planning horizon, especially by based electric training aircraft, transient aircraft, and electric vertical takeoff and landing aircraft. An electric aircraft charging facility would need to be located adjacent to a hangar large enough to accommodate multiple aircraft and be planned for safety so that it is at the adequate distance from any fuel trucks, fuel tanks, or other chemicals that it could ignite. Development of any electrical charging stations, for aircraft, vehicles, or equipment, should include proper engineering analysis of whether the system has capacity to handle additional load requirements.

3.8 AIRPORT LAND USE

A cursory review of the existing land uses and zoning surrounding the Airport was conducted to assess compatibility. Various statutes, regulations, and EOs relevant to land use include:

- » The Airport and Airway Improvement Act of 1982, and subsequent amendments (49 U.S.C. 47107(a)(10));
- » The Airport Improvement Program (49 U.S.C. 47106(a)(1);
- » The Airport Safety, Protection of Environment, Criteria for Municipal Solid Waste Landfills (40 CFR § 258.10); and
- » State and local regulations

The Airport is located directly at the border of Swanton Township and Monclova Township, both within Lucas County. Land uses within the immediate vicinity of the Airport include rural residential and industrial. Additionally, there are some agricultural land uses surrounding the Airport's general vicinity. The portions of the Airport and OANG base in Monclova Township are currently zoned 'Agricultural', while much of the portions in Swanton Township are zoned as 'Mixed', with immediately adjacent areas zoned for 'Industrial'. Currently, the former BAX Global facility is zoned as 'Agricultural'. It may be prudent to ensure 'Industrial' zoning is established or maintained for the areas to the south of the Airport, to maintain future cargo and intermodal facility development. There are several small wetland areas encumbering Airport property, and multiple large floodplain zones encumbering Airport property, the OANG base, and Runways 25 and 34. This will further be analyzed in the Environmental Overview section.

The Airport Layout Plan (ALP) set will include an On-Airport and Off-Airport Land Use Plan for both existing conditions, as well as by the end of the planning period development. Additionally, a Noise Land Reuse Plan will be conducted based on the Airport's most recently established noise contours.

3.9 FACILITY REQUIREMENTS SUMMARY

Table 3-31 is a summary of the requirements determined in this study for TOL. The next chapter of the master plan details the alternatives analysis conducted for those facilities that needed further study, indicated with a blue box in the table below. The alternatives chapter details the conclusions of the alternatives analysis and provides a comprehensive concept that integrates all chosen preferred alternatives.

TABLE 3-31 FACILITY REQUIREMENTS SUMMARY

Runways	
Runway Blast Pads	▪ Meet FAA blast pad ADG IV design standards for Runway 7-25 ▪ Meet FAA blast pad ADG II design standards for Runway 16-34
Pavement Strength	Should be monitored as the critical aircraft for Runway 7-25 exceeds pavement bearing capacity
Runway Visibility Zone	While not required with a 24/7 ATCT, it is recommended to mitigate the group of trees within the RVZ
Taxiways	
Shoulders	Additional shoulder pavement should be added to meet TDG 5 and TDG 2 standards
Fillet Geometry	Taxiway fillet geometry should be reevaluated and addressed as pavement surface maintenance is performed
Middle Third Crossings	Minimize the number of runway crossings in the middle third or "high energy zone" of a runway to reduce the risk of potential collisions
Direct Access	Reconfigure direct access taxiways as they can lead to pilot confusion and possible incursion
Non-Standard Taxiway Angle	B6 should be designed as a right angle taxiway intersecting Runway 7/25
Concrete RipRap	Mitigate concrete riprap within the TOFA of taxiways D11 and D13
Navigational Aids and Lighting	
Electronics Aids	▪ While not required, recommend adding DME for Runway 7 ▪ Installation of CAT II/III approach to Runway 7/25

Visual Aids	While not required, recommend adding: ▪ PAPI for RWY 7 ▪ windcone for RWY 34 ▪ TDLZ for RWY 25 ▪ segmented circle
Commercial Service Terminal	
Terminal Building	Alternatives will examine locations for a new terminal and renovation options to meet forecast demand
General Aviation	
T-Hangar Units	Recommend adding at least 19 additional T-Hangars through the planning period
Conventional Hangar Units	Recommend additional hangar space to accommodate all based aircraft plus 5% of itinerant aircraft
Itinerant Aircraft Tie Downs	Recommend adding tie-downs for increased aircraft safety
Aviation Support Facilities	
Air Traffic Control Tower	Relocate ATCT to provide clear line of sight to all controlled aircraft
Maintenance Facility/SRE	Relocate and increase size to accommodate current and future equipment
ARFF Facility	Continue cooperation with OANG to ensure any future ARFF facility suits the needs of all civil activity at the Airport
Airport Access and Circulation	
Perimeter Road	Pave existing segments of on-airport restricted access roads and ultimately develop full perimeter road
Utilities	
Electricity	Consider future redundancy and sustainable energy systems

Appendix B
2020 Airfield Capacity Analysis

RS&H

10748 Deerwood Park Boulevard S
Jacksonville, Florida 32256

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rsandh.com

MEMORANDUM:

Date: June 16, 2023

To: Kelsey Reeves

From: Matthew Shirey

Subject: TOL Third Runway

The FAA TAF shows 32,587 total operations in the year 2018. The projected total operations for the year 2045 is 32,850, fewer than a 300 annual operations increase from base year 2018. The annual growth rate is nearly flat, at .03%.

Enplanements | Airport Operations | Based Aircraft | Tracon Operations

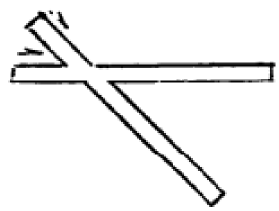
Airport Operations — View Previous Years

Year	F	Itn Air Carrier	Itn Air Taxi	Itn GA	Itn Mil	Local Civil	Local Mil	Total Airport Ops	Total Overflights	IFR Itn AC	IFR Itn AT	IFR Itn GA	IFR Itn MI
2016		1,379	4,419	13,657	2,458	5,164	2,150	29,227	11,241	1,371	3,778	8,208	2,156
2017		1,367	4,680	14,355	2,608	5,059	1,799	29,868	8,413	1,367	3,925	8,523	2,385
2018		1,555	5,814	15,595	2,600	5,490	1,533	32,587	6,373	1,551	5,113	9,482	2,378
2019	*	2,804	4,675	15,324	2,880	5,203	1,556	32,442	6,130	2,797	4,111	9,317	2,634
2020	*	1,903	5,693	15,502	2,880	5,204	1,556	32,738	6,293	1,898	5,006	9,425	2,634
2021	*	2,045	5,230	15,525	2,880	5,208	1,556	32,444	6,318	2,040	4,599	9,439	2,634
2022	*	2,317	4,246	15,548	2,880	5,212	1,556	31,759	6,302	2,311	3,734	9,453	2,634
2023	*	2,639	3,032	15,571	2,880	5,216	1,556	30,894	6,255	2,632	2,666	9,467	2,634
2024	*	2,713	2,838	15,595	2,880	5,220	1,556	30,802	6,296	2,706	2,495	9,482	2,634
2025	*	2,742	2,866	15,619	2,880	5,224	1,556	30,887	6,370	2,735	2,520	9,497	2,634
2026	*	2,772	2,895	15,643	2,880	5,228	1,556	30,974	6,446	2,765	2,545	9,512	2,634
2027	*	2,804	2,924	15,667	2,880	5,232	1,556	31,063	6,524	2,797	2,570	9,527	2,634
2028	*	2,839	2,953	15,691	2,880	5,236	1,556	31,155	6,605	2,832	2,595	9,542	2,634
2029	*	2,876	2,982	15,715	2,880	5,240	1,556	31,249	6,688	2,869	2,620	9,557	2,634
2030	*	2,914	3,012	15,739	2,880	5,244	1,556	31,345	6,773	2,907	2,646	9,572	2,634
2031	*	2,954	3,042	15,763	2,880	5,248	1,556	31,443	6,861	2,947	2,672	9,587	2,634
2032	*	2,995	3,072	15,787	2,880	5,252	1,556	31,542	6,951	2,988	2,698	9,602	2,634
2033	*	3,036	3,103	15,811	2,880	5,256	1,556	31,642	7,041	3,029	2,725	9,617	2,634
2034	*	3,076	3,134	15,835	2,880	5,260	1,556	31,741	7,132	3,069	2,752	9,632	2,634
2035	*	3,116	3,165	15,859	2,880	5,264	1,556	31,840	7,224	3,109	2,779	9,647	2,634
2036	*	3,157	3,196	15,883	2,880	5,268	1,556	31,940	7,318	3,150	2,806	9,662	2,634
2037	*	3,197	3,228	15,907	2,880	5,272	1,556	32,040	7,411	3,190	2,834	9,677	2,634
2038	*	3,236	3,260	15,931	2,880	5,276	1,556	32,139	7,505	3,229	2,862	9,692	2,634
2039	*	3,275	3,292	15,955	2,880	5,280	1,556	32,238	7,599	3,268	2,890	9,707	2,634
2040	*	3,314	3,325	15,979	2,880	5,284	1,556	32,338	7,695	3,307	2,919	9,722	2,634
2041	*	3,354	3,358	16,003	2,880	5,288	1,556	32,439	7,792	3,347	2,948	9,737	2,634
2042	*	3,394	3,391	16,027	2,880	5,292	1,556	32,540	7,890	3,387	2,977	9,752	2,634
2043	*	3,434	3,425	16,051	2,880	5,296	1,556	32,642	7,989	3,427	3,007	9,767	2,634
2044	*	3,475	3,459	16,075	2,880	5,300	1,556	32,745	8,090	3,468	3,037	9,782	2,634
2045	*	3,518	3,493	16,099	2,880	5,304	1,556	32,850	8,194	3,511	3,067	9,797	2,634

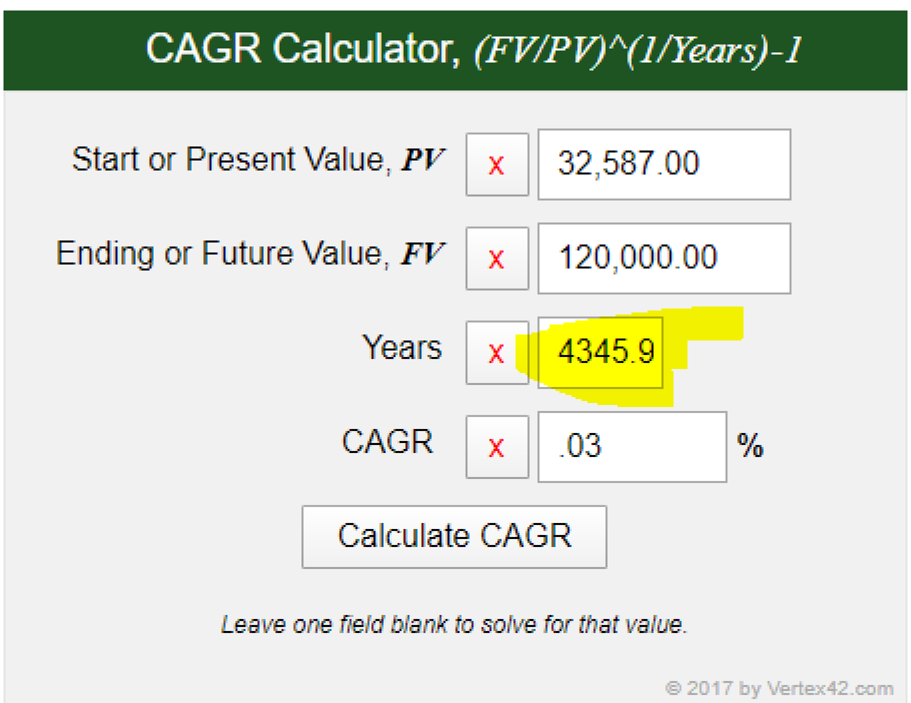
+ Add Year

Source: 2019 FAA TAF

A high-level airport capacity analysis, per FAA AC150/5060-5, *Airport Capacity*, shows estimated annual service volume (ASV) for an airport with primary runway and crosswind runway as follows:

NO.	Runway-use Configuration	Mix Index %(C+3D)	Hourly Capacity Ops/Hr VFR	Hourly Capacity Ops/Hr IFR	Annual Service Volume Ops/Yr
9.		0 to 20	98	59	230,000
		21 to 50	77	**57**	200,000
		51 to 80	77	56	**215,000**
		81 to 120	76	59	**225,000**
		121 to 180	72	60	265,000

The lowest anticipated total annual operations the airport configuration could handle is 200,000 aircraft (with a 77 VFR operations / 57 IFR operations per hour split). This determines that within 25 years, the airport will reach 16% of total capacity, at the most extreme. Planning for additional capacity does not typically begin until 60% of capacity is reached (120,000 annual operations). These calculations conclude that there is no capacity-driven demand for a third runway within the planning period.



Appendix C
2023 Terminal Area Plan

JUNE 2023

Eugene F. Kranz Toledo Express Airport Master Plan Update

Terminal Area Plan

RS&H

Terminal Area Plan

Volume No. 2.0
June 2023
Toledo-Lucas County Port Authority
Eugene F. Kranz Toledo Express Airport
Swanton, Ohio
RS&H No.: 1018-1858-012

Prepared by RS&H Ohio, Inc. at the direction
of the Toledo-Lucas County Port Authority

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1.1 INTRODUCTION

The Toledo-Lucas County Port Authority (TLCPA) leadership, Eugene F. Kranz Toledo Express Airport (TOL) staff, Federal Aviation Administration's Detroit Airports District Office (FAA-DET ADO) staff, and the local community understand that the current commercial passenger terminal at TOL has aging infrastructure, limited passenger amenities, and lacks the comfort, convenience and "curb appeal" the local community deserves. Furthermore, these entities believe now is the time to make the necessary investments in the passenger terminal to correct these concerns. In 2021, a 100 percent FAA-funded Airport Improvement Program (AIP) grant was provided to TLCPA so they could update their Airport Master Plan, which will provide the recommended and justification of the terminal improvements necessary for continued safe and secure operation while improving efficiency and the passenger experience. As part of the Master Plan, the TLCPA and RS&H will evaluate the existing passenger terminal facility based on current activity and future growth projections. Items to be evaluated include terminal capacity, infrastructure condition, and the efficiency and sustainability of the current facility. This terminal area plan aims to identify and evaluate the existing commercial terminal facility and generate a strategy for modernization, meeting current and future demand. Once complete, the TLCPA will progress with the appropriate NEPA documentation and begin the design process for the recommended improvements.

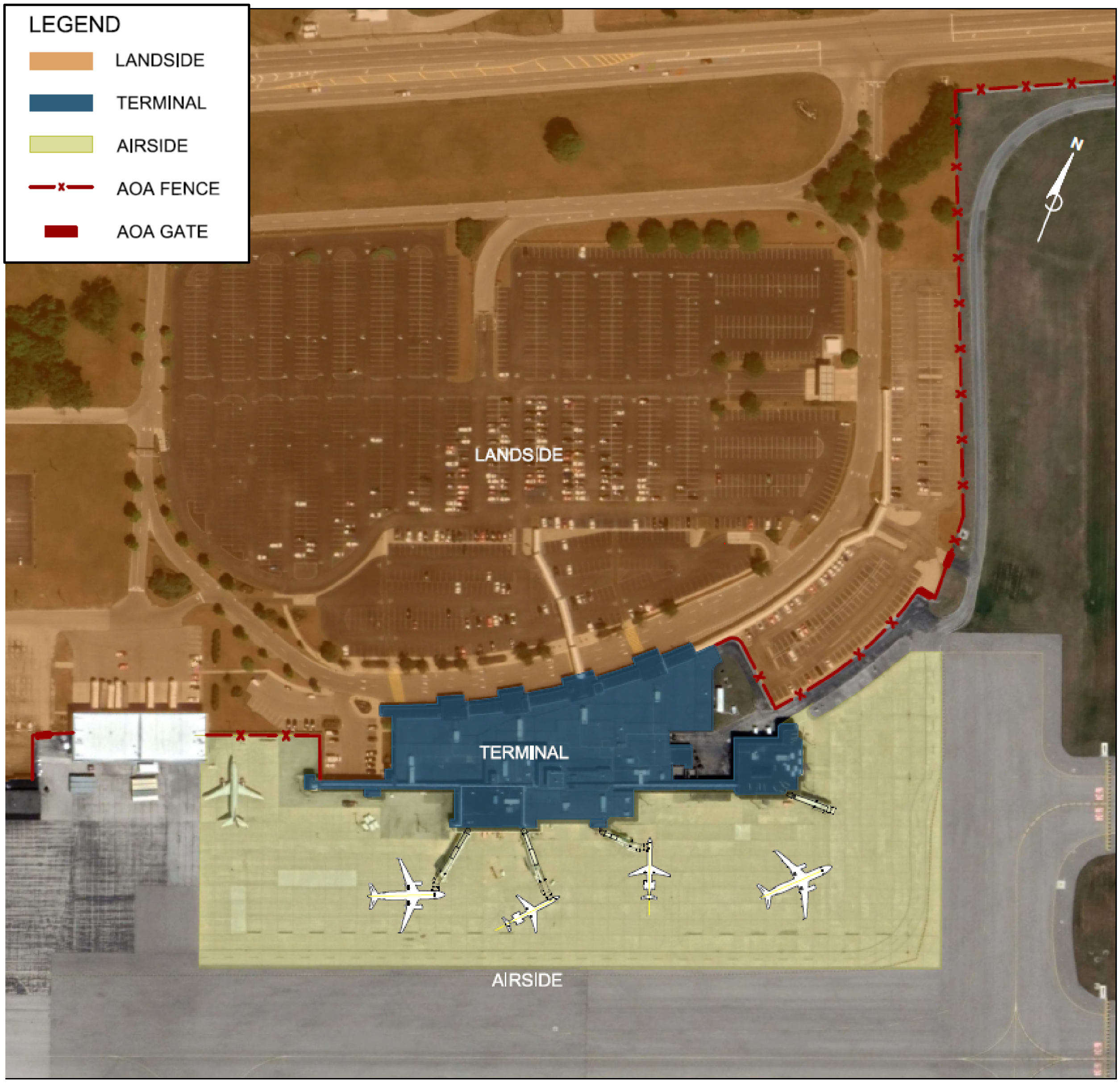
1.2 EXISTING CONDITIONS

In 1955 the existing passenger terminal opened and began serving the residents within the City of Toledo and the Toledo Metropolitan Service Area (MSA) with access to the world through commercial aviation. 137,000 SF, steel construction, 2 level, 2 concourse terminal facility with administration and air traffic control tower. The existing terminal facility has had several expansions and renovations, with the most recent occurring in 2006. This section describes the current condition of the terminal area serving commercial passenger traffic.

The commercial passenger terminal area consists of both landside and airside areas, with the terminal facility acting as the "bridge" between the two. These areas are designed to serve passengers using commercial airline services safely and securely at TOL and are divided by the Air Operations Area (AOA) fence. The commercial passenger terminal area is illustrated in **Figure 1.**

- **Airside Area** – This area includes the commercial apron where passenger aircraft park and ground service equipment are staged.
- **Terminal Building** – This area includes the existing facility that serves airline passengers. Areas include Ticketing Hall, Car Rental, Security Checkpoint, Passenger Holdrooms, Concessions, Baggage Claim, Airport Administration, and support area. The Air Traffic Control Tower (ATCT) is also located within the terminal building and is owned by the TLCPA.
- **Landside Area** – This includes the roadway network, terminal facility access points, parking lots, and the terminal curb where passengers are dropped off and picked up.

FIGURE 1
COMMERCIAL PASSENGER TERMINAL AREA



Source: RS&H, 2022

1.2.1 Airside Apron Condition

The commercial service apron, shown in **Figure 2**, is approximately 360,000 square feet and can accommodate up to five mid-sized commercial passenger aircraft simultaneously. Three of the four gates serviced by a passenger loading bridge at the airport remain in operation and are located on the main concourse. The one-passenger loading bridge gate and two ground loading gates in the satellite concourse are no longer active.

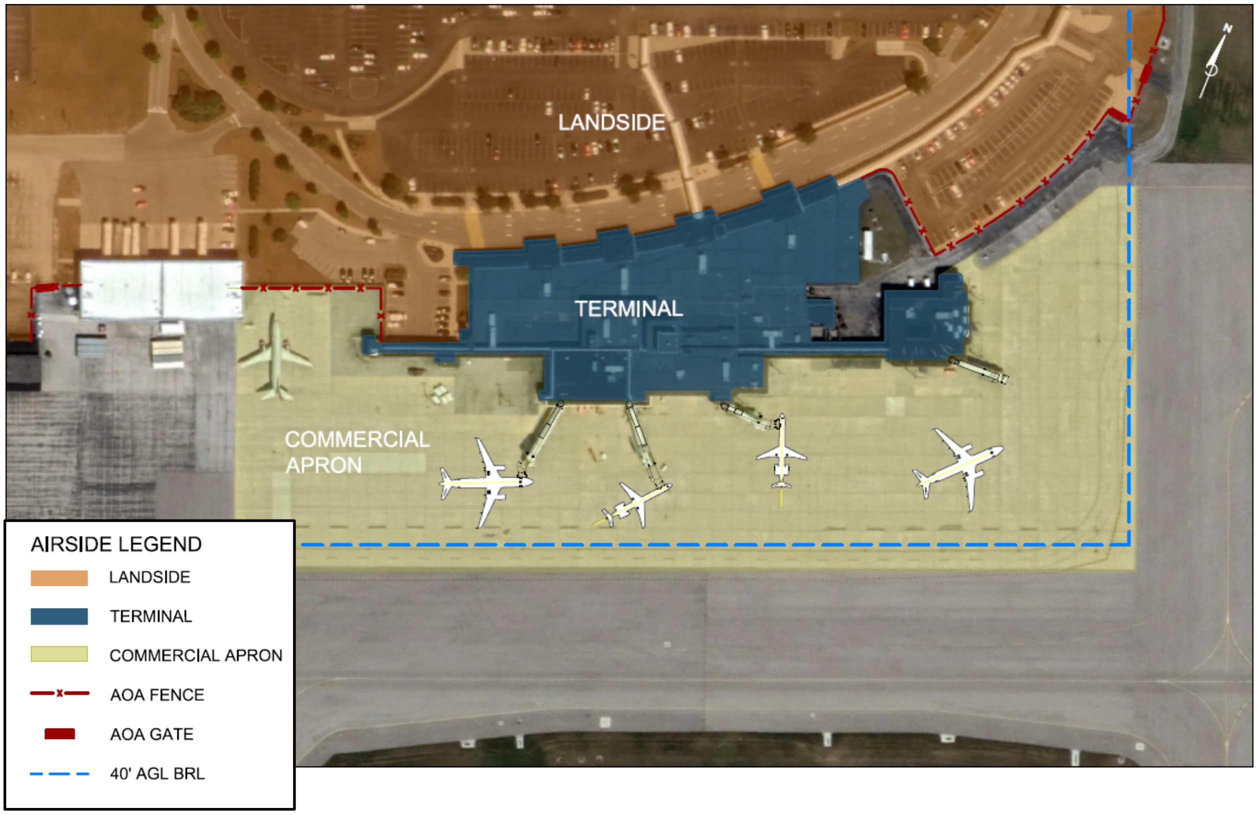
The commercial apron area is primarily comprised of 14-inch-thick Portland Cement Concrete (PCC) pavement to support the passenger aircraft. According to the 2018 Airfield Pavement Report, the pavement was considered "fair" condition, with the last rehabilitation project featuring crack sealant replacement and isolated slab repair in 2007[1]. The apron features in-pavement catch basins that collect and route all surface runoff to two airfield outfall catchment areas. The apron also features a glycol collection system able to be activated in the event the airport's deicing levels reach levels requiring catchment. Mast lighting mounted on the terminal facility structure provides sufficient illumination at night in the terminal apron area. The main utility corridor for FAA electrical and communication lines at TOL runs beneath the commercial apron connecting the ATCT with airfield facilities. Similarly, the primary sanitary sewer serving the Airport, as well as communication cables connecting nearby Airport buildings, run beneath the apron.

Originally designed to accommodate regional jet aircraft, the apron may face constraints if larger commercial aircraft start operating at TOL. During peak capacity, the apron could see up to four aircraft docked to passenger boarding bridges with allowance for additional aircraft parked in a ground-loading or remaining overnight configuration. Current aircraft that are serviced (regional and Airbus A320 and/or Boeing 737 family aircraft) at the terminal are able power in and out of gates 4 and 5 with gate 3 requiring ground handling pushback. Larger aircraft may require movement analysis and aircraft/airline performance limitation input prior to conducting gate operations under aircraft propulsion.

The commercial apron sits under intersecting Part 77 Imaginary Surfaces for the Airport's two runways, located about 750 feet from the Runway 7-25 centerline and about 520 feet from the Runway 16-34 centerline. Based on this location, aircraft current serviced at the terminal sit within and under the 40' Building Restriction Line (BRL) when parked at each respective gate. However, in the event larger aircraft begin operating out of the terminal facility, advanced airspace analysis will need to be performed in addition to the movement/parking analysis mentioned above to ensure full compliance.

[1] Toledo Express Airport Pavement Management Plan, Compiled by RS&H Ohio, Inc., December 2018

FIGURE 2
AIRSIDE AIRCRAFT APRON AREA



Source: RS&H, 2022

1.2.2 Terminal Building Condition

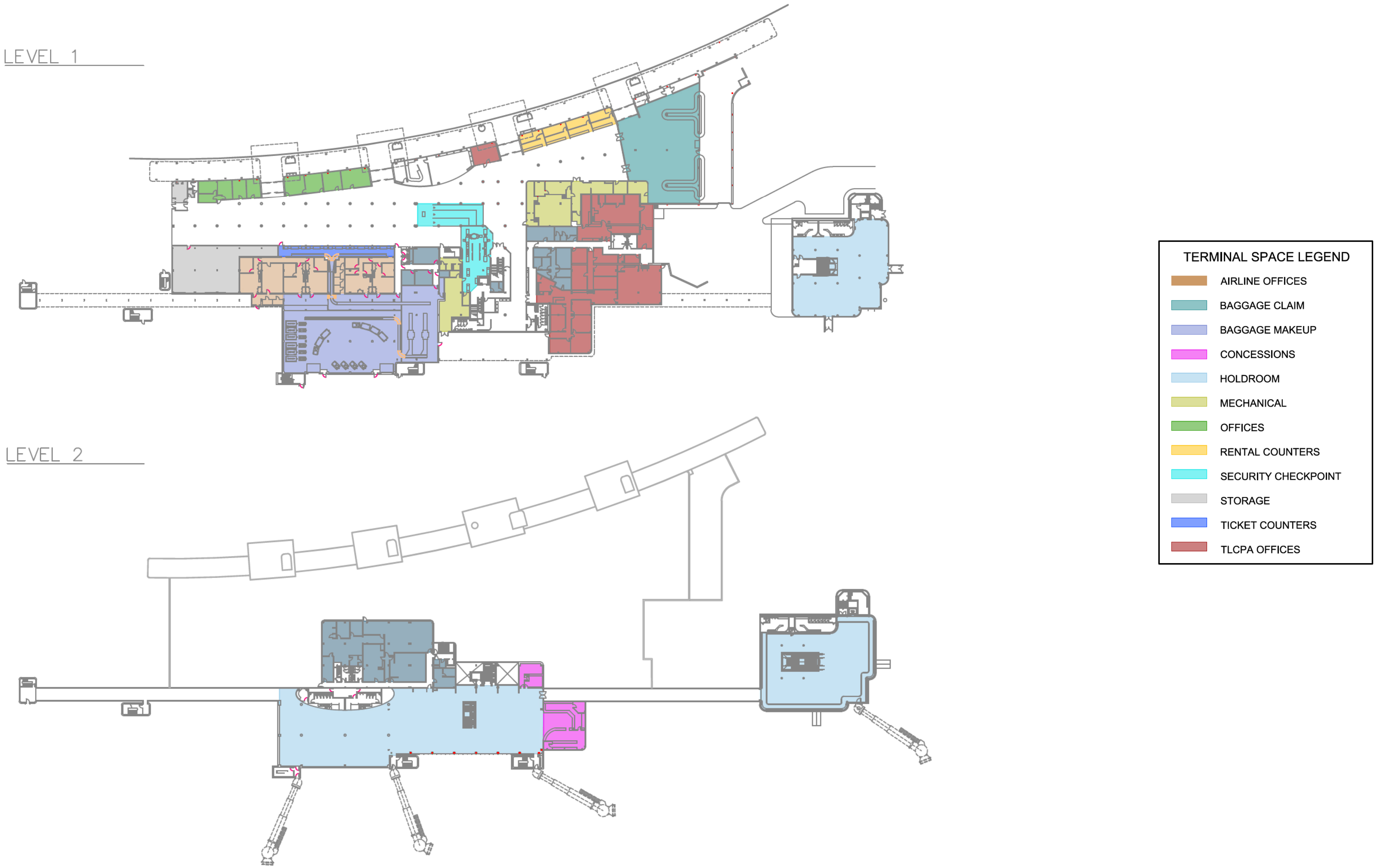
The *Terminal Building Security Reconfiguration and Development and Design* report completed in 2005 outlined a three-phase renovation program for the passenger terminal. To date, only the first phase of the program has been completed. Phase 1 included a new baggage makeup area, baggage screening, airline ticketing offices, and holdroom expansion. Phase 1 renovations improved public circulation, increased the capacity to handle passenger traffic, and enabled the Airport to meet the then current (2005/2006) Transportation Security Administration (TSA) requirements regulating passenger and baggage screening. A sharp decline in commercial operations removed the urgency for phase 2 or 3 of terminal enhancements.

