4. Facility Requirements

This chapter presents the airside and landside facility requirements necessary to accommodate existing and forecasted demand at Erie International Airport (ERI or the Airport) in accordance with Federal Aviation Administration (FAA) design criteria and safety standards. The facility requirements are based upon several sources, including the aviation demand forecasts presented in Chapter 3, *Forecast;* FAA Advisory Circular (AC) 150/5300-13A, *Airport Design;* and 14 Code of Federal Regulations (CFR) Part 77, *Objects Affecting Navigable Airspace.* The findings of this chapter serve as the basis for the formulation of airport alternatives and development recommendations. The major components of this chapter are listed below:

- Airfield Capacity Analysis
- Airside Facility Requirements
- Passenger Terminal Facility Requirements
- Parking and Roadway Access Facility Requirements
- General Aviation and Landside Facility Requirements
- Utilities and Support Facilities
- Forecast Scenario Facility Requirements
- Facility Requirements Summary

4.1. AIRFIELD CAPACITY ANALYSIS

Airfield capacity refers to the ability of an airport to safely accommodate a given level of aviation activity. The FAA has prepared a number of publications and computer programs to assist in the calculation of capacity. This report will use the methodologies described in AC 150/5060-5, *Airport Capacity and Delay*.

Capacity is described through three terms: annual service volume (ASV), visual flight rules (VFR) hourly capacity, and instrument flight rules (IFR) hourly capacity. The ASV is a reasonable estimate of the annual capacity, or the maximum annual level of aircraft operations that can be accommodated, at an airfield. It should be noted that airports could, and often do, exceed their stated ASV. However, delays begin to increase rapidly once the ASV is exceeded.

The VFR and IFR hourly capacities are the maximum number of aircraft operations that can take place on the runway system in one hour under VFR or IFR conditions, respectively. When hourly demand approaches or exceeds the hourly capacity, delays may force traffic into the succeeding hours or cause aircraft to divert to other airports.

4.1.1. Factors Affecting Capacity

It is important to understand the various factors that affect the ability of an air transport system to process demand. Once these factors are identified and their effect on the processing of demand is understood, efficiencies can be evaluated. The airfield capacity analysis considers several factors that affect the ability of the Airport to process aviation demand.

These factors include:

- Meteorological Conditions
- Runway/Taxiway Configuration
- Runway Utilization
- Aircraft Fleet Mix
- Percent Arriving Aircraft
- Percent Touch-and-Go operations
- Exit Taxiway Locations
- Peaking Characteristics

Meteorological Conditions

Meteorological conditions specific to the location of an airport not only influence the airfield layout, but affect the use of the runway system. As weather conditions change, airfield capacity can be reduced by low ceilings and visibility. Runway usage will change as the wind speed and direction change, also impacting the capacity of the airfield.

To better understand the impact of deteriorating weather on capacity, a brief synopsis of aviation flying conditions is provided. For the purposes of capacity evaluation, these flying conditions are described as VFR conditions, IFR conditions, and poor visibility and ceiling (PVC) conditions. VFR conditions occur whenever the cloud ceiling is at least 1,000 feet above ground level (AGL) and the visibility is at least three statute miles. IFR conditions occur when the reported cloud ceiling is at least 500 feet but less than 1,000 feet AGL and/or visibility is at least one statute mile but less than three statute miles. PVC conditions exist when the cloud ceiling is less than 500 feet and/or the visibility is less than one statute mile. Decreasing cloud ceiling and visibility require an increase in aircraft spacing, as mandated by the FAA. This increase in aircraft spacing causes decreases in the frequency at which aircraft can land and depart the airfield over a specified period of time.

In order to better understand the impact that inclement weather has on ERI, climate data from the National Oceanic and Atmospheric Administration (NOAA) was obtained and analyzed to determine the ceiling and visibility characteristics at this site. Based upon this data, VFR conditions occur at the Airport approximately 76.9 percent of the time and IFR conditions occur approximately 17.5 percent of the time. Finally, PVC conditions are present at the Airport approximately 5.5 percent of the time.

Wind direction and speed determine the desired alignment and configuration of the runway system. If possible, aircraft desire to take off and land into the wind, taking advantage of aircraft design. On departure into the wind, the air flowing over the wings allows the airplane to become airborne much sooner than under a no-wind or tail-wind condition. An aircraft landing into the wind will be able to slow down on approach much easier and land at a slower ground speed. Runways not orientated to take the most advantage of the prevailing winds at the site will restrict capacity of an airport to varying degrees as aircraft have long takeoff rolls and landings.

Runway/Taxiway Use Configurations

The configuration of the runway system refers to the number, location, and orientation of the active runway(s), the type and direction of operations, and the flight rules in effect at a particular time. ERI has two runways including a primary runway (Runway 6-24) and a crosswind runway (Runway 2-20).

Although not a traditional full-length parallel taxiway, Taxiways A and G provide access to both ends of Runway 6-24 and parallel it for most of its length. The Runway 20 end is served by access Taxiway B. There is currently no access taxiway located at the Runway 2 end.

Although ERI's Runway 6-24 does not have a full-length parallel taxiway, its exit taxiways allow aircraft to exit/enter the runway in an efficient matter.

Runway Utilization

As discussed in the meteorological conditions section, aircraft generally desire to takeoff and land into the wind. Since Runway 2-20 is not equipped with any approach procedures, it is only used during VFR operations. At ERI when winds are calm, both runways are used. Most aircraft operations favor Runway 6-24. When winds favor either end of Runway 2-20, additional traffic will use that runway. However, some jet traffic will continue to operate on Runway 6-24 due to its longer length and the availability of precision instrument approaches to both runway ends. Jet aircraft can typically handle stronger crosswinds than non-jet aircraft. Therefore, when winds favor Runway 2-20, operations may be conducted on either runway.

Air traffic control (ATC) management confirmed that approximately 20-30 percent of the time, operations are conducted on Runways 2 and 6 and 70-80 percent on Runways 20 and 24.

Aircraft Fleet Mix

The capacity of a runway is also dependent upon type and size of aircraft that use it. As per AC 150/5060-5, aircraft are placed into one of four classes (A through D) when conducting capacity analysis. These classes are based on the amount of wake vortex created when the aircraft passes through the air. They differ from the classes used in the determination of the aircraft approach category (AAC). Small aircraft departing behind larger aircraft must hold long for wake turbulence separation. The greater the separation distance required, the lower the airfield's capacity.

For the purposes of capacity analysis, Class A consists of aircraft in the small wake turbulence class, single engine and a maximum takeoff weight of 12,500 pounds or less. Class B is made up of aircraft similar to Class A, but with multiple engines. Class C aircraft are in the large wake turbulence class with multiple engines and with takeoff weights between 12,500 pounds and 300,000 pounds. Class D aircraft are in the heavy wake turbulence class and have multiple engines and a maximum takeoff weight greater than 300,000 pounds. Typically, Class A and B aircraft are general aviation single engine and light twin engine aircraft. Class C and D consist of large jet and propeller driven aircraft generally associated with larger commuter, airline, air cargo, and military use.

The aircraft fleet mix is defined by the percentage of operations conducted by each of these four classes of aircraft at ERI. The approximate percentage of operations forecasted at ERI by each of these types of aircraft is shown in **Table 4-1**.

Table 4-1: Aircraft Fleet Mix

Aircraft Type	2015 Percent of Operations	2035 Percent of Operations
Class A	36%	39%
Class B	15%	16%
Class C	49%	45%
Class D	0%	0%

Source: McFarland Johnson Analysis, 2016.

The mix index for an airport is calculated as the percentage of Class C aircraft operations, plus three times the percentage of Class D operations (%C + 3D). Since there are no Class D aircraft forecast to use the Airport, the mix index is equal to the percentage of Class C operations. At ERI this is approximately 45 percent of the forecasted activity. At airports with only Class A and B aircraft, the separation distance required for air traffic is lower than at airports with use by aircraft in Class C or D, as small aircraft departing behind larger aircraft must hold longer for wake turbulence separation. The greater the separation distance required, the lower the airfield's capacity.

Percent Arriving Aircraft

The capacity of the runway is also influenced by the percentage of aircraft arriving at the Airport during the peak hour. Arriving aircraft are typically given priority over departing aircraft; however, arriving aircraft generally require more time to land than departing aircraft need to takeoff. Therefore, the higher the percentage of aircraft arrivals during peak periods of operations, the lower the ASV. Discussions with Airport personnel indicate that operational activity at ERI is well balanced between arrivals and departures. Therefore, it is assumed in the capacity calculations that arrivals equal departures during the peak period.

Percent Touch-and-Go Operations

A touch-and-go operation refers to an aircraft maneuver in which the aircraft performs a normal landing touchdown followed by an immediate takeoff, without stopping or taxiing clear of the runway. A touch-and-go is counted as two operations. These operations are normally associated with training and are included in the local operations figures reported by the air traffic control tower (ATCT). Based on historical data from the Airport and the ATCT, touch-and-go operations comprise approximately 42 percent of total operations at the Airport. Since the local flight school has signed an agreement with the local college to start a professional pilot program, this number is anticipated to increase to above 50 percent of total operations within the planning period.

Exit Taxiway Locations

A final factor in analyzing the capacity of a runway system is the ability of an aircraft to exit the runway as quickly and safely as possible. The location, design, and number of exit taxiways affect the occupancy time of an aircraft on the runway system. The longer an aircraft remains on the runway, the lower the capacity of that runway.

Existing exit taxiways for Runway 6-24 include:

- Taxiway A: located at the Runway 24 threshold
- Taxiway A1: located approximately 1,970 feet from the Runway 24 threshold and approximately 4,570 feet from the Runway 6 landing (displaced) threshold
- Taxiway A2: located approximately 3,440 feet from the Runway 24 threshold and approximately 4,050 feet from the Runway 6 landing (displaced) threshold
- Taxiway A3: located approximately 4,500 feet from the Runway 24 threshold and approximately 3,170 feet from the Runway 6 landing (displaced) threshold
- Taxiway D: located approximately 5,800 feet from the Runway 24 threshold and is an acute taxiway exit; it is located approximately 2,300 feet from the Runway 6 landing (displaced) threshold
- Taxiway F: located approximately 7,700 feet from the Runway 24 threshold
- Taxiway G: located at the Runway 6 threshold

FAA AC 150/5300-13A provides guidance regarding the number and location of exit taxiways as shown in **Table 4-2**.

Table 4-2: Exit Taxiway Cumulative Utilization Percentage

Distance Threshold to Exit	Wet Runways			Dry Runways		
	Right and Acute Angle Exits			Right Angled Exits		
	A	B	C	A	B	C
2,000	60	0	0	84	1	0
2,500	84	1	0	99	10	0
3,500	99	41	0	100	81	2
4,000	100	80	1	100	98	8
4,500	100	97	4	100	100	24
5,000	100	100	12	100	100	49
5,500	100	100	27	100	100	75
6,000	100	100	48	100	100	92
7,000	100	100	88	100	100	100
7,500	100	100	97	100	100	100

A – small, single engine (<12,500 pounds); B – small, twin engine (<12,500 pounds); C – large (12,500 pounds to 300,000 pounds)

Source: FAA AC 150/5300-13A (Table 4-13) and McFarland Johnson, 2016.

According to this AC, 100 percent of aircraft capacity Class A, B and C aircraft can exit a runway under dry conditions with an exit taxiway located at least 7,500 from the landing threshold (Runway 6-24 at Taxiways F and G). Essentially all A and B aircraft could exit on Taxiways A3, D, F, and G landing on Runway 24 under wet runway conditions. Similarly, essentially all A and B aircraft could exit on Taxiways A1 and A landing on Runway 6 under wet runway conditions.

Existing exit taxiways for Runway 2-20 include:

- Taxiway B: located at the Runway 20 threshold
- Taxiway C: located approximately 1,170 feet from the Runway 20 landing (displaced) threshold and approximately 1,100 feet from the Runway 2 landing (displaced) threshold
- Taxiways D/E: located approximately 2,000 feet from the Runway 20 landing (displaced) threshold and approximately 360 feet from the Runway 2 landing (displaced threshold)

Runway 2-20 is mostly useful for aircraft capacity Class A aircraft. Landing on Runway 20, 60 percent of Class A aircraft can land in wet conditions and 84 percent in dry conditions when using Taxiways D/E. Any additional runway length requirement results in back-taxi operations. Aircraft landing on Runway 2 can taxi all the way to the end (approximately 2,600 feet), which accommodates 84 percent of Class A aircraft in wet conditions and 99 percent of Class A aircraft in dry conditions.

Peaking Characteristics

Airline peak periods are defined in terms of peak hour operations and peak hour enplanements. General aviation (GA) peak periods are defined in terms of peak month and peak hour operations, with a focus on the number of aircraft accommodated on the ramp(s) at any given time.

In addition to peaking characteristics described for airline and GA activity, peaking characteristics are also influenced by annual events that occur at an airport or in the vicinity of an airport that affect air travel, vehicle, and/or aircraft parking, etc.

4.1.2. Capacity Calculations

FAA AC 150/5060-5 provides guidance used to calculate airfield capacity and provide planning estimates on hourly airfield capacity under both VFR and IFR conditions, which are the theoretical maximum number of aircraft operations (takeoffs and landings) that can take place on the runway system in one hour under VFR or IFR conditions, respectively. The various capacity elements are then consolidated into a single figure, the ASV for the Airport. The ASV is the theoretical maximum number of aircraft operations that the Airport can support over the course of a year.

VFR/IFR Hourly Capacities

Because characteristics of airports vary so widely, guidance in AC 150/5060-5 is provided for different types of airports, from large commercial service hubs, to small single runway facilities. According to AC 150/5060-5, VFR and IFR capacity calculations are based on certain assumptions such as the previously calculated mix index. These assumptions and their relevance to ERI are described below:

- The Airport is currently used by approximately 51 percent Class A/B aircraft and 49 percent by Class C aircraft. In the future, it is anticipated use will change to include operations by approximately 55 percent Class A/B aircraft and 45 percent by Class C aircraft, which represents the twenty-year forecast condition.
- The Airport currently has a partial parallel taxiway to Runway 6-24 and a partial parallel taxiway to Runway 2-20.

- The Airport has two runway ends equipped with an ILS and necessary ATC facilities to carry out operations in a radar environment.
- Arrivals equal departures.
- There are no airspace limitations affecting runway use.
- Percentage of touch-and-go operations is less than 50 percent but anticipated to climb above 50 percent within the planning period.

