5. Facility Requirements

This chapter presents the airside and landside facility requirements necessary to accommodate existing and forecasted demand at Delaware Coastal Airport (GED 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 4, *Aviation Forecasts*; FAA Advisory Circular (AC) 150/5300-13A (Change 1), *Airport Design;* and 14 Code of Federal Regulations (CFR) Part 77, *Safe, Efficient Use, and Preservation of the 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
- Airfield Facility Requirements
- General Aviation Facility Requirements
- Support Facility Requirements
- Summary of Facility Requirements

5.1. 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 several publications and computer programs to assist in the calculation of capacity. This report will use the methodologies described in FAA AC 150/5060-5, *Airport Capacity and Delay*.

Capacity is described using three metrics: 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 has been exceeded. For prudent planning purposes, once airport operational levels reach 60 percent of the ASV, planning for capacity-increasing measures should take place. Once an airport reaches 80 percent ASV, the construction of capacity-increasing measures should begin, or demand strategies are put in place.

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.

5.1.1. Factors Affecting Capacity

It is important to consider 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 Use 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 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 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, 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 requires 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.

Climate data from the National Oceanic and Atmospheric Administration (NOAA) was obtained and analyzed to determine the ceiling and visibility characteristics at the Airport. Based upon this data, VFR conditions occur at the Airport approximately 79 percent of the time and IFR conditions occur approximately 21 percent of the time, and Poor Visibility Conditions (PVC) less than one percent of the time.

Wind direction and speed determine the desired alignment and configuration of the runway system. If possible, pilots normally desire to take off and land into the wind, taking advantage of aircraft design characteristics. 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 oriented to take the most advantage of the prevailing winds at the site will restrict the capacity of an airport to varying degrees as aircraft have longer 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. GED has two active runways, Runway 4-22, and Runway 10-28.

Runway 4-22 is served by a full-length taxiway that is parallel for most of its length and has five entrance/exit taxiways; two of which are located at either threshold, two of which cross the runway to provide access to Runway 10-28, and one leads to the Delaware Coastal Business Park near the Runway 22 threshold.

Runway 10-28 is served by a full-length parallel taxiway with four entrance/exit taxiways. The full-length parallel taxiway provides access to the Runway 28 threshold and a point approximately 900 feet from the Runway 10 threshold. Additionally, there are two stub taxiways.

Runway Utilization

As discussed in the meteorological conditions section, pilots generally desire to take off and land into the wind. Based on the information provided by Airport management, Runway 4-22 is the primary runway, used approximately 85 percent of the time, and Runway 10-28 is used approximately 15 percent of the time.

Aircraft Fleet Mix

The capacity of a runway is also dependent upon the type and size of aircraft that use it. FAA AC 150/5060-5 places aircraft 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 longer for wake turbulence separation. The greater the separation distance required, the lower the airfield's capacity.

For capacity analysis, Class A consists of aircraft in the small wake turbulence class, which are single-engine aircraft with a maximum takeoff weight (MTOW) of 12,500 pounds or less. Class B is comprised of aircraft like Class A but with multiple engines. Class C aircraft are in the large wake turbulence class with multiple engines and MTOW between 12,500 pounds and 300,000 pounds. Class D aircraft are in the heavy wake turbulence class, have multiple engines, and have an MTOW greater than 300,000 pounds. Typically, Class A and B aircraft are general aviation (GA) single-engine and light twin-engine aircraft. Classes C and D consist of large jet and propeller-driven aircraft generally associated with larger business jets, commuters, airlines, 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 the Airport. The approximate percentage of operations forecasted at the Airport by each of these types of aircraft is shown in **Table 5-1**.

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 GED, this is approximately 12 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, which increases capacity.

Table 5-1: Aircraft Fleet Mix

Aircraft Type	2018 Percent of Operations	2038 Percent of Operations
Class A	77%	70%
Class B	18%	18%
Class C	5%	12%
Class D	0%	0%

Source: FAA Traffic Flow Management System counts, McFarland Johnson analysis 2020.

Percent Arriving Aircraft

The capacity of a runway is also influenced by the percentage of aircraft arriving at an 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 take off. Therefore, the higher the percentage of aircraft arrivals during peak periods of operations, the lower the ASV. Historical operational data indicates that operational activity at GED 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. Based on airport management discussions, touch-and-go operations are estimated at 20 percent of total airport operations.

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.

Runway 4-22 has five taxiway exit locations, two at either runway end, and three throughout the runway length (two of which are crossover taxiways). The taxiways have the following distances from the Runway 4 end:

- Taxiway A at the Runway 4 end
- Taxiway H: 1,030 feet
- Taxiway B: 2,622 feet
- Taxiway M (acute-angled): 4,778 feet
- Taxiway A at the Runway 22 end: 4,960 feet

Runway 10-28 has four taxiway exits. The taxiways have the following distances from the Runway 28 threshold:

- Taxiway D3 at the Runway 28 end

- Taxiway D2: 483 feet
- Taxiway D1: 2,200 feet
- Taxiway C at the Runway 10 threshold: 3,058 feet

FAA AC 150/5300-13A guides the number and location of exit taxiways. **Table 5-2** presents the exit taxiway utilization percentage per aircraft class.

Table 5-2: Exit Taxiway Cumulative Utilization Percentage

Distance Threshold to Exit	Wet Runways			Dry Runways					
	Right and Acute Angle Exits			Right Angled Exits			Acute Angled Exits		
	A	B	C	A	B	C	A	B	C
500	0	0	0	0	0	0	1	0	0
1,000	4	0	0	6	0	0	13	0	0
1,500	23	0	0	39	0	0	53	0	0
2,000	60	0	0	84	1	0	90	1	0
2,500	84	1	0	99	10	0	99	10	0
3,000	96	10	0	100	39	0	100	40	0
3,500	99	41	0	100	81	2	100	82	9
4,000	100	80	1	100	98	8	100	98	26
4,500	100	97	4	100	100	24	100	100	51
5,000	100	100	12	100	100	49	100	100	76
5,500	100	100	27	100	100	75	100	100	92
6,000	100	100	48	100	100	92	100	100	98
6,500	100	100	71	100	100	98	100	100	100
7,000	100	100	88	100	100	100	100	100	100

Note: A = small, single engine (≤12,500 pounds); B = small, twin engine (≤12,500 pounds); C = large (12,501 pounds to 300,000 pounds)

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

As shown in **Table 5-2**, Class A and B aircraft have ample opportunity to exit Runway 4-22 under wet and dry conditions. The current taxiway configuration provides runway exit opportunities for approximately 27 percent of Class C aircraft in wet conditions and 75 percent of Class C in dry conditions when landing Runway 4-22 at maximum landing weight.

Runway 10-28 serves small aircraft. At just over 3,000 feet long, it can accommodate approximately 39 percent of Class B aircraft (100 percent of Class A aircraft) in dry conditions and 10 percent of Class B (96 percent of Class A) aircraft in wet conditions. Before the construction of the new full-length parallel Taxiway D, aircraft landing on Runway 10 or taking off on Runway 28 would need to back-taxi to use the full length of runway available.

Peaking Characteristics

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 apron(s) at any given time.

In addition to peaking characteristics described for GA activity, peaking characteristics are also influenced by annual events that occur at or near the Airport that affect air travel, vehicle and/or aircraft parking, etc. For the Airport, the planning peak hour was calculated by taking the number of peak month operations, dividing that number by 30 days per month, and assuming 20 percent of those operations would occur during the peak hour. These numbers are shown in **Table 5-3**.