The existing terminal building is a linear layout and is organized so that enplaning passenger facilities (concession area/gift shop, security checkpoint, airline ticket counters, and lobby) are in the western wing while deplaning passenger facilities (baggage claim and rental car counters) are in the eastern wing. The satellite concourse, currently not in operation, was added later to the far east side of the terminal facility. The addition added a 2-story holdroom space utilizing the terminals existing ticket counters, security checkpoint, baggage claim, and concessions. See **Figure 3** for a graphical depiction of the terminal building layout.

The first floor of the passenger terminal building consists of airline ticket offices, inbound/outbound baggage, baggage claim, rental car counters, concession area, security checkpoint, the TLCPA's administrative offices, and building support systems. The terminal's second floor consists of passenger holdrooms for bridge-loaded aircraft and a concessions space with two restaurants and a bar. It also houses the local FAA Technical Operations, FAA TRACON, and FAA ATCT departments.

As part of the Master Plan update, an inventory and building assessment of the existing terminal facility was conducted, which can be found in **Appendix B Terminal Facility Assessment**. The assessment identifies many critical infrastructure systems beyond their expected useful life which require replacement. It also indicates that based on the time of initial construction (1955 with expansions in 1966 and 1975), anticipated environmental hazards like asbestos and mold exist within the infrastructure. Based on the findings within the terminal facility assessment, many of the existing facilities need repair and updating.

FIGURE 3
TERMINAL BUILDING LAYOUT



Source: RS&H, 2022

1.2.3 Landside Conditions

The current terminal building is accessed from Airport Highway and Terminal Parkway loop. Public vehicle parking facilities for passengers are provided in the form of long-term, short-term, and rental car lots. These parking lots provide 1,755 spaces, broken out into 237 short-term, 1,412 long-term, and 106 rental vehicle parking spaces. Immediately to the west of the terminal building, a small parking lot comprised of 31 spaces is reserved for airport administration. The terminal curbfront is approximately 500 feet in length. The terminal curbfront is covered by a roof, with covered walkways providing shelter between the terminal facility and parking lots opposite Terminal Parkway. **Figure 4** depicts the terminal landside and vehicle movement areas as described above.

FIGURE 4
LANDSIDE AND VEHICLE MOVEMENT AREA

Source: RS&H, 2022

1.3 PASSENGER DEMAND FORECAST

To evaluate the existing passenger terminal facility against current and future activity, portions of the aviation demand forecast prepared for the overall Master Plan will be used. The following section summarizes the passenger activity portions of the demand forecast to provide greater context in the evaluation of existing conditions at the terminal and outline the planning activity levels that will be used to project the future terminal area needs by functional area in Section 1.4.

1.3.1 Historical Airline Service

In 1955 TOL was originally served by Capital Airlines, Delta Air Lines, Trans World Airlines, and United Airlines. Airline service at TOL has fluctuated throughout the years, with airlines entering and exiting the TOL market due to various reasons such as financial difficulty, market changes, and the events of September 11, 2001. Since 2004, 12 different airlines have operated out of TOL, as shown in **Table 1**. TOL is currently served by one airline, Allegiant Air that provides service to four destinations, shown in **Figure 5.**

TABLE 1
HISTORICAL AIRLINE ACTIVITY

Airline	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
American Airlines	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Continental Airlines	■	■	■	■	■													
Direct Air						■	■	■	■									
Delta Airlines	■	■	■	■	■		■	■										
Allegiant Air		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Northwest Airlines	■	■	■	■	■	■	■											
Sun Country Airlines				■	■					■								
Trans Meridian Airlines	■	■																
ATA Airlines	■	■																
United Airlines											■		■					
US Airways	■																	
Vision Airline									■									

Source: RS&H, 2022

*Note: American Airlines discontinued service to ORD in September 2022. The Aviation Activity Forecast anticipated the return of this service or similar within the near-term forecast period.

FIGURE 5
CURRENT AIRLINE ROUTES

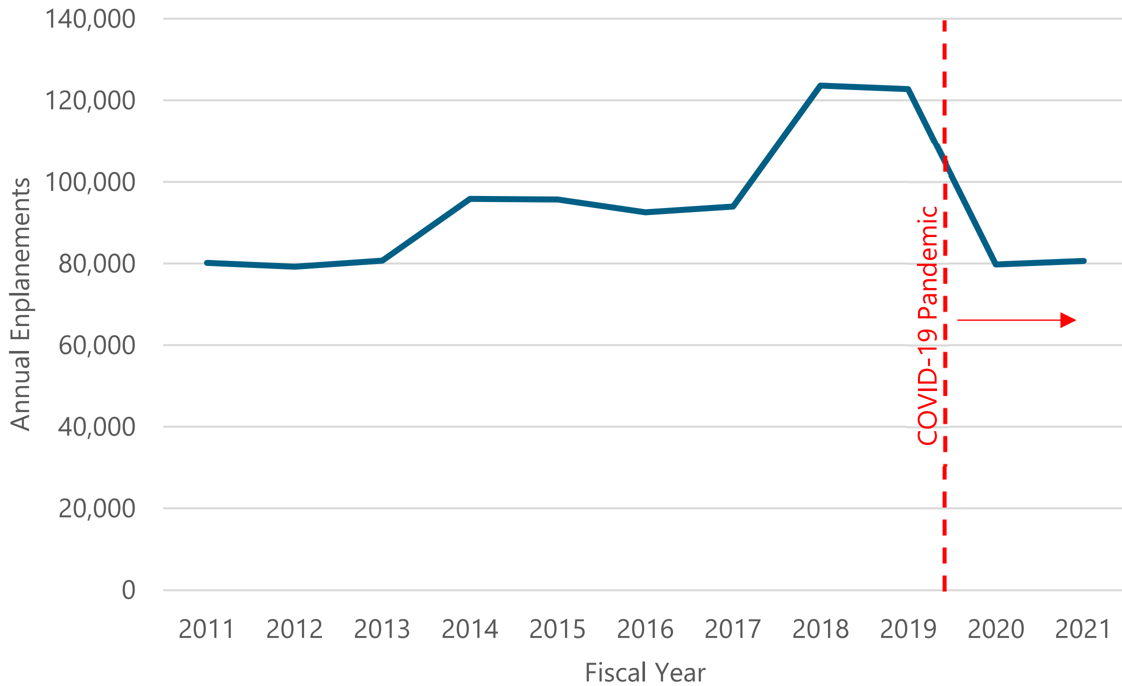
Source: https://www.toledoexpress.com/, Compiled by RS&H, 2022
*Note: American Airlines discontinued service to ORD in September 2022. The Aviation Activity Forecast anticipated the return of this service or similar within the near-term forecast period.

1.3.2 Historical Passenger Activity

Annual enplanements at TOL have decreased over the past decades partly due to factors unrelated to passenger demand for air service. As the airline model changed in the 1990s and 2000s, nearby hub airports, such as Detroit Metropolitan Wayne County Airport (DTW) and Cleveland Hopkins International Airport (CLE), became more popular by offering direct flights, resulting in leakage of passenger traffic at TOL.

In 2012, Allegiant added service to Punta Gorda. Annual enplanements at TOL increased from approximately 80,000 to over 120,000 between 2013 and 2019. This growth came to an almost immediate halt with the beginning of the COVID-19 pandemic in 2020. To control the outbreak, social distancing was encouraged, and non-essential businesses were closed. Most of the planet operated solely in the virtual world for work and school. As a result, global aviation activity saw massive reductions in operations and even cancellations of service. TOL experienced a 35 percent drop in passenger traffic from 2019 to 2020. With international travel bans due to the pandemic finally lifted in the later part of 2021 and domestic air traffic steadily increasing, passenger enplanements also started to rise. See **Figure 6** for historical passenger activity.

FIGURE 6
HISTORICAL PASSENGER ENPLANEMENTS



Source: RS&H, 2022

1.3.3 Annual Passenger Enplanement Forecast

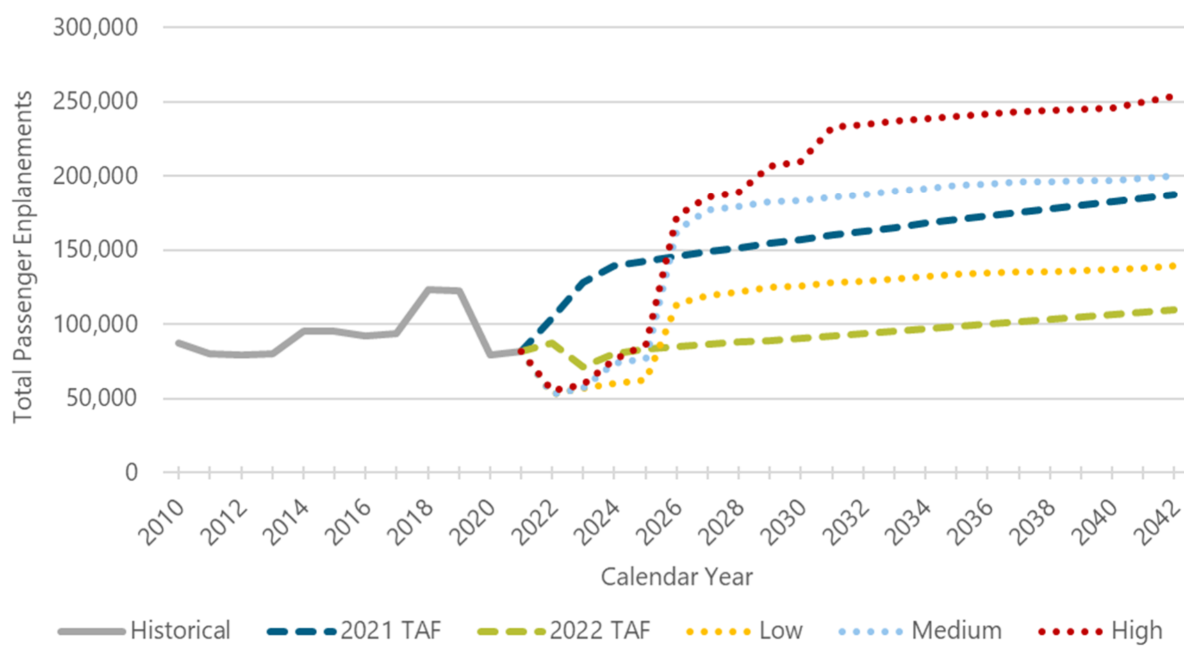
The TLCPA had formerly completed an aviation market study and commercial service forecast through Ailevon Pacific Consulting (Ailevon) that was completed in 2021 and was used as a baseline for the Master Plan forecast. The comparison of various socioeconomic factors (employment rate, population, gross regional product, income per capita, among others) across the Toledo Metropolitan Service Area (MSA) failed to show a strong correlation with the historical ebbs and flows of commercial passenger activity at TOL. The forecast model provided by Ailevon established low, medium, and high cases of commercial passenger activity growth over the planning period largely centered around the operation of ultra low-cost air carriers (ULCC) at the Airport, such as Allegiant. Beyond ULCC activity, the Ailevon forecast also factored in the departure of legacy carrier service (American, Delta, and United Airlines) from TOL as planned for September of 2022 but does anticipate the return of legacy service in the medium and high growth scenarios.

The departure of legacy service from TOL is a result of the shortage of regional pilots across the nation that arose during the COVID-19 pandemic and lingered well beyond the aviation industry's return to its traditional form. The departure of legacy service does not appear to be due to the demand for air service within the Airport's service area; however, it has left TOL with the lowest available seats per capita in the country. The Airport saw consistent load factors in the low to mid-80s for the American Airlines ERJ-145 service to Chicago O'Hare International Airport (ORD). Still, it was ultimately one of dozens of regional airports that saw route cancellations and one of four airports that lost American Airlines service altogether because of the pilot shortage in 2022.

With the departure of American from TOL already established, the forecasts developed by Ailevon were tweaked to reflect this loss of service, with an assumed return by 2026 as airlines start to gain control of service logistics. The low case for the forecast saw the largest change with the return of some form of commuter service in 2026.

Figure 7 details the modified forecast scenarios for passenger enplanements contained in the TOL Master Plan forecast.

FIGURE 7
TOL PASSENGER ENPLANEMENT FORECAST SCENARIOS



Source: RS&H, 2022

1.3.4 Design Activity Level

Determining the peak hour passenger demand is the traditional method for comparing terminal facility capacity with current and forecast demand. This is done by calculating the amount of enplaning and deplaning passengers processed through the terminal during the busiest hour of the average busy day of the year's peak month. Peak hour demand helps identify terminal facility accommodations needed to provide the optimal level of service for passengers.

The Master Plan forecast establishes three passenger enplanement forecast scenarios: Low (herein referred to as the Base scenario), Medium, and High scenarios with a base year of 2021 and a horizon year of 2041. To determine the necessary future passenger terminal needs, only the base case and high forecast scenarios were evaluated for the 2026 and 2041 analysis years only. The 2041 horizon year was analyzed to project terminal needs out for the full range of the passenger forecast. The 2026 horizon year corresponds to the forecast assumption that legacy airline activity would return to TOL by 2026. **Table 2** describes each activity level and the aircraft associated with the peak hour passenger demand.

TABLE 2
DESIGN ACTIVITY LEVEL SUMMARY

Scenario	Aircraft Type	Passenger Seats	Peak Enplaning Passengers	Peak Deplaning Passengers
Base 2026	Airbus A320	186	140	160
High 2026	Airbus A320 Embraer 175 Mitsubishi CRJ-900	186 76 76	210	220
Base 2041	Airbus A320	186	140	160
High 2041	Airbus A320neo Boeing 737 MAX 8 Mitsubishi CRJ-900	182 189 76	290	390

Source: RS&H, 2022

1.3.4.1 Peak Hour Design Levels

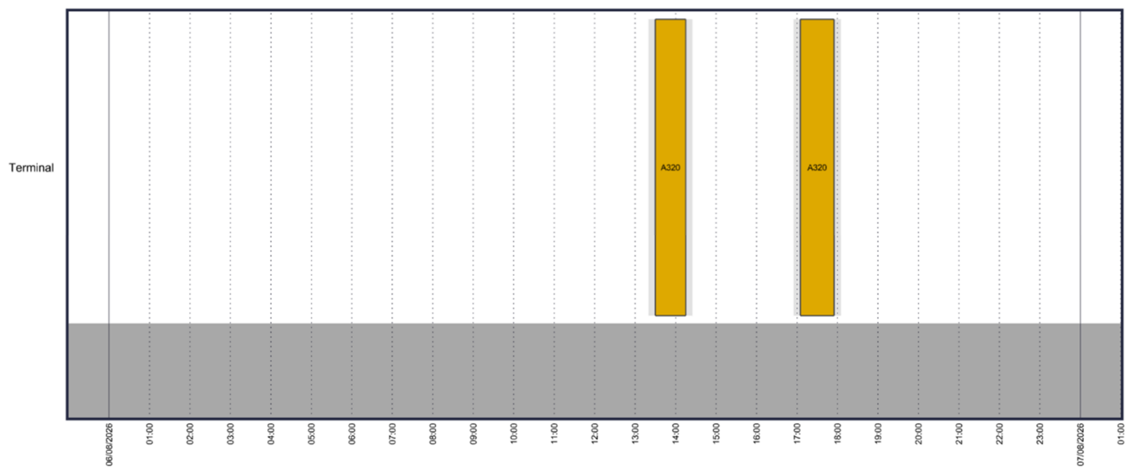
Forecasted airline schedules were analyzed to establish the peak hour passenger demand that will be used to determine terminal facility needs. Peak hour enplaning passengers (PHEP) and peak hour deplaning passengers (PHDP) are used to determine the peak hour passenger demand at the terminal. The peak hour is determined by summing the passengers performing like functions in 60-minute buckets using passenger reporting profiles. Once the peak hour values have been established, these values are used to calculate the facility requirements for specific functions such as ticketing, security screening, and public space, including restrooms and circulation. PHEP represents the peak hour in which demand for the terminal's processing functions is the greatest. The high demand within the hour is associated with flights scheduled for departure, which results in a surge of people arriving and processing through the terminal. These passengers put pressure on the terminal curb, ticket counters, screening functions, and holdrooms. The distribution of passengers for the PHEP in this study assumes that passengers will begin arriving about 110 minutes prior to the flight departure time, with the bulk of the passengers arriving between 40 and 80 minutes before departure.   PHDP represents the peak hour of arriving flights where passengers move through the terminal, adding pressure to restrooms, baggage claim, the terminal curb, and ground transportation facilities. Peak hour deplaning distributions are not as complex because of the short period required to unload an entire aircraft. The deplaning peak hour is the total number of passengers on the plane(s) factored in the scenario, as all passengers typically will have exited the terminal within 30 minutes.

The following scenarios are each illustrated with a design day flight schedule and peak hour passenger distribution graph. The design day flight schedule separates each airline by color and indicates the length of time an aircraft would be utilizing a gate and how many gates will be needed simultaneously. The larger blocks in the early morning and late evening indicate an overnight aircraft. The peak hour passenger distribution graph demonstrates the time-of-day enplaning and deplaning passengers are inside the terminal building and when they overlap.

1.3.4.1.1 Base 2026 Passenger Forecast

The low baseline scenario used for this study is taken from the existing ULCC operations occurring at TOL with two ULCC Air Airbus A320 flights and the removal of the legacy airline flights. ULCC operations at non-base airports arrive and depart (also known as "turn") anywhere from the late morning through early evening to return to their bases. Turn times with ULCC flights are typically between 30- to 60-minutes to maximize aircraft utilization. To maximize efficiency and reduce airport expenses, ULCCs try to utilize as few gates as necessary as many times per day as possible. Due to the non-overlapping nature of the flight operations, only one gate is necessary, as shown in **Figure 8.**

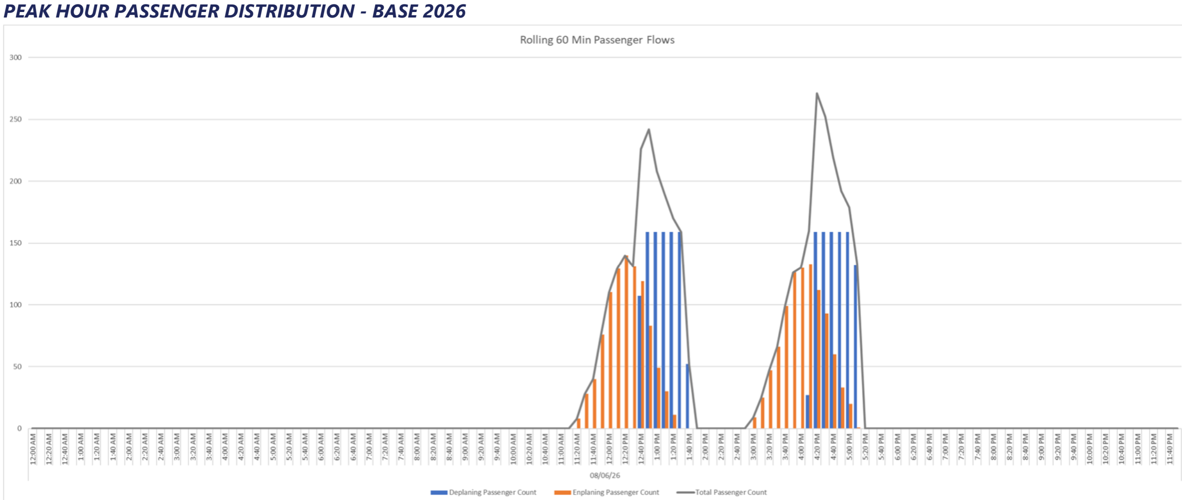
FIGURE 8
DESIGN DAY FLIGHT SCHEDULE – BASE 2026



Source: Ailevon/RS&H, 2022

Figure 9 shows the passenger distributions for the base 2026 DDFS. As previously mentioned, the two flights do not overlap. This schedule yields a PHEP of 140 and a PHDP of 160.

FIGURE 9
PEAK HOUR PASSENGER DISTRIBUTION - BASE 2026

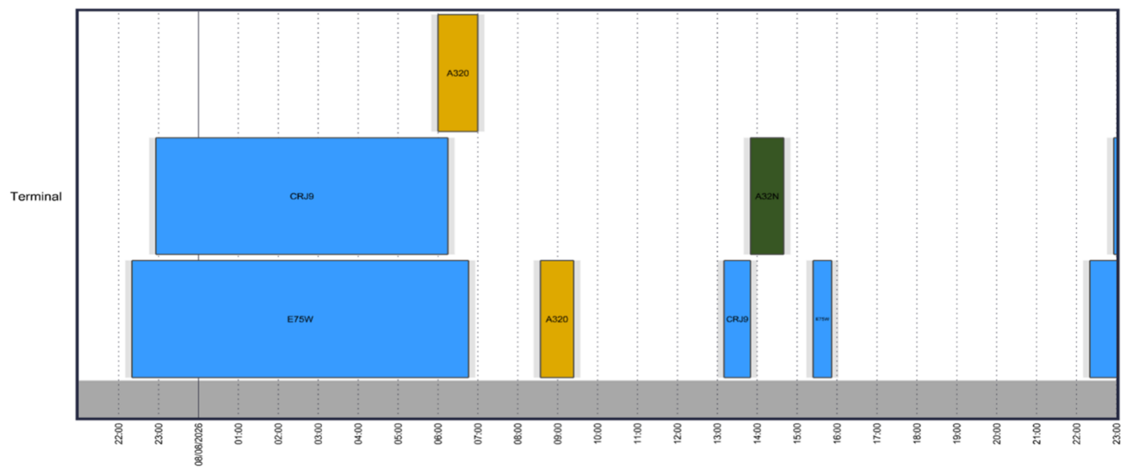


Source: RS&H, 2022

1.3.4.1.2 High 2026 Passenger Forecast

The high 2026 flight schedule builds upon the base 2026 schedule of two ULCC Air Airbus A320s, while adding four legacy airline flights, two originating aircraft, a Mitsubishi CRJ-700, and Embraer 175 flights, and two mid-day flights of each type. The legacy carriers, such as American Airlines, typically overnight aircraft at non-hub airports to provide early morning flights to give passengers connection opportunities at their hubs. This schedule introduces these flights and adds a ULCC turn in the early morning, occurring at the same time as the two-originating aircraft. Due to the overlapping nature of the flight operations, three gates will be necessary, as shown in **Figure 10.**

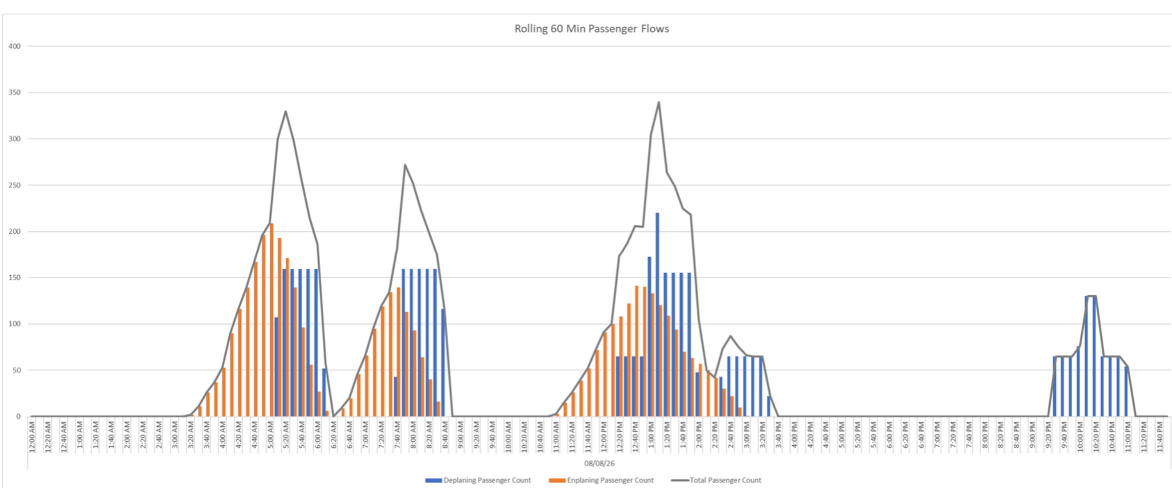
FIGURE 10
DESIGN DAY FLIGHT SCHEDULE – HIGH 2026



Source: Ailevon/RS&H, 2022

Figure 11 shows the passenger distributions throughout the design day and illustrates the peak values in the early afternoon. As mentioned previously, the two originating flights joined with the ULCC departure will increase the demand for the facility. This schedule yields a PHEP of 210 and a PHDP of 220.

FIGURE 11
PEAK HOUR PASSENGER DISTRIBUTION – HIGH 2026

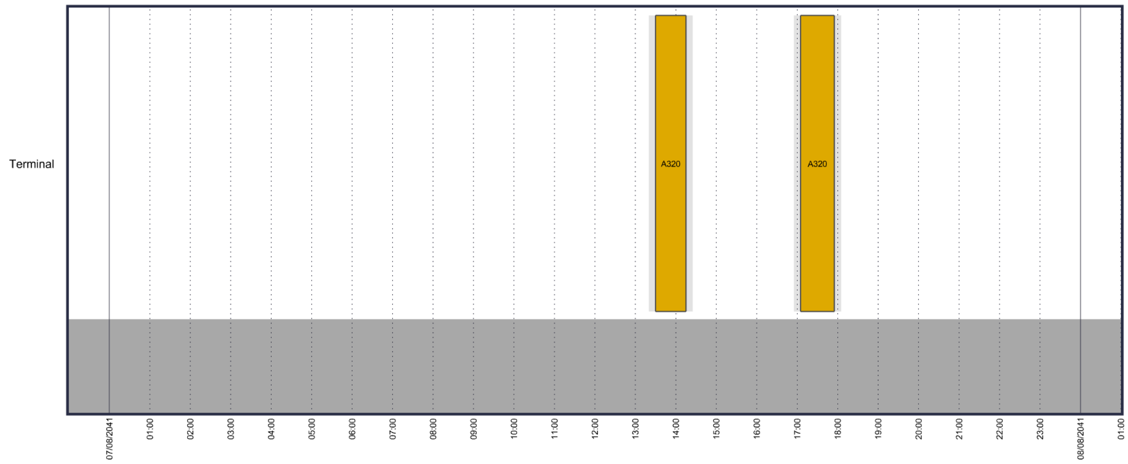


Source: RS&H, 2022

1.3.4.1.3 Base 2041 Passenger Forecast

The base 2041 flight schedule is essentially the same as the base 2026 schedule. While the peak day includes two non-overlapping A320 flights, the overall schedule differs because there is an early morning arrival twice per week. **Figure 12** shows the daily timeline utilizing one gate position.