Guidance in FAA AC 150/5060-5 was used to determine the ASV. **Table 4-3** presents a summary of the above airfield capacity calculations for ERI compared to the current and forecast level of activity. It is noted that the anticipated change in fleet mix, with a decreasing rate of use by Class C aircraft, but an increasing number of annual operations, will have no measurable impact on capacity. These figures indicate that the Airport is currently operating at 22 percent of capacity on an annual basis. The utilization of the airfield is expected to climb to approximately 27 percent of ASV by 2036. Because most of the Airport's operations are conducted during VFR conditions, the VFR hourly capacity figures are included for comparison purposes. Airfield capacity at ERI does not appear to be constrained at the present, and future capacity is also anticipated to be adequate. FAA guidance recommends that planning for capacity enhancement should begin when capacity reaches the 60 percent level. It is assumed that any runway improvements that are contemplated will be supplemented by taxiway improvements to maintain capacity.

Table 4-3: Annual Operations Forecast

Year	Demand		Capacity			Percent Peak Hour		Percent ASV
	Annual	Peak Hour	ASV	Hourly VFR	Hourly IFR	VFR	IFR	
2016	18,595	10	83,719	66	53	15	19	22
2021	19,187	11	83,719	66	53	17	21	23
2026	20,275	11	83,719	66	53	17	21	24
2036	22,530	13	83,719	66	53	20	25	27

Source: McFarland Johnson Analysis, 2016.

4.2. AIRSIDE FACILITY REQUIREMENTS

Airside facility requirements address the items that are directly related to the arrival and departure of aircraft, primarily runways and taxiways and their associated safety areas. To assure that all runway and taxiway systems are correctly designed, the FAA has established criteria for use in planning and design of airfield facilities. The selection of appropriate FAA design standards for the development of airfield facilities is based on the characteristics of the most demanding aircraft expected to use an airport or that particular facility at an airport on a regular basis (500 operations per year). Correctly identifying the future aircraft types that will use an airport is particularly important, because the design standards that are selected will establish the physical dimensions of facilities, and the separation distances between facilities that will impact airport development for years to come. Use of appropriate standards will ensure that facilities can safely accommodate aircraft using the Airport today, as well as aircraft that are projected to use the Airport in the future.

4.2.1. Critical Design Aircraft/Runway Design Code

Airport design standards are described in AC 150-5300-13A, *Airport Design.* This document provides criteria for grouping of aircraft into runway design codes (RDC). The RDC consists of a letter representing an aircraft approach category (AAC) which is based on approach speed, a number representing an airplane design group (ADG) which is based on tail height and/or wingspan, and a number representing the visibility minimums associated with the runway (based on corresponding runway visual range (RVR) values in feet). These groupings are presented in **Table 4-4** below.

Table 4-4: Runway Design Code Characteristics

Aircraft Approach Category (AAC)	
Category	**Approach Speed**
A	Approach speed less than 91 knots
B	Approach speed 91 knots or more but less than 121 knots
C	Approach speed 121 knots or more but less than 141 knots
D	Approach speed 141 knots or more but less than 166 knots
E	Approach speed 166 knots or more

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

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

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

Review of Chapter 3, *Forecasts*, indicates that the future design aircraft for ERI is the Airbus A320 series.

While the A320 will be used in the analysis for the design aircraft, it is important to note that the characteristics of the A320 are equal to or more demanding than other potential aircraft that may use ERI during the planning period. Other aircraft that can be accommodated include, but are not limited to: Airbus 319, Boeing 737-700, Boeing 737-800, Boeing 717-200, Bombardier C-

Series, Embraer 170 and all other regional airline aircraft. On a less frequent basis, the airport may see operations from Boeing 737, B757, and B767 aircraft. In addition, while detailed specifications are not currently available, it is anticipated that the Airbus 320 family new engine option (neo) and Boeing 737 MAX family of aircraft can also be accommodated within the specified design characteristics.

Although the A320 is forecast to reach 500 annual operations, it is anticipated that the aircraft will exclusively use Runway 6-24 at the Airport. The aircraft type anticipated to conduct at least 500 annual itinerant operations on the crosswind runway is the Cessna Citation. The characteristics of the Cessna Citation assign it an RDC of B-II. Based on these use characteristics, the crosswind runway at ERI will have a B-II design designation based on the most demanding aircraft characteristics.

Not all Airport facilities will be designed to accommodate the most demanding aircraft at the Airport. Certain airside facilities and landside facilities, such as taxiways and general aviation areas that are not intended to serve large aircraft, may be designed to accommodate less demanding aircraft, where necessary, to ensure cost effective development. Designation of the appropriate standards for all proposed development on the Airport is shown on the Airport Layout Plan.

Airfield facility requirements are covered in this section as follows:

- Runway Length
- Runway Width
- Runway Strength
- Runway Orientation
- Runway Safety Areas
- Runway Object Free Areas
- Runway Protection Zones
- Runway Visibility Zones
- Runway Pavement Markings
- Taxiways
- Potential Hot Spots and Geometry Requirements
- Airfield Lighting and Signage
- Visual Approach Aids
- Airfield Facility Requirements Summary

4.2.2. Runway Length

A wide variety of aircraft use ERI on a daily basis. These aircraft, both large and small, have different runway requirements. In some cases, smaller or older aircraft may require more runway length than larger or more efficient aircraft. A significant number of factors go into determining the runway performance of an aircraft such as airport elevation, aircraft weight, temperature, flap settings, payload or runway condition (wet/dry), which then dictate the runway requirements that must be met in order for an aircraft to utilize that runway.

The FAA has published AC 150/5325-4B, *Runway Length Requirements for Airport Design*, to assist in the determination of the required runway length for both the primary and crosswind runways. The requirements for both the primary and crosswind runways are based on the performance of a specific aircraft or a family of similar aircraft.

Existing services and operations at the Airport operate safely and efficiently from both Runways 6-24 (8,420 feet long) and 2-20 (3,508 feet long).

The existing and future design aircraft are the Embraer 145/Bombardier CRJ-200 and A320neo for the Airport and Runway 6-24, respectively. The existing and proposed design aircraft for Runway 2-20 is the Cessna Citation Excel. Per AC 150/5325-4B, all existing design aircraft should be reviewed as part of the 12,500-60,000-pound group. The A320neo should be reviewed on an individual basis, as it is greater than 60,000 pounds in its maximum takeoff configuration. The Embraer 145 and Bombardier CRJ-200 are considered part of the 100 percent of aircraft in the 12,500 to 60,000-pound range and will be reviewed accordingly.

Embraer 145/Bombardier CRJ-200 – The current approximately 8,400-foot runway accommodates 100 percent of the fleet of 12,500 to 60,000-pound aircraft at both the 60 percent useful load (5,200-foot long runway required) and 90 percent useful load (7,700-foot long runway required) per Erie’s unique location.

Airbus A320neo – Aircraft performance for an Airbus A320 varies depending on the weight variant used. The current approximately 8,400-foot runway accommodates takeoff weights of up to 180,000 pounds in the summer, which translates into ranges of approximately 1,700 nautical miles (nm) depending on weather conditions and direction of travel. This range allows for operations to destinations as far as Arizona, parts of Nevada, and Idaho. The A320neo provides a minimum of 15 percent fuel savings over the A320.

Cessna Citation – Most Cessna Citation models (including the Citation Excel, most commonly used at the Airport) fall within the 75 percent of the fleet mix between 12,500 and 60,000 pounds. Based on the analysis on the Embraer, the Airport can accommodate 100 percent of the fleet mix between 12,500 and 60,000 pounds, including Cessna Citation aircraft.

Recommendation: The existing and future design aircraft can safely takeoff and land at ERI. No runway extension is recommended.

4.2.3. Runway Width

Runways 6-24 and 2-20 are both 150 feet wide, which is meets FAA standards for C-III and B-II runways, respectively.

Recommendation: No changes are recommended for Runways 6-24 and 2-20.

4.2.4. Runway Strength

Pavement strength requirements are related to three primary factors: 1) the weight of aircraft anticipated to use an airport, 2) the landing gear type and geometry, and 3) the volume of aircraft operations. Airport pavement design, however, is not predicated on a particular weight that is not to be exceeded. The current methodology used in FAA’s FAARFIELD airfield pavement design program analyzes the damage to the pavement for each airplane and determines a final thickness for the total cumulative damage per AC 150/5320-6E.

Design is based on the mix of aircraft that are expected to use the runway over the anticipated life of the pavement (usually 20 years). The methodology used to develop the runway pavement design considers the number of operations by both large and small aircraft, and reduces this data to a number of "equivalent annual operations" by a design aircraft, which is the most demanding in terms of pavement loading expected to use an airport. This may or may not be the design aircraft for planning purposes and its selection considers the type of landing gear and tire pressure in addition to weight. The outcome of the design process is a recommended pavement section that will accommodate operations by the forecast fleet mix, and withstand weather stresses without premature failure of the pavement.

The current pavement at the Airport is rated for 114,000 pounds single-wheel, 161,000 pounds dual wheel, and 264,000 pounds dual tandem for Runway 6-24 and 50,000 single-wheel, 60,000 pounds dual wheel, and 150,000 pounds dual tandem for Runway 2-20 according to the Airport's FAA 5010 Form, *Airport Master Record*. Runway 6-24 is listed in good condition and Runway 2-20 in fair condition. The two critical aircraft, A320neo and Cessna Citation Excel, have maximum takeoff weights of 172,000 and 20,200 pounds, respectively. Runway 6-24 may need to be strengthened, depending on the number of A320neo operations conducted at the Airport within the planning period and their destinations (if full takeoff weight is required). The 2010 Pavement Evaluation Report for the Commonwealth of Pennsylvania Bureau of Aviation showed Runway 6-20 at a Pavement Condition Index (PCI) of 66 and Runway 2-20 at a PCI between 29 and 65. The PCI scale indicates that pavement with a PCI of 71-100 should receive preventative maintenance, PCIs of 41-70 should receive major rehabilitation, and PCIs of 0-40 should be reconstructed. This Master Plan Update (MPU) includes a pavement management plan that will have updated pavement conditions.

Recommendation: Runways 6-24 and 2-20 are anticipated to receive either major rehabilitation or reconstruction within the planning period. Additional recommendations may be made as the result of the pavement management study.

4.2.5. Runway Orientation

A significant factor in evaluating a runway's orientation is the direction and velocity of the prevailing winds. Ideally, all aircraft take off and land in the direction of the wind. A runway alignment that does not allow an aircraft to go directly into the wind creates what is known as a crosswind component (i.e. winds at an angle to the runway in use), which makes it more difficult for a pilot to guide the airplane down the intended path. The commonly used measure of degree to which a runway is aligned with the prevailing wind conditions is the wind coverage percentage, which is the percent of time crosswind components are below an acceptable velocity. Essentially, this measure indicates the percentage of time aircraft within a particular design group will be able to safely use the runway. Current FAA standards recommend that airfields provide 95 percent wind coverage.

Wind data for the Airport was obtained from the National Climatic Data Center (NCDC) in Asheville, North Carolina. The wind data was collected for a 10-year period from 2005 through

2014 at Erie International Airport, and was compiled into all weather and IFR wind roses presented in **Figure 4-1** and **Figure 4-2**, respectively. The wind roses show the percentage of time winds at the Airport originated from different directions at various velocities. These percentages were then analyzed based on runway orientation and can be seen in **Table 4-5**. Ideally, the primary instrument runway at an airport should be the runway that has the highest percentage of wind coverage under IFR conditions, during which an approach procedure is needed.

Table 4-5: Runway Wind Coverage Analysis

	All Weather Wind Coverage[1]			IFR Wind Coverage[2]		
	10.5 Knot	13 Knot	16 Knot	10.5 Knot	13 Knot	16 Knot
Runway 6-24	88.65%	93.97%	98.14%	89.60%	94.64%	98.28%
Runway 6	30.79%	31.65%	32.42%	32.92%	34.28%	35.28%
Runway 24	66.29%	70.77%	74.19%	63.85%	67.54%	70.19%
Runway 2-20	88.00%	93.40%	98.00%	82.04%	89.42%	95.84%
Runway 2	35.65%	37.07%	38.37%	39.35%	41.55%	43.46%
Runway 20	60.77%	64.78%	68.10%	49.89%	55.11%	59.67%
Both	95.31%	98.07%	99.50%	93.89%	97.14%	99.08%

[1] All Weather Conditions: all ceiling and visibility conditions

[2] IFR Weather Conditions: ceiling less than 1,000 feet and below three statue miles but greater than or equal to 200 feet and one statute mile

Source: National Climactic Data Center – Erie International Airport 2005-2014 (134,950).