Table 5-3: Annual Operations Capacity Forecast

Year	Demand		Capacity			Percent Peak Hour		Percent ASV
	Annual	Peak Hour	ASV	Hourly VFR	Hourly IFR	VFR	IFR	
2018	34,401	21	225,000	108	57	19%	37%	15%
2023	37,221	23	225,000	108	57	21%	40%	17%
2028	40,604	25	225,000	108	57	23%	44%	18%
2038	47,936	29	225,000	108	57	27%	51%	21%

Source: McFarland Johnson Analysis, 2020.

5.1.2. Capacity Calculations

FAA AC 150/5060-5 offers guidance used to calculate airfield capacity and provides planning estimates for 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. The various capacity elements are then consolidated into a single value, 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

Due to wide variations in airport design characteristics, guidance in FAA AC 150/5060-5 provides for diverse types of airports, from large commercial service hubs to small single-runway facilities. According to FAA 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 GED are described below:

- Approximately 95 percent of operations at the Airport are currently conducted by Class A and B aircraft, 5 percent by Class C aircraft, and zero percent by Class D aircraft. In the future, it is anticipated that use by Class A and B aircraft will decrease to approximately 88 percent and Class C aircraft operations will increase to 12 percent of operations. This represents the 20-year forecast condition.
- The Airport currently has a full parallel taxiway for Runway 10-28.
- Arrivals and departures will remain equal.
- No airspace limitations are affecting the Airport's runway use.
- The percentage of touch-and-go operations will be less than 50 percent.

Guidance in FAA AC 150/5060-5 was used to determine the ASV. **Table 5-3** summarizes the airfield capacity calculations for GED showing the current and forecast level of activity. These figures indicate that the Airport is currently operating at 15 percent of capacity on an annual basis. The utilization of the airfield is expected to climb to approximately 21 percent of ASV by 2038.

Based on the results of these capacity calculations, airfield capacity at the Airport does not appear to be constrained at present, and future capacity is also anticipated to be adequate. As stated previously, 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 coordinated with taxiway improvements to maintain capacity.

5.2. AIRFIELD 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 ensure that all runway and taxiway systems are correctly designed, the FAA has established criteria for use in the 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 a particular facility at an airport, regularly (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. The 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.

Airfield facility requirements are covered in this section as follows:

- Critical Design Aircraft/Runway Design Code
- Runway Length
- Runway Strength
- Runway Orientation
- Runway Width
- Runway Safety Areas
- Runway Object Free Areas
- Runway Protection Zones
- Instrument Approach Procedures
- Airfield Pavement Markings
- Taxiways
- Summary of Non-Standard Geometry
- Airfield Lighting and Signage
- Visual Approach Aids
- Obstruction Clearance
- Airfield Facility Requirements Summary

5.2.1. Critical Design Aircraft/Runway Design Code

Airport design standards are described in FAA AC 150-5300-13A, which provides criteria for grouping of aircraft into runway design codes (RDCs). The RDC consists of a letter representing an AAC (based on approach speed), a Roman numeral representing an airplane design group (ADG) (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 5-4** below. The RDC of a runway defines which specific dimensions apply for safety areas, protection zones, runway and taxiway widths and separations, and other planning and safety factors.

A review of Chapter 4, *Aviation Forecasts*, indicates that the existing and future critical design aircraft for Runway 4-22 has an AAC-ADG of B-II, and the ultimate critical design aircraft for Runway 4-22, will be an AAC-ADG C-II aircraft. For Runway 10-28, the existing and future critical design aircraft is an AAC-ADG B-I aircraft. The combined operations of these aircraft meet the criteria outlined in FAA AC 150/5000-17, *Critical Aircraft and Regular Use Determination*.

Table 5-4: 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
5000	Not lower than 1 mile
4000	Lower than 1 mile but not lower than ¾ mile (APV ≥ ¾ but < 1 mile)
2400	Lower than ¾ mile but not lower than ½ mile (CAT-I PA)
1600	Lower than ½ mile but not lower than ¼ mile (CAT-II PA)
1200	Lower than ¼ mile (CAT-III PA)

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

5.2.2. Runway Length

A wide variety of aircraft use GED daily. These aircraft 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, ambient environmental conditions, flap settings, payload, or runway condition (wet/dry), which then dictate the runway length requirements that must be met 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.

Runway 4-22

Runway 4-22 is the Airport's primary runway and is 5,500 feet long. Under existing conditions, Runway 4-22 has an AAC-ADG of B-II. It is anticipated future operations will meet the threshold for an AAC-ADG of C-II within the planning period. The Cessna Citation Excel/XLS is identified as the existing and future critical design aircraft, while a composite aircraft, represented by the Bombardier Challenger 600 and the Gulfstream G-IV, will be designated as the ultimate critical design aircraft. The runway is also frequently used by the Boeing 737-700, which use the Airport for the maintenance, repair, and overhaul (MRO) services at ALOFT AeroArchitects, but does not meet the FAA's defined threshold of regular use. The following list includes the MTOW for the existing and future critical aircraft, as well as the ultimate critical aircraft, as well as Airport conditions that impact runway length:

- Cessna Citation Excel/XLS+ MTOW: 20,200 lbs.[1]
- Gulfstream IV MTOW: 74,600 lbs. [2]
- Bombardier Challenger 600 MTOW: 48,200 lbs.[3]
- Mean daily maximum temperature during the hottest month: 90° F[4]
- Airport elevation: 53.4 feet

For aircraft with an MTOW of 60,000 lbs. or less, but more than 12,500 lbs., FAA AC 150/5325-4B utilizes a Percentage of Fleet which places some turbine-engine aircraft into either the "75 percent of fleet", or the remaining 25 percent of fleet, which they refer to as the "100 percent of fleet". Essentially, under standard conditions, and at standard day temperature, aircraft in the former require a greater runway length to operate than aircraft in the latter. For existing conditions, the Cessna Citation Excel/XLS+ is in the "75 percent of fleet" category, and the future design aircraft of the Challenger 600 is in the "100 percent of fleet" category. The Gulfstream IV is not listed in either category.

The AC further differentiates these categories of aircraft utilizing specific curves that use the mean maximum daily temperature of the hottest month and the airport elevation to provide a runway length that is sufficient to satisfy the operational requirements of that critical design aircraft. These curves will provide a runway length that is sufficient for the existing and future critical design aircraft at both 60 and 90 percent useful load.

At 60 percent useful load for aircraft within the 75 percent of the fleet category, the required runway length will be 4,800 feet, and at 90 percent useful load, the required runway length will be 6,700 feet. It is important to note that the runway lengths obtained are based on no wind, a dry runway surface, and zero effective runway gradient. For takeoff length requirements, FAA AC 150/5325-4B recommends increasing the runway length requirement at a rate of 10 feet for each foot of elevation difference between the high and low points of the runway centerline. With a high

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[1] https://cessna.txtav.com/en/citation/xls. Accessed August 30, 2021.