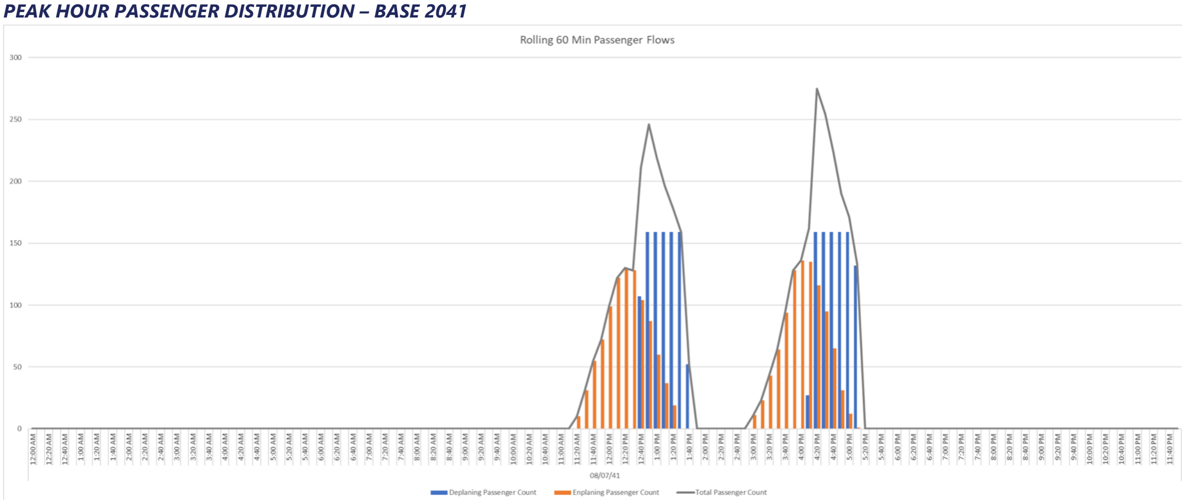
FIGURE 12
DESIGN DAY FLIGHT SCHEDULE – BASE 2041



Source: Ailevon/RS&H, 2022

Figure 13 shows the passenger distributions for the base 2041 DDFS. As previously mentioned, the two flights do not overlap. This scenario equates to a PHEP of 140 and a PHDP of 160.

FIGURE 13
PEAK HOUR PASSENGER DISTRIBUTION – BASE 2041

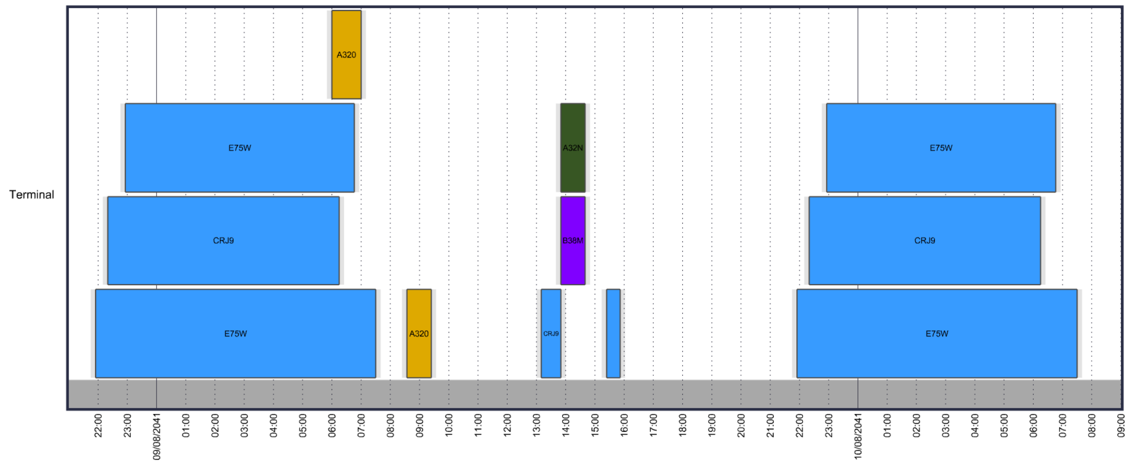


Source: RS&H, 2022

1.3.4.1.4 High 2041 Passenger Forecast

The high 2041 flight schedule accounts for an increase in daily regional jet service and new ULCC entrants to the market. The flight schedule, shown in **Figure 14,** shows a combined five legacy airline flights, consisting of Embraer E175 and Mitsubishi CRJ-900 regional jets, two A320 flights, one Boeing 737 MAX 8, and a A320 flight each. While the peak passenger loads occur at midday with three occupied gates, the gate requirement for this schedule is four which occurs with the early morning originating flights.

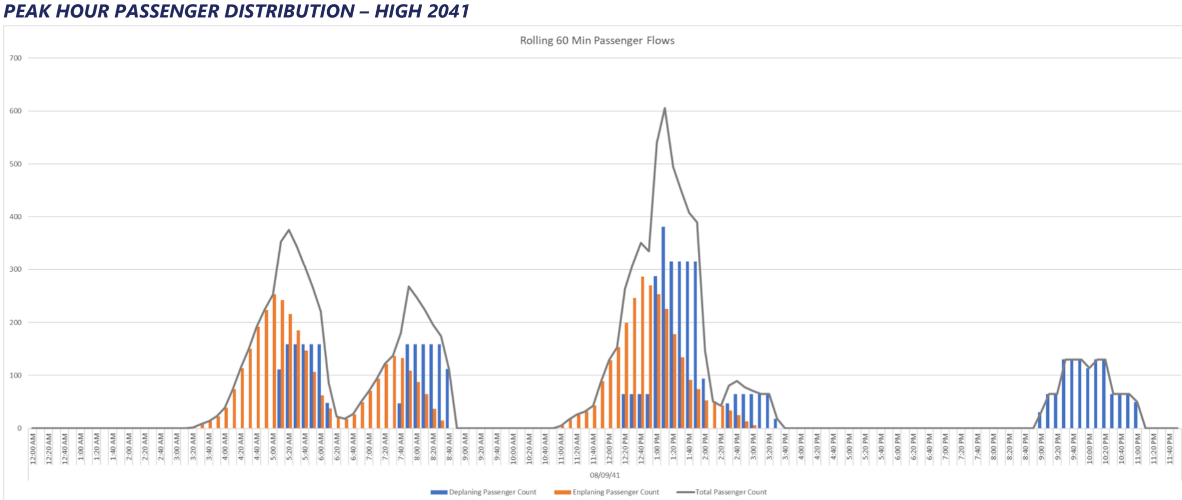
FIGURE 14
DESIGN DAY FLIGHT SCHEDULE – HIGH 2041



Source: Ailevon/RS&H, 2022

Figure 15 shows the passenger distributions throughout the design day and illustrates the peak values in the early afternoon. This schedule yields a PHEP of 290 and a PHDP of 390.

FIGURE 15
PEAK HOUR PASSENGER DISTRIBUTION – HIGH 2041



Source: RS&H, 2022

1.3.5 Forecast Summary

Four forecast scenarios from the overall Master Plan forecast were chosen for terminal planning purposes, and the design day flight schedules for those scenarios determined the peak-hour demand. **Table 3** summarizes each scenario's peak hour enplanement and deplanement metrics.

Passenger Boarding Bridges (PBB) are a system to enhance passenger comfort and access as they make their way to/from the terminal and the aircraft. PBBs are a critical link in the design and operation of major airports because they enhance safety and security by limiting passenger access only to and from the aircraft and not to the ramp area. TOL currently has four passenger boarding bridges. However, only three are operational. Due to the non-overlapping of the commercial aircraft operations in both the Base 2026 and Low 2041 scenarios, only one PBB is immediately necessary. As legacy airlines return and the ULCC introduces additional frequency and new destinations, there will be overlapping flights which could require up to four PBBs by 2041.

TABLE 3
PASSENGER ENPLANEMENT/DEPLANEMENT DATA

ANNUAL AND PEAK-HOUR PASSENGERS	Baseline Forecast					Surplus/(Deficiency)			
	Existing 2021	Base 2026	High 2026	Base 2041	High 2041	Base 2026	High 2026	Base 2041	High 2041
Annual Enplaned Passengers	79,300	63,100	163,300	90,100	245,800	**16,200**	**(84,000)**	**(10,800)**	**(166,500)**
Total Peak Hour Enplaned Passengers	120	140	210	140	290	**(20)**	**(90)**	**(20)**	**(170)**
Total Peak Hour Deplaned Passengers	160	160	220	160	390	**0**	**(60)**	**0**	**(230)**
Total Combined Peak Hour Passengers	270	280	340	280	610	**(10)**	**(70)**	**(10)**	**(340)**
Total Passenger Boarding Bridges	4	1	3	1	4	**3**	**1**	**3**	**0**

Source: RS&H, 2022

1.4 TERMINAL AREA PROGRAMMING REQUIREMENTS

Industry guidelines were used to assess the existing capacity and future requirements for different functional areas in the terminal corresponding with proposed annual enplanement growth in the planning periods. To simplify each analysis, the terminal building was broken down into functional areas that delineate types of space by use. For the planning period, the projected enplanement/deplanement levels were used to determine the space required to accommodate operations.

The terminal building programmatic requirements were calculated based upon airport terminal planning best practices and recommended methodologies which can be credited to the following industry resources.

- Airport Passenger Terminal Planning and Design – Airport Cooperative Research Program Report 25, 2010, Volumes 1 and 2
- IATA Airport Development Reference Manual, 11th Edition, 2019
- Checkpoint Design Guide, Revision 6.1, Transportation Security Administration (TSA), 2016
- TSA Planning Guidelines and Design Standards for Checked Baggage Inspection Systems, Version 4.1, 2011
- Federal Aviation Administration (FAA) Advisory Circular, AC No: 150/5360-13A, Planning and Design Guidelines for Airport Terminal Facilities, July 2018

- Federal Aviation Administration (FAA) Advisory Circular, AC No: 150/5360-14A, Access to Airports by Individuals with Disabilities, 2017
- Ailevon Pacific – Toledo Express Airport Master Plan, Draft, April 2022

The programmatic requirements for this terminal building were determined based on the peak activity identified in the scenario analysis combined with planning parameters tailored to meet a desired level of service. Level of service (LOS) is a qualitative and quantitative measure of passenger flows, level of delay, and level of passenger comfort. Two reputable industry sources have researched and developed rating systems that discuss methodologies and recommendations for determining LOS. These organizations are the International Air Transportation Association (IATA) and the Airport Cooperative Research Program (ACRP). **Table 4** shows the LOS ratings and attributes for each level. An "optimum" level of service is the benchmark for terminal planning because it offers a balance of cost efficiency while providing good LOS and comfort for passengers.

TABLE 4
TERMINAL PASSENGER LEVEL OF SERVICE STANDARDS

GRADE		LEVEL OF SERVICE	FLOW	DELAY	COMFORT LEVEL
A	Over-Design	Excellent	Free	None	Excellent
B		High	Stable	Few	High
C	Optimum	Good	Stable	Acceptably Brief	Good
D	Sub-Optimum	Adequate	Unstable	Acceptable for Short Periods	Adequate
E		Inadequate	Unstable	Unacceptable	Inadequate
F		Unacceptable	Cross Flows	System Breakdown	Unacceptable

Source: ACRP/IATA, 2010

All planning factors used in this study target an "optimum" level of service for each program area. To determine the programmatic area requirements, planning factors and industry best practices were applied according to the guidance outlined in the reference documents at the beginning of this section. It is important to note that some of the planning factors in those documents are better suited to large-hub airports. As such, adjustments to planning factors were made for use in this analysis when necessary to fit the Airport's operating environment best. Recommended areas for each terminal programmatic function were the result of applying the adjusted factors and best practices.

1.4.1 Terminal Building Components

To determine the size and area volumes for a passenger terminal that will adequately support airline operations at TOL, the 2026 and 2041 base and high scenarios were used. These scenarios were chosen to develop a range of sizing that, on the lower end, accommodates near-term single-gate ULCC flight operations and on the upper end, provides enough space to serve forecasted future demand levels with multiple overlapping flights. The terminal sizing is based upon the standards required to provide an optimum level of service to passengers and includes correctly sized processing functions.

The terminal facility requirements in **Table 5** show all the program elements described in this chapter together into a total program area. The numbers shown in the table are rounded as specific areas may fluctuate depending on numerous factors such as building code, operational efficiency and sustainability measures, and other architectural and engineering factors, which could amount to a 10-15 percent difference. The terminal facility is categorized into different functional areas, as listed below.

The programmatic space requirements analysis indicated nine specific areas of the terminal that notably accommodated the Base Case and High Growth passenger demand levels. These areas are highlighted in the table above. It should be noted that circulation, which is included under 'Public Space,' is calculated as a percentage of the total airside or landside spaces. Thus, the airside and landside circulation surpluses are associated with the other specific program areas. The surplus/deficient spaces, as illustrated in **Figure 16,** include:

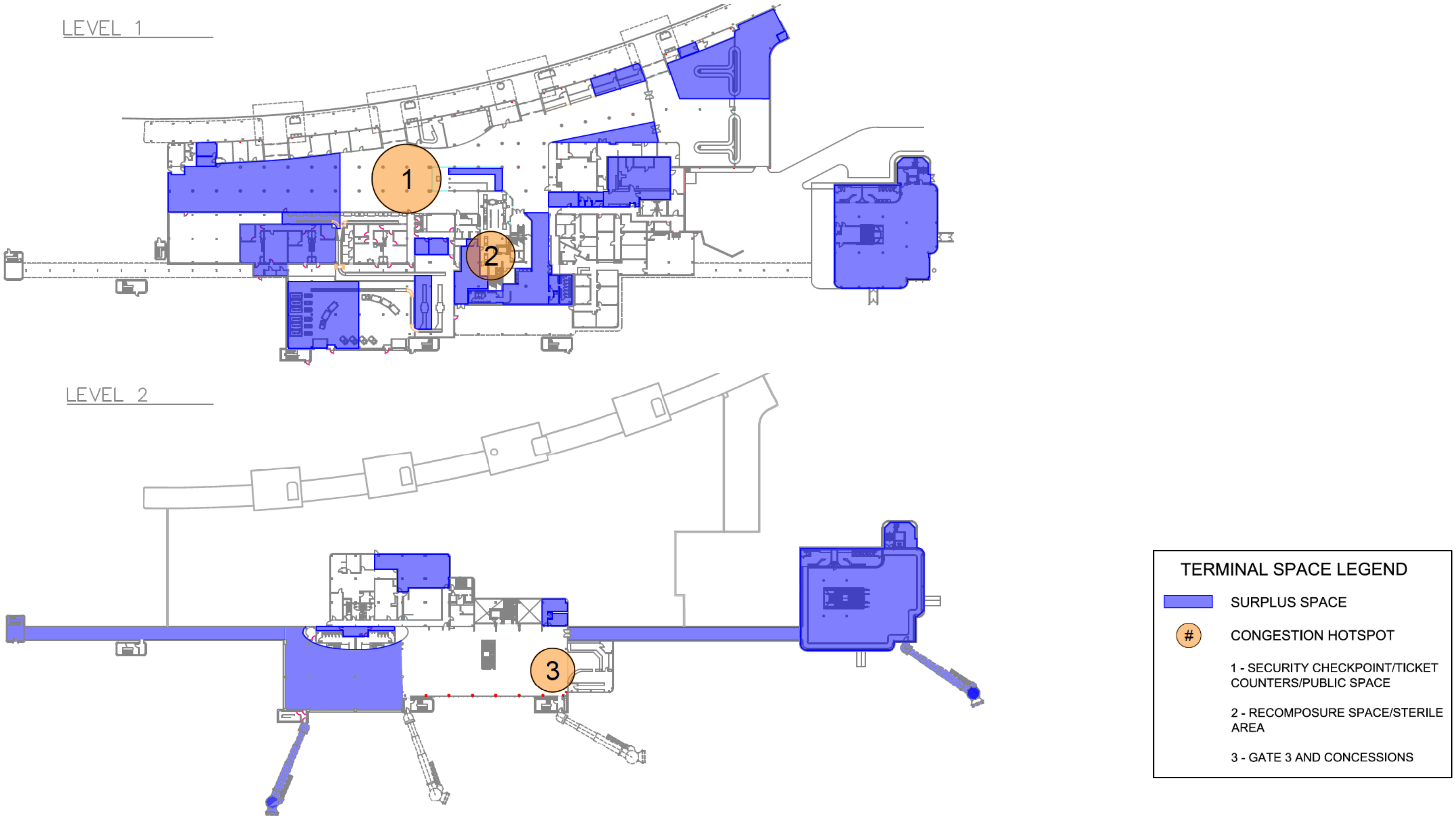
- **Airline Space:** The areas of the terminal used for ticketing/check-in, active and queuing spaces, as well as airline ticketing offices.
- **Airport Space:** The terminal areas used by the airport administration for offices, storage, and operations functions.
- **Baggage Service:** The areas of the terminal used to handle inbound and outbound baggage, including facilities necessary to perform baggage sorting, offloading, and retrieval.
- **Building Systems**: The areas of the terminal are reserved for mechanical, electrical, telecom, and other services that provide the utilities to operate the terminal.
- **Concessions:** The areas of the terminal that are leasable to third-party vendors, including food and beverage, retail, and banks/ATMs.
- **Ground Transportation:** The areas of the terminal used for car rental, taxi, bus, and ride-sharing counter space, queuing, and offices.
- **Holdrooms:** The areas of the terminal where passengers wait to board an aircraft, including airline customer service counters, boarding queues, and other amenities.
- **Public Space:** The areas of the terminal used by the public for circulation and associated functions, including waiting areas for meeters/greeters, restrooms, and baggage claim retrieval.
- **Transportation Security Administration (TSA):** The areas of the terminal operated by the TSA, including the security screening checkpoint (SSCP), offices, and baggage screening rooms.

TABLE 5
TERMINAL BUILDING PROGRAM REQUIREMENTS

		Baseline Forecast				Surplus/(Deficiency)			
TERMINAL FACILITIES COMPONENTS	**Existing 2021**	**Base 2026**	**High 2026**	**Base 2041**	**High 2041**	**Base 2026**	**High 2026**	**Base 2041**	**High 2041**
TOTAL TERMINAL PROGRAM AREA	**137,700 sf**	**58,900 sf**	**74,500 sf**	**67,600 sf**	**80,800 sf**	**78,900 sf**	**63,200 sf**	**70,400 sf**	**57,000 sf**
Airline Space	9,100 sf	2,000 sf	2,600 sf	2,000 sf	3,500 sf	**7,200 sf**	**6,500 sf**	**7,200 sf**	**5,600 sf**
Airport Space	26,100 sf	26,100 sf	26,100 sf	26,100 sf	26,100 sf	**0 sf**	**0 sf**	**0 sf**	**0 sf**
Baggage Service	19,900 sf	9,500 sf	14,100 sf	13,500 sf	19,400 sf	**10,400 sf**	**5,800 sf**	**6,400 sf**	**500 sf**
Building Systems	7,300 sf	2,800 sf	3,600 sf	3,200 sf	3,900 sf	**4,500 sf**	**3,700 sf**	**4,100 sf**	**3,400 sf**
Concessions	4,500 sf	1,000 sf	2,500 sf	1,400 sf	3,700 sf	**3,500 sf**	**2,000 sf**	**3,100 sf**	**800 sf**
Ground Transportation	2,700 sf	600 sf	1,500 sf	900 sf	2,300 sf	**2,100 sf**	**1,200 sf**	**1,900 sf**	**500 sf**
Holdrooms/Gates	24,400 sf	3,300 sf	10,700 sf	10,100 sf	7,200 sf	**21,100 sf**	**13,700 sf**	**14,400 sf**	**17,200 sf**
Public Space	38,600 sf	10,600 sf	9,000 sf	7,400 sf	10,200 sf	**28,000 sf**	**29,600 sf**	**31,200 sf**	**28,400 sf**
Transportation Security Administration (TSA)	5,100 sf	3,000 sf	4,400 sf	3,000 sf	4,500 sf	**2,100 sf**	**700 sf**	**2,100 sf**	**600 sf**

Source: RS&H, 2022

FIGURE 16
TERMINAL BUILDING DEFICIENCIES



Source: RS&H, 2022

The nine unsatisfactory areas of the terminal were discussed with Airport management and validated as areas that had become increasingly noticeable for not adequately meeting passenger demand and/or creating operational challenges. It should be noted that each of these areas of the terminal is interrelated and cannot be examined independently. As passengers flow through the building, each area will impact the next area downstream in the process. The following describes each of the nine areas in the terminal. Each description includes an explanation of those operational considerations that must be considered.

1.4.1.1 Airline Space:

Airline Space includes airline ticket counters, self-service kiosks, queue areas, and airline ticket offices. These areas are located on the non-secure side where passengers check in, obtain boarding documentation, and check bags. At TOL, the airline space is oversized in all areas. The ticket counters, sized for numerous airlines to use simultaneously, are currently used only by a single airline. Airline Ticket Offices (ATO) are also provided for each airline. Only one airline currently serves the airport; however, the final plan should incorporate flexibility and easy expandable options as it is expected that additional airlines will return to TOL during the planning period.

1.4.1.2 Airport Space:

This section details the areas used by the Airport to operate TOL. Facility requirements for these areas are based on input from the airport authority, and their current space allocation is adequate for their needs. These spaces include badging, conference rooms, offices, and operations.

1.4.1.3 Baggage Service:

Outbound passengers with checked baggage proceed to the check-in counters, where their bags are tagged and placed on a conveyor belt behind the counters. The baggage handling system moves the baggage to the TSA screening room, through the screening device, and outside to the outbound baggage sorting area, where the bags are loaded on the appropriate carts and taken to the aircraft.

Inbound baggage is taken off the aircraft, placed on carts, and taken to the inbound baggage devices, consisting of two flat-plate conveyor belts connected to each baggage claim carousel. Baggage claim is the area in the terminal where arriving passengers retrieve their checked baggage. This area includes the two revolving flat-plate baggage claim devices and the area surrounding the device. At TOL, the area is oversized for the current conditions but will be adequately sized for the High 2041 schedule.

1.4.1.4 Building Systems:

Mechanical systems consist of all the utility areas needed to allow the building to function correctly. These areas include electrical, plumbing, mechanical, telecom, support, and janitorial areas. The consensus is that most of the components are either beyond their useful life or are not code compliant and require upgrade or replacement. While more than adequate, the program space is divided into poorly located rooms, some of which are undersized. The airport Staff has listed these items to be considered in the design processes.

- Feasibility study of geothermal systems and VALE eligibility.
- Integration of visual paging, hearing loops, and the FIDS system.
- Ensuring that the fire alarm system is separate but prioritized with our PA system.

1.4.1.5 Concessions:

Concessions planning is essential to the overall terminal program because of its impact on airport revenue and passenger convenience and satisfaction. Concessions programs are typically calculated based on annual enplanements and can be broken down into four categories: Food and Beverage, Convenience Retail, Specialty Retail, and Services. For this analysis, all concessions are grouped. Typically, airside concessions are a larger percentage of the program versus the landside due to the nature of passengers spending more time post-security.

At TOL, the concessions program is oversized in square footage. However, the airside layout creates inefficiencies which can make the area feel smaller than it is. Currently, at TOL, the concessions area is set up as a horseshoe, with a bar/restaurant on the south, a pizza stand on the east, and a Subway and coffee shop on the north. Passengers looking to utilize the services here proceed into the open area in the middle, select one of several stanchioned queues, and wait for their meals. In periods of high demand, passengers are queued up adjacent to the seated bar patrons which, combined with some clothing racks and sundry stands, can make the area feel very confined. TOL has set up tables for passengers to eat that are outside of the concessions area, which alleviates the congestion at peak times.

Successful concessions programs spread the food and drink out in various parts of the facility. Newsstands and sundries are along the main circulation, while bars are becoming more intermingled in the holdrooms. Many airports utilize these types of holdroom bars as additional holdroom seating, where passengers often pick a seat and stay until boarding. These concepts help disperse the concessions crowds throughout the terminal, allowing each type of concessions program to have its own identity and give passengers a sense of space.

The future of passenger terminal concessions is leaning more towards self-service, either through online pre-ordering, tablet ordering, or upscale vending machines. Many bars and restaurants examples interspersed throughout the holdrooms have tablet ordering where food comes from a central kitchen, which saves space in the passenger areas. There are airports throughout the world that are trialing automated concessions delivery systems, which consist of automated trolleys that deliver items to passengers anywhere in the terminal. These technologies are in their infancy, but developments are being made.

Concessions bring in substantial revenue through food and drink sales at unique and casual settings. Passengers are inclined to spend for non-standard offerings, such as exotic cuisine, or 'pub-fare' branded by a celebrity chef. While these are good for passengers who come to the airport early to relax and enjoy the experience, there is also room for grab-and-go as many flights either do not offer food or offer highly priced selections.

1.4.1.6 Ground Transportation:

The ground transportation program in this analysis consists of rental car and shuttle services located within the passenger terminal and associated queue space. This space is oversized but should be sufficient for the High 2041 schedule.

1.4.1.7 Holdrooms:

The holdroom is where passengers congregate on the sterile side of the terminal to wait and board their aircraft. These areas include seating space, a standing area, an airline boarding podium, a queue area, and circulation for enplaning and deplaning passengers. Sizing is determined based on the type of aircraft expected to use each gate and considers space required for airline staff podiums and associated support areas.

At TOL, the holdroom area is significantly oversized since it serves as a common area for the three current gates and the two former gates found on the western side of the terminal. In all planning schedules, the holdroom shows to be oversized. Therefore, careful consideration will be taken on how to utilize different areas.

1.4.1.8 Public Space:

Public spaces in the terminal incorporate all circulation areas used by the public, as well as airside-to-landside exit lanes and restrooms. At TOL, the landside circulation is oversized, as it was designed to accommodate multiple simultaneous airline flights. Currently, the landside circulation area remains mostly uninhabited with sparsely placed bench-seating accompanied by numerous structural columns. The airside circulation is also oversized, as there is a hallway connecting the former western gates and a hallway connecting to the east terminal section, which has two levels. Overall, the terminal's program areas are vastly spread out, creating an expansive sprawling facility. This design creates multiple inefficiencies in circulation and public space. The restrooms at TOL need to be appropriately sized for peak-hour demand and accommodate all ADA provisions.

1.4.1.9 Transportation Security Administration (TSA):

After completing the check-in process, passengers proceed to the security screening checkpoints (SSCP). Security screening is regarded as a significant "pressure point" in terminal facility planning as it must serve all passengers and employees going from the landside to the airside. The SSCP program for a terminal of this size consists of a standard template with either single or dual inspection lanes, queuing area where passengers line up for document check, and the composure area where passengers re-arrange their belongings before heading to the gates. The TSA policy is that these lane configurations can be further enhanced for higher throughput rates by utilizing automated technology, and these allowances are incorporated in current planning standards.

TSA is also responsible for the baggage screening system behind the check-in counters. Once the airline agent tags a checked bag, it is placed on a conveyor belt and taken to the screening room. The bags are screened for explosives and other hazardous materials before being cleared and sent on for sortation.

At TOL, the SSCP is adequately sized with two screening lanes; however, typically, only one lane is used. This has provided a significant chokepoint as wait times can be long, extending out of the designated stanchioned queue area. While upgraded equipment with higher throughput will help, both lanes need to be operated to meet the demand. Furthermore, upgrading and preserving space for additional TSA screening equipment should be included in the terminal design phase. TOL does not have a recomposure area after each screening lane. This creates congestion as passengers struggle to collect their belongings and not block the circulation path. Finally, the location of the SSCP at TOL creates further issues. Its central position between other program areas prevents it from current & future expansion possibilities.

1.4.2 Federal Inspection Services (FIS)

The Port Authority has expressed interest in the presence of an FIS at the airport for potential flights to leisure destinations in the Caribbean and Mexico. The Port Authority presently has an FIS established for maritime traffic at the ports, so a relationship with the United States Customs and Border Protection already exists. The airport facility would be sized to accommodate one flight at a time and adhere to the 'bags-first' arrangement of passengers initially retrieving their checked baggage and then proceeding to primary inspection. The presence of an FIS will require one gate to be converted to a swing gate to allow international arriving passengers to remain sterile until primary inspection.