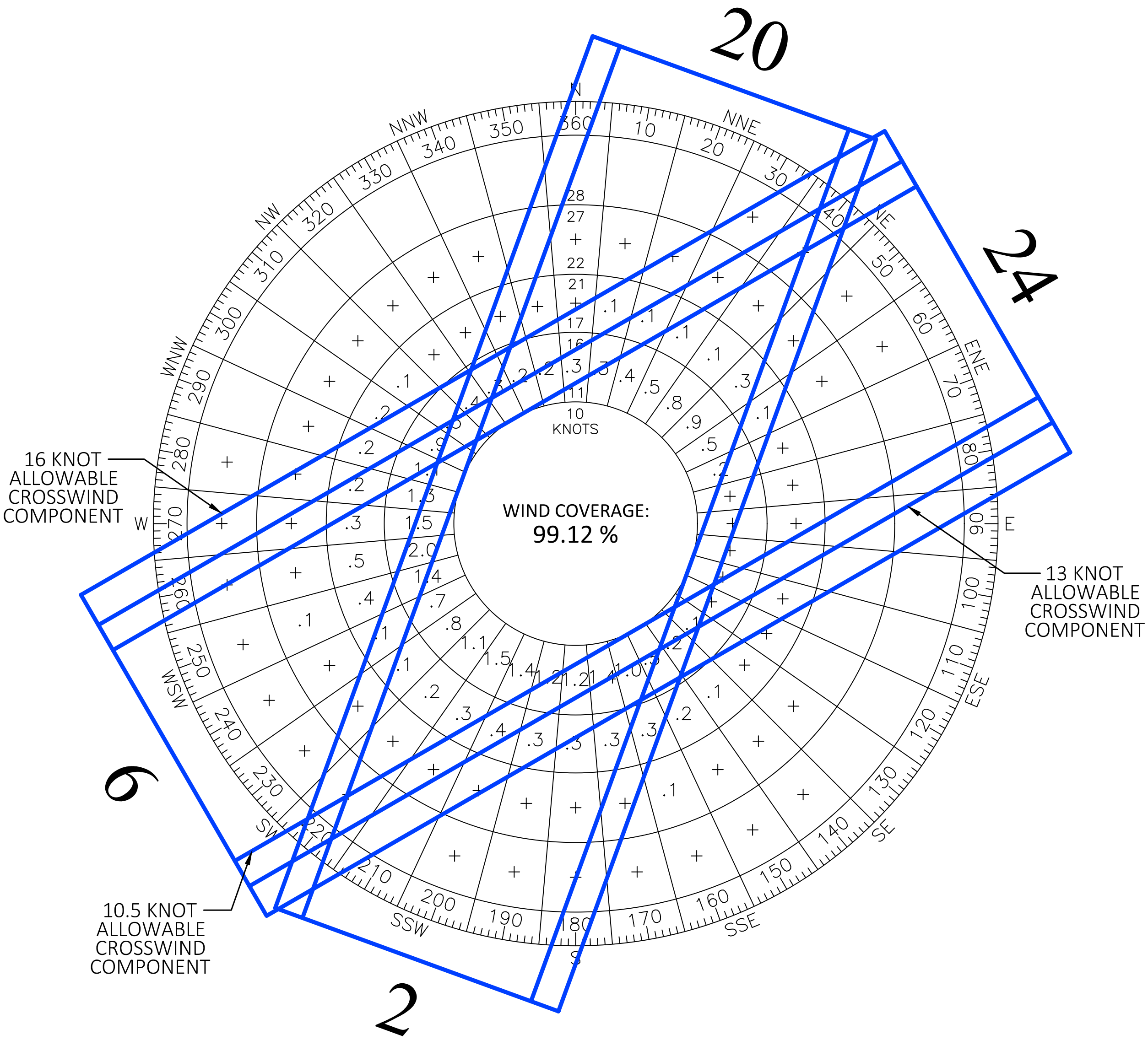
According to the runway wind analysis, the current runway alignment at the Airport provides the recommended 95 percent coverage. The RDC of C-III coverage is shown by the 16-knot coverage percentages as smaller aircraft cannot withstand as strong crosswinds. The 16-knot crosswind coverage allows operations at the Airport approximately 99 percent of the time. Crosswind coverage of 20 knots was not shown, as it does not apply at the Airport. Coverage for B-II aircraft is based on 13-knot crosswind maximums and is provided 97 to 98 percent of the time.

Recommendation: Wind coverage meets 95 percent for both runways in both all-weather and IFR conditions. There is no recommendation for change.

4.2.6. Runway Safety Areas

Runway safety areas (RSAs) are defined by the FAA as surfaces surrounding a runway that are prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. RSAs consist of a relatively flat graded area free of objects and vegetation that could damage aircraft. According to FAA guidance, the RSA should be capable, under dry conditions, of supporting aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft. The FAA design standards for RSAs surrounding runways serving C-III aircraft (Runway 6-24) is a width of 500 feet, a length that extends 600 feet prior to the landing threshold, and a length that extends 1,000 feet beyond the runway end. RSAs for runways serving B-II aircraft (Runway 2-20) standards include a width of 150 feet and 300 feet beyond the departure end and prior to the

Figure 4-1: All Weather Wind Rose



ALL WEATHER WINDROSE

ALL CEILING AND VISIBILITIES

Source: National Climactic Data Center - Erie International Airport 2005-2014 (134,950).

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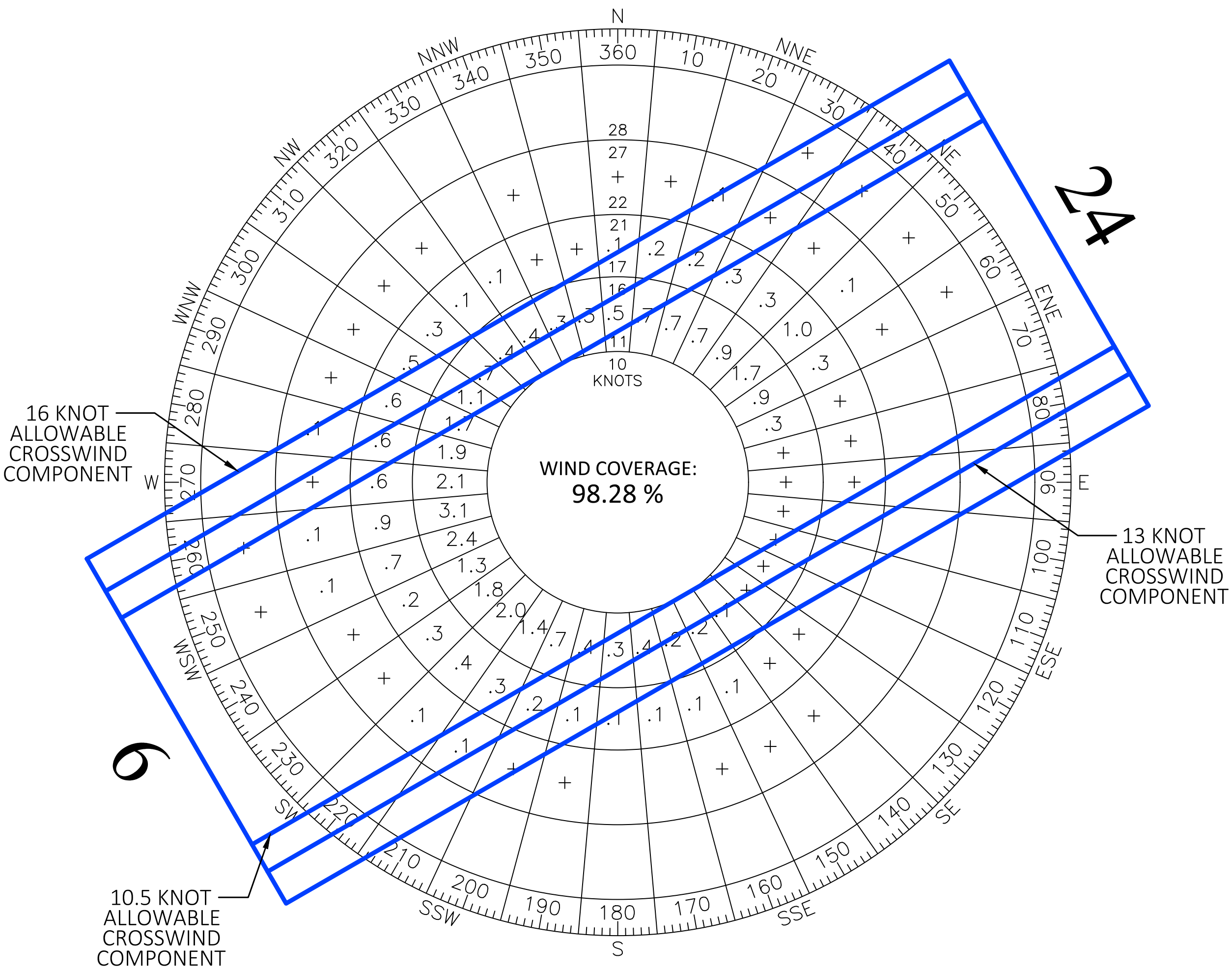
Figure 4-2: IFR Wind Rose



IFR WINDROSE

CEILING < 1000' AND / OR VISIBILITY < 3 MILES BUT CEILING ≥ 200' AND VISIBILITY ≥ ½ MILES

Source: National Climactic Data Center - Erie International Airport 2005-2014 (134,950).

threshold. Both runways have published declared distances, as shown in **Table 4-6**. A portion of the Runway 24 RSA extends beyond Airport property and should be acquired in easement or fee.

Table 4-6: Declared Distances

Runway	6/24	2/20
Takeoff Run Available (TORA)	8,420 / 8,420	3,508 / 3,508
Takeoff Distance Available (TODA)	8,420 / 8,420	3,508 / 3,508
Accelerate-stop Distance Available (ASDA)	8,420 / 7,500	3,508 / 3,508
Landing Distance Available (LDA)	7,500 / 7,500	2,691 / 3,202

Source: Federal Aviation Administration (FAA) 5010-1, effective 8/17/2017.

Recommendation: The Runway 24 RSA portion extending beyond Airport property should be acquired in easement or fee.

4.2.7. Runway Object Free Areas

In addition to the RSA, a runway object free area (ROFA) is also defined around runways in order to enhance the safety of aircraft operations. The FAA defines ROFAs as an area cleared of all objects except those that are related to navigational aids and aircraft ground maneuvering. However, unlike the RSA, there is no physical component to the ROFA. Thus, there is no requirement to support an aircraft or emergency response vehicles.

Not unlike the RSA, FAA design standards for ROFAs surrounding runways serving RDC C-III (Runway 6-24) aircraft are a width of 800 feet, a length that extends 600 feet prior to the landing threshold, and a length that extends 1,000 feet beyond the runway end. Runways serving RDC B-II (Runway 2-20) aircraft have a width of 500 feet and protect 300 feet beyond the runway end and prior to the threshold. A small corner of the Runway 20 ROFA extends over West 12th Street. Additionally, portions of Runway 24 ROFA extends beyond Airport property.

Recommendation: ROFA areas extending beyond Airport property should be acquired in easement or fee.

4.2.8. Runway Protection Zones

RPZs are large trapezoidal areas on the ground off each runway end that are within aircraft approach and departure paths. The RPZ begins 200 feet beyond the end of the runway. The dimensions of the RPZ for each runway end are dependent on the type of aircraft and the approach visibility minimums associated with operations on that runway.

The RPZ is intended to enhance the protection of people and property on the ground. Many land uses (i.e. residential, places of public assembly, fuel storage) are prohibited by FAA guidelines within these areas. However, these limitations are only enforceable if the RPZ is owned or controlled by the Airport sponsor. Airport control of these areas is strongly recommended and is primarily achieved through Airport property acquisition, but can also occur through easements or zoning to control development and land use activities.

The dimensions of the RPZ for each runway end are a function of the type of aircraft and the approach visibility minimums associated with operations on that runway. The RPZ begins 200 feet beyond the end of the area usable for takeoff and landing for all runways. The existing approach visibility minimums are shown in **Table 4-7**.

Table 4-7: RPZ Dimensions Per Runway End

Runway	Minimums	Length	Inner Width	Outer Width	Acreage
Runway 6	2,400'	2,500'	1,000'	1,750'	78.914
Runway 24	2,400'	2,500'	1,000'	1,750'	78.914
Runway 2	Visual	1,000'	500'	700'	13.770
Runway 20	Visual	1,000'	500'	700'	13.770

Source: FAA AC 150/5300-13A.

The Airport currently owns land in fee or easement off all runway ends to control portions of the Airport's RPZs as well as to prevent the construction of obstructions to the 14 Code of Federal Regulations (CFR) Part 77 approach surfaces. It is recommended that the Airport acquire interest for all areas within RPZs that are not currently under Airport control. These areas include the northern corner of the Runway 24 RPZ. This area is comprised of several land uses considered non-compatible for an RPZ, including public roads.

As previously noted, there are several public roads located within the RPZs. According to recently published guidance by the FAA, public roads are not considered compatible land uses within RPZs and are not recommended. The current FAA guidance does not require relocation of existing roadways within RPZs unless a change in geometry of the runway or a roadway occurs.

Recommendation: Acquire control of all land uses within existing RPZs (through fee simple acquisition or avigation easements) for those properties not currently under Airport control or owned by a public entity.

4.2.9. Runway Visibility Zone

Standards have been developed for pilot visibility along runways, and between intersecting runways, which are known as the runway visibility zone (RVZ). The RVZ is an area formed by imaginary lines connecting the two runway's visibility points, which are located half of the length between each runway end and the runway intersection. The current standard for intersecting runways recommends a clear line of sight between the ends of intersecting runways. According to FAA AC 150/5300-13A, terrain needs to be graded and permanent objects need to be designed or sited so that there will be an unobstructed line of sight from any point five feet above one runway centerline to any point five feet above an intersecting centerline, within the RVZ. These standards are currently met at ERI.

Recommendation: No improvements to the existing RVZ are recommended.

4.2.10. Runway Pavement Markings

Both ends of primary Runway 6-24 have precision instrument approach runway markings. Both ends of Runway 2-20 have non-precision instrument runway markings. There are no plans for the establishment of a precision approach to either end of Runway 2-20, nor are they recommended. Consequently, the runway markings at the Airport are appropriate for their current and future approach requirements respectively.

Recommendation: No improvements to the existing runway pavement markings are required.

4.2.11. Taxiways

There are currently 10 taxiways at the Airport. Runways 6-24 and 2-20 are served by partial parallel taxiways. Planning standards for taxiways include taxiway width, taxiway safety areas, taxiway object free areas, taxiway shoulders, taxiway gradient, and for parallel taxiways, the distance between the runway and taxiway centerlines. The dimensions of each standard vary based on the identified airplane design group (ADG) and taxiway design group (TDG) for each taxiway. The ADG is based on the wingspan and tail height of an aircraft, while the TDG is based on the distance between an aircraft's cockpit to main gear, as well as the width of the main gear. There are six ADG groups, and seven TDG groups. Details regarding the various dimensions follow in **Table 4-8** and **Table 4-9**.

Table 4-8: Taxiway Requirements – Airplane Design Group

Design Standard	ADG I	ADG II	ADG III	ADG IV	ADG V	ADG VI
Taxiway Safety Area	49	79	118	171	214	262
Taxiway Object Free Area	89	131	186	259	320	386
Runway/Taxiway Separation	225 – 400*	240 – 400*	400	400	400	500*

Source: FAA AC 150/5300-13A.

** Runway/taxiway separation vary based on approach visibility minimums*

Table 4-9: Taxiway Requirements – Taxiway Design Group

Design Standard	TDG 1	TDG 2	TDG 3	TDG 4	TDG 5	TDG 6	TDG 7
Taxiway Width	25	35	50	50	75	75	82
Taxiway Shoulder Width	10	10	20	20	25	35	40

Source: FAA AC 150/5300-13A.

As taxiways are constructed or rehabilitated, design should carefully consider the recently updated guidance for taxiway design as published in FAA AC 150/5300-13A. The new requirements include the design of taxiways for cockpit over centerline taxiing as opposed to judgmental oversteering. This change particularly impacts curves and intersections, which will require changes to accommodate the cockpit over centerline taxiing. The dimensions of intersection fillets and taxiway curves are based on the associated TDG for each taxiway.

The future design aircraft (A320neo) for Runway 6-24 is TDG 3 aircraft. Certain taxiways will only be used by B-II or smaller aircraft; these taxiways will be designed to meet TDG 2 standards.