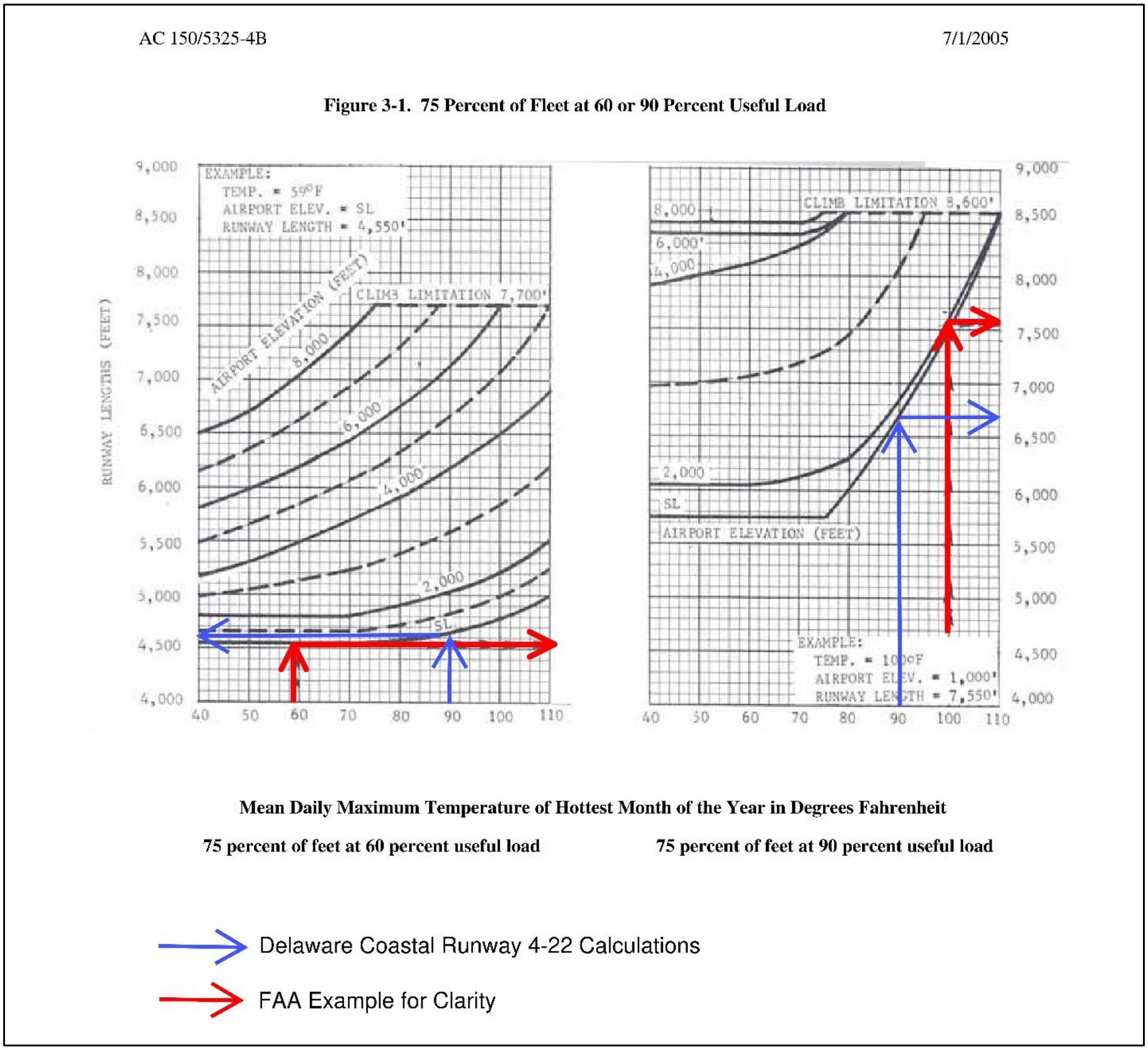
[2] *Janes: All the World's Aircraft 2011-2012*, HIS Jane's Global Ltd., 2011.

[3] Ibid.

[4] *Future Climate Scenarios for Runway Length: Assessment of Future Temperature and Precipitation Trends* DOT/FAA/TC-21/43 Authors: Annick Dewald and John Hansman, November 30, 2021.

point of 50.7 feet and a low point of 48.5 feet, the adjustment identified would be 22 feet or lengths of 4,822 feet at 60 percent useful load and 6,722 feet at 90 percent useful load. For landing length requirements, it is recommended that the runway length requirements are increased by 15 percent, up to 5,500 feet, at 60 percent useful load, and by 15 percent, up to 7,000 feet, at 90 percent useful load. At 60 percent useful load, this would require a runway length of 5,500 feet and at 90 percent useful load a runway length of 7,000 feet is recommended. The runway length curves from AC 150/5325-4B can be seen in **Error! Reference source not found.**.

Figure 5-1: Runway 4-22 Length Calculations



Source: FAA AC 150-5325-4B, 2005.

Lastly, both ends of Runway 4-22 contain displaced thresholds. Further review related to obstacles and Runway Safety Areas and Runway Object Free Areas should be completed to identify if the displaced thresholds are required under existing conditions and if so, identify mitigations to enable the removal of the displaced thresholds, if possible.

Runway 10-28

Runway 10-28 is the Airport's crosswind runway and has an existing and future AAC-ADG of B-I. The existing runway is 3,109 feet in length. The Embraer Phenom 100 has been designated as the critical aircraft. The Embraer Phenom 100 has the following characteristics relevant to determining the runway length according to FAA AC 150/5325-4B:

- MTOW less than or equal to 12,500 pounds
- Approach speed greater than 50 knots
- Seating capacity of less than 10 passengers
- Mean daily maximum temperature of the hottest month: 90° F
- Airport elevation: 53.4 feet

AC 150/5325-4B prescribes runway lengths for aircraft weighing less than 12,500 pounds in two ways. The first is using a 95 percent of fleet calculation which is used for airports like GED that are primarily intended to serve communities with small to medium-sized populations. The second is using a 100 percent of fleet calculation used for airports intended to serve communities located on the fringe of a metropolitan area or those with a relatively large population remote from a metropolitan area. Using the runway length curves for 95 percent of fleet results in a recommended runway length of 3,200 feet. The runway length curves from AC 150/5325-4B can be seen in **Figure 5-2**.

When Runway 4-22 meets FAA's criteria for regular use by C-II aircraft, the RSA will expand in width from 150 feet to 500 feet and will overlap the Runway 10-28 RSA at the approach end of Runway 10. FAA standards prohibit overlapping RSAs for runways that do not intersect one another. In order to preclude the RSAs of Runway 4-22 and Runway 10-28 overlapping, Runway 10-28 will need to be shifted 75 feet toward the east.

Recommendation: An extension to both runways should be considered during the planning period. Due to the small impact of the runway gradient on future runway length requirements, the inclusion of 22 additional feet beyond the lengths identified in the runway curves was not included. The length of Runway 4-22 meets requirements under existing and future conditions at 60 percent useful load; however, it should be extended up to 1,500 feet to a total length of up to 7,000 feet to accommodate the existing and future critical design aircraft at 90 percent useful load, but only when the regular use demand is met. The ultimate critical design aircraft, at 75 percent useful load, would remain capped at 5,500 feet, but at 90 percent useful load will also benefit from the additional length in circumstances when greater than 75 percent useful load is attained.

The Alternatives will review the feasibility of providing this length based on existing geographic constraints at the Airport and will determine if a 7,000-foot runway could be considered, or what maximum length could be considered. A review of the displaced thresholds on each end is also recommended to identify improvements, if necessary, to enable the removal of the displacements. The recommended runway length for Runway 10-28 under existing and future conditions is 3,200 feet and should be shifted east 75 feet and extended 91 feet for a total length of 3,200 feet.