1.4.3 Airside Components

Airside components include aircraft aprons and aircraft gates. The gates should be within a short distance of the terminal building and provide ADA accessibility between the aircraft and the building. The analysis for total apron space began with the requirements necessary to provide four aircraft gate positions large enough for the Boeing B737-900ER and Airbus A321neo aircraft (which are all Aircraft Design Group (ADG) III aircraft). While these aircraft are not specifically in the flight schedules, it is appropriate to plan for the most significant aircraft type for that ADG. While the primary focus of this study is the passenger terminal facility, **Figure 2** illustrated that the airside apron is more than adequate to accommodate the planning levels discussed earlier in this section.

1.4.4 Landside Components

Landside components of the passenger terminal include the terminal roadway loop, terminal curb, and vehicle parking areas. The sizing of the terminal curb and parking areas are based on various planning parameters and needs specific to a region's passenger characteristics. The terminal roadway must be sized appropriately to accommodate vehicle parking and the terminal curb. As illustrated in **Figure 4** the landside components at TOL are considered adequate for the existing and future passenger demand, and the study will continue to focus primarily on the passenger terminal facility. However, as part of the design phase, the following items should be considered:

- Consideration of raised crosswalks and ramped curbs.
- Ensure that parking and front drive are configured to allow traffic flow during an elevated threat level (300' setback).

1.4.5 Terminal Area Programming Summary

In summary, the Terminal Area at TOL comprises 60 acres of parking lots, terminal roadways, the airside terminal apron, and the passenger terminal building. The existing airside apron, terminal roadways, and parking lots are sufficient to meet passenger demand, but the passenger terminal building does not. The existing passenger terminal building has sufficient aggregate space to accommodate the current passenger activity, however, the allocation of space is inadequate to meet existing and future needs. Furthermore, the age and condition of the building's infrastructure have outlived its useful life and should be replaced. Based on the current utilization and condition of the existing facilities, the commercial passenger terminal building requires significant renovations to enhance the safety and security of the facility for passengers now and in the future. It is recommended that TOL consider the construction of a new commercial passenger facility or renovation of the existing facility to provide the ideal LOS to current and future passengers. The above analysis determined that these components within the existing terminal facility are deficient in meeting these goals. Based on the passenger demand and airline operation forecast, it is determined that a 58,900 – 74,800 square foot facility would be necessary to meet the anticipated base and high demand scenario in 2026, respectively, and a 67,600 - 80,800 square foot facility would be necessary to meet the anticipated base and high demand scenario in 2041, respectively.

1.5 TERMINAL AREA ALTERNATIVES

This section will discuss alternatives for renovation of the existing terminal as well as determining a site for a new-build facility. Based on the passenger demand forecasts discussed earlier in this chapter, it was determined that a 59,000 square-foot facility would be necessary to meet the short-term demand and be expandable to 80,000 square-foot to meet the demand scenarios anticipated in 2041. The concepts shown in this section aim to provide layouts that can be expanded to accommodate future growth.

New-build concepts included in this report show the proposed site alternatives for a terminal facility. Prior to any design, choosing the proper site is most important, and that requires analysis of existing infrastructure, safety areas, and geographic constraints.

The renovation concepts show ideas utilizing the existing facility. There are several parts of the terminal that are unused and past their useful life span, and by removing these elements, short term footprint reduction and rearrangement of space can be accomplished. Future facility growth can be accomplished, when needed, by having a clean building edge to expand from for program elements such as outbound baggage sorting, inbound baggage service and claim, ticketing, and holdrooms; to name a few.

1.5.1 TLCPA Vision

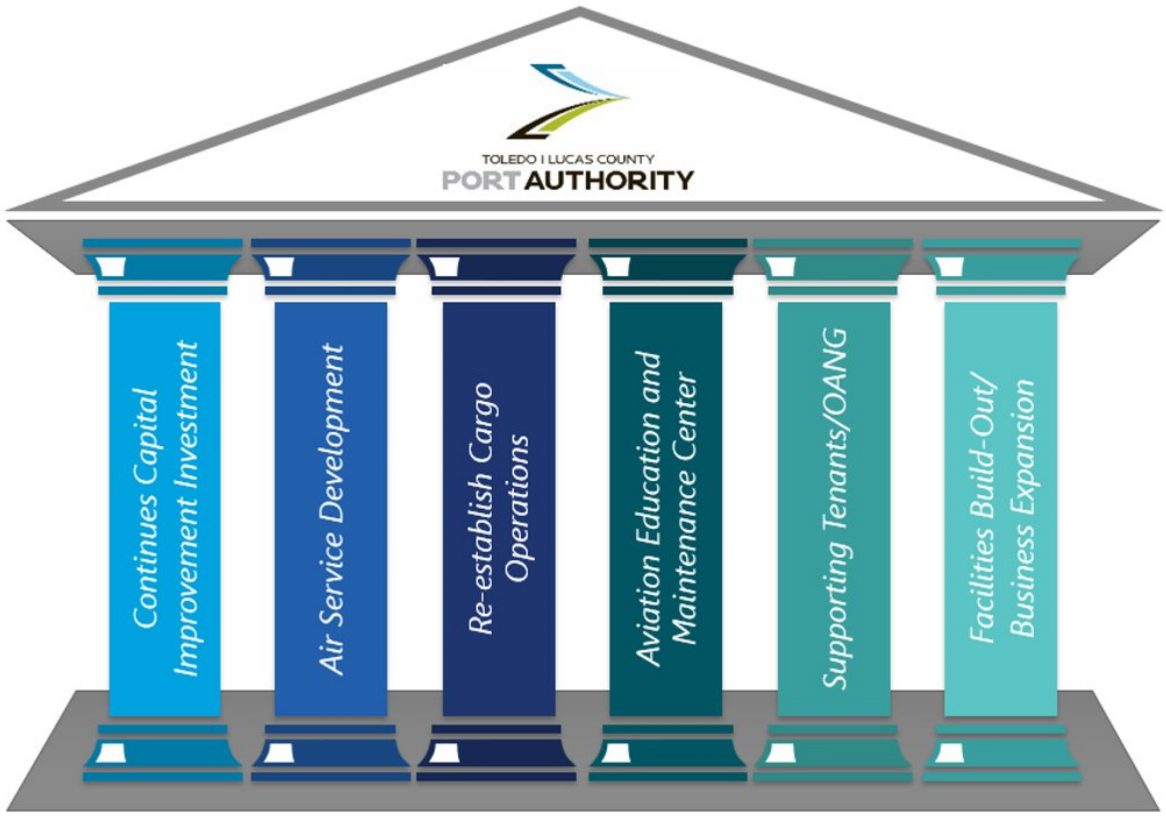
The TLCPA has an established vision, as outlined in **Figure 17,** and has developed airport-specific goals to better serve Northwest Ohio. These goals include sustainability of future infrastructure, accessibility for all airport users, and flexibility to be future-ready.

Sustainability of future infrastructure describes the intent to modernize the inner workings of the facility to current and projected standards, including the use of efficient electronics, natural light, and geothermal engineering. Accessibility for all airport users intends to make the airport usable for all people from getting to/from the airport, to navigating the facility from drop-off to departure, and arrival to pick-up.

The flexibility to be future-ready describes the intent to leave the facility larger than the forecasted program to allow for near-term airline growth through increased service by existing carriers and/or new entrants. This flexibility to provide growth addresses future visioning provided by the Port Authority Board and airport staff discussed at the March 17, 2023, Board meeting. This vision intends to renovate the existing facility and provide amenities within the existing terminal footprint to attract additional carriers and flight services. The TLCPA's vision for the airport aims to optimize the marketability of the existing terminal facility and not incorporate a reduction of the overall terminal footprint.

These goals have provided some direction in the preference to renovate the existing facility versus replacing it with a smaller, new facility.

FIGURE 17
TLCPA ESTABLISHED VISION



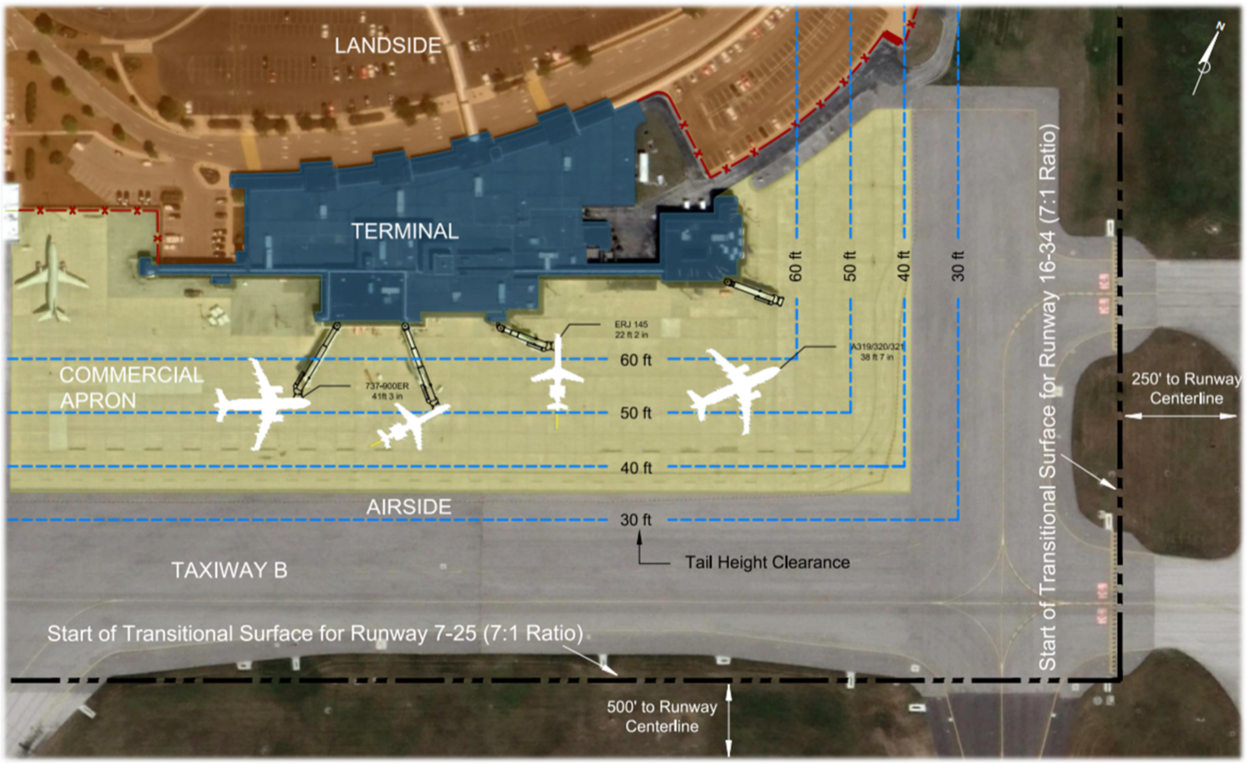
Source: TLCPA

1.5.2 Site Constraints

Though the site has an abundance of space, various constraints exist which must be considered in the development of terminal area concepts. As shown in **Figure 18**, the site is constrained by existing landside access to the north, existing cargo facilities to the west, a taxiway and runway to the east, and a taxiway and runway to the south. The terminal and apron must be set back from Runway 07-25 and Runway 16-34 sufficiently to ensure the Part 77 transitional surface, extending perpendicular to each runway up and out at a 7′ to 1′ slope, is not impacted. The required setback is based upon the tail height of an Airbus A320 aircraft, which is the tallest aircraft that is expected to service the passenger terminal at TOL in the future. It was determined that Terminal Instrument Procedures (TERPS) surfaces will not be impacted by any of the proposed terminal development alternatives within the site.

At the time of this writing, efforts were underway to reevaluate the condition and location of the ATCT currently within the terminal building. The FAA claims the existing tower has line of sight (LOS) issues to runway ends and is beyond its useful life. In 2008 a siting study was completed and approved that recommended a new ATCT be constructed on an independent site west of the existing terminal along West Airport Service Road that would be owned and operated by the FAA. A subsequent design was completed in 2012 but was not publicly bid and the project was shelved. Efforts in 2023 sought to bring the project back to life to have ATCT relocation happen in parallel with any prospective terminal development program, but with no definitive direction, the existing ATCT was planned to remain untouched through the proposed terminal development alternatives.

FIGURE 18
EXISTING SITE CONSTRAINTS



Source: RS&H, 2023

1.5.3 New Build Site Concepts

In order to best determine a site for a new-build facility, the following points were used to assist in the decision-making process.

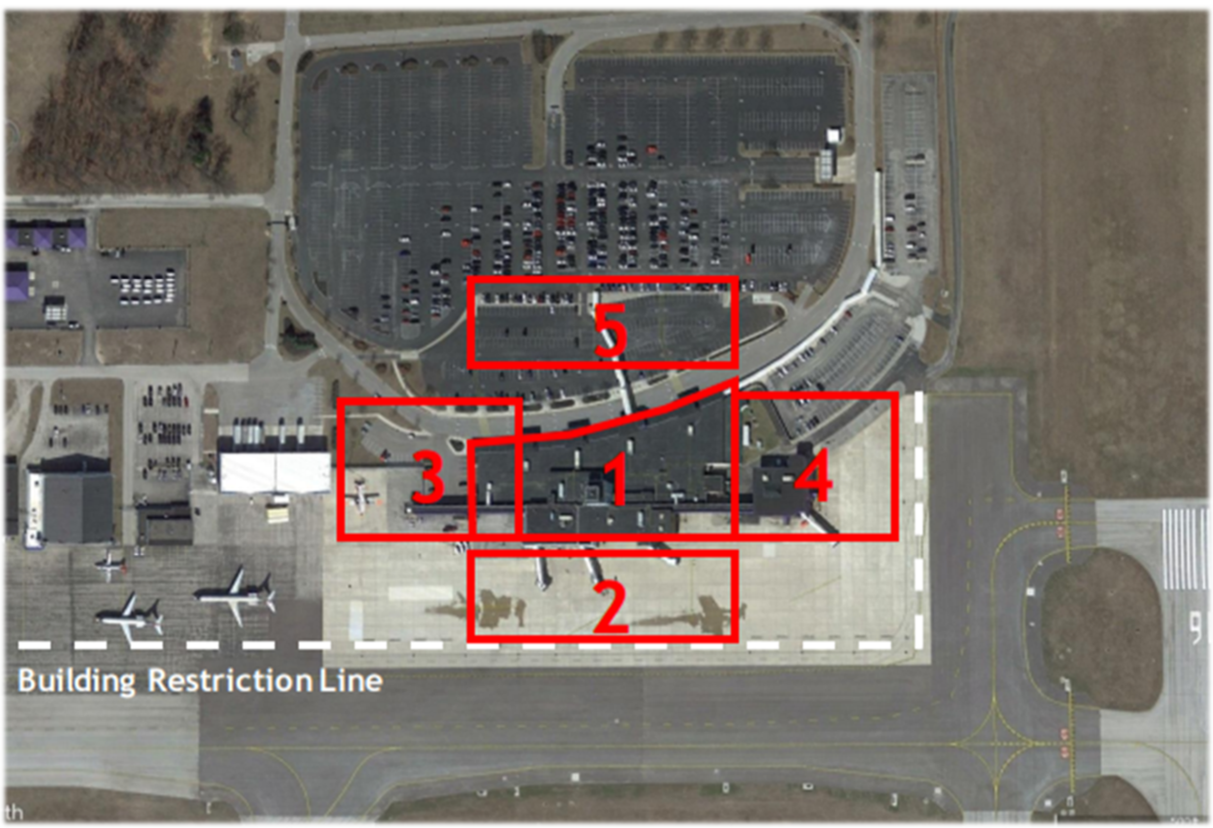
Initial key evaluation points looked at sites that would improve airfield safety. As discussed in **Section 1.5.2**, FAA Part-77 transitional surfaces determine the safety distances and heights that affect ATCT visibility lines, building restriction lines (BRL), and aircraft tail height limitations. Should a new-build facility be the preferred development option, careful consideration of these surfaces is required for terminal siting to maintain flexibility in accommodating a large variety of aircraft types. The site locations have a further effect on the design of the facility, as ATCT sight lines and compliance with the 40' BRL and aircraft tail heights will determine the extents of the structure and placement of each aircraft parking position.

A new-build passenger terminal facility would incorporate modern infrastructure, including environmental sustainability, energy efficiencies, and improved airport access. The Leadership in Energy and Environmental Design (LEED) certification process outlines numerous standards that designers and operators can adopt to utilize modern design and engineering technologies to develop and maintain and efficient facility. The terminal program layout would be arranged to provide the most effective and efficient means to move through the facility, providing ease of access from curb front to the aircraft and back again.

The placement of the terminal on each site would be determined by its ability to accommodate phased expansion. As passenger numbers grow, certain elements of the facility program become inadequately sized, so developing a layout that can easily expand at once, or in phases, is important.

Figure 19 shows the five new-build site locations in relation to the existing facility. As shown in the exhibit, each location makes use of the existing landside access and infrastructure. Further evaluation of each site is provided in this section.

FIGURE 19
NEW-BUILD SITE LOCATIONS



Source: RS&H, 2022

1.5.3.1 Site 1

This site is the location of the existing terminal, and while difficult to phase, would make use of the existing landside infrastructure almost exactly as it is currently used. Additionally, the apron infrastructure would remain as well. Careful consideration should be taken to assess whether it would be costly to reuse the existing facility should this site be preferred.

1.5.3.2 Site 2

This site builds a new facility to the south of the existing terminal. While phasing the project would be less complex as on site 1, there would be complications with the apron and location of aircraft. Numerous Part 77 surfaces, including the 40' BRL, would make aircraft parking around the proposed terminal a difficult task.

1.5.3.3 Site 3

This site builds a new facility to the west of the existing terminal, adjacent to the ticketing hall. The benefit to this site is that it can be constructed while the existing facility is in use and can utilize the existing roadways and parking facilities. Expansion would be blocked to the west, due to a cargo facility, so the only option for expansion would be eastward over the site of the existing terminal once it is demolished.

1.5.3.4 Site 4

This site builds a new facility to the east of the existing terminal, adjacent to the baggage claim facility, and on the site of the east holdroom. This site, like Site 3, can be constructed while the exiting terminal is in use, and can utilize the existing roadways and parking facilities. Expansion would only be possible to the west, as the east is blocked by the BRL, as well as other Part 77 and airfield safety surfaces.

1.5.3.5 Site 5

This site builds a new facility in the current short-term parking lot in front of the existing terminal. The size of the proposed facility would not require extensive amounts of parking area to be repurposed, and there is plenty of long-term parking area available to convert to short-term. The curbside access portion of the roadway would have to be realigned, but once completed, the new terminal would be able to expand east, south, and west. There would be more apron area for a variety of aircraft parking options, as well as an area for de-icing, and RON's.

1.5.3.6 New-Build Summary

With each of the proposed site options for a new facility, several additional tasks are needed to accommodate the new terminal site and allow the remaining FAA ATCT and TLCPA offices to remain in operation. These tasks include partial demolition of the terminal facility to accommodate the new building, enclosing remaining portions of the existing building, rerouting building systems to accommodate the partial demolition, reworking airfield pavement areas, and rerouting site utilities.

Conceptual budgets for a new terminal facility are difficult to determine without a preferred layout, scope, and full estimate. Ranges for constructing the new minimally-recommendation 59,000 square foot terminal facility (per the base aviation forecast) are approximated (in 2023 dollars) as follows: $65M to $80M for a new terminal facility (including partial existing terminal demolition); $10M to $20M for utility rerouting, roadway realignment and parking lot modifications; $5M to $20M for airfield improvements, and $40M to $50M for demolition of remaining portions of the terminal facility. Eligibility percentages will be impacted by this approach, which may increase the local share of funding a new terminal facility versus renovating the existing facility.

1.5.4 Preliminary Renovation Program Concepts

There are five options discussed in this section, four of which involve physical changes to the structure and shape of the building. The ideas behind the renovation concepts deal primarily with being able to utilize the existing facilities as much as possible by renovating parts of the facility that require the most work, repurposing parts of the facility that are in good condition and customizing the interior layout to best work around the existing infrastructure. While these layouts yield more square footage than what is recommended in the facility requirements, careful consideration is taken to balance demolition and construction, and reusing existing space to promote safe and efficient flow of passenger traffic. As with any construction project, costs are associated with demolition and construction, so certain options try to leave as much of the existing facility in place as possible.

Option 1 represents the 'no-build' scenario and the reconfigurations shown in Options 2 through 5 have several design consistencies throughout. Due to the physical changes of the facility, the mechanical space is consolidated into fewer, more efficient areas, utilizing efficient, modern, and code-compliant equipment. The ticketing counters are consolidated to allow for reuse of the vacant areas, and as a result, the ticketing lobby will be able to reduce in size. The east holdroom and corridor, and the west gates hallway will be demolished as they are unused, and the restrooms in the central holdroom area will be expanded to fill out the space. The result of the footprint reduction will be a facility that is better suited for expansion of the inbound baggage and claim area, ticketing lobby, outbound baggage room, holdrooms, and restrooms.

Options 2 and 3 are centered on minimizing the overall site footprint by focusing on the necessary part of the structure and consolidating the program to make the best use of a leaner facility. These options are geared toward the base forecasts, they would reduce the amount of unused space, and would require more expansion work if passenger numbers grow beyond those numbers.

Options 4 and 5 focus on minimizing the demolition required and leaving most of the facility as it exists today. These options are designed for the high forecast and while they would be oversized in the short term, there would be less expansion-related construction taking place once the forecasted passenger numbers are met. When renovation work occurs, the excess space will allow the work to be phased such that disruptions to passenger operations will be minimized.

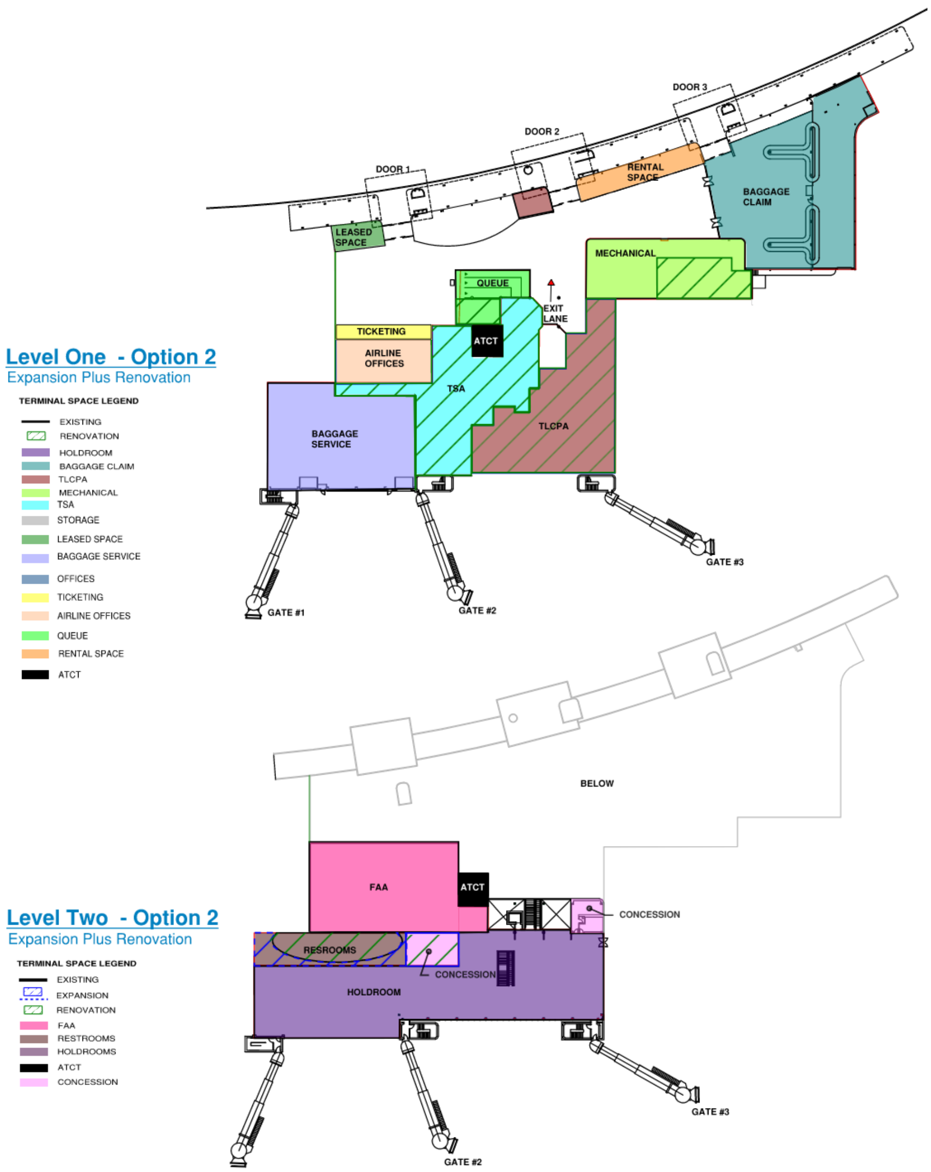
1.5.4.1 Option 1 – No-Build

The first option to consider is to leave the facility exactly as it is and focus solely on interior updates to infrastructure. The facility would undergo no demolition or new construction but would undergo minimal renovation work to bring the facility up to date based on the findings from the Facility Assessment. This option requires the least amount of capital expenditure but securing AIP funding could be more challenging as the eligibility of the proposed renovation work would need to be carefully considered.

1.5.4.2 Option 2 – Most Demolition

Option 2, as shown in **Figure 20**, was developed to simply reduce the footprint of the existing facility as much as possible, while leaving as much of the interior program intact. The most notable difference is that the TLCPA administrative space has been relocated to the west of its current location, filling in the hallways and unused space. The central holdroom area is left unchanged, but the concessions are moved to a larger, centralized location with better access from all gates. While the base forecasts only show the need for one gate, this provides some redundancy for irregular operations, especially since the area beneath the holdrooms is used for several important functions.

FIGURE 20
TERMINAL FACILITY ALTERNATIVES – OPTION 2

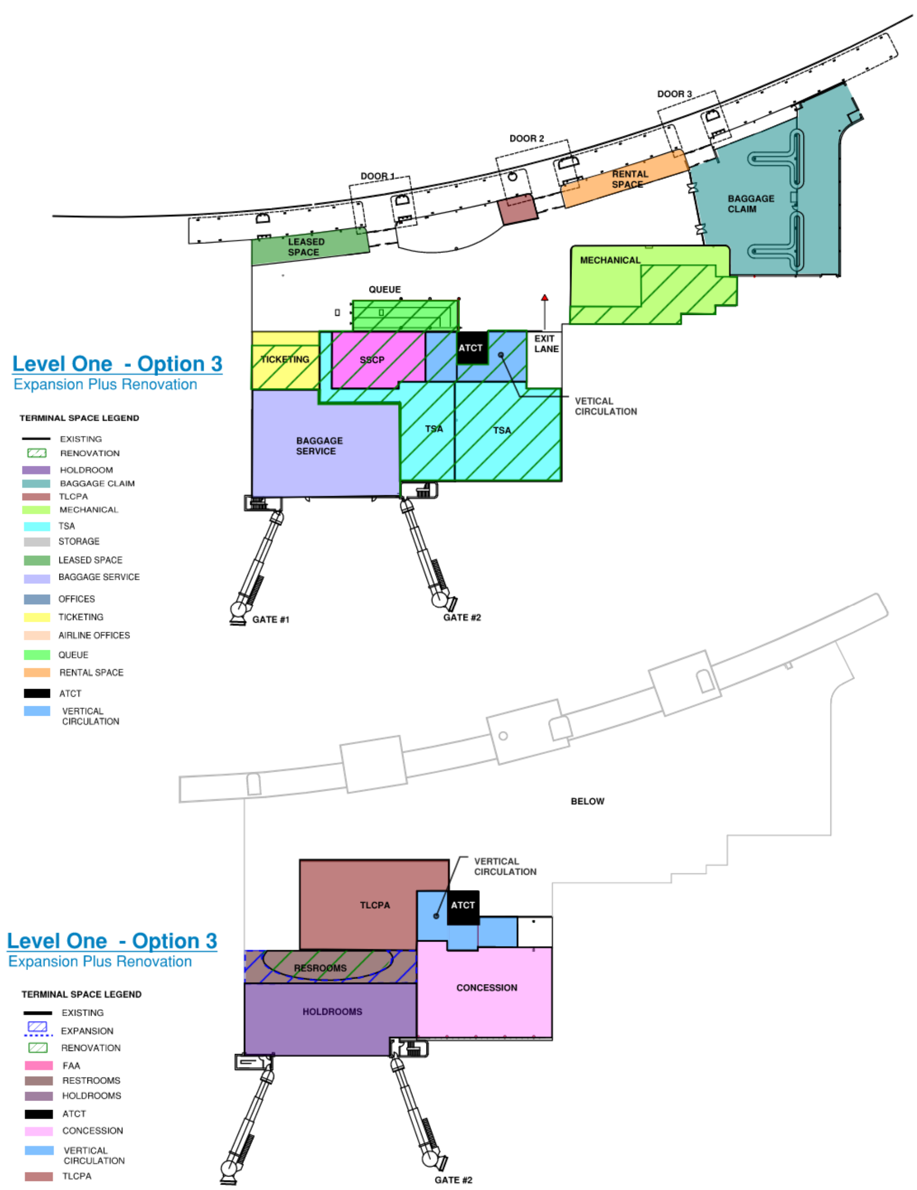


Source: RS&H, 2022

1.5.4.3 Option 3 – ATC/FAA Relocated

Option 3, as shown in **Figure 21**, reduces the footprint by rearranging some key program functions. This concept relocates the FAA to another facility most likely associated with a new ATCT. The former FAA area is repurposed for the TLCPA staff, whose original space is demolished. The SSCP is relocated and modernized, allowing for future expansion to the north, and a new vertical circulation core provides more effective access to the departure area. The holdrooms are reduced to two gates, and the concession program utilizes the former Gate #3 seating area. Arriving and departing passengers will pass through the concessions area like arrangements found in larger terminal facilities. Future expansion can build out to the east while still utilizing the concessions program already in place.