Taxiway A is a partial parallel taxiway to Runway 6-24, providing access to the Runway 24 end. Access to Taxiway A is provided by Taxiways C and D from the terminal apron and fixed base operator (FBO) apron. The taxiway width varies from 75 feet to 90 feet between Runway 2-20 and Taxiway A1. The taxiway width from Taxiway A1 to the Runway 24 end is 50 feet and therefore meets TDG 3 standards. The runway centerline to taxiway centerline distance between Taxiway A and Runway 6-24 varies; from Runway 2-20 to Taxiway A1 it is approximately 370 feet, which does not meet the standard separation distance of 400 feet for aircraft approach category (AAC)-ADG C-III according to FAA Advisory Circular (AC) 150/5300-13A. The 2004 Master Plan prepared by C&S Engineers noted that ERI has an approved Modification to Standards for the non-standard separation distance. Additionally, a project is in design to relocate Taxiway A to meet the 400-foot separation.

Taxiways A1, A2, and A3 provide access to Runway 6-24 from Taxiway A. The taxiway widths are 90 feet and therefore meet TDG 3 standards.

Taxiway B is a partial parallel taxiway to Runway 2-20 and provides access from the terminal apron to the Runway 20 end. The taxiway width is 50 feet which meets TDG 2 standards. The runway centerline to taxiway centerline distance between Taxiway B and Runway 2-20 is approximately 320 feet, which exceeds the standard separation distance of 240 feet for AAC-ADG B-II according to AC 150/5300-13A.

Taxiway C provides direct access from the terminal apron area to Taxiway A. The taxiway width varies from 75 to 90 feet, which meets TDG 3 standards.

Taxiway D provides direct access to Runways 2-20 and 6-24 from the terminal and FBO aprons. The taxiway width is 75 feet with 12.5 foot shoulders between the apron and Runway 2-20. The taxiway width is 150 feet between Runway 2-20 and Runway 6-24. This taxiway formerly served as Runway 10-28 prior to 1992. Taxiway widths meet TDG 3 standards. This taxiway intersects Runway 6-24 in a non-perpendicular fashion and the Taxiway D/E crossing of Runway 2-20 could be confusing.

Taxiway E provides direct access from the terminal apron to Runway 2-20. The taxiway width is 80 feet and meets TDG 3 standards.

Taxiway F provides access from the terminal and FBO aprons to Taxiway G and Runway 6. The taxiway width varies from 80 to 90 feet and meets TDG 3 standards.

Taxiway G is a partial parallel taxiway to Runway 6-24 and provides access to the Runway 6 end. The taxiway width is 90 feet and meets TDG 3 standards. The runway centerline to taxiway centerline distance between Taxiway G and Runway 6-24 is approximately 350 feet, which does not meet the standard separation distance of 400 feet for AAC-ADG C-III according to AC 150/5300-13A.

Recommendation: The following design and geometry issues were found and should be investigated:

- Taxiway C: direct access.
- Taxiway D: direct access, non-perpendicular intersection with Runway 6-24.
- Taxiway E: direct access.
- Taxiway G: runway separation does not meet design standards.

Additionally, any pavement condition in failed, serious, very poor, and poor condition should be rehabilitated in the short-term. Pavement assessed as fair should be rehabilitated within the planning period.

If any changes to the taxiways occur, Engineering Brief No. 89, *Taxiway Nomenclature Convention*, dated March 29, 2012 should be used to ensure clear taxiway nomenclature.

4.2.12. Passenger Terminal Apron

The terminal apron at ERI is approximately 31,000 square yards (279,000 square feet), and extends approximately 285 feet from airfield side of the terminal building to Taxiway E. North of Taxiway E, the terminal apron narrows to a distance of approximately 255 feet from the terminal building. South of Taxiway E, the terminal apron widens to a distance of approximately 325 from the terminal building. The usable area of the terminal apron is reduced by a designated taxilane that traverses the south and east end of the apron, connecting the FBO apron on the south end via Taxiway D to Taxiways C and B on the north end. Additionally, a portion of the terminal apron on the south end is utilized by the U.S. Customs and Border Patrol facility and ancillary storage, which also reduces the area of usable terminal apron. The remaining terminal apron area is available for use by airline aircraft, which has a usable width of approximately 810 feet. This area of the terminal apron will be utilized to determine the number of aircraft parking positions for this Master Plan Update.

Aircraft Parking Positions

The capacity of a terminal apron to accommodate aircraft parking positions is determined by the type of aircraft utilizing the terminal, guidance for wingtip separation and nose-to-building clearances, and considers the type of passenger loading bridges in use. Published guidance utilized to determine terminal apron capacity are AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*, and Air Transport Association of America, *Safety Guidelines SG 908, Revision 2010.1.*

As detailed in Section 2.4 Aviation Forecast, and Section 4.3 Passenger Terminal Facility Requirements, the critical aircraft forecasted to utilize the terminal apron through the planning period is a combination of C-II and C-III aircraft. The terminal apron is currently configured to accommodate three parking positions with jetways/gates for scheduled passenger service. The terminal apron is marked with four aircraft parking positions today, and the terminal building is fitted with seven departure gates, which indicates that both the terminal and the apron have the capacity to accommodate more aircraft during peak periods than are in use today.

The usable width of the terminal apron can accommodate up to six parking positions by aircraft in ADG III (A-319/A-320, or similar), and up to seven positions for aircraft in ADG II (regional jet aircraft) under taxi-in, power/push-out procedures. Taxi-in/out procedures will reduce the total number of parking positions; however, not to an extent that the terminal apron's existing size will be deficient over the long term.

FAA guidance delineates four different Gate Types, A through D, which relate to the wing spans and fuselage lengths of the aircraft they are designed to accommodate. Gate Type A is the FAA standard for aircraft in ADG III. Design guidelines for this gate type call for minimum wingtip clearances of 15 feet between parked aircraft. Nose-to-building clearance varies from 15-30 feet if the aircraft are positioned perpendicular to the building, but is greater for taxi-in/taxi-out procedures.

Recommendation: No deficiency in the existing terminal apron area is forecasted for the long term. However, if scheduled passenger service increases significantly, or changes to the type of aircraft utilizing the terminal occur, reconfiguration of the terminal apron may be required.

4.2.13. Potential Hot Spots and Geometry Requirements

A hot spot is defined as "a location on an airport movement area with a history of potential risk of collision or runway incursion, and where heightened attention by pilots and drivers is necessary."[1] There are no published hot spots at the Airport.

Between 1990 and 2016 there were two accidents at the Airport. The Airport had six runway incursions since 2005.[2] At two of these incursions, aircraft entered the runway from taxiways with direct access between the ramp and the runway. One was Taxiway D to Runway 6-24 and one was at Taxiway C to Runway 2-20.

Geometry Requirements

FAA AC 150/5300-13A has multiple criteria in the design of taxiways. These geometry criteria are as follows:

- Three Node Concept: The three node concept means that any taxiway intersection has no more than three choices – ideally left, straight, and right. Any more decision points make it potentially confusing to a pilot and does not allow for the proper placement of airfield markings, signage, and lighting. The three node concept helps pilots maintain situational awareness.

- Taxiway Intersection Angles: Taxiway intersections are preferred to be 90-degrees whenever possible. Standard angles including 30, 45, 60, 90, 120, 135, and 150 degrees are preferred over other, non-standard, angles.

- Wide Expanse of Pavement: Wide pavements require placement of signs far from the pilot's eye which can be missed during low visibility conditions and should be avoided. This is especially critical at runway entrance points.

- Limit Runway Crossings: Limiting runway crossings reduces the opportunity for human error and reduces air traffic controller workload.

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[1] Runway Safety – Hot Spot List, accessed Sep. 20, 2016 <http://www.faa.gov/airports/runway_safety/hotspots/hotspots_list/>.
[2] FAA Runway Incursion Database, accessed Sep. 20, 2016 <http://www.asias.faa.gov/pls/apex/f?p=100:28:0::NO:28::>.

- Avoid “High Energy” Intersections: These intersections are located in the middle third of runways. This portion is where the pilot can least maneuver to avoid a collision.

- Runway Intersection Angles/Increase Visibility: Right (perpendicular) intersection angles between taxiways and taxiways and taxiways and runways provide the best visibility to the left and right for a pilot. A right angle at the end of a parallel taxiway is a clear indication of approaching a runway. Acute angle runway exits (high-speed taxiways) provide for greater efficiency in runway usage, but should not be used as a runway entrance or crossover point.

- Avoid “Dual Purpose” Pavement: Runways used as taxiways and taxiways used as runways can lead to confusion. A runway should always be clearly identified as a runway and only a runway.

- Indirect Access: Taxiways leading directly from an apron to a runway without requiring a turn can lead to confusion when a pilot typically expects to encounter a parallel taxiway but instead accidentally enters a runway.

- Multiple Taxiway Crossings Near Runway: A taxiway crossing a high-speed taxiway or multiple taxiways crossing each other between the hold line and the runway could cause confusion, additional time on the runway, and wrong turns/loss of pilot situational awareness.

- Taxiway Intersecting Multiple Runways: Taxiways must never coincide with the intersection of two runways. This creates a large expanse of pavement making it difficult to provide proper signage, marking and lighting. These could lead to pilot disorientation and potential wrong runway use.

- Aligned/Inline Taxiway: An aligned taxiway is one whose centerline coincides with a runway centerline. This places taxiing aircraft in direct line with aircraft landing or taking off therefore closing the runway for other traffic and potentially causing loss of situational awareness. Existing aligned taxiways should be removed as soon as practicable.

- “Y” Shaped Taxiway Crossing a Runway: Any runway crossing or runway exit that requires a pilot to make a decision prior to exiting the runway may cause a delay in the aircraft existing the runway and loss of situational awareness.

- Multiple Runway Thresholds in Close Proximity to One Another: If possible, safety areas of runway ends should not overlap, since work in the overlapping area would affect both runways. Configurations where runway thresholds are closer together should be avoided, as they can be confusing to pilots, resulting in wrong-runway takeoffs. The angle between extended runway centerlines should not be less than 30 degrees to minimize confusion.

- Short Taxi Distance: A short distance between the terminal and the runway requires flight crews to complete the same number of checklist items in a shorter timeframe and requires more heads-down time during taxi. Many of the event reports mentioned that the flight crew members were rushing to complete their checklists or to expedite their departures.

- Taxiway Stubs: Short taxiway stubs including overlapping holdlines or holdlines too close together to accommodate the length of an aircraft can create confusion and may cause runway incursions or accidents.

- Unexpected Holdlines: Holdlines located on a parallel taxiway or other unexpected location are more likely to be overlooked and cause a runway incursion or accident and should be avoided.

- Intersection Departures: Airports with a single runway layout were not immune to airplanes taking off on the wrong runway, especially when intersection departures were made. In these events, the flight crew taxied onto the runway and turned in the wrong direction, taking off 180 degrees from the intended direction.

The following elements or contributing factors are historically associated with wrong runway uses and should have the highest priority in resolving: [34]

- Multiple runway thresholds located in close proximity to one another.
- A short distance between the airport terminal and the runway.
- A complex airport design.
- The use of a runway as a taxiway.
- A single runway that uses intersection departures.
- A single taxiway leading to multiple runways.
- More than two taxiways intersecting in one area.
- A short runway (less than 5,000 feet).
- Joint use of a runway as a taxiway.

Table 4-10 shows geometry issues at ERI by geometry requirement.

Recommendation: Geometry issues should be resolved as much as practicable. Priority should be set to resolve the following geometry requirements in **Table 4-10**: direct access, runway crossings (Runway 2-20), and multiple taxiways crossing.

[3] Wrong Runway Departures, Aviation Safety Information Analysis and Sharing, July 2007.
[4] Wrong Runway Departures, FAA Runway Safety, September 2009, accessed Feb. 3, 2016 <https://www.faa.gov/airports/runway_safety/publications/media/wrong%20runway%20FINAL%20draft%20sept09.pdf>.

Table 4-10: Geometry Issues at Erie

Geometry Requirement	Taxiway/Taxiway Int.	Runway/Taxiway Int.
Three node concept	None	None
Taxiway intersection angle	TWYs A & D - 37°	See Increase Visibility
Wide expanse of pavement	None	RWY 20 & TWY B RWY 2-20 & TWYs A & D RWY 6-24 & TWY D
Runway crossings	N/A	RWY 6-24: 0 RWY 2-20: 2
High energy intersections	N/A	RWY 2-20 & TWY D RWY 2-20 & TWY C
Increase visibility	See Taxiway Intersection Angle	RWY 20 & TWY B RWY 6-24 & TWY D
Dual purpose pavement	None	RWY 2 via TWY D
Direct access	N/A	RWY 2-20 via TWY C RWY 2-20 via TWY D RWY 2-20 via TWY E
Multiple taxiways crossing	N/A	None
Taxiway intersecting multiple runways	N/A	None
Aligned taxiway	N/A	None
Y-Shaped Runway Crossing	TWYs A & D	N/A
Multiple Runway Thresholds in Close Proximity	N/A	None
Short Taxi Distance*	None	N/A
Taxiway Stubs	TWY D between RWYs 6-24 and 2-20	N/A
Unexpected Holdline	None	None
Intersection Departure	N/A	Yes, when beneficial for ATCT or upon pilot request (all)

** Commercial aircraft all use Runway 6-24, therefore there are no short taxi distances.*
N/A – not applicable; RWY – runway; TWY – taxiway
Source: McFarland Johnson Analysis, 2016.

4.2.14. Airfield Lighting and Signage

Approach Lighting

The existing precision approaches to Runways 6 and 24 are equipped with 1,400-foot medium intensity approach lighting systems with runway alignment indicator lights (MALSRs).

The current approach lighting systems on Runways 6 and 24 meet the standards for ILS category (CAT) I approaches and meet existing needs at the Airport. Wind conditions predominantly favor Runway 24 during IFR conditions (approximately 70 percent).

Presently, no approach lighting systems are available for Runways 2 and 20.

Recommendation: There are no recommendations for approach lighting. A Category II approach would increase the utility of the existing approach by approximately seven percent. This is a significant increase over the existing approach and consideration is warranted.

The required infrastructure, including runway centerline lights, touchdown zone lights, runway visual range (touchdown, midfield, and end of the runway), and approach light system with sequenced flashing lights would be too costly to recommend a Category II approach system given the current usage of the Airport. However, with constantly changing technology, the ability to allow for this type of approach in the future without significant terrestrial improvements at the Airport may be possible. If activity at the Airport continues to grow and such technology exists, it would be recommended to re-evaluate the Category II installation given the notable improvements in weather minima.