Figure 5-2: Runway 10-28 Length Calculations

7/1/2005 AC 150/5325-4B

Figure 2-1. Small Airplanes with Fewer than 10 Passenger Seats
(Excludes Pilot and Co-pilot)

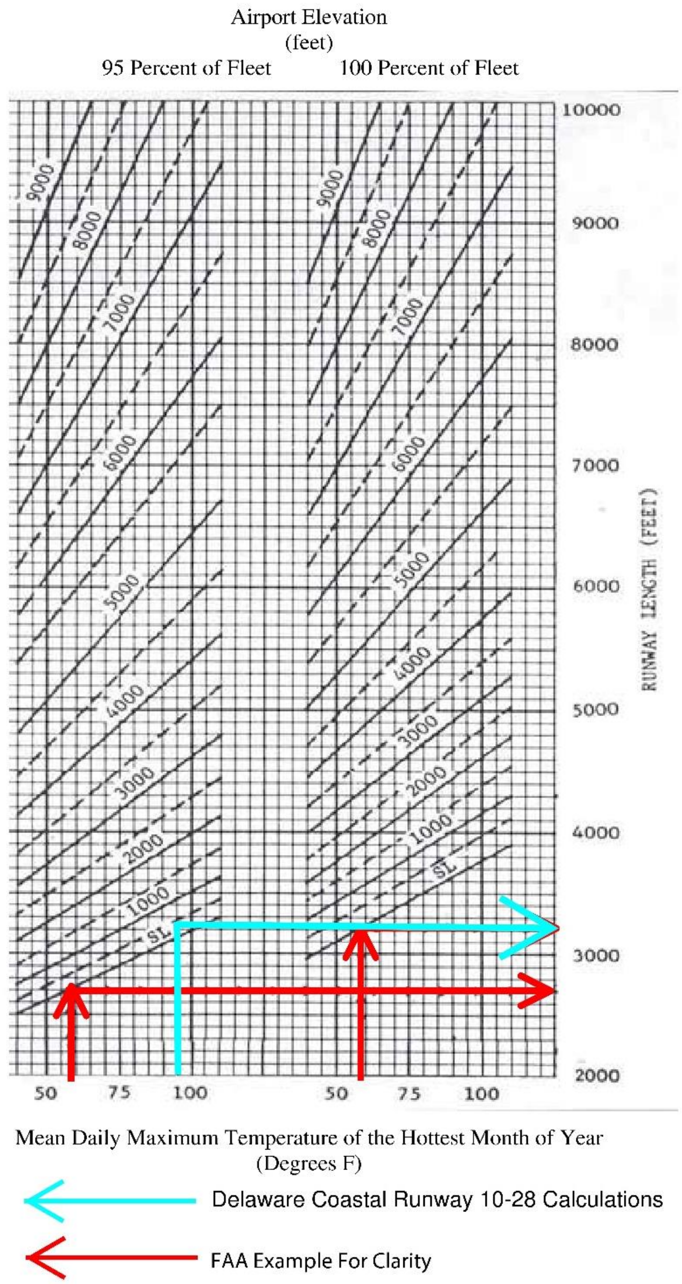
Example:

Temperature (mean day max hot month): 59° F (15° C)
Airport Elevation: Mean Sea Level

Note: Dashed lines shown in the table are mid values of adjacent solid lines.

Recommended Runway Length:

For 95% = 2,700 feet (823 m)
For 100% = 3,200 feet (975 m)



Source: FAA AC 150-5325-4B, 2005.

5.2.3. 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 the 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 FAA AC 150/5320-6F, *Airport Pavement Design and Evaluation*.

Pavement 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 several "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 for Runway 4-22 is rated for 50,000 pounds single-wheel and 175,000 pounds dual-wheel according to the Airport's FAA 5010-1 Form, *Airport Master Record*. The Runway 4-22 existing critical design aircraft is the Cessna Citation Excel, which has an MTOW of 20,330 pounds. The ultimate critical design aircraft is a composite of the Bombardier Challenger 600 and the Gulfstream G-IV with MTOWs of 41,250 and 73,200 pounds. Runway 4-22 is also regularly used by the Boeing 737-700, which has a typical operating weight of around 154,500 pounds. An operating weight is used for the Boeing 737-700 because the aircraft operate at GED for maintenance and repair services at ALOFT AeroArchitects, and do not typically carry passengers and cargo.

The current pavement for Runway 10-28 is rated 50,000 pounds single-wheel and 91,000 pounds dual-wheel according to the Airport's FAA 5010-1 Form, *Airport Master Record*.

Appendix B of this report includes a study detailing the Pavement Condition Index (PCI) of each runway, taxiway, and apron at the Airport. The PCI is a scale between 0 and 100 and is used to indicate the general condition of a section of pavement, regardless of material. The PCI scale indicates that pavement with a PCI of 70-100 should receive preventative maintenance, PCIs of 55-69 should receive major rehabilitation, and PCIs of 0-54 should be reconstructed. The study found that Runway 4-22 has a PCI between 80 and 88, and Runway 10-28 has a PCI between 86 and 87, both indicative of good condition and will likely maintain this condition within the planning period if preventative maintenance measures are taken.

Recommendation: No additional pavement strengthening is needed. The Airport should regularly monitor pavement conditions, perform preventative maintenance, as required, and plan for runway rehabilitations as necessary throughout the planning period.

5.2.4. 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 the 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 for categories of aircraft using the airport.

Wind data for the Airport was obtained from NOAA's National Centers for Environmental Information (NCEI) database. The wind data was collected for 10 years from 2008 through 2018 at the Airport and was compiled into all-weather, VFR, and IFR wind roses presented in **Figure 2-4, Figure 2-5, and Figure 2-6** of Chapter 2 – *Inventory*, 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 are shown in Error! Reference source not found.. 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 5-5: 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 4-22	93.16%	96.20%	98.86%	92.54%	95.90%	98.47%
Runway 4	55.02%	55.95%	56.61%	69.59%	70.83%	71.60%
Runway 22	60.23%	61.66%	62.87%	44.93%	45.80%	46.55%
Runway 10-28	89.97%	94.34%	98.02%	87.46%	92.55%	96.93%
Runway 10	54.45%	56.56%	58.26%	63.60%	66.86%	69.10%
Runway 28	57.22%	59.12%	60.80%	44.21%	45.41%	46.51%
Both	96.93%	98.63%	99.77%	97.24%	98.77%	99.72%

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

[2] IFR Weather Conditions: ceiling less than 1,000 feet and below three statute miles but greater than or equal to 500 feet and one statute mile

Source: NOAA – GED 2010-2020.

According to the runway wind analysis, the current runway alignment at the Airport provides the recommended 95 percent coverage. The existing and future AAC-ADG of B-II coverage for Primary Runway 4-22 is shown by the 13-knot crosswind coverage. The 13-knot crosswind coverage allows operations in all weather conditions 96.20 percent of the time on Primary Runway 4-22, and 98.63 percent of the time when both runways are considered.

The ultimate AAC-ADG of C-II coverage is shown by the 16-knot coverage percentages as larger aircraft can withstand the stronger crosswinds. The 16-knot crosswind coverage allows operations during all weather conditions on Primary Runway 4-22 98.86 percent of the time and 99.77 percent of the time when both runways are considered. The coverages are slightly reduced during IFR conditions but still exceed the 95 percent threshold.

Of note, however, is the wind coverage on Primary Runway 4-22 for the smallest aircraft with an RDC of A/B-I. In all-weather conditions, wind coverage at 10.5 knots is provided by Runway 4-22 93.16 percent of the time, which decreases to 92.54 percent during IFR conditions. In both instances, these coverages do not meet the standard of 95 percent. As a result, a crosswind runway to adhere to RDC A/B-I standards is justified.

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

5.1.1. Runway Width

Runway 4-22 is 150 feet wide, which exceeds standards for both a B-II (existing) and C-II (future) runway. The standard width of a B-II runway is 75 feet, while the standard width for a C-II runway is 100 feet.

Runway 10-28 is 75 feet wide, which exceeds the standards for a B-I runway. The standard width of a B-I runway is 60 feet.