FIGURE 21
TERMINAL FACILITY ALTERNATIVES – OPTION 3

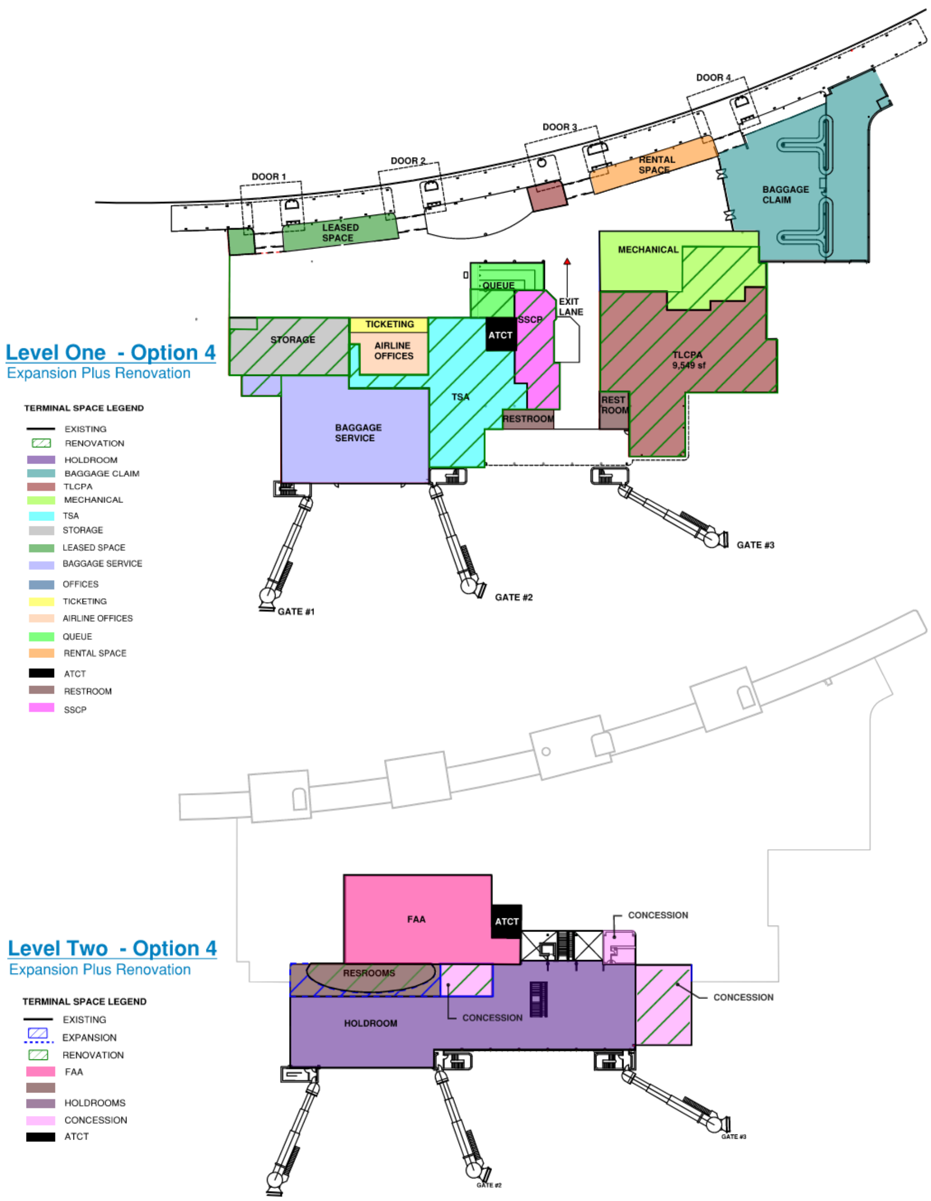


Source: RS&H, 2022

1.5.4.4 Option 4 – Minimal Reconfiguration

Option 4, as shown in **Figure 22**, was developed by reducing the amount of demolition work required. This concept leaves most of the interior program in place, with some minor adjustments and right-sizing. TSA makes use of abandoned offices adjacent to the SSCP, and the concessions program receives additional storage from the hallway that is closed off by the demolition of the east holdroom. Operational redundancy is maintained by leaving the holdroom as it exists today and keeping the three gates available.

FIGURE 22
TERMINAL FACILITY ALTERNATIVES – OPTION 4

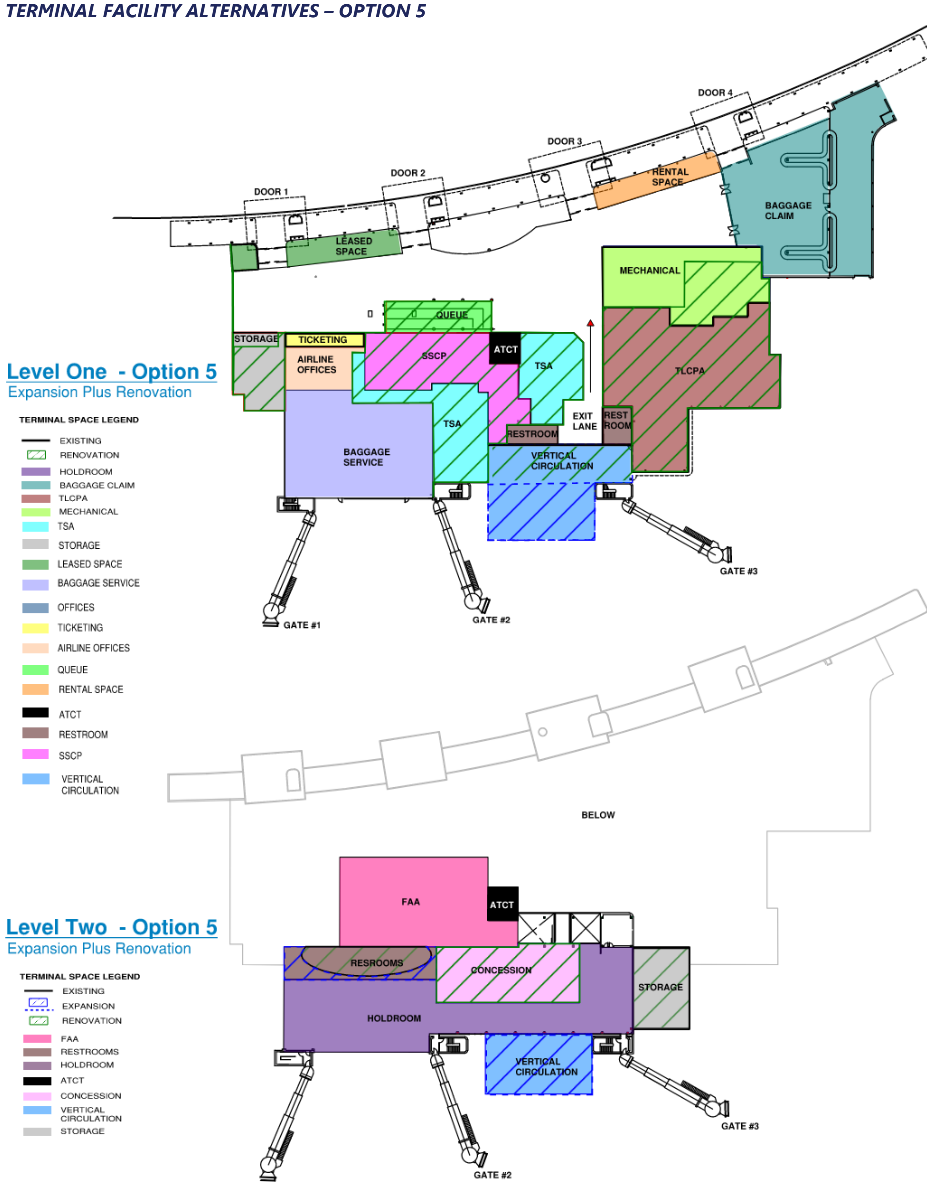


Source: RS&H, 2022

1.5.4.5 Option 5 – New Circulation

Option 5, as shown in **Figure 23**, was developed to minimize demolition work. In this layout, the SSCP is relocated and modernized to better accommodate future expansion and provides more area for passengers exiting the screening area. This option places the vertical circulation, both departing and arriving, in a new, glass structure built on the south wall between Gates #2/3. The city of Toledo is historically known for manufacturing, notably in the production of glass which bestowed the moniker "The Glass City" on Toledo. As a tribute to this, Option 5 would celebrate the city with enhanced glass elements giving passengers a great airfield view. The concessions program would be centralized in the holdroom providing more unobstructed access, and the restrooms would be expanded to better accommodate high-passenger loads.

FIGURE 23
TERMINAL FACILITY ALTERNATIVES – OPTION 5



Source: RS&H, 2022

1.5.5 Alternatives Evaluation

The alternatives described in the previous section were evaluated by RS&H and TLCPA staff on a range of factors, ranging from relocation of certain program elements, to cost and implementation efforts, to level of service and longevity. Each option had varying advantages and disadvantages and was scored based on a color-coded ranking system. **Table 6** evaluates the level of construction, costs associated with construction, and program locations for each option, while **Table 7** evaluates key program elements and ranks each option. Option 5 was selected by the TLCPA as the preferred path forward in the planning process discussed in the next section.

TABLE 6
ALTERNATIVES EVALUATION CHART – CONSTRUCTION, COSTS, AND PROGRAM

	Option 1	Option 2	Option 3	Option 4	Option 5
	'No-Build'	**'Most Demolition'**	**'FAA/ATC Relocated'**	**'Minimal Reconfiguration'**	**'New Circulation'**
Vertical Circulation	Existing	Existing	Relocated	Existing	Relocated
TLCPA Offices	Existing	Relocated	Relocated	Existing	Existing
SSCP	Existing	Existing	Relocated	Existing	Relocated
Concessions	Existing	Relocated	Relocated	Existing	Relocated
FAA/ATCT	Existing	Existing	Relocated	Existing	Existing
Number of gates	4	3	2	3	3
Exterior/Interior Demolition	Insignificant	Moderate	High	Low	Low
Exterior/Interior Renovation	Low	Low	Very High	Moderate	High
Exterior/Interior New-Build	Insignificant	Moderate	Low	Insignificant	High
Addresses Health/Safety Concerns					
Airport Operational Impacts					
Timely Implementation					
Demolition/Renovation ROM	Low	Moderate	Very High	Moderate	High

Source: RS&H, 2023

TABLE 7
ALTERNATIVES EVALUATION CHART – KEY PROGRAM ELEMENTS

	Option 1	Option 2	Option 3	Option 4	Option 5
	'No-Build'	'Most Demolition'	'FAA/ATC Relocated'	'Minimal Reconfiguration'	'New Circulation'
Ticketing					
Ability to Handle Long Term Needs	Green	Red	Red	Yellow	Yellow
Level of Service	Green	Green	Green	Green	Green
Expandability	Green	Red	Red	Yellow	Yellow
Security Screen Checkpoint (SSCP)					
Ability to Handle Long Term Needs	Yellow	Yellow	Green	Yellow	Green
Level of Service	Yellow	Yellow	Green	Yellow	Green
Expandability	Red	Red	Green	Red	Green
Vertical Circulation					
Ability to Handle Long Term Needs	Yellow	Red	Yellow	Red	Green
Level of Service	Yellow	Yellow	Green	Yellow	Green
Expandability	Red	Red	Yellow	Red	Green
Concessions					
Ability to Handle Long Term Needs	Yellow	Green	Yellow	Red	Green
Level of Service	Yellow	Green	Green	Yellow	Green
Expandability	Red	Yellow	Yellow	Red	Yellow
Holdrooms					
Ability to Handle Long Term Needs	Green	Yellow	Yellow	Yellow	Yellow
Level of Service	Green	Green	Green	Green	Green
Expandability	Green	Yellow	Yellow	Yellow	Yellow
COMBINED RATING	**73%**	**64%**	**78%**	**60%**	**89%**

Source: RS&H, 2023

1.6 REFINED TERMINAL ALTERNATIVES

With the footprint of the existing terminal facility already surpassing the programmable space required per the aviation activity forecast, as well as being located in the most desirable location for safe and secure transition between landside and airside operations, the TLCPA prefers to renovate the existing facility bringing the building up to current building and FAA design requirements. The preferred terminal renovation concept, selected by the TLCPA, is based on the previously discussed (**Section 1.5.4**) new-circulation option 5. This preferred concept, known as the refined development plan, was further refined as an implementable program with rough order-of-magnitude (ROM) cost estimates generated to establish a threshold by which future value engineering efforts could be made better suiting the proposed terminal facility to the vision, implementation, funding capacity, and future considerations of the TLCPA. This new baseline alternative is known as the refined redevelopment option and is further detailed below.

1.6.1 Redevelopment Plan

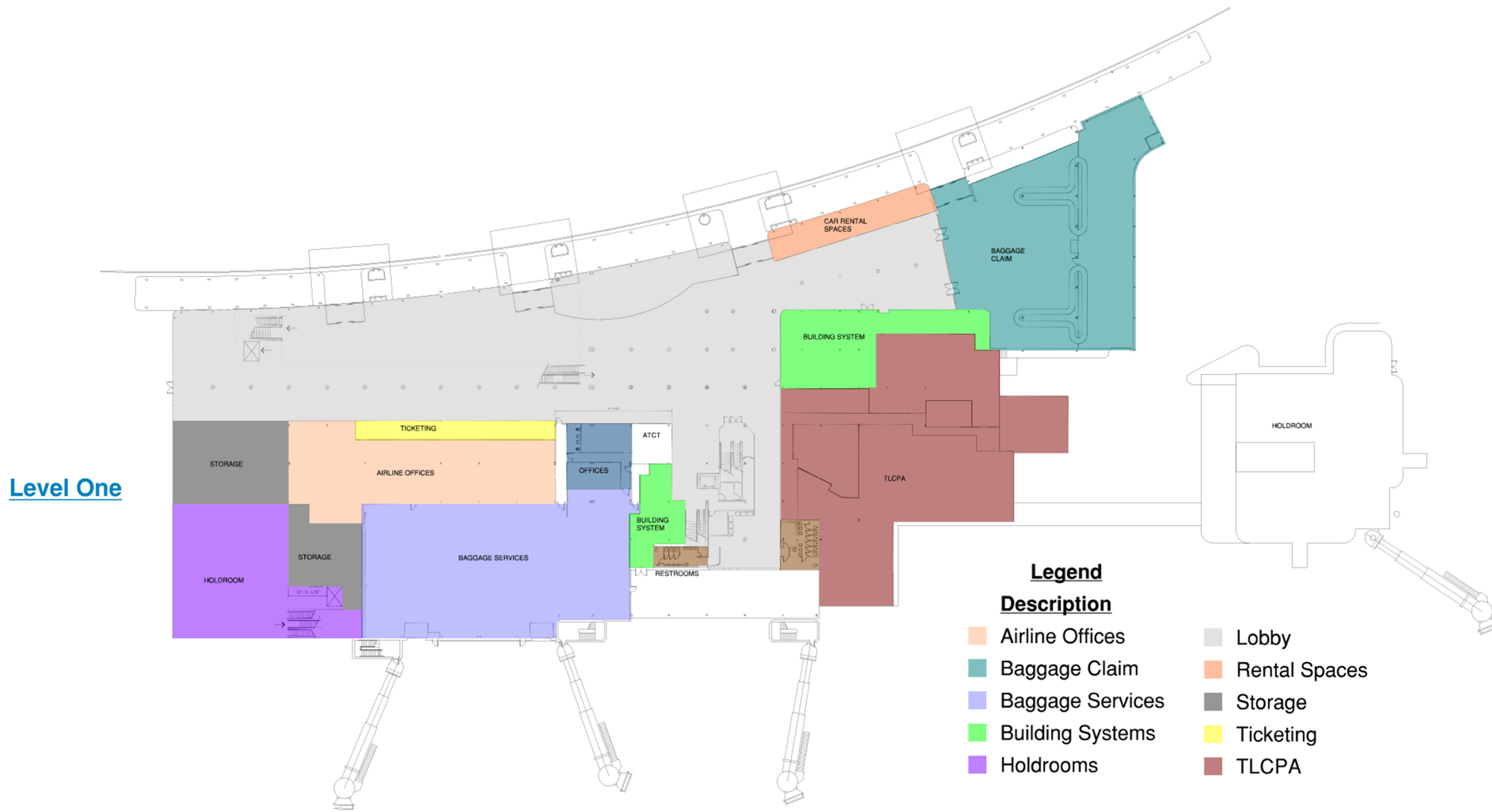
The aim of the refined redevelopment plan was to provide a conceptual program that could be visualized by the TLCPA serving as a design development "baseline." Input from the TLCPA during this programming stage prompted the creation of two alternatives further refining this option that are anticipated to serve as a blueprint leading into design phase of the proposed project. These two alternatives are further discussed later in this section.

1.6.1.1 Facility Layout

For the refined redevelopment plan, the overall footprint of the facility is left intact, except for the addition of a ground-level holdroom, and the demolition of the west pier. The interior floor plan is rearranged, similar to option 5, to make better use of existing space and provide for future expansion opportunities. The most notable addition to this hybrid plan, is the construction of a new modernized SSCP at the westernmost portion of the facility in a dual level construction which would place it on the second floor, while the first floor would be reserved for offices, storage, and a ground-level holdroom. The use of the east holdroom would remain dormant, however, it would be ready for use once demand increases. Below are the floor plans for the preferred alternative, **Figure 24** is level one, while **Figure 25** is level two. The ground-level holdroom on level one is sized for one large-narrowbody aircraft but can accommodate multiple smaller commuter aircraft if needed. The SSCP's relocation to the second floor reduces the congestion in the center of the terminal and allows opportunity to repurpose the area.

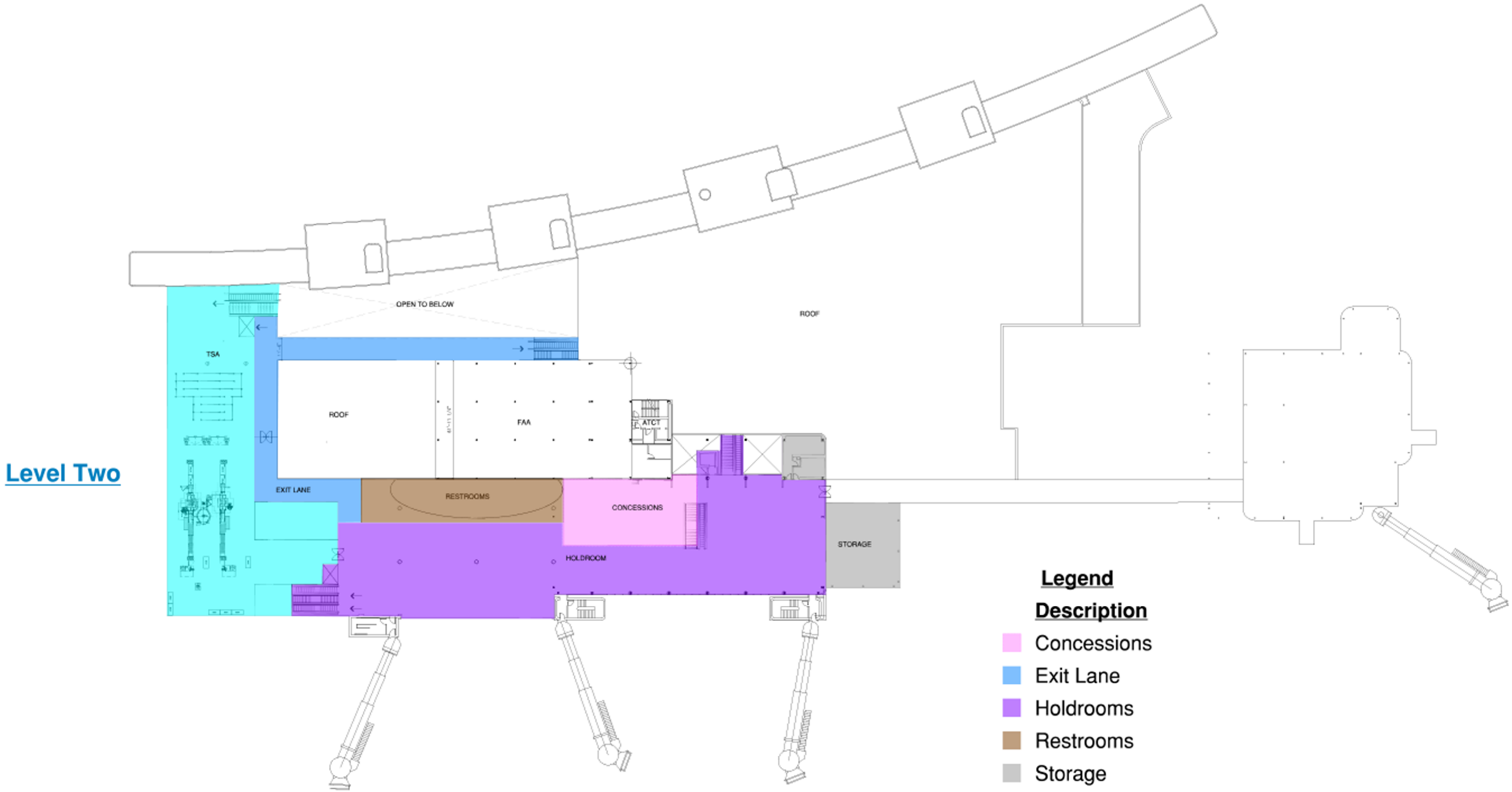
The level two floor plan shows the addition of the expanded SSCP on the westernmost part of the terminal. The space provided for the SSCP is able to accommodate the high-growth passenger forecast scenario and leaves potential for further expansion, aligning with the airport's vision. Additional changes to the second floor include expanded restrooms to better accommodate traffic generated from larger aircraft, and a relocated concessions footprint to the center of the holdroom so passengers have better unconstrained access to the concessions program. The exit lane will parallel the SSCP and bring passengers to the central lobby by a second story walkway along the open atrium of the ticketing hall, with vertical circulation adjacent to where the existing SSCP is located. The existing vertical circulation elements, such as the escalators in the middle of the holdroom currently used for departing passengers clearing security, will be removed.

FIGURE 24
REFINED REDEVELOPMENT OPTION – LEVEL ONE



Source: RS&H, 2023

FIGURE 25
REFINED REDEVELOPMENT OPTION – LEVEL TWO



Source: RS&H, 2023

1.6.1.1.1 Architectural Considerations

The renovation of the terminal is planned to incorporate elements of glass which not only pays homage to the city of Toledo as "The Glass City" but will open the facility to more natural light and modern aesthetics. Certain elements of the terminal can easily be enhanced by the presence of glass, including the ceilings by adding skylight windows, the elevators, and escalators by replacing existing devices with glass-enclosed equipment, and adding windows to existing walls. Additionally, the presence of glass provides natural lighting during daylight hours and natural heating in cold weather.

1.6.1.1.2 Airside

The airside component of the refined redevelopment option will be left relatively unchanged from its existing condition. If needed, ramp provisions for the ground-level holdroom to accommodate commuter aircraft will be included in the program.

1.6.1.1.3 Landside

The landside component of the refined redevelopment option, like that of the airside, will be left relatively unchanged. The Airport has requested dedicated areas for a cell-phone lot and a ride-share pick-up/drop-off area. These items are not directly related to the Terminal Area Plan and will be addressed the ongoing, root airport master plan update. Additionally, further enhancements for accessibility and safety will be made. These enhancements shall include relocating pedestrian crosswalks to align with terminal entry points, minimize curbs at passenger loading zones, widening walkways, consistent mounting heights for required signage, placement of service animal relief area closer to terminal, and related improvements.

1.6.1.2 Health and Safety

One of the primary components driving the renovation and modernization of the passenger terminal facility is bringing the health and safety elements up to current standards and providing for future enhancements. The Terminal Facility Assessment, which was completed in 2022, documented numerous elements within the facility that need modernization, including removal of materials to provide a cleaner air environment, replacing outdated equipment to install more efficient technology, and ensuring accessibility compliance to make using the facility a pleasant experience for all employees and passengers.

1.6.1.3 Adherence to Vision

The decisions behind the selection of the refined redevelopment option center around the adherence to the TLCPA vision for the airport, which is discussed in **Section 1.5.1**.

1.6.1.4 Preliminary Cost Estimate

Rough order magnitude (ROM) cost estimates were generated for the refined redevelopment option. The estimates were broken into landside site work, terminal building renovation and construction, upgrades in security and information technology, and passenger boarding bridge equipment, along with the associated program engineering and construction fees. Impacts to existing airside facilities are assumed to be minimal per the program scope and thus are not included in these cost estimates. Landside site work includes the modifications to the existing terminal loop road, parking lot, associated curbs and gutters, as well as changes in landscaping, lighting, striping, and other general construction items. The terminal building construction category includes the costs of reconfiguring a 139,000 square foot terminal with full fit out. details the ROM cost estimate for the refined redevelopment option. All estimates' values were increased by a constant 10 percent escalation rate consistent with industry pricing trends for calendar year 2028, the proposed last year of project construction at the time of this writing. The full, detailed cost estimate for the refined redevelopment option can be found in **Appendix A**.

TABLE 8
ROM PROJECT COSTS – REFINED REDEVELOPMENT OPTION

	DEVELOPMENT AREA	QUANTITY	UNITS	UNIT PRICE (2028 ADJUSTED)	TOTAL (2028 ADJUSTED)
New Terminal Addition					
1	Partial Demolition of Terminal	1	LS	$1,926,000	**$ 1,926,000**
2	New Addition	21,964	SF	$1,771	**$ 38,907,000**
Existing Terminal Renovation					
3	Building Envelope Replacement	1	LS	$12,249,000	**$ 12,249,000**
4	Plumbing Upgrades, Fire Sprinkler Modifications, Restroom Renovation/Expansion	108,773	SF	$48	**$ 5,175,000**
5	Mechanical System Renovation	108,773	SF	$118	**$ 12,816,000**
6	Electrical System Renovation	108,773	SF	$88	**$ 9,585,000**
7	Technology System Renovation	108,773	SF	$69	**$ 7,542,000**
8	Interior Renovation of Existing Finishes	108,773	SF	$177	**$ 19,278,000**
Sitework					
9	Sitework Improvements	1	LS	$324,000	**$ 324,000**
10	Add for Glass Jet Bridges	3	EA	$2,002,500	**$ 6,003,000**
11	Replace Pedestrian Canopies	766	LF	$2,432	**$ 1,863,000**
Total Construction ROM Estimate - 2028 Adjusted:					**$ 115,668,000**
12	Engineering Design + Contingency				**$ 12,852,000**
Total Program ROM Estimate - 2028 Adjusted:					**$ 128,520,000**

Source: McGuiness Unlimited, Inc./RS&H, 2023

1.6.1.5 Evaluation and Further Refinement

Through the Terminal Building Assessment and the Aviation Activity Forecast, the TLCPA determined the size of the existing terminal facility is more than enough to protect for future expansion with preference for a renovation and modernization project. The refined development option achieves the vision of the TLCPA in modernizing the terminal as well as improving efficiency and level of service for passengers. However, as this concept more than doubles the space required per existing passenger activity (58,900 SF) as well as exceeds the projected space need in the high growth forecast scenario (80,800 SF) by 38 percent, the TLCPA does not feel the projected cost or surplus of renovated space is justifiable. Key elements established in the refined redevelopment option that closely align with the envisioned program were carried forward into two derivative alternatives. These alternatives combined advantages of both new-build and renovation techniques but were focused on slimming the program to the needs provided in the Aviation Activity Forecast.