Runway and Taxiway Lighting

Runway and taxiway edge lights are provided on Runways 6-24 and 2-20 and all taxiways. High intensity runway edge lights (HIRLs) are provided on Runway 6-24 and medium intensity runway edge lights (MIRLs) on Runway 2-20. All lighted taxiways are currently equipped with medium intensity taxiway edge lights (MITLs); the soft surface taxilane has reflectors. Airfield lighting is controlled by the on-site airport electric vault located north of Taxiway C.

Recommendation: There are no recommendations for runway and taxiway lighting.

Airfield Signage

There have been no complaints about missing or confusing airfield signage. Should the Federal Aviation Regulations (FAR) Part 139 inspections show up any non-standard conditions, these should be addressed.

Recommendation: Airport management noted all signage was to standard. There are no recommendations for airfield signage.

4.2.15. Visual Approach Aids

Presently, Runways 6 and 24 have a four-box precision approach path indicator (PAPI) system on the left side of each end with a standard 3-degree glide path. Runway 20 has a 4-box visual approach slope indicator (VASI) on the left side with a non-standard 4-degree glide path and Runway 2 end has no visual approach aids. It is not anticipated that Runway 2 will require visual approach aids due to its low use.

Recommendation: There are no recommendations for visual approach aids.

4.2.16. Airfield Facility Requirements Summary

Several requirements for airside facilities have been discussed throughout this section. A summary of the key requirements identified can be found in **4.2.16**. Geometry issues are identified in **Table 4-10**.

Table 4-11: Summary of Airside Facility Requirements

Item/Facility	Existing Facility or Capacity	Ultimate Requirement	Deficit
Runway Length	Runway 6-24 – 8,420’ Runway 2-20 – 3,508’	Runway 6-24 – 8,420’ Runway 2-20 – 3,508’	None
Runway Width	Runway 6-24 – 150’ Runway 2-20 – 150’	Runway 6-24 – 150’ Runway 2-20 – 75’	None
Runway Safety Areas	Runway 24 off Airport Standard on Runway 2-20 through declared distances	Provide standard RSA on all runways	Control of all RSA through ownership or avigation easements
Runway Object Free Area	Portion of Runways 2 and 24 extend off Airport	Provide standard on all runways	Control of all ROFA through ownership or avigation easements
Runway Protection Zone	Partially under airport control through ownership	Under airport control through ownership or avigation easements	Control of all RPZs through ownership or avigation easements
Runway Lighting	Runway 6-24 – HIRLs Runway 2-20 – MIRLs	Runway 6-24 – HIRLs Runway 2-20 – MIRLs	None
Runway Visual Aids	Runway 6 – MALSR Runway 24 – MALSR Runway 2 – None Runway 20 – VASI	Runway 6 – MALSR Runway 24 – MALSR Runway 2 – None Runway 20 – VASI	None
Instrument Approaches	Runway 6 – ILS Runway 24 – ILS Runway 2 – Visual Runway 20 – Visual	Runway 6 – ILS Runway 24 – ILS Runway 2 – Visual Runway 20 – Visual	None
Taxiways	Runway 6-24 – partial parallel; MOS Runway 2-20 – partial parallel; 320 feet	Runway 6-24 – partial parallel; 400 feet Runway 2-20 – partial parallel; 240 feet	Address airfield geometry concerns and meet FAA standards
Taxiway Width	50 – 90 feet	50 – 75 feet	None
Taxiway Lighting	All taxiways – MITL Soft surface taxilane – reflectors	All taxiways – MITL	None

Sources: FAA Form 5010-1; McFarland Johnson analysis, 2016.

4.3. PASSENGER TERMINAL FACILITY REQUIREMENTS

This section summarizes the methodology, assumptions, and general planning-level factors used to analyze facility requirements for key functional areas of the ERI passenger terminal. Requirements were analyzed based on a multitude of factors. The primary tool for the analysis was ACRP Report 25, *Airport Passenger Terminal Planning and Design, Volume 2: Spreadsheet Models and User's Guide (Model)*. Additionally, guidelines published in the following publications were included: International Air Transport Association's (IATA) *Airport Development Reference Manual (ADRM, 10th Edition)*; FAA AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*; FAA AC 150/5360-9, *Planning and Design of Airport Terminal Facilities at Non-Hub Locations*; and FAA AC 150/5300-13A, *Airport Design*.

4.3.1. Existing Passenger Terminal

As described in Chapter 1, *Inventory*, the existing terminal building at ERI was opened in 1958 and has had several expansions and upgrades since its construction. The 1970s saw expansions to baggage claim facilities and later an office expansion for FAA office facilities on the second floor. A ticketing area on the western end of the terminal building was added in 1990. Upgrades to the lobby area, boarding gates, and passenger boarding bridges followed in the late 1990s and early 2000s.

Originally constructed at 15,750 square feet, the first floor of the passenger terminal building has been expanded to approximately 43,200 square feet and is generally in fair condition. At nearly 60-years old, a number of the building's functional areas have become outdated and require short-term improvements to maintain a functioning terminal. One example of this is the location of the Explosive Detection System (EDS) unit utilized for Level 1 screening of checked baggage. This unit has been placed in the main lobby area among airline check-in/ticketing counters because there is no adequate area behind ticket counters and among the many other functional areas required by Level 2 and 3 baggage screening, make-up, and airline operations offices. At check-in, passengers transfer checked baggage themselves to this screening area, rather than drop-off to the ticketing agent at the staffed airline counter. While the operation by Transportation Security Administration (TSA) is secure, this is not the desired configuration of a secure baggage screening operation. Additionally, any future changes to equipment or outbound baggage screening and make-up operations may create further challenges and highlight deficiencies in the existing terminal building.

Despite these and other challenges, the existing terminal building has been maintained in good repair and functions relatively well in terms of passenger flow from ticketing through enplanement. However, based on conversations with Airport management and operations staff, there are concerns regarding the terminal building's ability to accommodate changes in air service and aircraft over the planning period. These concerns include:

- Existing ATCT: The existing ATCT equipment is outdated and does not meet current standards.
- Deicing Operation: Deicing fluid collection is problematic as airlines prefer to deice after push-back from gate. Deicing fluid buildup on apron is then often comingled with snow removal and pushed off apron to grass areas where it cannot be collected.

- Holdroom: The configuration of existing holdrooms and gate positions may not function well for larger aircraft such as the Airbus A319 or the A320, which is in use by low cost carriers.
- Terminal Retail/Concessions: Lack of secure-area retail and concessionaire offerings.
- Operational Costs: The cost of operating the terminal building is high, due to inefficiency of systems and high energy use. The Airport Authority has a program in place to make terminal updates. These include a recent boiler replacement, roof repairs, replacing rooftop heating, ventilation, and air conditioning units, and some window replacements.

The sections that follow detail and summarize the methodology used to assess the requirements for the ERI terminal building through the planning period.

4.3.2. Methodology

Utilizing the ACRP Model and FAA and industry standards guidance listed above, the following passenger processing functions were examined:

- Gates
- Terminal Curb Length
- Passenger Check-In and Ticketing
- Outbound Baggage Screening and Make-Up
- Passenger Security Screening Checkpoint
- Passenger Lounges/Holdrooms
- Inbound Baggage Handling and Baggage Claim
- Concourse Circulation/Concessions
- Other Terminal Support Functions

The terminal building analysis was performed under two scenarios: standard service by legacy air carriers as set forth in the *Forecast* and standard service with the introduction of service by an Ultra-Low Cost Carrier (ULCC). Application of the Model under these scenarios is presented in the following section.

Application of ACRP Model

The ACRP Model is designed to determine terminal requirements by functional area based on historical and forecasted annual enplanements, departures, and gates. The Model uses these inputs (along with a variety of assumptions) to identify peak hour activity. From this point, the Model relies on peak hour activity levels to produce space requirements that can accommodate demand as it grows. In this way, the Model serves as "top down" analysis, starting with annual demand to estimate peak activity demand.

Table 4-12 below details available aircraft seats by aircraft type, projected passenger load factors, and estimated peak period activity.

Table 4-12: Aircraft Seats and Scheduling Peaking Characteristics

Forecast Period	Aircraft	Seats Available	Load Factor	90 Min Pax Peak	60 Min Pax Peak
	E-170	70	83.0%	58	39
Future - 2036	CRJ-900	76	83.0%	66	44
	A319	126	83.0%	105	73
TOTAL		272		229	156

Source: Innovata LLC Flight Schedule & Boyd Group International.

For the purposes of this analysis, the 60-minute peak period was utilized based on a load factor of 83 percent, which indicates that 156 passengers will need to be processed and accommodated by each terminal functional area with standard air carrier service. If ULCC service is initiated, it is assumed that the Airbus A320 will be the aircraft operated for this service and will be configured for a seating capacity of 177 passengers. It is also assumed that the A320 will operate at a load factor of 95 percent (which represents 112 passengers during the 60-minute peak period) and replace the A319. This results in 195 passengers during a 60-minute peak period.

Building on the Model, the analysis includes a range of other estimates for areas associated with the primary functional spaces determined by the Model. These estimates will be described in the sections that follow.

Level of Service (LOS) Standards

The IATA has published a comprehensive guide with standards for planning various passenger processing functions for airport terminal buildings. These standards reflect the dynamic nature of terminal operations and throughput (passenger processing rate from check-in through enplanement), and have the goal of increasing infrastructure efficiency. The ADRM sets forth two variables, which jointly dictate a Level of Service. These variables are space and maximum waiting time. This space-time concept is the LOS framework for measuring the performance of passenger processing through each functional area of an airport terminal building and corresponding waiting areas. The measurement yields an indication of existing performance within four categories: under-provided, sub-optimum, optimum, and over-design.

Figure 4-3 illustrates how the space-time concept of LOS performance in airport terminals is evaluated.

As indicated in **Figure 4-3**, the space axis defines the amount of space available per occupant, and the time axis denotes the maximum waiting time for passengers in the queue. The objective of the space-time concept in ADRM is the provision of optimum passenger facilities and the avoidance of both over- or under-providing for passengers and the airport, airline, regulatory, or tenant staff doing the work of processing arriving and departing passengers to and from aircraft.

Figure 4-3: IATA Level of Service Performance Categories

MAXIMUM WAITING TIME		SPACE: Overdesign	SPACE: Optimum	SPACE: Sub-Optimum
		Excessive or empty space	Sufficient space to accommodate necessary functions in a comfortable environment	Crowded and uncomfortable
Overdesign	Overprovision of resources	OVERDESIGN	Optimum	SUB-OPTIMUM ► Consider Improvements
Optimum	Acceptable processing and waiting times	Optimum	OPTIMUM	SUB-OPTIMUM ► Consider Improvements
Sub-Optimum	Unacceptable processing and waiting times	SUB-OPTIMUM ► Consider Improvements	SUB-OPTIMUM ► Consider Improvements	UNDER-PROVIDED ► Reconfigure

Source: IATA and ACI, 2014.

4.3.3. Assumptions

This section summarizes the assumptions utilized for the assessment of the existing Airport terminal building.

Percentage of Originating Passengers

For purposes of analyzing passenger terminal space requirements, it is assumed that 100 percent of enplaned passengers are originating at ERI. The originating passenger percentage is used to determine the number of passengers to be processed through check-in/ticketing and security screening, along with associated demands on outbound baggage functions, holdroom usage, and gate/boarding area egress.

Vehicle Demand at Terminal Curb

Vehicle demand in the Model is comprised of a range of types utilized by passengers as ground transport to an airport for departing flights. These include everything from private automobiles carrying one to three passengers to tour buses carrying large groups of passengers. For this analysis, a focus was placed on private autos, taxis, and hotel shuttles. Table 4-13 illustrates the assumed breakdown of peak vehicle demand at the curb.

Table 4-13: Peak Hour Vehicle Volume Assumptions

Vehicle Type	Peak Hour Vehicles	Total Passengers by Vehicle
Private Auto	77	120
Rental Car Shuttle	6	12
Taxi	3	3
Limousine	1	2
Hotel Shuttle	2	8
Bus	1	11
Total	90	156

Source: McFarland Johnson Analysis, 2016.

The number of vehicles assumes that private autos will average less than two passengers each, rental car shuttles will carry an average of two passengers, taxis will transport one passenger per vehicle, hotel shuttles will carry up to four passengers, and buses will average over 10 passengers. The Model then applies an assumption that a peak 15-minute period will require the curb to accommodate about 32 vehicles, each making one stop and dwelling from two to four minutes for all vehicles except busses, which can require up to 10 minutes. The Model requirements for the terminal curb are in linear feet (LF). The existing curb length is approximately 340 linear feet.

Passenger Check-In/Ticketing

Passenger check-in/ticketing includes the functions of full-service staffed airline counter positions, self-serve kiosks, active check-in area, passenger queue area, airline ticket office areas, circulation area, and public restrooms. Assumptions for these areas include the following:

- Airline Staffed and Kiosk Check-In Area: Includes active check-in, passenger queue, counter areas, and office areas for a total of 2,078 square feet.
- Circulation Area: Assumes an area requirement of 25 percent of total check-in area.
- Restrooms: Assumes an area requirement of 15 percent of total check-in area.

It is also assumed that 40 percent of passengers will utilize staffed airline counters, 40 percent of passengers will opt for self-serve kiosks, and the remaining passengers will check-in online prior to arrival to the Airport.

Outbound Baggage Make-Up and Screening

Outbound baggage screening and make-up functions includes operations by TSA to screen checked baggage and airline staff to collect and disperse bags to carts and the appropriate aircraft prior to departure. For outbound baggage volume the following assumptions in **Table 4-14** were used.

Table 4-14: Outbound Baggage and Screening System Assumptions

Item for Analysis	Assumption
Peak Hour Passengers Checking Bags [1/]	75%
Checked Bags per Passenger [2/]	1.0
Bag Size – Standard	95%
Bag Size – Oversized	5%

Source: McFarland Johnson Analysis, 2016.
[1/] *Number of checked bags remains constant over the period, should the trend of reduced checked baggage not continue.*
[2/] *It has been identified that certain legacy airlines are currently observing lower "checked bag per passenger" quantities; for planning purposes, the higher quantity has been used.*

The Model assumes three departures per peak hour, and that the volume of checked baggage can be accommodated utilizing four baggage carts. The Model suggests that each cart requires 600 square feet of space. An additional 20 percent of square footage is included for baggage train circulation and 15 percent for mechanical and support space.