Recommendation: No changes are recommended to the width of Runway 4-22 or Runway 10-28. If the Airport requires additional runway width beyond what is AIP eligible, alternate funding sources may be required.

5.2.5. 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. The RSA consists 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 firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

The FAA design standards for RSAs surrounding runways serving B-II (Runway 4-22) aircraft with visibility minimums not lower than ¾ mile (as is the existing condition at GED) is a width of 150 feet and a length that extends 300 feet beyond each runway end. In the ultimate scenario, the standards for C-II aircraft, with visibility minimums not lower than ¾ mile, 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. The existing and future RSA standards for runways serving B-I aircraft (Runway 10-28) include a width of 120 feet and 240 feet beyond the departure end and prior to the threshold. Existing RSA standards for Runway 10-28 are being met. If and when Runway 4-22 exceeds regular use by C-II aircraft, and the runway is shifted as recommended, the future RSA standards for Runway 10-28 will also be met.

Error! Reference source not found. shows the existing and ultimate safety areas. A common issue with RSAs is the terrain does not meet FAA grading standards. In reviewing the existing RSAs at

GED, two areas are slightly above (approximately two feet) FAA standards. These two areas are at the edge of the RSA where the existing and former taxiways connect to the runway ends.

Under the ultimate condition for Runway 4-22, a 1,000-foot safety area is not available beyond the runway end for aircraft departing from Runway 22 between the Runway 4 end and Park Avenue. There are similar constraints for aircraft departing from Runway 22, where a 1,000-foot safety area is not available due to the presence of a stream. There are also some areas of the future RSA that do not meet FAA grading criteria, particularly near both Runway 4-22 thresholds, and along the edges of Runway 4-22 where ponding occurs. The alternatives analysis will assess options to provide standard safety areas off both runway ends in the future when the RDC is upgraded to C-II.

In addition, with the ultimate RSA for Runway 4-22 widening to 500 feet from 150 feet, there will be overlap with the RSA beyond the end of Runway 10. The alternatives analysis should review options towards adherence to the design recommendation to avoid overlapping RSAs for runways that do not intersect.

Recommendation: RSA grading issues should be corrected with the next runway rehabilitation or reconstruction. The alternatives analysis will review options to provide standard RSAs under existing, future, and ultimate (C-II) conditions, including the provision of a standard RSA beyond the departure end for both Runway 4 and Runway 22, as well as a standard RSA prior to the threshold for Runway 4, and FAA standard grading. The alternatives will also review opportunities to eliminate the RSA overlap off the sides of Runway 4-22 and the approach end of Runway 10.

5.2.6. Runway Object Free Areas

In addition to the RSA, a runway object free area (ROFA) is also defined around runways 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.

FAA design standards for ROFAs surrounding runways with an RDC of B-II (Runway 4-22), with visibility minimums not lower than ¾ mile, have a width of 500 feet and a length that extends 300 feet prior to the landing threshold and beyond the runway end. In the ultimate scenario, the standards for C-II aircraft, with visibility minimums of not lower than ¾ mile, is 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 with an RDC of B-I (Runway 10-28) with visibility minimums not lower than ¾ mile have a width of 400 feet and extend 240 feet beyond the runway end and prior to the threshold.

A common issue with visual approach aids such as precision approach path indicators (PAPIs) and visual approach slope indicators (VASIs) is that FAA standards require the electrical control equipment to be outside of the ROFA. As can be seen in **Figure 5-4** and **Figure 5-5**, all four electrical control boxes for Runway 4-22 and Runway 10-28 are below ground. Also, the northern corner of the Runway 4-22 ROFA extends beyond the railroad tracks.

Like the RSA, there are areas of concern under the future condition that will require further

Figure 5-3: GED Safety Areas

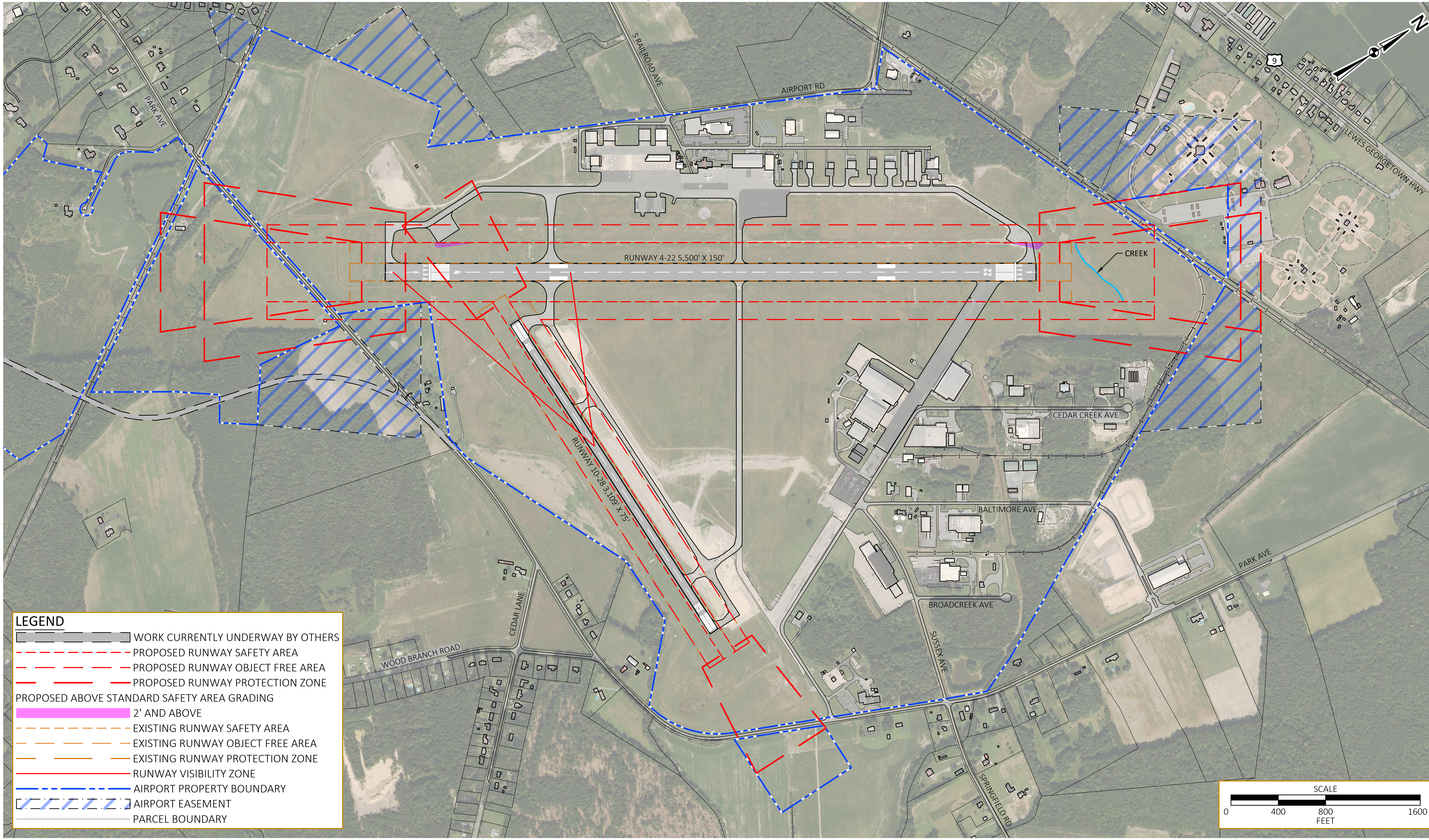


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Figure 5-4: Runway 4-22 PAPIs

Runway 4 **Runway 22**

Source: Delaware Coastal Airport, 2022.