1.6.2 Alternative 1 – New Build Integration

The TLCPA has continued to promote the airport and greater Toledo metropolitan area as not only the gateway to northwest Ohio, but also a key neighbor to large metropolitan service areas that have more congested airspace (i.e., Detroit and Cleveland). As discussions and growing relationships continue to develop with low-cost and ultra low-cost carriers, the TLCPA believes growth in the near-term is very possible with a new airline/market as well as potential for the return of a regional legacy service largely attributed to the COVID-19 pandemic. The availability of a terminal already able to accommodate growth would present a huge advantage and selling point for the airport.

Alternative 1 creates a hybrid approach with a new terminal, constructed to support the needs of the aviation forecast, constructed within the footprint of the existing terminal and integrated with a portion of the current facility to remain.

1.6.2.1 Facility Layout

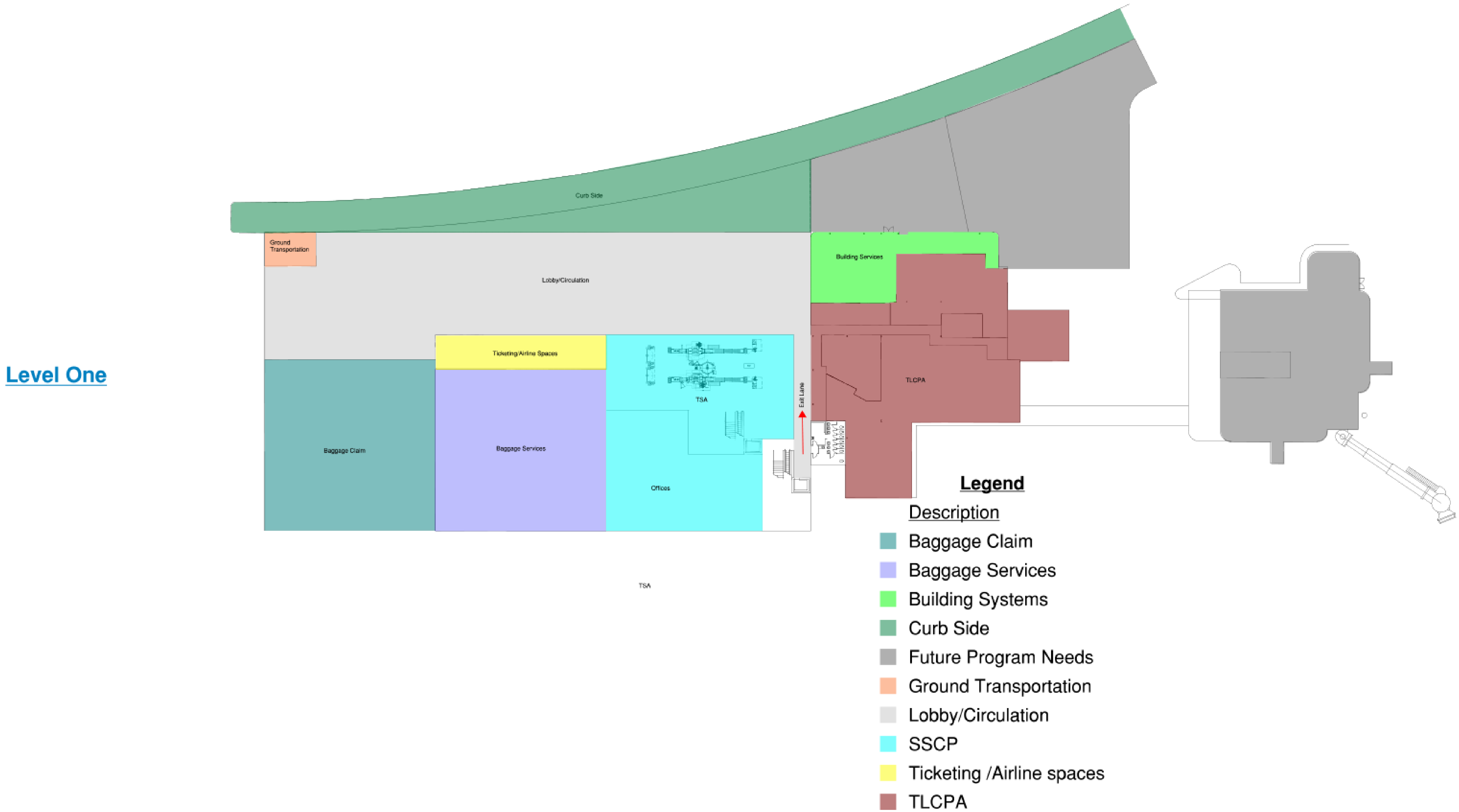
With the existing terminal serving as a longitudinal barrier between landside and airside facilities, the approach of Alternative 1 would essentially construct a new facility on the existing western terminal footprint that would include all passenger service facilities with the existing eastern footprint to remain inclusive of mechanical/building support system space, airport and stakeholder administrative spaces, and storage/room for eastern expansion. The FAA's ATCT, currently in the middle of the existing terminal, serves as a conceptual "dividing" of proposed new construction versus renovation spaces. **Figure 26** and **Figure 27** depict the proposed layout for Alternative 1.

As eligibility of project costs participating in federally-funded projects is often dependent on space that is both accessible to the public and non-revenue generating or may be common use to airlines, Alternative 1 would permit the TLCPA to maximize funding support of the new terminal and related passenger services, while establishing a separate scope of renovation for those spaces not related to the public and thus not as likely to receive funding support.

1.6.2.2 Health and Safety

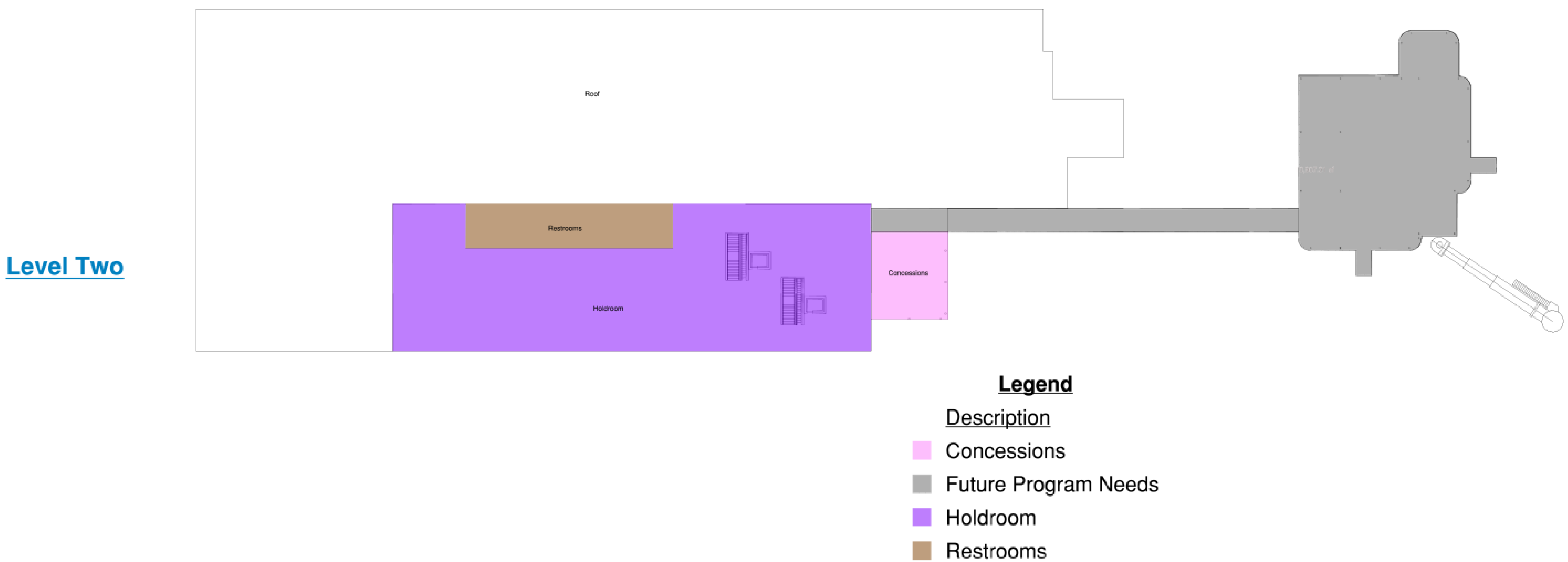
Similar to the refined redevelopment option, Alternative 1 would be able to address elements within the existing facility that is to remain that need modernization, including removal of materials to provide a cleaner air environment, replacing outdated equipment to install more efficient technology, and ensuring accessibility compliance as well as an enhanced level of service to passenger in the proposed new terminal construction.

FIGURE 26
ALTERNATIVE 1 – LEVEL ONE



Source: RS&H, 2023

FIGURE 27
ALTERNATIVE 1 – LEVEL TWO



Source: RS&H, 2023

1.6.2.3 Preliminary Cost Estimate

Rough order magnitude (ROM) cost estimates were generated for Alternative 1. The estimates were broken into the same categories as the refined redevelopment option, but the landside site work, upgrades in mechanical, electrical and other infrastructure were based on an allowance that could increase/decrease as the time of design based on funding available. All costs include associated program engineering and construction fees. Impacts to existing airside facilities are assumed to be minimal per the program scope and thus are not included in these cost estimates. **Table 9** details the ROM cost estimate for Alternative 1. All estimate values were increased by a constant 10 percent escalation rate consistent with industry pricing trends for calendar year 2028, the proposed last year of project construction at the time of this writing.

TABLE 9
ROM PROJECT COSTS – ALTERNATIVE 1

	DEVELOPMENT AREA	QUANTITY	UNITS	UNIT PRICE (2028 ADJUSTED)	TOTAL (2028 ADJUSTED)
New Terminal Addition					
1	Partial Demolition of Terminal	1	LS	$8,000,000	**$ 8,000,000**
2	New Addition	58,900	SF	$1,089	**$ 64,143,000**
Existing Terminal Renovation					
3	Building Envelope Replacement	1	LS	$3,960,000	**$ 3,960,000**
4	Plumbing Upgrades, Fire Sprinkler Modifications, Restroom Renovation/Expansion	2,000	SF	$50	**$ 99,000**
5	Mechanical System Renovation	2,000	SF	$122	**$ 243,000**
6	Electrical System Renovation	2,000	SF	$90	**$ 180,000**
7	Technology System Renovation	2,000	SF	$72	**$ 144,000**
8	Interior Renovation of Existing Finishes	2,000	SF	$180	**$ 360,000**
Sitework					
9	Sitework Improvements	1	LS	$324,000	**$ 324,000**
10	Add for Glass Jet Bridges	2	EA	$2,002,500	**$ 4,005,000**
				Total Construction ROM Estimate - 2028 Adjusted:	**$ 81,378,000**
11	Engineering Design + Contingency				**$ 8,376,000**
				Total Program ROM Estimate - 2028 Adjusted:	**$ 90,420,000**

Source: McGuiness Unlimited, Inc./RS&H, 2023

1.6.3 Alternative 2 – Temporary Footprint Reduction (*Preferred*)

Alternative 2 focuses on the same objective as Alternative 1, to preserve as much of the existing building footprint as is viable to increase the attractiveness of the airport to airlines concerned with growth capacity but does so through a reconfiguration and consolidation of the "active" space needed to support current-day operations. By consolidating terminal facilities, costs of infrastructure modernization, renovation, and future costs of operation will be greatly decreased while not sacrificing the remaining structure in the event of needed expansion. Alternative 2 was selected by the TLCPA as the preferred terminal development alternative.

1.6.3.1 Facility Layout

The consolidation of the terminal facility is focused on reducing the active footprint of public spaces to that of the needs as outlined in the terminal facility requirements to minimize development costs, maximize funding support and eligibility, and to maintain a high level of efficiency and security.

The consolidation of Alternative 2, depicted in **Figure 28** and **Figure 29**, includes a reorientation of the west airline ticket counters and walling off of unused space as well as a similar relocation of the baggage claim from the furthest eastern extent to be closer to the main traffic flow of the terminal. Vertical circulation improvements will be made to ease security checkpoint congestion with enhanced wayfinding helping to promote continual passenger flow. TLCPA and other stakeholder administration spaces will largely remain in their current location as will the building support systems staying consistent with the proposed consolidation plan as well as future expansion opportunities. Spaces that are walled off from public access can be used by airport or other operations staff until a future expansion opportunity arises.

1.6.3.2 Health and Safety

Alternative 2 would feature the same removal, replacement, and modernization of all hazardous materials and antiquated equipment as the refined redevelopment option, but at a prorated percentage of the existing space to meet the needs of the reconfigured space.

1.6.3.3 Preliminary Cost Estimate

Rough order magnitude (ROM) cost estimates were generated for Alternative 2 (see **Table 10)**. As this alternative is comprised of the renovation and consolidation of the existing facility, the only cost associated with new construction is reserved for enhancements to be made to the vertical circulation corridor. Impacts to existing airside facilities are assumed to be minimal per the program scope and thus are not included in these cost estimates. All other costs and renovation scope are believed to be consistent with that of the refined redevelopment alternative. All estimate values were increased by a constant 10 percent escalation rate consistent with industry pricing trends for calendar year 2028, the proposed last year of project construction at the time of this writing.

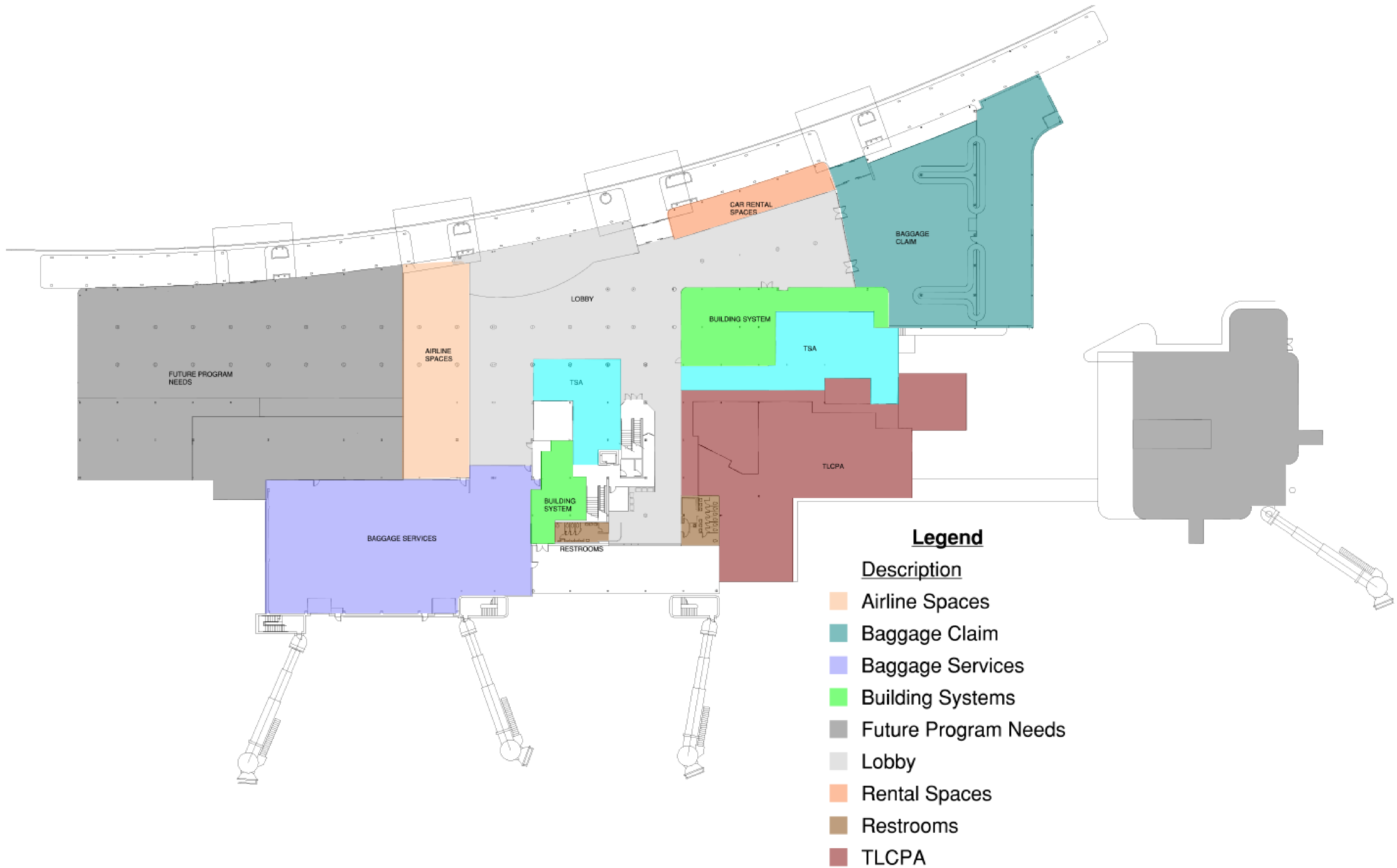
TABLE 10
ROM PROJECT COSTS - ALTERNATIVE 2

DEVELOPMENT AREA		QUANTITY	UNITS	UNIT PRICE (2028 ADJUSTED)	TOTAL (2028 ADJUSTED)
New Terminal Addition					
1	Partial Demolition of Terminal	1	LS	$1,926,000	**$ 1,926,000**
2	New Addition	5,000	SF	$1,771	**$ 8,856,000**
Existing Terminal Renovation					
3	Building Envelope Replacement	1	LS	$7,920,000	**$ 7,920,000**
4	Plumbing Upgrades, Fire Sprinkler Modifications, Restroom Renovation/Expansion	64,000	SF	$48	**$ 3,042,000**
5	Mechanical System Renovation	64,000	SF	$118	**$ 7,542,000**
6	Electrical System Renovation	64,000	SF	$88	**$ 5,643,000**
7	Technology System Renovation	64,000	SF	$69	**$ 4,437,000**
8	Interior Renovation of Existing Finishes	64,000	SF	$177	**$ 11,349,000**
Sitework					
9	Sitework Improvements	1	LS	$324,000	**$ 324,000**
10	Add for Glass Jet Bridges	2	EA	$2,002,500	**$ 4,005,000**
Total Construction ROM Estimate - 2028 Adjusted:					**$ 55,044,000**
11	Engineering Design + Contingency				**$ 6,116,000**
Total Program ROM Estimate - 2028 Adjusted:					**$ 61,160,000**

Source: McGuiness Unlimited, Inc./RS&H, 2023

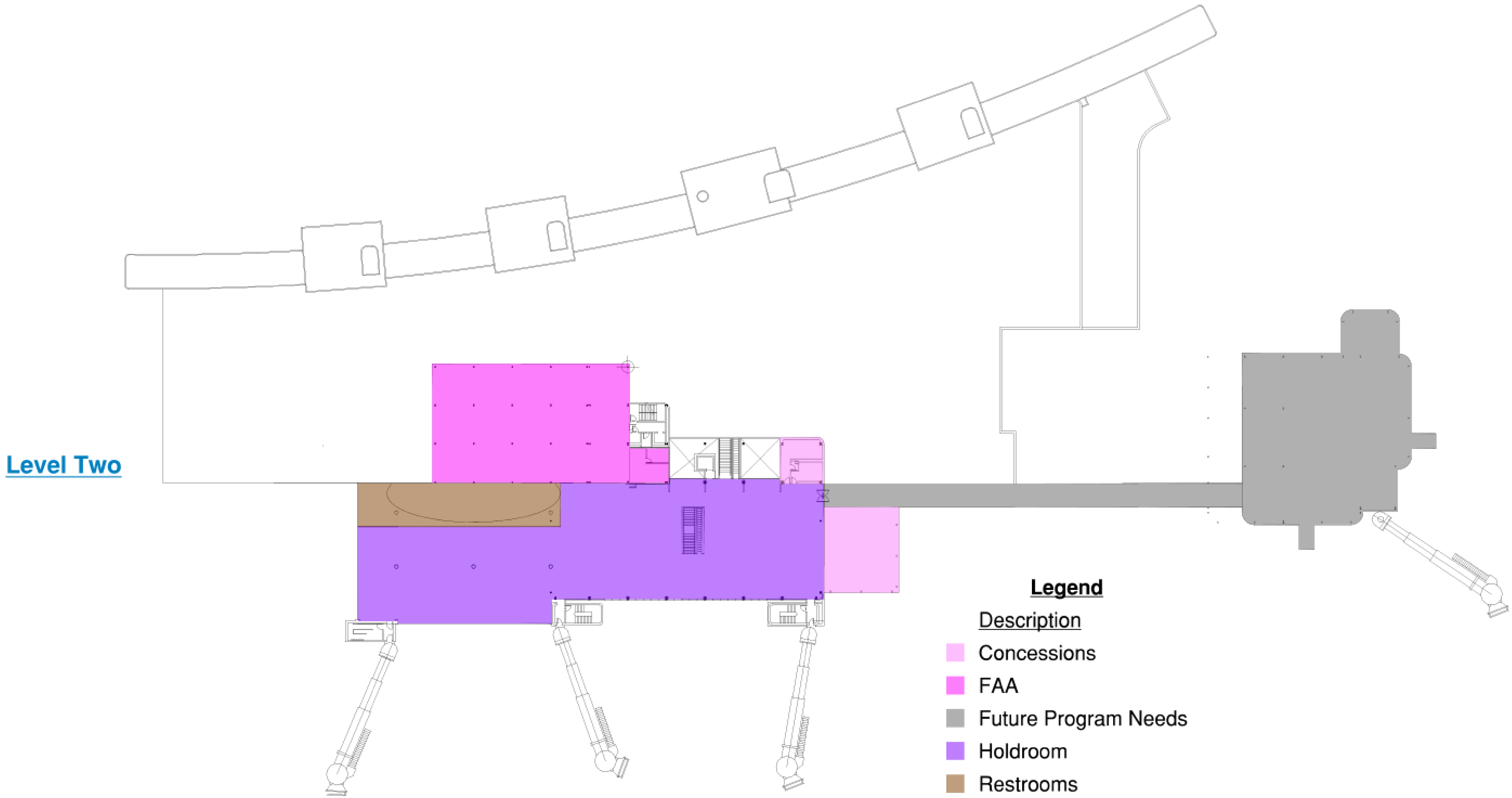
FIGURE 28
ALTERNATIVE 2 – LEVEL ONE

Level One



Source: RS&H, 2023

FIGURE 29
ALTERNATIVE 2 – LEVEL TWO



Source: RS&H, 2023

1.7 IMPLEMENTATION

There are multiple ways to implement large scale projects such as the preferred terminal development project. At a master planning level, generalized high level solutions are developed and used to determine a program of funding over the course of the planning period. After this high-level plan is completed, further implementation analysis will be completed as part of the conceptual design.

To implement the preferred terminal solution, program scheduling and funding must be examined to ensure capital outlays are in alignment with project phasing. As the program is anticipated to participate in the Airport Improvement Program and potentially available avenues of the Bipartisan Infrastructure Law, the project phasing will be incorporated into the Airport's Capital Improvement Program (ACIP). Program elements, delivery methods, and program financial planning are discussed in the following sections.

1.7.1 Environmental Overview (NEPA Documentation)

Regulatory elements that must be considered in the development of the preferred terminal development project include those related to environmental documentation requirements (described in detail below) and environmental permitting requirements Environmental permitting must be considered for all aspects of both building and civil works. However, environmental permitting requirements associated with drainage, building construction, and public roadway construction will need to be defined in the next phase of design and not discussed in this section.

The FAA Reauthorization Act of 2018 (Act) included provisions related to non-aeronautical development at airports. Section 163 of the Act takes two significant steps to limit FAA's authority over non-aeronautical development. First, the Act explicitly limits FAA's authority to "directly or indirectly regulate" non-aeronautical property transactions at an airport, except: (1) to ensure the safe and efficient operation of aircraft, or the safety of people and property on the ground; (2) to ensure the receipt of fair market value for the use or disposal of property; or (3) where the property was itself purchased with Airport Improvement program (AIP) grants or is subject to the Surplus Property Act. The Act also limits FAA's authority to review and approve Airport Layout Plan (ALP) amendments to only those amendments that "materially impact" safety and efficiency for aircraft operations, or that "adversely affect the value of prior Federal investments to a significant extent." FAA's position is that an ALP amendment and FAA approval is required for non-aeronautical development (even on property which has been released from grant obligations) when combined with an aeronautical development project, which triggers environmental review and slows development efforts.

When the FAA retains approval authority over a project, then an airport must demonstrate compliance with the National Environmental Policy Act (NEPA) and implementing regulations issued by the Council on Environmental Quality (CEQ). Documentation of compliance with NEPA and the implementing regulations must be completed prior to construction for airport projects receiving federal funding or ALP approval. There are three levels of NEPA documentation depending on the scope of a proposed project and the potential environmental impacts associated with a proposed project. These include categorical exclusion (CATEX), environmental assessment (EA), and environmental impact statement (EIS). FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures,* [4] lists actions that the FAA has found in the past to not normally have a significant effect on the environment. Proposed projects that fall within the list found in FAA Order 1050.1F and do not have an extraordinary circumstance[5] can be processed with a CATEX. For proposed projects that do not fall within the list specified as a CATEX in FAA Order 1050.1F, an EA must be prepared. At the completion of the EA, the FAA will issue a Finding of No Significant Impact (FONSI) or continue with an EIS. An EIS must be prepared if the environmental impacts associated with a proposed project are significant impacts that cannot be mitigated below the established significant threshold. At the completion of an EIS, the FAA will issue a Record of Decision (ROD).

FAA Order 1050.1F and FAA Order 5050.4B, *NEPA Implementing Instructions for Airport Actions*, require the evaluation of airport development projects in NEPA documents as they relate to specific environmental resource categories by outlining impacts and thresholds at which the impacts are considered significant. NEPA documents must be prepared in compliance with both FAA Orders, as well as applicable Executive Orders, and other applicable federal, state, and local requirements.

It is our recommendation that the appropriate level of NEPA documentation for this terminal renovation project is a CATEX under Paragraph 5-6.4(h) in FAA Order 1050.1F, which states:

> *"Federal financial assistance, licensing, or Airport Layout Plan (ALP) approval for construction or expansion of facilities—such as terminal passenger handling and parking facilities or cargo buildings, or facilities for non-aeronautical uses at existing airports and commercial space launch sites—that do not substantially expand those facilities (see the FAA's presumed to conform list (72 Federal Register 41565 (July 30, 2007)))."*

Depending on the final scope of the project, the CATEX may also include Paragraphs 5-6.4(i) and 5-6.4(e), in FAA Order 1050.1F. Paragraph 5-6.4(i) states:

> *"Demolition and removal of FAA buildings and structures, or financial assistance for or approval of an Airport Layout Plan (ALP) for the demolition or removal of non-FAA owned, on-airport buildings and structures, provided no hazardous substances or contaminated equipment are present on the site of the existing facility. This CATEX does not apply to buildings and structures of historic, archaeological, or architectural significance as officially designated by Federal, state, tribal or local governments."*

Paragraph 5-6.4(e) in FAA Order 1050.1F states:

> *"Federal financial assistance, licensing, or Airport Layout Plan (ALP) approval for the following actions, provided the action would not result in significant erosion or sedimentation, and will not result in a significant noise increase over noise sensitive areas or result in significant impacts on air quality.*

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4 FAA, Order 1050.1F, *Environmental Impacts: Policies and Procedures*, Sections 5-6.1 through 5-6.6. July 16, 2015.