In terms of Explosive Detection System (EDS), On-Screen Resolution (OSR), and Explosives Trace Detection (ETD) equipment requirements, the analysis assumed a Level 1 EDS screening rate of 220 bags per hour, with an alarm rate of 20 percent. Level 2 OSR processing ration was set at 120 bags per hour. For Level 3 ETD screening, the TSA suggests 24 bags per hour per operator.

Baggage screening space requirements contained in the Model were utilized here, and are as follows:

- Level 1 Area: 800 square feet per EDS Unit
- Level 2 Area: 175 square feet per OSR Station

An additional 35 percent of space is added for circulation area, and 15 percent to allow for future equipment changes and any required reconfiguration or renovations.

Passenger Security Screening Checkpoint

The following assumptions were utilized to analyze the future demand for security screening of departing passengers. The assumed processing rate for the analysis is 175 persons per hour for a two-lane screening module configuration. TSA recommends 2,800 square feet of space for a two-lane screening module. The percentage assumed for non-passenger traffic, such as employees and crew, is 10 percent, which was added to the design peak hour passenger screening demand and is based on recent experience at other airports.

As with other functional areas, allowances were also included for future equipment changes (10 percent) or reconfigurations and TSA support space (eight percent).

Passenger Lounges/Holdrooms

Holdroom space planning typically accounts for seating a certain percentage of passengers, with the remaining passengers standing. For this analysis, seating area was included for 80 percent of passengers to allow for adequate space for future holdroom configuration changes or shared holdrooms among multiple flights. Additionally, the analysis assumed 17 square feet per seated passenger and 12 square feet per standing passenger. The Model also includes some flexibility to account for amenities (e.g., children's play area, telephones, work areas, charging stations, etc.), and high utilization and holdroom sharing, when the holdroom is utilized for passengers waiting for more than one flight or is shared between gates.

The Model recommends approximately 230 square feet to accommodate one airline gate podium and agents, as well as 240 square feet for boarding corridor space per gate. Both are added to holdroom space requirements in the analysis.

Allowances for amenities, circulation, restrooms are assumed to be five percent, 35 percent, and 15 percent, respectively.

Inbound Baggage Handling and Baggage Claim

Inbound baggage handling includes the unloading of baggage from aircraft and transferring them to the baggage claim unit for circulation to the baggage claim hall. It is assumed that a three-cart baggage train is will accommodate the number of bags through the planning period, which requires an area of 850 square feet, and allowances for baggage train circulation (35 percent) and conveyor belts and equipment (20 percent) are included. A baggage service office area is included for support of the inbound baggage handling operation, as well as 25 percent for circulation and 15 percent for restrooms.

The Model calculates baggage claim requirements assuming that a certain percentage of passengers will deplane in a peak 20-minute period. For ERI, it is assumed that 100 percent of passengers terminating at the Airport. As previously noted, it is also assumed that 75 percent of passengers will check one bag.

The Model also recommends adding square footage to the baggage claim area to account for passengers accompanying their travel party to the baggage claim area, which was assumed to be 30 percent.

Concourse Circulation/Concessions

In terms of area required for passenger circulation on the secure side of the terminal building, the Model considers whether the Airport operates as a hub for connecting passengers, the type of concourse design (e.g., single- versus double-loaded, with or without moving walkways), and includes assumptions for percentage of the concourse length that is usable (e.g., concourses with holdrooms at the end are not 100 percent usable). For this analysis, a single-loaded concourse with no moving walkways and no connecting flights was used, making 100 percent of the concourse usable by passengers.

Terminal concessions include both non-secure and secure area retail establishments to service departing and arriving passengers. For this assessment, it is assumed that 10 percent of peak hour passengers will utilize pre-secure concessions and 90 percent of peak hour passengers will patronize post-secure area concessions. Based on conservative planning factors for square footage per passenger, about 180 square feet was estimated pre-secure concessions and support areas. Post-secure concession and support area is estimated to be 1,600 square feet.

Internal circulation area allowance of 15 percent is also included for terminal building concession areas.

Other Terminal Support Functions

The final consideration of passenger terminal functional areas include allowances for the following:

- Airline Support Operations: This assumption includes 520 additional square feet based upon airline operations.
- Airport Support Operations: This assumption includes additional space allowances of 2,734 square feet for ground handling services, operations and maintenance, and facilities support services.
- Building Design and Mechanicals Allowance: Approximately 6,874 square feet is estimated for building structure and design variations, mechanical/electrical/utility systems, and stairwells and elevators.

4.3.4. Impacts of Ultra Low Cost Carrier (ULCC) Service

As stated, the Model was also run to evaluate terminal building functional area requirements under a future scenario where ULCC service is introduced. The same assumptions utilized in the previous analysis were applied, except for the following, which were customized to reflect the operations under this scenario:

- Peak 60-Minute Passengers: It is assumed that ULCC service would utilize Airbus A320 aircraft configured for 177 available seats. Such service would operate at a higher load factor due to the limited flight schedules typical of such carriers, which is assumed to be 95 percent. A total of 195 peak period passengers was used in the model.

- Vehicle Demand at Curb: It is assumed that the introduction of ULCC service at ERI would be attractive to leisure travelers. As such, vehicle demand by private autos would increase by approximately 30 vehicles in the peak period.

4.3.5. Results of Analysis

The results the ERI terminal capacity assessment are summarized in **Table 4-15**.

Table 4-15: Terminal Functional Area Requirements

Functional Area	Ultimate Requirement	ULCC Requirement
Gates		
Gates	3	No Change
Curb Length		
Curb Length	120 – 142 LF	155 - 184 LF
Check-In/Ticketing	**2,910 SF**	**4,637 SF**
Staffed Counter Positions	5	7
Check-In Ticket Counter Area	300 SF	420 SF
Active Check-In Area	250 SF	350 SF
Passenger Queue Area	272 SF	496 SF
Kiosks Positions	4	6
Kiosk Check-In Area	240 SF	630 SF
Active Check-In Area	200 SF	300 SF
Kiosk Queue Area	141 SF	141 SF
Airline Ticket Office Area	675 SF	975 SF
Check-In/Ticketing Circulation Area	520 SF	828 SF
Restrooms	312 SF	499 SF
Outbound Baggage Screening and Make-Up	**4,826 SF**	**4,826 SF**
Level 1 EDS Units	1	No Change
Level 2 OSR Stations	1	No Change
Level 1 EDS Screening Area	800 SF	No Change
Level 2 OSR Screening Area	175 SF	No Change
Circulation Area	342 SF	No Change
Allowance for Future Equipment Changes	197 SF	No Change
Make-Up Area	2,400 SF	No Change
Allowance for Baggage Train Circulation	480 SF	No Change
Allowance for Mechanical/Support Space	432 SF	No Change
Passenger Security Screening Checkpoint	**3,935 SF**	**4,049 SF**

Functional Area	Ultimate Requirement	ULCC Requirement
Screening Lanes	2	2
Security Screening Module Area	2,800 SF	2,800 SF
Passenger Queue Area	512 SF	608 SF
Allowance for Future Equipment Changes	331 SF	341 SF
TSA Support Space Area	292 SF	300 SF
Passenger Lounges/Holdrooms	**10,001 SF**	**10,001 SF**
Seated Passenger Area	4,526 SF	No Change
Standing Passenger Area	799 SF	No Change
Ticketing Podiums	336 SF	No Change
Boarding Corridor Area	720 SF	No Change
Allowance for Amenities	319 SF	No Change
Holdroom Circulation Area	2,344 SF	No Change
Restrooms	957 SF	No Change
Inbound Baggage Handling and Claim	**8,302 SF**	**8,302 SF**
Baggage Claim Units	1	No Change
Baggage Claim Unit Area	1,250 SF	No Change
Passenger Queue & Bag Retrieval Area	2,636 SF	No Change
Baggage Service Office	583 SF	No Change
Allowance for Meeters/Greeters	583 SF	No Change
Baggage Claim Area Circulation	1,117 SF	No Change
Restrooms	925 SF	No Change
Take-Off Belts	1	No Change
Take-Off Belt Area	850 SF	No Change
Allowance for Baggage Train Circulation	298 SF	No Change
Allowance for Conveyor Belts/Equipment	60 SF	No Change
Concourse Circulation/Concessions	**2,046 SF**	**2,046 SF**
Pre-Secure Concession Area	178 SF	No Change
Post-Secure Concession Area	1,601 SF	No Change
Circulation Area	267 SF	No Change

Functional Area	Ultimate Requirement	ULCC Requirement
Other Terminal Function Allowances	**10,129 SF**	**10,786 SF**
Airline Operations Support Area	521 SF	555 SF
Airport Ops./Maint./Facilities Support Area	2,734 SF	2,915 SF
Utility/Mechanicals/Stairwells/Elevators	6,874 SF	7,316 SF
Total Terminal Building Area Requirement	**42,150 SF**	**44,647 SF**

Source: AECOM Analysis, 2016.

Based on the analysis performed, and as shown in **Table 4-15**, the existing footprint of the passenger terminal building (43,200 square feet) appears to be adequate for the planning period in terms of total square footage provided. However, the introduction of service by a ULCC will impact passenger check-in/ticketing and security screening during peak periods, when a higher number of passengers will need to be processed. In order to accommodate a ULCC, some terminal modifications may be required.

Further, while the building's overall footprint may be adequate under traditional scheduled air service model, the current spaces allotted for various functional areas have been renovated or reconfigured over time in ways that make the current operation sub-optimum during periods of peak passenger activity. The age of the building not only affects the effectiveness of functional areas in processing passengers and baggage, but also makes energy use inefficient and costly. Over time, the combination of deficient functional areas, increasing costs to operate, maintain and repair, and a substandard co-located ATCT with visibility issues makes sustaining the existing passenger terminal building an increasingly difficult and expensive proposition.

Recommendations: It is recommended that alternatives for the renovation and improvement of the existing passenger terminal be considered to better accommodate existing and future levels of scheduled commercial service. Additionally, options for a new passenger terminal building located on the existing site or at a new site on Airport property should be explored and evaluated if renovation or improvement of the existing passenger terminal is cost-prohibitive or cannot adequately accommodate a terminal design that best suited for sustainable use over the long term.

4.4. PARKING AND ROADWAY ACCESS FACILITY REQUIREMENTS

To determine future parking and roadway access facility requirements at ERI, the performance of existing facilities was assessed via on-site assessment and observations during peak periods of scheduled passenger service. Based on this on-site assessment of existing facilities performance and capacity-related data and information presented in Chapter 1, *Inventory* this section presents an analysis of parking and roadway requirements to accommodate future levels of

Terminal area activity as presented in Chapter 2, *Forecasts.* The analysis and results are presented in the following sections:

- On-Site Parking and Roadway Facilities Assessment
- Parking and Roadway Facilities Performance Key Findings
- Forecast of Peak Period Passenger Parking Demand
- Forecast of Rental Car Parking Demand

4.4.1. On-Site Parking and Roadway Facilities Assessment

The following summarizes the facilities considered:

- Airport Entrance Road and Circulation: The east Airport entrance road is comprised of two lanes for ingress and two lanes for egress, divided by a landscaped median, and at a width of 12 feet per lane. The west Airport entrance road is approximately 15 feet wide, accommodating ingress for larger shuttles and buses. At the terminal building curb, the roadway widens to 71 feet and includes a dedicated parking lane at the curb, two through lanes, a raised median (11 feet in width), a rental car parking lane, and a third through lane. All parking and through lanes are a width of 12 feet. The Airport entrance/circulatory roadway does not have shoulders; rather, the roadway is lined with vertical faced concrete curbing.

  The existing condition of the Airport entrance/circulatory roadway is poor to fair condition, exhibiting extensive longitudinal and transverse cracking with some alligator cracking and utility cutouts along the road. Most of the cracks appear to have been sealed recently. Pavement drainage is good, with some ponding of water along curb lines. The only major issue is at the intersection of the Airport entrance/circulatory roadway and the west entrance. In this area, a large area of water ponding in the right lane of circulatory roadway at the intersection covers almost the entire right lane. The Airport entrance road is owned and maintained by ERAA.

  The terminal curb is approximately 340 feet in length, of which 215 feet is associated with passenger drop-off/ticketing and 125 feet is located outside baggage claim hall for passenger pick-up.

  Access to the airport property is through the signalized east entrance intersection of W. 12th Street and Airport entrance roadway, and the unsignalized west entrance. Vehicle detection is by microwave cameras mounted to the span wires.

- Terminal Area Parking[5]: As presented in Chapter 1, *Inventory*, ERI maintains three long-term parking lots containing 437 spaces and one short-term parking lot with 155 spaces. These lots include 16 spaces for handicapped users, four reserved spaces, and eight

[5] Terminal area parking utilization is based on visual/on-site observations during peak periods, August 23-25, 2016.

spaces marked for use by Enterprise Rent-a-Car, for a total of 592 parking spaces (580 spaces for use by passengers).

Other terminal area parking includes staff parking (93 spaces), a government and media lot (22 spaces), rental car parking facilities totaling 238 spaces (including “ready” spaces, storage and staff parking, and car return spaces). Aviation tenant parking in the terminal area totals 155 spaces for use by the FAA, rental car overflow, ATCT staff, and Customs and Border Protection staff. There is no cell phone lot at ERI.

The condition of surface parking facilities in the terminal area is fair to good condition, with sections exhibiting longitudinal, transverse, and alligator cracking. Pavement drainage is good, with some ponding of water in parking lots most likely due to pavement overlays and crack sealing creating small low points.

4.4.2. Parking and Roadway Facilities Performance Key Findings

Table 4-16 summarizes the key findings made via field observations of Airport parking and entrance/circulatory roadway performance.

Table 4-16: Parking and Roadway Facilities Performance Key Findings

Facility	Performance Key Findings
Airport Entrance/Circulatory Roadway	
Traffic Levels, Congestion, and Level of Service	No major traffic issues in the AM or PM peak hours. No congestion in the terminal lanes during the AM or PM peak hours AM Peak Hour - 68 vehicles/hour (peak 15-minute period was 5:00-5:15 AM with 17 vehicles) PM Peak Hour - 56 vehicles/hour (peak 15-minute period was 5:00-515 PM with 14 vehicles) Peak period rental car activity observed 2-3 car returns every 15 minutes at terminal drop off area
Operating Speeds	Posted Speed Limit of 15 MPH Traffic Operated at 20-30 MPH on roadway Traffic Operated at 15-20 MPH in through lanes at terminal building
Geometric Issues	The double left turn at the stop sign where the circulatory roadway intersects the west entrance road could be problematic due to the tight radius of the turn. The turning path for a large vehicle (single unit truck) in the left lane would overlap the path of an adjacent vehicle operating in the right lane.
Multi-Modal Path Conflicts	Potential for vehicle/pedestrian conflicts at crosswalks within drop off/loading area; pavement markings for crosswalks should be white to comply with the Manual on Uniform Traffic Control Devices (MUTCD) and detectable warning surfaces should be provided on the curb ramps as required by Americans with Disabilities Act (ADA).
Access Control Issues	Security noted an issue at the east entrance, such that some vehicles entering the airport turned in to the exit lanes. Larger/improved signage needed to keep vehicles to the right of the median.