Figure 5-5: Runway 10-28 PAPIs

Runway 28 **Runway 10**

Source: Delaware Coastal Airport, 2023.

analysis in the development of airside alternatives. These concerns are like those identified for RSAs, including an overlap of the ROFA on Park Avenue for aircraft departing Runway 22 and the rail lines for aircraft departing Runway 4. While the creek will not impact the ROFA, there are several areas of vegetation in the vicinity of the creek, north of the Taxiway A approach to Runway

22, that will need to be addressed. In addition, as the ROFA is wider than the RSA, it will extend further into the Sports at the Beach complex, on property owned by Sussex County but leased to the adjacent complex, including portions of one of the baseball fields and a circulation road with adjacent vegetation. The alternatives analysis will assess options to provide standard object free areas off both runway ends in the future when the RDC is upgraded to C-II.

Recommendation: Under ultimate conditions, Runway 4-22 should be relocated so the railroad tracks on the north end are no longer in the ROFA. The alternatives analysis will review options to provide standard ROFAs when the AAC-ADG is upgraded to C-II, including the provision of a standard ROFA beyond the departure end for both Runway 4 and Runway 22.

5.2.7. Runway Protection Zones

RPZs are large trapezoidal areas on the ground of 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: GED Safety Areas 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, future, and ultimate dimensions of the RPZ are shown in **Table 5-6**.

Table 5-6: Existing, Future, and Ultimate RPZ Dimensions Per Runway End

Runway	Minimums	Length	Inner Width	Outer Width	Acreage
Runway 4	¾ SM	1,700 ft	1,000 ft	1,510 ft	48.978
Runway 22	⅞ SM	1,700 ft	1,000 ft	1,510 ft	48.978
Runway 10	Visual	1,000 ft	500 ft	700 ft	13.770
Runway 28	Visual	1,000 ft	500 ft	700 ft	13.770

Source: FAA AC 150/5300-13A.

Should the approach minimums change for any of the runway ends, the future dimensions of the RPZ could increase as a result. Visibility minimums of less than ¾ mile on Runway 4-22 will increase the length of the RPZ to 2,500 feet and the outer width to 1,750 feet.

Portions of the RPZs for Runway 4-22 are outside of Airport-owned property, per the Airport's current Exhibit "A" Property map, however, all property within the RPZs are within land owned or under avigation easement by the Sponsor, Sussex County, or the State of Delaware. Land uses within the RPZ include a public road (Park Avenue) (at the time of the writing of this document, the road is being rerouted outside of the RPZ) on the approach ends of Runway 4 and Runway 28, and a rail line (owned by the State of Delaware) as well as a parking lot and a portion of a baseball field within the RPZ on the approach end of Runway 22. These land uses are all considered non-compatible within an RPZ as defined in FAA AC 150/5300-13A. According to 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 the geometry of the runway or a roadway occurs. However, the State of Delaware is in the process of implementing a relocation of Park Avenue to a new routing substantially outside of the Runway 4 RPZ by 2025.

Recommendation: The alternatives analysis will consider options to mitigate non-standard RPZ conditions on both Runway 4 and Runway 22. As the Sponsor already has land use control over much of the RPZs (and in remaining areas the control is maintained by the State of Delaware), options to be reviewed are anticipated to include the relocation of non-standard development or no action. Additionally, as defined in AC 150/5300-13A, alternatives that identify an extension to Runway 4-22 will assess the ongoing relocation of Park Avenue and any future modifications to the road alignment that may be required. Any alternatives or subsequent facility requirements that recommend improvements that will reduce visibility minimums to any runway end should consider subsequent impacts on the dimensions of RPZ.

5.2.8. Instrument Approach Procedures

Both ends of Runway 4-22 have instrument approach procedures (IAPs) utilizing area navigation (RNAV) through the Global Positioning System (GPS) and Very High-Frequency Omni-Directional Range (VOR) approaches. There are no instrument approaches available for Runway 10-28. At the current length of 3,109 feet, the current runway is 91 feet too short to qualify for the implementation of a vertically guided approach to Runway 10-28 but does qualify for horizontally guided approaches.

The most stringent minima are provided through the localizer performance with vertical guidance (LPV) category on the Runway 4 RNAV (GPS) approach, with a decision altitude (DA) of 300 feet above ground level (AGL) in ¾ statute mile visibility for all categories of aircraft. With the present approach lighting system on Runway 4, the visibility minimums are presently at their lowest limit.

Recommendation: If the length of Runway 10-28 is increased to 3,200 feet, the Airport should pursue an instrument approach with vertical guidance to either end of Runway 10-28. There are no recommendations for the instrument approaches for Runway 4-22.

5.2.9. 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 ADG and Taxiway Design Group (TDG) for each taxiway. 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 as they apply to the Airport are shown in **Table 5-7** and **Table 5-8**.

Existing taxiways were analyzed and were found to have no obstacles within the TSA or TOFA. Existing taxiways have a TDG of 1B, Future taxiways will be designed to ensure the TSAs and TOFAs are clear of obstacles to FAA standards and designed to accommodate aircraft with a TDG of 2A.

As taxiways are constructed or rehabilitated, design should carefully consider the updated guidance for taxiway design as published in FAA AC 150/5300-13A. The requirements include the design of taxiways for cockpit over centerline taxiing as opposed to judgmental oversteering. This change particularly affects 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.

Table 5-7: Taxiway Requirements – Airplane Design Group

Design Standard	ADG I	ADG II	ADG III
Taxiway Safety Area (TSA)	49 ft.	79 ft.	118 ft.
Taxiway Object Free Area (TOFA)	89 ft.	131 ft.	186 ft.
Runway/Taxiway Separation	150 – 200 ft.*	240 – 400 ft.*	400 ft.

** Runway/Taxiway Separation varies based on approach visibility minimums.*

Source: FAA AC 150/5300-13A.

Table 5-8: Taxiway Requirements – Taxiway Design Group

Design Standard	TDG 1A	TDG 1B	TDG 2	TDG 3
Taxiway Width	25 ft.	25 ft.	35 ft.	50 ft.
Taxiway Shoulder Width	10 ft.	10 ft.	15 ft.	20 ft.

Source: FAA AC 150/5300-13A.

The ultimate critical aircraft for Runway 4-22 and taxiways utilized by aircraft accessing Runway 4-22 is represented by the Bombardier Challenger 600 and the Gulfstream IV, which are a TDG 2. While Runway 4-22 does experience occasional use by the Boeing 737-700, which is categorized as TDG 3, the level of use is not of the magnitude that it will qualify to serve as the critical design aircraft for taxiway design. Through conversations with ALOFT, it was identified that the current practice of back-taxiing on the runway, while not ideal, was sufficient for their level of use of the Airport. The critical aircraft for Runway 10-28 and taxiways utilized by aircraft accessing Runway 10-28 is the Embraer Phenom 100, which is a TDG 1B.

FAA AC 150/5300-13A provides additional criteria regarding the geometry of taxiways. The following geometry criteria are relevant to GED:

- **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 (Taxiway A and Runway 22 / Taxiway C and Runway 10).
- **Avoid "High Energy" Intersections:** These runway crossings are located in the middle third of runways. This portion is where the pilot can least maneuver to avoid a collision (Taxiway B and Runway 4-22).
- **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 (Taxiway A and Runway 22 / Taxiways C/D and Runway 10).

- **Direct Access:** Taxiways leading directly from an apron to a runway without requiring a turn can cause confusion when a pilot typically expects to encounter a parallel taxiway but instead accidentally enters a runway (Taxiway B and Runway 4-22).