5 FAA, Order 1050.1F, *Environmental Impacts: Policies and Procedures*, Sections 11-5(6). July 16, 2015.

• Construction, repair, reconstruction, resurfacing, extending, strengthening, or widening of a taxiway, apron, loading ramp, or runway safety area (RSA), including an RSA using Engineered Material Arresting System (EMAS); or

• Reconstruction, resurfacing, extending, strengthening, or widening of an existing runway.

This CATEX includes marking, grooving, fillets and jet blast facilities associated with any of the above facilities."

However, the TLCPA will need to coordinate with the FAA Environmental Protection Specialist (EPS) at the Detroit ADO to who will make the final determination which level of NEPA documentation is the most appropriate for the project, as well as the scope needed for that NEPA documentation.

1.7.2 Delivery Methods

This section details factors critical to the implementation of the preferred terminal solution. Considering that the TLCPA desires to renovate the existing facility and associated landside and airside components in the very near term, an examination of project delivery methods is needed. The FAA AIP Handbook, Order 5100-38D, discusses allowable delivery methods. A typical delivery method for FAA funded projects is Design-Bid-Build (DBB). Two additional delivery methods are also included within the AIP Handbook: Design-Build (DB) and Construction Manager-At-Risk (CMAR). These are detailed within Chapter 3, Section 10, 3-47D and in Table U-9 within the Handbook. An overview and comparison of these delivery methods is included in this section.

Costs, funding, and schedule will drive how implementation materializes. At this initial stage in the implementation process, estimates of these factors are needed to develop an understanding of the project, and to determine what actions are immediately required. For this effort, the ROM cost estimates that were developed are further split into implementation phases further discussed in this section. These are high-level estimates of project costs related to all elements within the preferred terminal solution.

The overall schedule of full implementation, from beginning to completion, will depend on what project delivery method is used. Schedule estimates were developed based on the three delivery methods explored in this study. These schedules are expected to aid in evaluating which project delivery method will work best for the TLCPA. But note that without further project definition, the schedule estimates are hypothetical.

The three typical project delivery methods have benefits and draw-backs dependent upon the owner's preference for certain levels of risk and control. The goal is to select a delivery method that best suits the Airport and will complete the project in the most effective and efficient manner possible. Key considerations for determining which method is most appropriate are dependent upon the budget, design, schedule, level of risk aversion, and TOL experience. The following provides a high-level summary of the distinguishing features of each method.

1.7.2.1 Design-Bid-Build (DBB)

This is a traditional delivery method in the U.S., involving three distinct sequential phases: design, procurement, and construction. The design phase develops architecture and engineering construction documents necessary for the proper execution and completion of the construction work. The procurement phase involves the project bidding process and contractor selection. Finally, the construction phase builds the project according to construction plans. DBB involves moderate levels of owner/contractor risk and control. This method commonly involves a negotiated lump-sum payment for a specific scope of work based on the available construction documents. Contractors are selected according to the owner's preference between lowest cost and highest qualification and are responsible for constructing the building according to contractual obligations. One owner benefit of a DBB contract is the reliability of cost information prior to commencing construction. Once bids are received, costs remain relatively predictable throughout the life of the project. This enables the owner to retain a moderate level of control over the project and the associated costs. The main challenge with the DBB method is a longer execution time. Construction cannot begin until design and procurement are complete, and the lack of contractual agreements between contractors and designers may create challenges resulting in schedule delays. Additionally, because the design process does not normally include collaboration with the contractor, an inherently adversarial relationship can evolve during construction.

1.7.2.2 Design-Build (DB)

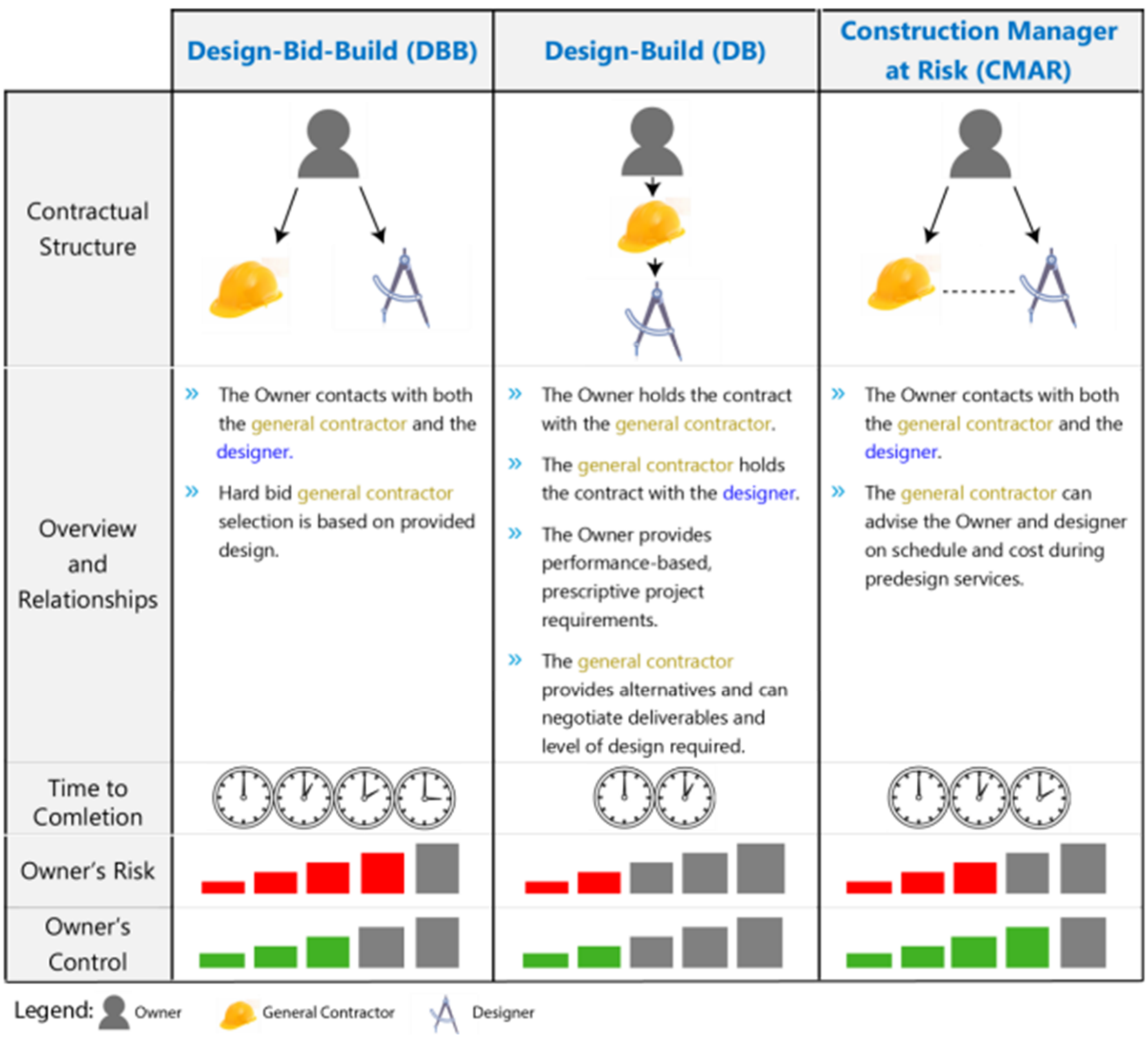
Per the FAA AIP Handbook, Design-Build is "an agreement that provides for both design and construction of a project by a contractor." This process enables owners to contract with a team which includes a designer and contractor, in some form, which performs the complete facility design, usually based on an owner-provided scope. At an early point in the process, a pricing structure is established to complete design and construction. Since collaboration is programmed into the process from the start, significant financial and time savings can be realized. DB projects are completed more quickly than traditional methods and provide a single point of accountability for design and construction. Unlike a DBB structure, the designer works for the contractor, which allows greater cost control but a reduced role of authority for the designer. The DB process is a transparent one that ensures an owner is receiving the best value for its investment. It is important to note that for the DB process to be truly successful, the owner must be fully engaged from the onset, and able to make many design-related decisions early in the process. Early decisions result in the establishment of the guaranteed maximum price (GMP) that is approved by the owner. Because design decisions are made early, DB projects are often phased into packages to save time. If changes are requested after the establishment of the GMP and the construction of initial packages, then there could be substantial ramifications to cost and schedule.

1.7.2.3 Construction Manager at Risk (CMAR)

Per the FAA AIP Handbook, under CMAR, the construction manager is responsible for procuring the construction component of the project and incurs the risk for ensuring the project is completed within budget and schedule. This method is like the DBB method in that the contractor must perform and guarantee project completion in accordance with a negotiated price and scope but must also provide assistance to the owner prior to construction by way of scheduling, budget development, and constructability advice during the planning and design phases. One advantage to the CMAR approach is the flexibility to begin construction prior to the completion of design documents, thereby shortening project timelines. This often involves the negotiation of a guaranteed maximum price (GMP) based on a partially completed design. The CMAR approach also aids in streamlining the process by reducing specifications in early agreements on materials and equipment.

Figure 30 shows a summary breakdown of each delivery method with contract structures, relationship overviews, length of schedule, and the associated levels of owner risk versus control. When considering the implementation and cost needs of TOL, the Design-Build or the CMAR delivery methods seem to be most appropriate.

FIGURE 30
DELIVERY METHODS



Source: RS&H, 2023

Assuming the environmental analysis and documentation stage begins alongside the design effort in FY 2024, is completed in time to enable FY 2025 construction, and a design-bid-build delivery method is used, final completion of the project could be expected in the fourth quarter of FY 2028.

1.7.3 Financial Planning

Critical to any project listed on an airport's CIP is the formulation of a financial plan or a yearly outlook on how the airport's sponsor intends to fund the proposed project through all funding sources anticipated to participate. A financial plan for a program such as this proposed terminal development will break the project into yearly chunks or phases, the cost of each yearly phase across each funding source, and furthermore, the percentage of those costs that are eligible under that particular source of funding until a complete picture of all contributing members and their anticipated contributions is generated.

1.7.3.1 Funding Avenues

A master planning level examination of funding channels was conducted to determine those committed and those that are potentially viable for funding the terminal renovation project. The examination determined that there is a gap between committed (expected) funds and the total project cost. That gap can be potentially reduced through other funding channels described in this section. Additionally, the scope of the project can be reduced to lessen funding requirements. Advanced planning performed during conceptual design will refine the scope of the project to be tailored to a finalized budget maximum. However, for the purpose of this terminal area plan funding channels were examined with consideration of the full scope of preferred terminal renovation solution. Below are the identified funding channels that have been confirmed or are potentially viable and worthy of further examining.

1.7.3.1.1 Federal Grant Assistance

The FAA Airport Improvement Program (AIP) will fund project elements considered as eligible for participation. Typically, this eligibility for terminal facilities is based on the square footage of terminal development costs associated with public use with those spaces not accessible to the public are viewed as ineligible. Airport projects are typically programmed in their respective ACIP through two AIP funding streams: annual allotments of primary/Nonprimary entitlement funds and additional discretionary funding.

1.7.3.1.1.1 Primary Entitlements

As stated in 49 USC § 47114(c), primary airports are apportioned funds based on passenger enplanement activity from the prior calendar year. The FAA's Terminal Area Forecast (TAF), updated for fiscal year 2023, recorded 81,969 total passenger enplanements in CY 2021 for TOL. This amounts to roughly $1.11M in entitlement apportionment for the airport and based on the gradual increase in traffic anticipated in the aviation activity forecast will serve as the baseline for annual primary entitlement funding for TOL.

1.7.3.1.1.2 Discretionary Fund

Per 49 USC § 47115, of the amount subject to apportionment for a fiscal year, at least 75 percent of the remainder beyond the apportionment distribution is made available for the purpose of grant funding for airports. Airports and their projects seeking this funding follow a selection process with the function of each project receiving a National Priority Rating (NPR). The NPR generally categorizes airport development in accordance with FAA goals and objectives.

1.7.3.1.2 Infrastructure Investment and Jobs Act

Commonly known as the Bipartisan Infrastructure Law (BIL), this Act authorized up to $108 billion in support of federal public transportation programs. Funding allocated for the aid of airports was programmed in equal allotments over a five-year program with the funding made available in each fiscal year further split across three funding categories.

1.7.3.1.2.1 Airport Infrastructure Grant (AIG)

$3 billion annual distribution to airports based on passenger traffic (for primary airports). TOL received $1.5 million in the first year of AIG (FY2022) allocations.

1.7.3.1.2.2 Airport Terminal Program (ATP)

$1 billion annual distribution to airport terminal projects based on a yearly application and selection process. This process is highly competitive with each application aiming to satisfy multiple program initiatives such as increasing capacity, improved accessibility, promoting sustainability, among others.

1.7.3.1.2.3 Air Traffic Facilities

$5 billion total made available for FAA internal use only to upgrade facilities, equipment, and infrastructure.

1.7.3.1.3 Passenger Facility Charge (PFC)

Commercial service airports may impose/collect a facility charge per enplaned passenger with a use program approved by both airlines operating at the airport and the FAA. The current level of PFC collection is $4.50, Additionally, it should be noted that FAA expects PFC collection from airports to substantiate the commitment of both airport and airline as it relates to paying for and supporting terminal area facilities.

1.7.3.1.4 State Grant Assistance

State participation in airport improvement projects in Ohio largely follows that of the FAA's AIP. The Ohio Department of Transportation (ODOT) Office of Aviation handles all funding distribution to airports with an approximate annual budget of $7 million. The state will typically contribute a 5 percent match to the airport sponsor's own 5 percent for AIP project and eligible elements with the FAA funding the remaining 90 percent. ODOT Matching Grant funding is procured after the award of previous AIP grant funding and cannot be amended above 5 percent.

1.7.3.1.5 Local Share Funding

The TLCPA may also have several methods available to obtain the funding required to meet the local share for the terminal area development in addition to any currently programmed airport funds. These sources could potentially include using bank financing, bonds, donations, third party support, and airport revenues. These are discussed in further detail below.

1.7.3.1.5.1 Airport Fund

Any funding currently appropriated by the TLCPA or programmed for the immediate support of the terminal development program would reduce alternative source funding required and/or allow greater efficiencies related to more up-front construction completed.

1.7.3.1.5.2 Bank Financing

Generally, two conditions are required for bank financing. First, the airport sponsor must have the ability to repay the loan plus interest. Second, the cost of capital improvements must be less than the value of the present facility, or some other collateral must be used to secure the loan. Bank financing for a portion of the local share could be explored to further reduce the immediate funding burden.

1.7.3.1.5.3 Bonds

Bond types that may be applicable include general obligation bonds, self- liquidating general obligation bonds, revenue bonds, and combined revenue/general obligation bonds. Bonds can be structured to use tax revenues or cash flow from the operation to retire debt. Some bonds ("Double-Barrel") can be structured to use cash flows to retire debt but be backed by tax revenues. With the strong support of the Toledo metropolitan community for air service, bonds may be an applicable funding source that could be further considered.

1.7.3.1.5.4 Donations

Depending on the capabilities of the airport, the use of force accounts, in-kind service, or donations may be approved by the FAA and the State for the airport sponsor to provide their share of the eligible project costs. An example of force accounts would be the use of heavy machinery and operators for earthmoving and site preparation. In-kind service may include surveying, engineering, or other services. Donations may include land or materials, such as gravel or water, needed for the project. The value of these items must be verified and approved by the FAA and/or the state prior to initiation of the project. Large cash donations could also be provided by local institutions including church organizations, colleges, and/or businesses that have the desire to support the local community and capture visibility. Large corporations will especially benefit from having new air service at TOL that meets the needs of their employees who must travel for work. Independently or collectively, large businesses may have interest in donating to ensure required funding levels are met.

1.7.3.1.5.5 Third Party Support

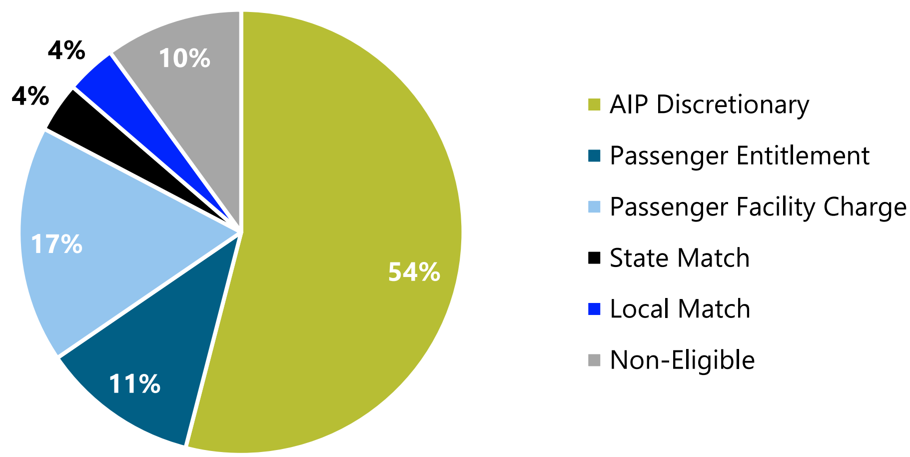
This type of funding can be generated in numerous ways. For example, individuals or interested organizations may contribute portions of the required development funds. In the United States, some airport terminals have been developed in part or completely by private companies with contract agreements to manage and maintain the terminal for a set period. Another third-party option is to seek funding for the construction of the parking lot by a parking concessioner within an agreement for parking management.

1.7.3.1.5.6 Other Airport Revenues

This source of funding stems from existing revenues that can be dedicated for a set time toward the terminal project. Examples include revenues from land leases, tie down spaces, aviation fuel flowage, landing fees, customer facility charges (CFC), and parking revenues.

Figure 31 depicts the anticipated funding sources to participate in a terminal redevelopment project at TOL. Overall, numerous funding sources are currently available, and others are potentially viable and are worth exploring further. The funding sources discussed in this section, such as bonds, donations, and financing may be able to fill the gap in funding levels, or as mentioned, the scope of the project can be reduced to lower funding needs.

FIGURE 31
ANTICIPATED AIRPORT TERMINAL FUNDING DISTRIBUTION



Source: RS&H, 2023

1.7.3.2 Eligibility

The construction, reconstruction, rehabilitation, renovation, and expansion of airport passenger terminals are eligible for grants through the FAA's AIP and PFC programs. Under the law, work may be done in public use areas that are used for movement of passengers and their baggage. For large, medium, and small hub airports, the areas are limited to nonrevenue producing areas. Roadways, walkways, and vehicles that go to and from the terminal including multimodal terminals, are also covered under the "terminal development" umbrella. Non-hub primary airports have the same eligibility as the larger airports with the addition of revenue producing public-use areas. In addition, non-hub primary airports may be provided with up to $20 million in discretionary funds and funds from the Small Airport Fund. With enplanements of 85,599 reported in the latest calculation for the year ending December 31, 2022, TOL is designated as a primary non-hub airport since it has enplanements less than 0.05 percent of National enplanements for all airports. As such, TOL can use the expanded eligibility and increase funding availability for non-hub primary airports.

The Bipartisan Infrastructure Law from 2021 established new funding streams for airport projects on a temporary/stimulus basis to be available through federal fiscal year 2026. Included in these packages was the availability of funding solely reserved for terminal development under the Airport Terminal Program (ATP) and Airport Infrastructure Grant (AIG). For terminal projects participating in the BIL ATP, the Federal share for non-hub airports will be 95 percent of the eligible portions of the terminal project as opposed to the normal 90 percent federal share for AIP projects. Projects funded through BIL AIG share the same federal participation (90 percent) and eligibility requirements of AIP In the latest Frequently Asked Questions about the BIL programs, dated March 27, 2023, the FAA requires that an eligibility analysis is required for project participating in either of these programs. Details regarding these two programs can be found in **Section 1.7.3.1**.

Table 11 provides an initial estimated eligibility analysis for the concept provided. This analysis emphasizes the impact of work done as part of the project that contains various levels of ineligible work based on interpretations of Federal law for the AIP and PFC programs under Title 49 of the United States Code (USC) Subchapter VII – Aviation Programs.

TABLE 11
CONCEPTUAL PROGRAM AIP AND PFC ELIGIBILITY

		AIP ANALYSIS					PFC ANALYSIS				
DESCRIPTION	TOTAL AREA	ELIGIBILITY	ELIGIBLE AREA	INELIGIBLE AREA	PRORATED ELIGIBLE AREA	PRORATED INELIGIBLE AREA	ELIGIBILITY	ELIGIBLE AREA	INELIGIBLE AREA	PRORATED ELIGIBLE AREA	PRORATED INELIGIBLE AREA
1st Level											
Vertical Circulation	1,504	Y	1,504				Y	1,504			
Inbound Baggage	10,410	Y	10,410				Y	10,410			
Outbound Baggage	9,889	N		9,889			Y	9,889			
Rental Space	1,392	N		1,392			N		1,392		
TLCPA	12,884	N		12,884			N		12,884		
Storage	4,177	N		4,177			N		4,177		
Mechanical Spaces	4,004	P			2,914	1,090	P			3,108	896
Ticketing	1,054	N		1,054			Y	1,054			
Lobby	30,592	Y	30,592				Y	30,592			
2nd Level											
SSCP	10,151	Y	10,151				Y	10,151			
Holdroom	15,775	Y	15,775				Y	15,775			
Restrooms	2,878	Y	2,878				Y	2,878			
Concessions	2,273	Y	2,273				Y	2,273			
Vertical Circulation	1,149	Y	1,149				Y	1,149			
Exit Lane	3,703	Y	3,703				Y	3,703			
TOTALS	111,835		78,435	29,396	2,914	1,090		89,378	18,453	3,108	896

Proration Factor (PF) = (Total of [B]+Total [C]	*AIP Prorated Eligible*	*72.74%*		*PFC Prorated Eligible*	*82.70%*

Source: RS&H, 2023

An analysis is done by identifying which spaces in the terminal are eligible for AIP and/or PFC funding. There are three categories that are used to identify the spaces are: "eligible, ineligible" and "prorated". The first two are determinations are based upon the concept of "nonrevenue and revenue producing, public use spaces for the movement of passengers and baggage in air commerce" (Identified for Non-hub Primary Airports under 49 USC § 47119). "Prorated" space is a determination that the function using the space serves both "eligible and ineligible" space. Generally, prorated facilities include such items as mechanical rooms and electrical rooms. Under longstanding FAA guidance, these prorate areas are computed for the entire facility regardless of the work being considered for a specific project. That percentage is then carried over for any prorated area included in the specific program. If ineligible areas are included in the contract with construction contractors, then the airport must be diligent in accounting for costs incurred and separate costs for ineligible spaces from reimbursement from FAA or PFC revenue. The accounting would be simpler if the airport had contracts for ineligible spaces separate from eligible and prorated eligible spaces.

It is important to note that these computations are only done by square footage at this conceptual level; actual cost eligibility for grant or PFC approval will be performed during the project design phase when accurate estimations can be made.

1.7.3.3 Phasing

The phasing of design and construction focuses on terminal modernization completed in sections to minimize impacts to terminal operations and passenger movement. **Figure 32** illustrates a conceptual phasing plan for the preferred alternative developed to detail how the large program could be split over multiple phases/years to minimize impacts to airport operations as well as ease financial implementation.

A description of the construction phases are as follows:

1.7.3.3.1 Phase 1

Phase 1 includes enhancements to the vertical circulation transitioning outbound passengers from the first floor security checkpoint to the second floor holdroom and inbound passengers down to the first floor. Also included is the first phase of the renovation of interior finishings for all associated spaces in this corridor.

1.7.3.3.2 Phase 2

Phase 2 of construction focuses on the realignment of the new ticket counters along a new western wall, demolition of the old counters, and a reconfiguration of the space between the ticket counters and security checkpoint to mitigate the congestion that exists today. Also included in Phase 2 is the upgrade and replacement of all mechanical, electrical, plumbing, and information technology infrastructure in the consolidated western wing of the new terminal configuration. Similarly, renovation of interior finishes to this wing will also occur in Phase 2.

1.7.3.3.3 Phase 3

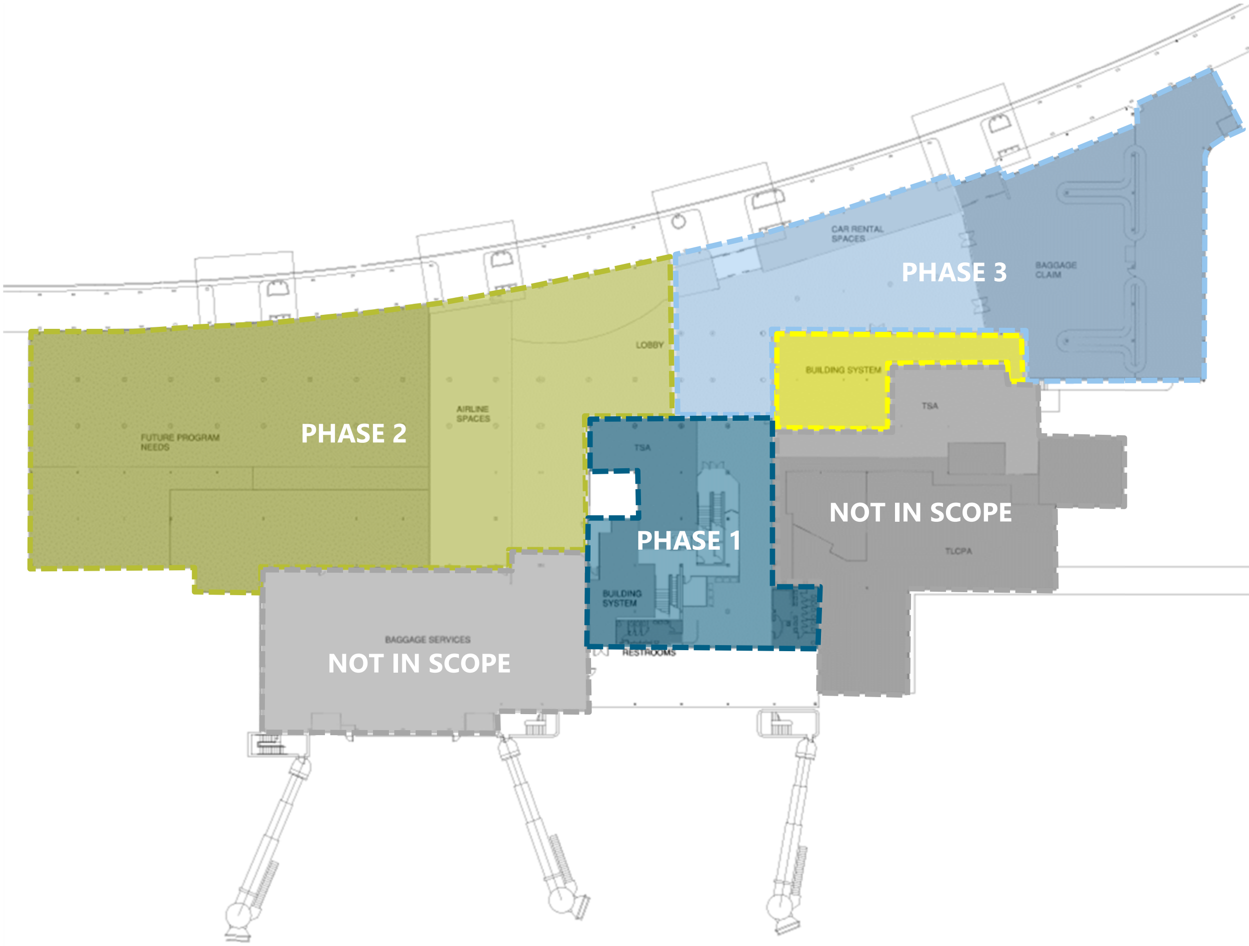
This portion of work will focus on renovations to the inbound baggage handling carousels in the eastern wing of the new terminal configuration and complete the remainder of facility infrastructure upgrades and replacement. Renovations to the second floor holdroom and bathrooms are also part of Phase 3. The replacement of two (2) PBBs is also planned for Phase 3, though this can be included in any previous or subsequent phases due to the unrelated nature of the PBB replacement in relation to the rest of the terminal upgrades.