Facility	Performance Key Findings
Terminal Area Parking	
Parking Lot Utilization	Short Term - 10-15 percent utilized Long Term – 75 percent utilized Long Term/Rental Car Overflow Lot - 25-35 percent utilized Employee Lot (East of Terminal) - 90-95 percent utilized Employee Lot (West of Terminal) – 90 percent utilized
Sight Distance	Sight distance issue where the parking exit road intersects the circulatory roadway. The intersection is skewed approximately 50° from perpendicular, which makes it difficult for drivers exiting the parking lot to see vehicles to their right on the circulatory roadway.
Other Facilities	
Lighting - Location and Effectiveness	Single arm stick lighting along circulation road; dual arm stick lighting in parking lots. Lighting appears adequate, although some lights were not working at the time of field review.
Pedestrian Accommodation	Concrete sidewalks line the parking lots and the circulatory roadway at the terminal area. A majority of the sidewalks are in good condition. The concrete median in front of the terminal is cracking and spalling. Three striped crosswalks between the terminal and parking lots are marked in yellow and should be white to comply with MUTCD. Sidewalk curb ramps at these crosswalks do not have detectable warning surfaces as required by ADA.
Sign and Wayfinding	Some of the signs do conform to the MUTCD, in addition, some appear smaller than they should be. Wayfinding is poor to fair, directional signs to parking and rental car drop off are small and difficult to see, and there is no sign to direct vehicles into long term parking lot. Wayfinding markings would be useful in long term parking lot to direct people toward the exit. Rental car signage is poor, drop off location signs are small and confusing. Security noted an issue at the east entrance that some vehicles entering the airport turned in to the exit lanes, larger/better signing needed to keep vehicles to the right of the median.
Security Issues	Vehicles allowed to park close to the terminal for an extended period of time. Short term parking area has first 20 minutes free, but vehicles do not utilize this lot.

Source: McFarland Johnson Analysis, 2016.

4.4.3. Forecast of Peak Period Passenger Parking Demand

Drawing on the forecast of annual enplanements in Chapter 3, *Forecast*, and recent counts of vehicles parked in short and long term lots at the Airport, an estimate of peak parking demand for the 20-year planning period was determined.

Table 4-17 presents recent counts of vehicles parked, and forecasted levels of annual and peak passenger enplanements.

Table 4-17: Passenger Parking Demand Factors

Factor	Demand	
Passenger Parking Facility	**Vehicles Parked**	
Average Month - Short Term Lot	314	
Average Month - Long Term Lot	3,317	
Average Month Total	3,631	
Enplanements	**2016**	**2036**
Average Month	7,461	8,891
Peak Month	8,393	10,002
Average Day/Peak Month	280	333
Peak 60-Minute	86	131
Peak 90-Minute	156	229
Passengers per Parked Vehicle	**Variables**	
Peak Month Enplanements	8,393	
Average Month Parked Vehicles	3,631	
Average Month Passengers per Parked Vehicle	2.3	

Source: Republic Parking System, Inc.; McFarland-Johnson Analysis, 2016.

The forecast of peak period passenger parking demand at ERI was calculated using the ratio of passengers per parked vehicle (2.3). **Table 4-18** presents the forecast of peak passenger parking demand at ERI.

Table 4-18: Peak Period Passenger Parking Demand

Year	60-Minute Vehicle Demand	90-Minute Vehicle Demand
2016	38	68
2021	42	75
2026	46	83
2036	57	100

Source: McFarland-Johnson Analysis, 2016.

Considering that existing parking facilities at ERI consist of 580 passenger parking spaces, and peak demand is forecasted to be between 57-100 spaces, existing passenger parking capacity should be sufficient to accommodate peak parking demand through the 20-year planning period. However, a number of factors that affect parking demand at airports should be monitored if scheduled passenger service offerings change at ERI. These factors include:

- Originating Passengers: The ratio of originating to terminating passengers is a key metric for auto parking because only originating passengers have the ability to park at the airport. The inverse of this ratio, which represents terminating passengers is helpful in planning for rental car facilities and ground transportation. For this analysis, it is assumed that all passengers enplaned at ERI are originating passengers, since the Airport does not function as a hub for connecting flights. If service changes and the volume of terminating passengers at ERI increases significantly, parking demand could increase.

- Impacts of ULCC Service: The average number of passengers per vehicle could increase if service by a ULCC is added at ERI, as leisure markets typically experience higher travel party size compared to business markets. ULCC service will also increase the duration of parked vehicles at ERI, and ULCC flights that operate once per day should limits space turnover since passengers departing on the one daily flight will arrive to the airport before arriving passengers on the inbound flight can vacate parking spaces. In the event that significant increases to weekly available seats to leisure markets are added at ERI, parking duration should be monitored to ensure that peak demand can be accommodated.

Recommendations: It is recommended that existing auto parking capacity in passenger lots within the terminal area at ERI be maintained through the planning period. For the Airport entrance/circulatory roadway, it is recommended that existing lane widths, through-lane(s) and parking lanes capacities at the terminal curb be maintained. Additionally, specific operational improvements described in **Table 4-16** should be addressed, including: geometry and sight distance issues; compliance with MUTCD and ADA; signage; drainage; and the provision of a cell phone lot. In the event that modifications, improvements, expansions to the terminal building are made, the existing circulation patterns and roadway capacity should be maintained and/or replicated, and options considered to accommodate existing passenger parking facility capacity if passenger activity and demand increases.

4.4.4. Forecast of Rental Car Parking Demand

The terminal area also must accommodate parking required for rental cars agencies at ERI. The existing rental car parking capacity by facility is shown in **Table 4-19**.

Table 4-19: Existing Rental Car Parking Capacity

Agency	Main Storage Lot	Ready/ Return	Ready Line (Shared)
Budget/Avis	40	11	4+/-
Hertz	65	8	4+/-
Enterprise/National/Alamo	80	21	4+/-
Total	**185**	**40**	**13**

Source: ERI Airport Management, 2016.

As shown in **Table 4-19**, rental car agencies share the 13 spaces in the “ready line” along the median in front of the terminal building, and have exclusive use of storage spaces by the rental car building facility and near the terminal in a ready/return lot. The ready/return lot does not have sufficient capacity, which requires one rental car agency to utilize reserved spaces in the Airport’s short-term parking lot. This deficiency was supported by rental car agencies, as input solicited from them noted a need for additional capacity for ready/return use and in the shared ready line of spaces in front of the terminal. A majority of rental car agencies did not identify capacity deficiencies in the main storage lot.

To estimate peak rental car parking demand for the 20-year planning period, the analysis compared existing enplanements in Chapter 3, *Forecast* to the existing rental car parking facility capacity to determine a ratio of rental car parking spaces to enplaned passengers. Currently, the ratio of passengers per space in the ready/return lot is 2-3 passengers, and the ratio for the ready line is 7-10 passengers, during peak periods. This means that one rental car space in the ready/return lot is required for every 2-3 passengers during the peak period, and one space in the ready line for every 7-10 passengers during the peak period. Applying these ratios to forecasted passenger enplanements results in a forecast that illustrates peak period capacity deficits during the 20-year planning period, as shown in **Table 4-20**.

Table 4-20: Rental Car Parking Demand

Factor	Peak Period Demand
Peak Rental Car Demand	**2036**
Ready/Return Lot	73
Ready Line	24
Peak Rental Car Space Deficits	**2036**
Ready/Return Lot	30 – 33
Ready Line	10 – 11

Source: McFarland-Johnson Analysis, 2016.

Based on this analysis, it is forecasted that approximately 40-45 additional spaces are required to accommodate peak period demand for rental cars in ready/return facilities.

Additionally, input received from car rental agencies stated a need for improved wayfinding/signage for passengers returning vehicles, covered ready line spaces, and the desire for a separate or dedicated entrance to the terminal building for rental car customers.

Recommendations: It is recommended that existing rental car parking capacity in the main storage lot within the terminal area at ERI be maintained through the planning period. For the ready/return lot and ready line facilities utilized by car rental agencies, it is recommended that a total of 45 additional spaces be added to accommodate peak period demand. These additional spaces may be accommodated by expanding into the existing and underutilized short-term passenger parking lot (short term period), or could be consolidated into a single location (intermediate or long term period). Improved wayfinding/signage for passengers returning vehicles should also be made in the near term, and options to provide covered ready/return and/or ready line spaces should be considered. In the event that modifications, improvements, expansions to the terminal building and/or circulatory roadway and passenger parking facilities are made, options to provide a separate entrance for rental car customers should also be considered.

4.5. GENERAL AVIATION AND LANDSIDE FACILITY REQUIREMENTS

The existing general aviation areas are located on northwest side of the Airport. This section discusses the requirements for each of the general aviation elements while the Alternatives chapter will explore the future location of the required facilities. Requirements for GA facilities at

ERI were calculated on the basis of data collected during the inventory, forecasts of aviation demand, consultation with Airport staff, as well as FAA standards. The following facilities were examined:

- Aircraft Hangars
- Aircraft Parking Apron
- Airport Administrative/Operations Offices
- Aviation Fuel Storage and Distribution
- General Aviation Auto Parking
- Non-Aviation Use Areas

4.5.1. Aircraft Hangars

General aviation hangars at an airport are planned for both based and itinerant aircraft. Requirements are calculated based on the size and quantity of aircraft based at the Airport. While each aircraft will vary in size, the following planning factors were used to calculate the approximate hangar space requirements for aircraft based at Erie International Airport:

- 1,200 SF for Single Engine and Rotor Aircraft
- 1,600 SF for Multi Engine Aircraft
- 3,200 SF for Jet Aircraft

The forecast for based aircraft reflects a one percent growth of total based aircraft based on the market share or based aircraft in the area. Existing hangar space is shown in **Table 4-21**. The overall hangar requirements are displayed in **Table 4-22**. It should be noted that all hangars at Erie are privately owned and operated.

Table 4-21: Existing Hangar Facilities

Hangar Name	Lessee/Owner	Individual Hangar Units	Conventional Hangar Space in SF (Aircraft Storage in SF)
T-Hangars (3)	North Coast Air (2) Aviation Flyers (1)	28	None
Hangar 20	Hangar 20, LLC	9	None
Hangar 5 and FBO Hangars (4)	North Coast Air	None	13,600 + 55,275 (29,950)
Maintenance Hangars (2)	Erie Aviation	None	17,800 (0)

Source: Urban Engineers and McFarland Johnson Analysis, 2016

As of 2016, 100 percent of jet and multi-engine aircraft are housed within North Coast Air's conventional hangar space. It is anticipated that any additional jet and multi-engine aircraft will require additional conventional hangar space.

Ideally, 100 percent of aircraft are stored in hangars. For planning purposes, it is assumed that 50 percent of single-engine aircraft will be stored in individual hangars, 25 percent in conventional hangars, and 25 percent on tie-downs. Additionally, 25 percent of multi-engine aircraft will be stored in individual hangars, 25 percent on tie-downs, and 50 percent in conventional hangars. Jet aircraft will be stored in conventional hangars. A seen in **Table 4-21**, there 37 individual box hangars and t-hangars at the Airport. Additionally, total conventional hangar space of approximately 29,950 square feet is used for hangar storage, while the remaining portions of these hangars are being used for aircraft maintenance, offices, etc.

All hangars are privately owned (corporations, FBO, or otherwise). **Table 4-22** shows the break-down of anticipated hangar usage. Within the planning period, current hangars are adequate to meet demand. Should demand exceed the forecast or the use of hangars change, private entities should coordinate with Airport Management to identify where additional hangars can be constructed.

Recommendations: There are no recommendations for additional hangars. Should additional demand arise during the planning period, private parties should coordinate with Airport management to determine where to construct additional hangars.

Table 4-22: Aircraft Hangar Demand

Year	Facility Demand	Current Provision	Shortage
2016			
Individual/T-Hangars	25	37	0
Conventional Hangars	19,500 SF	29,950 SF	0
2021			
Individual/T-Hangars	27	37	0
Conventional Hangars	20,700 SF	29,950 SF	0
2026			
Individual/T-Hangars	29	37	0
Conventional Hangars	25,100 SF	29,950 SF	0
2036			
Individual/T-Hangars	33	37	0
Conventional Hangars	28,600 SF	29,950 SF	0

SF – square feet

Source: McFarland-Johnson Analysis, 2016.

4.5.2. Aircraft Parking Apron

There are four components that typically determine the required apron area for general aviation uses. They are: 1) based-aircraft parking, 2) itinerant aircraft parking (transient apron), 3) aircraft fueling apron, and 4) staging and maneuvering areas. The sum of these components determines the total area of apron required to meet the forecasted level of general aviation activity at the Airport.

Based Aircraft Parking

Based-aircraft apron tie-down requirements were developed in the *Aircraft Hangars* section because they are a factor in determining hangar requirements. All based aircraft (tie-downs and hangars) are located on the northeast side of the Airport. Pavement conditions will be assessed at a later portion of this master plan.

There are approximately 13 tie-downs available on the north apron, eight of which are associated with the FBO. During the planning period, it is anticipated that 17 based aircraft will be stored on tie-downs. Since the anticipated number exceeds total tie-downs, some of these aircraft may be stored in individual or conventional hangars, as there is a forecast excess, as shown in **Table 4-22**.

Recommendations: Should additional tie-downs be needed, which is not anticipated, they will be constructed by the Airport authority, if necessary.

Transient Aircraft Parking

The second major apron need is parking space for itinerant aircraft. FAA AC 150/5300-13A suggests one methodology for determining apron space requirements for transient aircraft. This methodology has been adjusted as outlined below to reflect current conditions at the Airport and is used to project future transient apron space requirements.

- Calculate the total design day operations for all itinerant GA operations
- Calculate itinerant arrivals on the design day assuming that half of the operations are arrivals.
- Assume that approximately 75 percent of these aircraft will require transient parking space during the course of the day. The other 25 percent of the itinerant arrivals are based aircraft that will return to their assigned spaces.
- Assume that up to 75 percent of these transient aircraft will be on the apron at the same time during peak events.
- Allow an area of 400 square yards (3,600 square feet) per transient airplane, due to the need for taxiing space and aircraft of different sizes.