A figure depicting the layout of the taxiway network at GED was provided in **Figure 2-7**. A description of each taxiway segment is provided below:

Taxiway A

Taxiway A is a parallel taxiway and provides access to both ends of Runway 4-22 from the general aviation apron and hangar taxilanes. Taxiway A has a width of 50 feet across its entire length and meets TDG-3 standards. Where the majority of the taxiway is parallel to the runway, the Runway 4-22 centerline to Taxiway A centerline distance is approximately 700 feet, which well exceeds the standard separation distance of 240 feet for RDC B-II aircraft and 300 feet for RDC C-II according to FAA AC 150/5300-13A, *Airport Design*. The parallel separation distance drops to approximately 400 feet near the Runway 4 end.

As the taxiway traverses the general aviation apron, this brings additional traffic to the parking areas of the airport which become congested during peak periods, and due to taxiway design criteria can reduce space available to park aircraft. The alternatives should consider options to provide a parallel taxiway or at a minimum a partial parallel taxiway in the vicinity of the general aviation parking aprons, with a standard runway-taxiway centerline separation to remove congestion from the general aviation areas and improve the flow of traffic for aircraft not accessing or departing these areas. Finally, where Taxiway A meets Runway 22, there is additional, unnecessary pavement, likely to meet out of date taxiway fillet standards.

Taxiway B

Taxiway B is a cross-field taxiway and provides access to Taxiway D and the Runway 28 end of Runway 10-28 from the fixed-base operations (FBO) ramp. Taxiway B has a width of 50 feet across its entire length and meets TDG-3 standards. Taxiway B provides direct access from the apron, as well as crossing the primary runway in the middle third, both of which are considered non-standard geometries.

Taxiway C

Taxiway C connects the approach end of Runway 10 to Taxiway D. The taxiway maintains an irregular angle as it connects to Taxiway D near the intersection of Taxiway D and Runway 4-22. Taxiway C has a width of 100 feet at its most narrow point and exceeds TDG-3 standards, particularly where it meets Runway 4-22.

Taxiway D

Taxiway D is a parallel taxiway for Runway 10-28 at a separation distance of 240 feet. It provides access to Runway 10-28 from Runway 4-22 at a right angle and on the opposite side of the runway from Taxiway H. Taxiway D has a width of 50 feet from Runway 4-22 to Taxiway C, and 35 feet from Taxiway C to Taxiway D3 at the Runway 28 approach end. Taxiway D meets TDG-2 standards.

Taxiway D1 through D3

Taxiways D1, D2, and D3 provide access to Runway 10-28 from Taxiway D. Each taxiway measures 35 feet in width. Taxiway D2 directly connects to Taxiway B. Each taxiway meets TDG-2 standards.

Taxiway H

Taxiway H connects Taxiway A at a perpendicular angle with Runway 4-22 approximately 1,000 feet from the Runway 4 threshold. The taxiway is directly across from Taxiway D, which commences on the south side of Runway 4-22. Taxiway H has a width of 50 feet and meets TDG-3 standards.

Taxiway M

Taxiway M is a former runway that provides access to the Runway 22 end of Runway 4-22 from the ALOFT ramp. Taxiway M has a width of 150 feet across its entire length and exceeds TDG-3 standards. While Taxiway M is considered an angled taxiway, the acute angle requires a less than 90-degree turn for aircraft arriving on Runway 4, requiring a slower speed. Due to the location, it is not feasible for an aircraft that had just landed on Runway 22 to exit onto Taxiway M. Taxiway M is not directly accessible from any other taxiways on the Airport. As a result, aircraft landing on Runway 4 would taxi on the runway to Taxiway M and exit. Aircraft landing on Runway 22 will typically turn around on the runway and will back taxi to Taxiway M.

Recommendation: It is recommended that the Airport consider the construction of a standard separation parallel taxiway or partial parallel taxiway in the vicinity of the general aviation apron areas. The alternatives should also consider and identify options to mitigate non-standard taxiway design considerations (i.e., direct access, angled taxiway/runway intersections). The Airport should issue a remark in the Chart Supplement that large aircraft typically back taxi on Runway 4-22.

5.2.10. Airfield Pavement Markings

Runway 4-22 has non-precision instrument approach runway markings noted to be in good condition according to the most recent airfield inspection. All taxiway hold positions for Runway 4-22 are located 250 feet from the runway centerline, which exceeds the standard of 200 feet under existing (B-II) conditions but meets standards under ultimate (C-II) conditions.

Runway 10-28 has visual markings also noted to be in good condition. If instrument approaches are added, the markings will need to be updated to non-precision instrument markings. Taxiway hold positions for Runway 10-28 are all 200 feet from the runway centerline, which meets the current and future (B-I) standards.

Recommendation: There are no recommendations with respect to airfield pavement markings, however Runway 10-28 will require non-precision instrument markings if instrument approaches are added to the runway.

5.2.11. Airfield Lighting and Signage

Approach Lighting

The existing approach to Runway 4 is equipped with a 1,400-foot medium-intensity approach lighting system (MALS). Since Runway 4 has visibility minimums of ¾ statute mile, approach lighting systems are recommended and not required, however the MALS system is acceptable and meets existing needs at the Airport. There are no approach lighting systems for Runway 22 or Runway 10-28.

Recommendation: There are no recommendations for approach lighting under existing conditions. If the approach end of Runway 4 is extended, as recommended in the Alternatives chapter, the MALS will need to be relocated.

Runway and Taxiway Lighting

Runway 4-22 and Runway 10-28 are equipped with medium-intensity runway edge lights (MIRLs) which meet the requirement for visual runways, as well as precision and non-precision approach runways with visibility minimums greater than or equal to ¾ statute mile. All taxiways, except for Taxiway M, are equipped with medium-intensity taxiway lights (MITL), which meet standard lighting requirements for airports where runway lighting systems are installed.

Recommendation: Although Taxiway M is dedicated to aircraft using the ALOFT ramp, it is recommended that MITL be installed on this taxiway. Any development associated with TWY M will need to be reviewed regarding what portions would be eligible due to exclusive use.

Airfield Signage

Airport management reported the airfield signs are all up to standard and are in working order.

Recommendation: There are no recommendations with respect to airfield signage.

5.2.12. Visual Approach Aids

Runway 4-22 and Runway 10-28 are equipped with runway end identifier lights (REILs) to support visual approaches.

Each end of Runway 4-22 is equipped with a 4-light PAPI system on the left side with a standard three-degree glide path angle. Each end of Runway 10-28 is equipped with a 2-light PAPI system on the left side. The PAPI at the Runway 28 end has a standard three-degree glide path angle, while the PAPI at the Runway 10 end has a 3.50° glide path angle.

Recommendation: No changes to visual approach aids at the Airport are recommended.

5.2.13. Obstruction Clearance

To protect the safety of aircraft operations, the FAA defines and regulates the airspace surrounding airports utilizing numerous metrics including 14 CFR Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*, and Table 3-2 of FAA AC 150/5300-13A, known as the

Approach/Departure Standards Table. The airspace is defined and delineated by a set of geometric surfaces referred to as "imaginary surfaces" that extend outward and upward from airport runways. An object that protrudes through an imaginary surface is an obstruction. Obstructions may be hazards, and an FAA analysis may result in a recommendation to remove, light, and/or mark the object. The height and dimension of the imaginary surfaces are determined by the runway end and airfield elevation, aircraft size, and runway approach capabilities.