Upon the completion of Phase 3, the new, consolidated terminal layout will be complete in the interior with all infrastructure and finishing having been either upgraded or replaced. Similarly, all excess space no longer accessible to the public will be walled off and repurposed by the airport.

1.7.3.3.4 Phase 4

Phase 4 includes all planned exterior improvements to the existing facility including the replacement of the building envelope, facility roof, and all access doors. Associated site work improvements including sidewalk widening, relocation of pedestrian crosswalks, and placement of curbside bollards are also included in Phase 4.

FIGURE 32
PREFERRED ALTERNATIVE PHASING CONCEPT



Source: RS&H, 2023

1.7.3.4 Airport Capital Improvement Program

As the program (design and construction elements) is broken down into respective implementation phases, each phase must have a calculated cost estimate. At that time, the scope of the elements include in each phase of work is used to determine eligibility of the cost therein based on the funding sources anticipated to be utilized that have these requirements (in this scenario, AIP, BIL, and PFC funds are all anticipated to have eligibility limits). Once eligibility is applied to the estimates of each respective phase, the total program is included in the ACIP in order of implementation detailing the funding outlay anticipated for each. **Table 12** details the preliminary program breakdown for the preferred terminal development plan as would appear in the ACIP.

TABLE 12
ACIP TERMINAL AREA PROGRAM

			GRANT FUNDS				LCOAL FUNDS		
FISCAL YEAR	**PROJECT DESCRIPTION**	**TOTAL COST**	**ENTITLEMENT**	**BIL AIG**	**DISCRETIONARY**	**STATE MATCH**	**PFC**	**LOCAL MATCH**	**OTHER**
YEAR 1 - PROGRAM DESIGN									
2024-1	Terminal Renovation - NEPA Documentation (CATEX)	$ 50,000	$ 32,733			$ 1,819	$ 4,980	$ 1,819	$ 8,650
2024-2	Terminal Renovation - Design	$ 6,066,000	$ 1,067,267		$ 2,903,901	$ 220,620	$ 604,174	$ 220,620	$ 1,049,418
	Subtotal:	**$ 6,116,000**	**$ 1,100,000**	**$ -**	**$ 2,903,901**	**$ 222,439**	**$ 609,154**	**$ 222,439**	**$ 1,058,068**
YEAR 2 – VERTICAL CIRCULATION IMPROVEMENTS									
2025-1	Terminal Renovation - Construct Phase 1	$ 13,120,000	$ 1,100,000		$ 7,489,139	$ 477,174	$ 1,306,752	$ 477,174	$ 2,269,760
	Subtotal:	**$ 13,120,000**	**$ 1,100,000**	**$ -**	**$ 7,489,139**	**$ 477,174**	**$ 1,306,752**	**$ 477,174**	**$ 2,269,760**
YEAR 3 – TICKET COUNTER AND OUTBOUND RENOVATION									
2026-1	Terminal Renovation - Construct Phase 2	$ 14,597,000	$ 1,100,000		$ 8,456,072	$ 530,893	$ 1,453,861	$ 530,893	$ 2,525,281
	Subtotal:	**$ 14,597,000**	**$ 1,100,000**	**$ -**	**$ 8,456,072**	**$ 530,893**	**$ 1,453,861**	**$ 530,893**	**$ 2,525,281**
YEAR 4 – BAGGAGE CLAIM AND OUTBOUND RENOVATION									
2027-1	Terminal Renovation - Construct Phase 3	$ 18,601,000	$ 1,100,000	$ 3,604,500	$ 7,472,831	$ 676,518	$ 1,852,660	$ 676,518	$ 3,217,973
	Subtotal:	**$ 18,601,000**	**$ 1,100,000**	**$ 3,604,500**	**$ 7,472,831**	**$ 676,518**	**$ 1,852,660**	**$ 676,518**	**$ 3,217,973**
YEAR 5 – FACILITY EXTERIOR IMPROVEMENTS									
2028-1	Terminal Renovation - Construct Phase 4	$ 8,726,000	$ 1,100,000	$ 3,895,500	$ 717,063	$ 317,365	$ 869,110	$ 317,365	$ 1,509,598
	Subtotal:	**$ 8,726,000**	**$ 1,100,000**	**$ 3,895,500**	**$ 717,063**	**$ 317,365**	**$ 869,110**	**$ 317,365**	**$ 1,509,598**
	Total:	**$ 61,160,000**	**$ 5,500,000**	**$ 7,500,000**	**$ 27,039,006**	**$ 2,224,389**	**$ 6,091,536**	**$ 2,224,389**	**$ 10,580,680**

Source: RS&H, 2023
*Notes:
1. All estimates are rough order magnitude and not based on engineering design.
2. All estimates include escalation to anticipated 2028 cost of construction (10%)
3. Construction estimates include permitting, engineering services, contractor profit, planning and construction contingency.

1.8 CONCLUSION

The Terminal Area Plan has determined a forecast of passenger demand and identified the requirements of a terminal area facility to meet that demand. The TLCPA has determined that based on their vision for the airport, the consolidation, renovation, and modernization of the existing facility provides the best case for the airport operationally for both immediate and future and reserves the cost benefit of the facility for program expansion for air service and expanded supporting program expansion in a constructed element allowing a reduced time to market as air service expands.

To address the goals, opportunities exist to complete both the new construction and renovation elements of the terminal program in phases, with limited impacts to daily operations. While the proposed new facility will satisfy the needs of the near-term, base forecast scenario, the remaining program space will allow TLCPA to focus on expanding service from existing carriers as well as attracting new carriers to the market in the TLCPA's push to achieve the long-term, high growth forecast scenario. With the FAA's support of the Terminal Area Plan and preferred development alternative, the TLCPA can continue down the path towards achieving this vision.

APPENDIX A
REFINED REDEVELOPMENT PLAN
DETAILED ROUGH ORDER OF MAGNITUDE COST ESTIMATE

Toledo Express Airport
Master Plan Estimate

5.17.2023

Partial Demolition of Terminal

Item	Description	Quantity	Unit	Unit Price	Total	Comment
1	**General Requirements**				**$ 94,628**	
	Based on 10% of direct construction costs	1	ls	94628	$ 94,628	
2	**Demolition**				**$ 946,280**	
	Demo of existing canopy	300	lf	500	$ 150,000	
	Demo of existing entry points	2	ea	25000	$ 50,000	
	Demo of existing roof and structure for new second floor addition	12,105	sf	25	$ 302,625	
	Add for temporary wall/weather enclosure	7,200	sf	15	$ 108,000	
	Select demo of existing building façade	7,200	sf	20	$ 144,000	
	Demo of passenger bridge west of terminal	63,885	cf	3	$ 191,655	
Subtotal		**1**	**ls**	**$ 1,040,908**	**$ 1,040,908**	
	Phasing/MOT	5%			$ 52,045	
	Bond, Permit & Insurance	3%			$ 32,789	
	GC Overhead & Profit	10%			$ 112,574	
	Planning Contingency	25%			$ 309,579	
Subtotal - Construction Costs		**1**	**ls**	**$ 1,547,895**	**$ 1,547,895**	
	Construction Contingency	5%			$ 77,395	
	FF+E	0%			$ -	
	Engineering Costs (Design)	10%			$ 154,790	
	CM Fee	7%			$ 108,353	
	Inspection (RE) & Material Testing	3%			$ 46,437	
TOTAL PROGRAM		**1**	**ls**	**$ 1,940,000**	**$ 1,940,000**	**Partial Demolition of Terminal**

Toledo Express Airport
Master Plan Estimate
5.17.2023

New Addition

Item	Description	Quantity	Unit	Unit Price	Total	Comment
1	**General Requirements**				**$ 1,847,664**	
	Based on 10% of direct construction costs	1	ls	1847664	$ 1,847,664	
2	**Building Structure**				**$ 2,650,880**	
	Foundations	21964	sf	40	$ 878,560	
	Slab on grade	7,885	sf	8	$ 63,080	
	Concrete floor on metal deck-second floor	14,079	sf	15	$ 211,185	
	Structural steel/Joists	220	tons	6500	$ 1,427,660	
	Metal roof deck	14079	sf	5	$ 70,395	
3	**Building Envelop**				**$ 5,366,400**	
	Curtain wall w/ sunshades	18,045	sf	150	$ 2,706,750	75%, 40' high
	Metal panel exterior	4,800	sf	100	$ 480,000	25%, 40' high
	TPO Roof	19990	sf	35	$ 699,650	
	Roof overhand/soffit	4800	sf	100	$ 480,000	
	Entry structure w/ sliding doors and canopy	2	ea	500000	$ 1,000,000	
4	**Interiors**				**$ 2,175,175**	
	Carpentry - blocking	21964	sf	0.5	$ 10,982	
	Interior Walls (gyp)	6,000	sf	15	$ 90,000	
	Interior Walls (glass)	1,800	sf	75	$ 135,000	
	Paint/Wall treatments	21,964	sf	4	$ 87,856	
	Ceiling	21,964	sf	32.5	$ 713,830	assume 50% Gyp, 50% feature
	Flooring - carpet/LVT	7,885	sf	10	$ 78,850	office, hold room
	Flooring - terrazzo	14,079	sf	35	$ 492,765	all other areas
	Interior Doors	21,964	sf	3	$ 65,892	
	Signage	1	ls	500000	$ 500,000	
5	**MEP**				**$ 3,755,844**	
	Wet fire suppression system	21,964	sf	6	$ 131,784	
	Plumbing	21,964	sf	15	$ 329,460	
	HVAC	21,964	sf	50	$ 1,098,200	
	Electrical-Distribution, Lighting & Fire Alarm	21,964	sf	55	$ 1,208,020	
	Technology-Roughen & Equipment	21,964	sf	45	$ 988,380	
	Estimate assumes current terminal MEP equipment sufficient to support new terminal and additional utility plant is not required					
6	**Equipment**				**$ 30,000**	
	Relocate TSA screen equipment	1	allow	30000	$ 30,000	
7	**Conveying Systems**				**$ 3,618,500**	
	Elevators - 2 stop - glass - 2 doors	2	ea	600000	$ 1,200,000	2 stop/ Std elev $135K
	Add for fire rated glass elevator shafts	2,560	sf	600	$ 1,536,000	
	Escalators	3	ea	200000	$ 600,000	
	Stairs	4	flights	40000	$ 160,000	
	Glass handrail	350	lf	350	$ 122,500	
8	**Sitework**				**$ 879,840**	
	Assume 5% of Building Costs	1	ls	879840	$ 879,840	
Subtotal		**21964**	**sf**	**$ 925**	**$ 20,324,303**	
	Phasing/MOT	5%			$ 1,016,215	
	Bond, Permit & Insurance	3%			$ 640,216	
	GC Overhead & Profit	10%			$ 2,198,073	
	Planning Contingency	25%			$ 6,044,702	
Subtotal - Construction Costs		**21,964**	**sf**	**$ 1,376**	**$ 30,223,509**	
	Construction Contingency	5%			$ 1,511,175	
	FF+E	5%			$ 1,511,175	
	Engineering Costs (Design)	10%			$ 3,022,351	
	CM Fee	7%			$ 2,115,646	
	Inspection (RE) & Material Testing	3%			$ 906,705	
TOTAL PROGRAM		**21,964**	**sf**	**$ 1,789**	**$ 39,300,000**	**New Addition**

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Building Envelop Replacement

Item	Description	Quantity	Unit	Unit Price	Total	Comment
1	**General Requirements**				**$ 604,913**	
	Based on 10% of direct construction costs	1	ls	604913	$ 604,913	
2	**Building Envelop**				**$ 6,049,130**	
	Demo of existing building envelop	27,235	sf	20	$ 544,700	15'-30' high
	Demo of existing entry points	2	ea	25000	$ 50,000	
	Curtain wall w/ sunshades	10,894	sf	150	$ 1,634,100	40% of building envelop
	Metal panel exterior	16,341	sf	100	$ 1,634,100	60% of building envelop
	Replace roof w/ new TPO roof	31790	sf	37	$ 1,176,230	inc demo
	Miscellaneous deck repairs	1	allow	10000	$ 10,000	assume 5%
	Entry structure w/ sliding doors and canopy	2	ea	500000	$ 1,000,000	
			LF			
Subtotal		**1**	**ls**	**$ 6,654,043**	**$ 6,654,043**	
	Phasing/MOT	5%			$ 332,702	
	Bond, Permit & Insurance	3%			$ 209,602	
	GC Overhead & Profit	10%			$ 719,635	
	Planning Contingency	25%			$ 1,978,996	
Subtotal - Construction Costs		**1**	**LS**	**$ 9,894,978**	**$ 9,894,978**	
	Construction Contingency	5%			$ 494,749	
	FF+E	0%			$ -	
	Engineering Costs (Design)	10%			$ 989,498	
	CM Fee	7%			$ 692,648	
	Inspection (RE) & Material Testing	3%			$ 296,849	
TOTAL PROGRAM		**1**	**LS**	**$ 12,370,000**	**$ 12,370,000**	**Building Envelop Replacement**

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Plumbing Upgrades, Fire Sprinkler Modifications, Restroom Renovation/Expansion

Item	Description	Quantity	Unit	Unit Price	Total	Comment
1	**General Requirements**				**$ 256,890**	
	Based on 10% of direct construction costs	1	ls	256890	$ 256,890	
2	**Plumbing Equipment and Branch Piping**				**$ 1,043,350**	
	Replace electric water heater - 40 gallon	1	ea	2600	$ 2,600	
	Replace electric water heater - 30 gallon	1	ea	2400	$ 2,400	
	Replace electric water heater - 20 gallon	1	ea	2200	$ 2,200	
	Replace natural gas water heater - 420 MBH	1	ea	18000	$ 18,000	
	Replace natural gas water heater - 200 MBH	1	ea	12000	$ 12,000	assumed size, no size given
	Replace cold water main and branch piping	108,773	sf	3	$ 326,319	
	Replace hot water main and branch piping	108,773	sf	3	$ 326,319	
	Replace piping insulation	108,773	sf	1	$ 135,966	
	Demo of existing	108,773	sf	2	$ 217,546	
	Existing main branch sanitary to remain					
3	**Fire Sprinkler**				**$ 217,546**	
	Mains to remain, adjust branch piping and heads for new wall layouts	108,773	sf	2	$ 217,546	
4	**Restrooms Renovation/Expansion**				**$ 1,308,000**	
	First floor restroom renovation	840	sf	450	$ 378,000	within existing walls
	Second floor restroom expansion	1860	sf	500	$ 930,000	new walls, new sanitary
	Above costs include new plumbing fixtures, new piping, new finishes, new accessories					
	Estimate assumes 2700 sf of restroom renovation/expansion. One restroom is located on the 1st floor and one restroom is located on the 2nd floor					
Subtotal		**108773**	**sf**	**$ 26**	**$ 2,825,786**	
	Phasing/MOT	5%			$ 141,289	
	Bond, Permit & Insurance	3%			$ 89,012	
	GC Overhead & Profit	10%			$ 305,609	
	Planning Contingency	25%			$ 840,424	
Subtotal - Construction Costs		**108,773**	**sf**	**$ 39**	**$ 4,202,120**	
	Construction Contingency	5%			$ 210,106	
	FF+E	0%			$ -	
	Engineering Costs (Design)	10%			$ 420,212	
	CM Fee	7%			$ 294,148	
	Inspection (RE) & Material Testing	3%			$ 126,064	
TOTAL PROGRAM		**108,773**	**sf**	**$ 48**	**$ 5,260,000**	**Plumbing Upgrades, Fire Sprinkler Modifications, Restroom Renovation/Expansion**

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Mechanical System Renovation

Item	Description	Quantity	Unit	Unit Price	Total	Comment
1	**General Requirements**				$ 630,002	
	Based on 10% of direct construction costs	1	ls	630002	$ 630,002	
2	**Mechanical**				$ 6,300,018	
Equipment						
	Replace RTU's 1-7, 9, 10, 12-20 + MAU	475	tons	3500	$ 1,662,500	
	Boilers B1 and B2	4,000	MBH	30	$ 120,000	
	Replace pumps	1	ls	95000	$ 95,000	
	Exhaust fans	25	ea	1500	$ 37,500	
	Expansion tank/Air separator	1	ls	30000	$ 30,000	
	ACU 3, 4 and 5	17	tons	1636	$ 26,994	
	VAV's	218	ea	1000	$ 217,546	
Ductwork and Accessories						
	New ductwork	108,773	sf	12	$ 1,305,276	
	New insulation	108,773	sf	1.2	$ 130,528	
	New accessories	108,773	sf	1	$ 108,773	
Piping and Insulation						
	HWS&R - Copper press	108,773	sf	2.25	$ 244,739	
	HWS&R - Grooved steel	108,773	sf	1	$ 108,773	
	Coil Connections at VAVs	218	sf	500	$ 108,773	
	Pipe Insulation	108,773	ea	0.9	$ 97,896	
Controls						
	New BAS	108,773	sf	15	$ 1,631,595	
Miscellaneous						
	Test and Balance	108,773	sf	0.75	$ 81,580	
	Rigging of equipment	1	ls	75000	$ 75,000	
	Demolition	108,773	sf	2	$ 217,546	
	Scope of work as identified in TOL Assessment Report V2					
Subtotal		**108773**	**sf**	**$ 64**	**$ 6,930,020**	
	Phasing/MOT	5%			$ 346,501	
	Bond, Permit & Insurance	3%			$ 218,296	
	GC Overhead & Profit	10%			$ 749,482	
	Planning Contingency	25%			$ 2,061,075	
Subtotal - Construction Costs		**108,773**	**sf**	**$ 95**	**$ 10,305,373**	
	Construction Contingency	5%			$ 515,269	
	FF+E	0%			$ -	
	Engineering Costs (Design)	10%			$ 1,030,537	
	CM Fee	7%			$ 721,376	
	Inspection (RE) & Material Testing	3%			$ 309,161	
TOTAL PROGRAM		**108,773**	**sf**	**$ 119**	**$ 12,890,000**	**Mechanical System Renovation**

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Electrical System Renovation

Item	Description	Quantity	Unit	Unit Price	Total	Comment
1	**General Requirements**				**$ 474,785**	
	Based on 10% of direct construction costs	1	ls	474785	$ 474,785	
2	**Electrical**				**$ 4,747,853**	
Electrical Equipment and Distribution						
	Replace MDS and associated panels (terminal only, no airfield)	108,773	sf	10	$ 1,087,730	
	Panel feeders	108,773	sf	2	$ 217,546	
	Wiring devices and branch wiring	108,773	sf	6	$ 652,638	
Motor Control						
	HVAC System and Miscellaneous Equipment Feeders and Connections.	108,773	sf	3	$ 326,319	
Lighting						
	Lighting	108,773	sf	15	$ 1,631,595	
	Lighting controls	1	allow	125000	$ 125,000	
Fire Alarm						
	New sensors and alarms	108,773	sf	3	$ 326,319	
	Existing panel to remain					
Miscellaneous						
	Demolition	108,773	sf	2.5	$ 271,933	
	Lightening protection	108,773	sf	1	$ 108,773	
	Scope of work as identified in TOL Assessment Report V2					
Subtotal		**108773**	**sf**	**$ 48**	**$ 5,222,638**	
	Phasing/MOT	5%			$ 261,132	
	Bond, Permit & Insurance	3%			$ 164,513	
	GC Overhead & Profit	10%			$ 564,828	
	Planning Contingency	25%			$ 1,553,278	
Subtotal - Construction Costs		**108,773**	**sf**	**$ 71**	**$ 7,766,389**	
	Construction Contingency	5%			$ 388,319	
	FF+E	0%			$ -	
	Engineering Costs (Design)	10%			$ 776,639	
	CM Fee	7%			$ 543,647	
	Inspection (RE) & Material Testing	3%			$ 232,992	
TOTAL PROGRAM		**108,773**	**sf**	**$ 89**	**$ 9,710,000**	**Electrical System Renovation**

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Technology System Renovation

Item	Description	Quantity	Unit	Unit Price	Total	Comment
1	**General Requirements**				**$ 373,951**	
	Based on 10% of direct construction costs	1	ls	373951	$ 373,951	
2	**Technology**				**$ 3,739,509**	
	New rough-in for telecommunication	108,773	sf	4	$ 435,092	
	New access control	**108,773**	**sf**	**8**	**$ 870,184**	**potential airport project**
	New PA system	108,773	sf	6	$ 652,638	
	New DAS system	108,773	sf	10	$ 1,087,730	
	Replace analog cameras and tie into existing system	54,387	sf	10	$ 543,865	assume 50%
	New telcom room	1	allow	150000	$ 150,000	
	BIDS and FIDS - acceptable condition					
	Scope of work as identified in TOL Assessment Report V2					
Subtotal		**108773**	**sf**	**$ 38**	**$ 4,113,460**	
	Phasing/MOT	5%			$ 205,673	
	Bond, Permit & Insurance	3%			$ 129,574	
	GC Overhead & Profit	10%			$ 444,871	
	Planning Contingency	25%			$ 1,223,394	
Subtotal - Construction Costs		**108,773**	**sf**	**$ 56**	**$ 6,116,972**	
	Construction Contingency	5%			$ 305,849	
	FF+E	0%			$ -	
	Engineering Costs (Design)	10%			$ 611,697	
	CM Fee	7%			$ 428,188	
	Inspection (RE) & Material Testing	3%			$ 183,509	
TOTAL PROGRAM		**108,773**	**sf**	**$ 70**	**$ 7,650,000**	**Technology System Renovation**

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Interior Renovation of Existing Finishes

Item	Description	Quantity	Unit	Unit Price	Total	Comment
1	**General Requirements**				**$ 895,332**	
	Based on 10% of direct construction costs	1	ls	895332	$ 895,332	
2	**Interior Demolition**				**$ 1,283,754**	
	Demo flooring	82221	sf	4	$ 328,884	
	Demo ceilings	82221	sf	5	$ 411,105	
	Mold abatement	108,773	sf	3	$ 326,319	
	Asbestos abatement	1	allow	50000	$ 50,000	
	Demo miscellaneous - assume 15% of above	1	ls	167446	$ 167,446	
	Most of existing walls are assumed to remain					
3	**Interiors**				**$ 7,119,567**	
	Carpentry - blocking	108,773	sf	0.5	$ 54,387	
	New ticket counters	105	lf	500	$ 52,500	
	Interior Walls and Doors	108773	sf	8	$ 870,184	
	Paint	108773	sf	2	$ 217,546	
	Custom wall finished (metal panels)	108773	sf	2	$ 217,546	
	Ceilings - open painted	26552	sf	2	$ 53,104	Mech rooms, BHS
	Ceilings - ACT	31188	sf	8	$ 249,504	Airport space (office)
	Ceilings- Gyp	13796	sf	20	$ 275,920	Hold rooms
	Ceilings - Feature (metal, soffits)	37237	sf	35	$ 1,303,295	Ticketing, public space
	Flooring - clean and seal	26552	sf	5	$ 132,760	Mech rooms
	Flooring - LVT,carpet	44984	sf	12	$ 539,808	Hold rooms, airport space
	Flooring - Terrazzo	37237	sf	35	$ 1,303,295	Public space
	Signage	108773	sf	10	$ 1,087,730	
	Service Animal Relief Areas	2	ea	300000	$ 600,000	
	Add sound insulation to increase STA rating	21747	sf	4	$ 86,988	assume office areas only
	Sensory room	1	ls	75000	$ 75,000	
4	**Equipment**				**$ 550,000**	
	Refurbish in bound baggage conveyor	1	allow	500000	$ 500,000	
	Replace conveyor from ticketing to in line baggage	1	ls	50000	$ 50,000	
Subtotal		**108773**	**sf**	**$ 91**	**$ 9,848,653**	
	Phasing/MOT	5%			$ 492,433	
	Bond, Permit & Insurance	3%			$ 310,233	
	GC Overhead & Profit	10%			$ 1,065,132	
	Planning Contingency	25%			$ 2,929,112	
Subtotal - Construction Costs		**108,773**	**sf**	**$ 135**	**$ 14,645,562**	
	Construction Contingency	5%			$ 732,278	
	FF+E	8%			$ 1,171,645	
	Engineering Costs (Design)	10%			$ 1,464,556	
	CM Fee	7%			$ 1,025,189	
	Inspection (RE) & Material Testing	3%			$ 439,367	
TOTAL PROGRAM		**108,773**	**sf**	**$ 179**	**$ 19,480,000**	**Interior Renovation of Existing Finishes**

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Sitework Improvements						
Item	**Description**	**Quantity**	**Unit**	**Unit Price**	**Total**	**Comment**
1	**General Requirements**				**$ 15,500**	
	Based on 10% of direct construction costs	1	ls	15500	$ 15,500	
2	**Sitework**				**$ 155,000**	
	Relocate pedestrian cross walks so that they line-up with terminal entry points	1	ls	15000	$ 15,000	
	Sidewalk widening for ADA (inc demo existing)	5,000	sf	15	$ 75,000	assumed qty
	Bollards at curb line	65	ea	1000	$ 65,000	500' at 8' oc
	Scope of work as identified in TOL Assessment Report V2					
Subtotal		**1**	**LS**	**$ 170,500**	**$ 170,500**	
	Phasing/MOT	5%			$ 8,525	
	Bond, Permit & Insurance	3%			$ 5,371	
	GC Overhead & Profit	10%			$ 18,440	
	Planning Contingency	25%			$ 50,709	
Subtotal - Construction Costs		**1**	**LS**	**$ 253,544**	**$ 253,544**	
	Construction Contingency	5%			$ 12,677	
	FF+E	0%			$ -	
	Engineering Costs (Design)	10%			$ 25,354	
	CM Fee	7%			$ 17,748	
	Inspection (RE) & Material Testing	3%			$ 7,606	
TOTAL PROGRAM		**1**	**LS**	**$ 320,000**	**$ 320,000**	**Sitework Improvements**

Toledo Express Airport
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Add for Glass Jet Bridges

Item	Description	Quantity	Unit	Unit Price	Total	Comment
1	**General Requirements**				**$ 375,000**	
	Based on 10% of direct construction costs	1	ls	375000	$ 375,000	
2	**Conveying Systems**				**$ 3,750,000**	
	Demo of existing jet bridges	3	ea	50000	$ 150,000	
	Jet bridges (including foundations) - Glass	3	ea	1200000	$ 3,600,000	120' w/ PC air
Subtotal		**3**	**ea**	**$ 1,375,000**	**$ 4,125,000**	
	Phasing/MOT	2%			$ 82,500	
	Bond, Permit & Insurance	3%			$ 126,225	
	GC Overhead & Profit	10%			$ 433,373	
	Planning Contingency	5%			$ 238,355	
Subtotal - Construction Costs		**3**	**ea**	**$ 1,668,484**	**$ 5,005,452**	
	Construction Contingency	2%			$ 100,109	
	FF+E	0%			$ -	
	Engineering Costs (Design)	10%			$ 500,545	
	CM Fee	7%			$ 350,382	
	Inspection (RE) & Material Testing	2%			$ 100,109	
TOTAL PROGRAM		**3**	**ea**	**$ 2,020,000**	**$ 6,060,000**	**Add for Glass Jet Bridges**

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Replace pedestrian canopies

Item	Description	Quantity	Unit	Unit Price	Total	Comment
1	**General Requirements**				**$ 91,920**	
	Based on 10% of direct construction costs	1	ls	91920	$ 91,920	
2	**Sitework**				**$ 919,200**	
	Replace canopy to parking lot	766	lf	1200	$ 919,200	pre-fab'd
Subtotal		**766**	**LF**	**$ 1,320**	**$ 1,011,120**	
	Phasing/MOT	5%			$ 50,556	
	Bond, Permit & Insurance	3%			$ 31,850	
	GC Overhead & Profit	10%			$ 109,353	
	Planning Contingency	25%			$ 300,720	
Subtotal - Construction Costs		**766**	**LF**	**$ 1,963**	**$ 1,503,599**	
	Construction Contingency	5%			$ 75,180	
	FF+E	0%			$ -	
	Engineering Costs (Design)	10%			$ 150,360	
	CM Fee	7%			$ 105,252	
	Inspection (RE) & Material Testing	3%			$ 45,108	
TOTAL PROGRAM		**766**	**LF**	**$ 2,454**	**$ 1,880,000**	**Replace pedestrian canopies**

APPENDIX B
EUGENE F. KRANZ TOLEDO EXPRESS AIRPORT
TERMINAL FACILITY ASSESSMENT