Table 4-23 presents the results of these computations. According to the above methodology, approximately 26,000 square feet of apron space is currently required for transient parking. By the end of the planning period this need is forecast to increase to approximately 34,000 square feet.

Table 4-23: Transient GA Aircraft Apron Area Demand

Year	Design Day Itinerant GA Operations	Itinerant Arrivals per Design Day	Itinerant Aircraft on Apron	Peak Hour Transient Parking Demand	Required Transient Apron Space (SF)
2015	25	13	10	7	25,725
2020	27	13	10	8	27,196
2025	29	14	11	8	29,154
2035	34	17	13	9	33,972

Source: McFarland-Johnson Analysis, 2016.

Transient aircraft are parked on the FBO and private user aprons. Total apron area for the tie-down and other apron areas is approximately 207,000 square feet. The sum of based and transient aircraft anticipated to use tie-downs is 20 in 2015 and 16 in 2035, which can be accommodated on the current apron and therefore meets the planning period forecast.

Based and transient aircraft demands and current provisions are shown in **Table 4-24**.

Recommendations: Should additional tie-downs be needed, which is not anticipated, they will be constructed by a private party with Airport management coordination.

Table 4-24: Tie-Down Demand

Year	Facility Demand	Current Provision	Shortage
2015			
Based and Transient	20		
Square Feet	71,625	207,000	0
2020			
Based and Transient	21		
Square Feet	76,696	207,000	0
2025			
Based and Transient	23		
Square Feet	82,254	207,000	0
2035			
Based and Transient	27		
Square Feet	96,072	207,000	0

Source: McFarland Johnson analysis, 2016.

Staging and Maneuvering Areas

Adequate space for the safe maneuvering of aircraft to and from aprons, hangars, and taxiways must also be included in any forecast of apron requirements. Staging and maneuvering is most closely associated with the provision of space in front of conventional hangars and between rows of box and t-hangars. Currently, the separation between the t-hangars is approximately 90 feet between all t-hangar rows. **Table 4-25** shows the taxiway and taxilane object free area requirements (TOFA and TLOFA, respectively).

Table 4-25: Taxiway/Taxilane Object Free Area Requirements by ADG

ADG	I	II	III
Taxiway OFA	89’	131’	186’
Taxilane OFA	79’	115’	162’

Source: FAA AC 150/5300-13A.

These t-hangars are constructed for small, general aviation aircraft and meet ADG I taxiway and taxilane object free area requirements. Enough space is provided in front of conventional hangars and tie-downs for required clearances.

Recommendations: There are no recommendations for staging and maneuvering.

4.5.3. Airport Administrative/Operations Offices

There is no self-standing Airport administrative/operations office at the Airport. These offices are distributed throughout the Airport and the passenger terminal building.

Recommendations: Airport administration offices should remain within the passenger terminal building and be expanded.

4.5.4. Aviation Fuel Storage and Distribution

The Airport does not currently have any aviation fuel storage facilities. The FBO, North Coast Aviation, provides fueling services to the commercial air carriers at the Airport. Airlines contract with the FBO(s) for fuel needs, which meets airline needs.

Recommendations: There is no recommendation for additional fuel facilities. Capacities, capabilities, and services provided by the FBO's as a result of private investment should be continuously monitored to ensure facilities at ERI adequately meet demand.

4.5.5. General Aviation Auto Parking

There are several corporate hangar areas on-Airport which individually provide vehicular parking for their users. With all of these being privately owned/operated facilities, the Airport does not provide any vehicle parking for the private use facilities.

The methodology used below is based on a previously completed Aircraft Owners and Pilots Association (AOPA) survey that found an average of 2.5 persons aboard the average general aviation operation and automobile parking requirements for GA operations are displayed in **Table 4-26**:

- Determine the number of peak hour operations from the *Forecast* chapter.
- Determine the number of peak-hour pilots and passengers by multiplying the number of peak hour operations by 2.5.
- Estimate the number of parking spaces in use by assuming that parking demand will be half the number of pilots and passengers, since parking spaces will be utilized only by departing pilots and passengers.
- Multiply by a contingency factor of 1.10.

As shown, a need of 13 parking spaces is identified for based and transient GA operations at Erie through 2035. The current parking lot areas have over 70 spaces.

Recommendations: There are no GA parking recommendations. Any parking requirements that may arise will be resolved by private parking construction as coordinated with Airport management.

4.5.6. Non-Aviation Use Areas

Airport property without direct airside access was determined to be non-aviation use areas. This includes all land southwest of Asbury Road, residential parcels northwest of Taxiway A, and property east of the Marshall Drive. Most of the open areas beyond Asbury Road and Marshall Drive will remain open space to protect for the Runway 6 and 24 approach areas. Existing and proposed non-aeronautical use areas will be further reviewed in a later portion of this MPU as part of the land use drawing.

Table 4-26: Automobile Parking Requirements

Year	Peak Hour Operations	Pilot and Passenger Parking Demand	Contingency	Total Parking Demand
2015	7	9	1.1	10
2020	8	9	1.1	10
2025	8	10	1.1	11
2035	9	22	1.1	13

Source: McFarland-Johnson Analysis, 2016.

4.6. UTILITIES AND SUPPORT FACILITIES

4.6.1. Air Traffic Control Tower (ATCT)

The current ATCT is located on top of the terminal building; it is operated between 6:00AM and midnight local time. As noted in Chapter 1, *Inventory*, of this MPU, the building was constructed in 1958. Equipment and height do not meet current standards. ERI has an FAA Terminal Radar Approach Control facility (TRACON). ERI handles traffic below 10,000 feet mean sea level (MSL) and the Cleveland Air Route Traffic Control Center (ARTCC) controls above 11,000 feet MSL.

ERI has a designated Terminal Radar Service Area (TRSA) centered on the Airport where radar service and control is available to aircraft. A TRSA is a specified size and shape of airspace designed to provide traffic separation between participating VFR aircraft and all IFR aircraft.

Recommendation: The ATCT should be updated within the planning period to meet current equipment needs and meet height standards.

4.6.2. Aircraft Rescue and Fire Fighting (ARFF)

As discussed in Chapter 1, *Inventory*, of this MPU, the ARFF station at the Airport is an Index B station under FAR Part 139 and is a combined ARFF/maintenance facility. The ARFF station is located east of the passenger terminal with access to Taxiway B. The station includes the following vehicles:

- Mobile 822 – Structural Fire Truck
- Mobile 823 – Primary Oshkosh ARFF truck
- Mobile 824 – E-One ARFF truck
- Mobile 829 – Incident command vehicle

Recommendation: The ARFF facility may need to be updated to included electrical, heating, and technical improvements.

4.6.3. Airfield Maintenance Facility and Snow Removal Equipment (SRE)

The Airport operations staff performs the day-to-day responsibilities of maintaining and inspecting the airfield facilities, including the removal of snow during winter months.

As noted in Chapter 1, *Inventory*, the Airport has 22 vehicles for maintenance and snow removal. Storage space in the ARFF/maintenance building is limited and many vehicles are stored outside. Any changes recommended to this building should include an expansion so all maintenance/SRE/ARFF vehicles can be stored indoors to extend their useful life.

Recommendation: Airfield maintenance and SRE equipment should be maintained or replaced, as needed, throughout the planning period. The Airport is in the process of designing an SRE/storage facility which will be adequate to house all vehicles.

4.6.4. Utilities

Based on information provided in Chapter 1, *Inventory* the Airport's utility services – electric/natural gas, water, telecommunications, storm drainage, and sewer – is adequate to meet the existing needs of the facility. In the event there are additional developments throughout the planning period, a review of the utilities and their respective capacities should be taken into account, including the potential development of hangar facilities related to the necessity of electricity, telephone, sanitary sewer, and cable.

Recommendation: There are no recommendations for utilities.

4.7. FORECAST SCENARIO FACILITY REQUIREMENTS

The following forecast scenarios were developed for ERI:

- *New Destination* – The high-revenue business traffic base at ERI, on which current airlines depend, may well entice other airlines to add service at a new hub airport, which could open service to new domestic and international destinations.

- *Increased Existing Service* – Incumbent carrier increases service in an existing market with larger aircraft in the 70+-seat range. Also, carriers could increase the number of available flights at ERI by adding daily departure to current destinations. It is expected the new service could operate at an 80 percent load factor.

- *New Ultra Low Cost Carrier Service (ULCC)* – This would entail an airline providing service to a leisure destination. The new service could begin with limited weekly flight operating to a single destination and then potentially increase to multiple weekly flights and multiple destinations. Normally carriers operating in these types of markets use aircraft with 160+ seats similar to the Boeing 737 and A319 aircraft.

- *Possibility of Decreased Service* – ERI is currently served by three major airlines offering flights to three different hub airports where passengers make connections to other flights and worldwide destinations.

- *New Corporate General Aviation* – This would entail a new corporate tenant basing additional aircraft at ERI, most of which are forecast to be jets.

- *Air Cargo* – This would entail a dedicated cargo operator at ERI.

This section will summarize potential facility requirements associated with each forecast scenario.

4.7.1. New Destination

Adding a new destination to ERI's flight schedule could increase total enplanements for the planning period by approximately 36,135 over the baseline forecast to a total of approximately 144,000 enplanements. Should this new destination be added during the peak hour operations, this may result in additional terminal space requirements as it would push the terminal's performance into sub-optimum range levels.

4.7.2. Increased Existing Service

Increasing existing service is forecast to increase total annual aircraft operations to approximately 22,900 throughout the planning period and add 5,610 enplanements, for a total 2036 enplanement number of approximately 113,400. Should increased service be added during the peak hour operations, this may result in additional terminal space requirements as it would push the terminal's performance into sub-optimum range levels.

4.7.3. New Ultra Low Cost Carrier (ULCC) Service

New ULCC service could increase total enplanements to approximately 134,000 by 2036. As shown in Sections 4.3.4 and 4.3.5, this could result in the need of a terminal expansion or new terminal within the planning period.

4.7.4. Possibility of Decreased Service

Should service decrease during the planning period, no additional facility requirements would be required within the planning period as associated with terminal facilities.

4.7.5. New Corporate General Aviation

A new corporate general aviation tenant could bring up to five additional based aircraft to the Airport, which would mean providing additional conventional hangar space within the planning period. If the new tenant increases based aircraft numbers by four jets and one multi-engine aircraft, it is anticipated that an additional approximately 15,000 square feet of conventional hangar space should be provided. Any hangar construction would be conducted by private parties and should be coordinated with Airport management to determine where to construct additional hangars.

4.7.6. Air Cargo

Should an air cargo operator start service at ERI within the planning period, a new dedicated air cargo facility should be constructed at the Airport, including conventional hangar space, apron area, and landside access. It is anticipated that this construction would be done by private parties and should be coordinated with Airport management. The location for this area is planned for the southern side of the Airport at the corner of Powell Avenue and the railroad tracks. Approximately 19 acres of land could be converted for cargo development (as needed). This would protect for maximum cargo operations up to 400,000 tons of cargo and 12 C-III or smaller peak hour cargo aircraft. It is not anticipated that more than 16,000 square feet of dedicated space would be needed for the air cargo scenario within the planning period.

4.8. FACILITY REQUIREMENTS SUMMARY

The facility requirements recommended for ERI are summarized in **Table 4-27**. Although not all of the improvements recommended throughout this chapter are provided in **Table 4-27**, the table highlights the key improvements that are recommended for future development at ERI.

Table 4-27: Summary of Facility Requirements

Item/Facility	Existing	Ultimate Requirement	Deficit
Runway	6-24/2-20		
Length	8,420'/3,508’	8,420'/3,508’	None
Width	150' (both)	150' (both)	None
Safety Area	Runway 24 off Airport Standard on runway 2-20 through declared distances	Provide standard RSA on all runways	Control of all RSA through ownership or avigation easements
Object Free Area	Portion of Runways 2 and 24 extend off Airport	Provide standard on all runways	Control of all ROFA through ownership or avigation easements
Protection Zone	Partially under Airport control through ownership	Under airport control through ownership or avigation easements	Control of all RPZs through ownership or avigation easements
Lighting	Runway 6-24 – HIRLs Runway 2-20 – MIRLs	Runway 6-24 – HIRLs Runway 2-20 – MIRLs	None
Visual Aids	Runway 6 – MALSR Runway 24 – MALSR Runway 2 – None Runway 20 – VASI	Runway 6 – MALSR Runway 24 – MALSR Runway 2 – None Runway 20 – VASI	None
Approaches	Runway 6 – ILS Runway 24 – ILS Runway 2 – Visual Runway 20 – Visual	Runway 6 – ILS Runway 24 – ILS Runway 2 – Visual Runway 20 – Visual	None

Item/Facility	Existing	Ultimate Requirement	Deficit
Taxiways	A/A1		
Width	75'-90'/90'	50'	None
Separation (if applicable)	370'-400'/NA	400'	Relocate portion of Taxiway A
Lighting	MITL/MITL	MITL	None
Taxiways	A2/A3		
Width	90'/90'	50'	None
Separation (if applicable)	NA/NA	400'	None
Lighting	MITL/MITL	MITL	None
Taxiways	B/C		
Width	50'/75'-90'	35'/50'	None
Separation (if applicable)	320'/NA	240'/NA	None
Lighting	MITL/MITL	MITL	None
Taxiways	D/E		
Width	75'/80'	50'	None
Separation (if applicable)	NA/NA	NA	None
Lighting	MITL/MITL	MITL	None
Taxiways	F/G		
Width	80'-90'/90'	50'	None
Separation (if applicable)	NA/350'	400'	Relocate Taxiway G
Lighting	MITL/MITL	MITL	None
Terminal Apron	6-7 Positions	3-4 Positions	None
Passenger Terminal Facilities	43,200 SF	42,150 SF	Outdated facilities, functional area deficiencies, energy inefficient
Curb Length	300 LF	120-142 LF	None
Gates	7	3	None
Passenger Parking	580	100	None
Rental Car Parking	238	283	45
GA Terminal Facilities	Private Investment	Private Investment	N/A
GA Auto Parking	70	13	None
Individual/T-Hangars	37	33	None
Conventional Hangars	29,950 SF	28,600 SF	None

Item/Facility	Existing	Ultimate Requirement	Deficit
Tie-Downs	207,000 SF	34,000 SF	None

LF – linear feet, SF – square feet, NA – not applicable
Source: McFarland Johnson analysis, 2016.