When an object penetrates an imaginary surface, it is considered an obstruction to air navigation. Obstructions can include man-made objects (buildings, towers, vehicles), objects of natural growth (trees), and terrain. Not all obstructions are hazards, although they are generally presumed to be hazards in the absence of further FAA study. The determination of obstruction hazard status is made by the FAA as a result of an aeronautical study conducted in accordance with CFR Part 77 procedures. Existing and proposed imaginary surfaces at GED are discussed below.

CFR Part 77 Primary Surface

A surface longitudinally centered on the runway. When the runway has a paved surface, the primary surface extends 200 feet beyond each runway end. The width of the primary surface depends upon the type of approach provided to the runway, the aircraft using the approach, and the associated visibility minimums. The elevation of any point of the primary surface is the same as the nearest point on the runway centerline.

The width of the existing and future primary surface for Runway 4-22 is 1,000 feet centered on the centerline, based upon the established approach with a visibility minimum of ¾ statute mile (SM) or less. There were found to be 21 obstacles to the Runway 4-22 Part 77 primary surface.

The width of the existing primary surface for Runway 10-28 is 500 feet centered on the centerline, based upon a visual approach to a runway designated as "other than utility". With the future implementation of an approach procedure to Runway 10-28, it is anticipated that the visibility minimums will remain above ¾ SM, and the width of the primary surface will remain unchanged. There were found to be three obstacles to the Runway 10-28 Part 77 primary surface.

CFR Part 77 Horizontal Surface

This surface is a horizontal plane 150 feet above the highest point on the runway surface. The elevation of the horizontal surface at the Airport is 203.4 feet mean sea level (MSL). The existing and future edges of this surface are defined by 10,000-foot radial arcs centered on each end of Runway 4-22 and Runway 10-28. There were found to be four obstacles to the Part 77 horizontal surface.

CFR Part 77 Conical Surface

This surface extends outward and upward from the perimeter of the horizontal surface at a slope of 20:1 for a horizontal distance of 4,000 feet. There was found to be one obstacle to the Part 77 conical surface.

CFR Part 77 Approach Surface

An approach surface is an inclined plane longitudinally centered on the extended runway centerline, extending outward and upward from the primary surface. The dimensions and slope of these surfaces are based on the category of approach (visual, non-precision, or precision), the visibility minimums of the published approach, and the type of aircraft that will use the approach.

The approach surfaces for Runways 4 and 22 start 200 feet from the end of the usable pavement where they are 1,000 feet wide to match the primary surface. For a non-precision instrument runway end with ¾ SM visibility, including Runway 4, they extend outward and upward from the end of the primary surface for 10,000 feet at a slope of 34 to 1 to an outer width of 4,000 feet. For a non-precision instrument runway end with greater than ¾ SM visibility, including Runway 22, the surface extends outward and upward from the end of the primary surface for 10,000 feet at a slope of 34 to 1 to an outer width of 3,500 feet. There were found to be 737 obstacles to the Runway 4 Part 77 approach surface, and 47 obstacles to the Runway 22 Part 77 approach surface.

The approach surfaces for Runways 10 and 28 also start 200 feet from the end of the usable pavement where they meet the primary surface. They have an inner width of 500 feet to correspond with the end of the primary surface. Under existing conditions with visual approaches to each end, the approach surface extends uniformly a distance of 5,000 feet at a slope of 20 to 1 to an outer width of 1,500 feet. With the future implementation of a straight-in approach procedure to either (or both) of the runway ends, assuming visibility minimums greater than ¾ SM, the approach surface will extend uniformly for 10,000 feet at a slope of 34 to 1 to an outer width of 3,500 feet. There were no obstacles found to either of the Runway 10-28 Part 77 approach surfaces.

CFR Part 77 Transitional Surface

A surface extending outward and upward at right angles to the runway centerline from the sides of the primary and approach surfaces at a slope of 7 to 1. The transitional surfaces terminate at the overlying horizontal surface. There were found to be 176 obstacles to the Runway 4-22 Part 77 transitional surface, and 33 obstacles to the Runway 10-28 Part 77 transitional surface.

Approach/Departure Standards Surfaces

The approach/departure standards surfaces (ADSS) are inclined planes longitudinally centered on the extended runway centerline. ADSS are designed to protect the use of the runway in both visual and instrument meteorological conditions at the Airport. The dimensions and slope of each ADSS depend on the visibility minimums and type of procedure associated with each runway end and are taken from FAA Engineering Brief 99A, *Changes to Airport Design Tables 3-2 and 3-4*. Unlike the CFR Part 77 approach surfaces, these surfaces will consider the presence of a displaced threshold. Where a displaced threshold is present, such as the existing condition on Runway 4 and Runway 22, the starting position of the surface will commence based on the location of the displaced threshold and not the physical end of the runway.

Approach/Departure Standards Surface #2 – Existing Runway 10-28

ADSS #2 is utilized for the approach ends of runways expected to serve small airplanes with approach speeds of 50 knots or more (visual runways only, day/night). This applies to both ends of Runway 10-28 under existing conditions. This surface starts at the approach threshold with an inner width of 250 feet centered on the runway centerline. The surface extends out uniformly for 2,250 feet at a slope of 20 to 1 to an outer width of 700 feet, before extending an additional 2,750 feet at a width of 700 feet. The ADSS #2 for both ends of Runway 10-28 were found to be clear of obstacles.

Approach/Departure Standards Surface #4 – Existing and Future Runway 4-22 and Future Runway 10-28

ADSS #4 is utilized for the approach ends of runways with instrument approaches having visibility greater than or equal to ¾ SM. This applies to both ends of Runway 4-22 and will apply to either or both ends of Runway 10-28 if an approach procedure is implemented. If penetrations to this surface are present, visibility minimums are limited to one mile, and utilization of the procedures at night is not permitted. If the obstacle is lighted, utilization of the approach at night can be permitted. This surface starts 200 feet from the approach threshold with an inner width of 400 feet centered on the runway centerline. The surface extends out uniformly for 10,000 feet at a slope of 20 to 1 to an outer width of 3,400 feet. The ADSS #4 for both ends of Runway 4-22 were found to be clear of obstacles.

Approach/Departure Standards Surface #6 – Existing and Future Runway 4-22 and Future Runway 10-28

ADSS #6 is utilized for the approach ends of runways expected to accommodate instrument approaches with vertical guidance. This applies to both ends of Runway 4-22 under existing conditions and would apply to Runway 10-28 if an extension is constructed to 3,200 feet and vertically guided approaches are feasible. This surface starts at the approach threshold with an inner width of the runway plus 200 feet (350 feet). The surface extends out uniformly for 10,000 feet at a slope of 20 to 1 to an outer width of 1,520 feet. The ADSS #6 for both ends of Runway 4-22 was found to be clear of obstacles. There were found to be two obstacles to the proposed Runway 10 ADSS #6, and four obstacles to the proposed Runway 28 ADSS #6, all trees.

Approach/Departure Standards Surface #7 – Runway 22

ADSS #7 is also commonly referred to as the Departure Surface. ADSS #7 is utilized for the departure ends of runways with published takeoff minimums or departure procedures. This applies to Runway 22 at GED. The surface starts at the departure threshold with an inner width of 150 feet centered on the runway centerline. The surface extends out uniformly for 12,152 feet at a slope of 40:1 to an outer width of 7,512 feet. This center portion of the departure surface is known as the Obstacle Clearance Surface (OCS). Coupled with the OCS are wings on both sides that slope upward and outward from the OCS.

The Runway 22 instrument departure procedure has non-standard takeoff minimums of 1¼ statute mile visibility with a normal 200-foot per nautical mile climb gradient. Standard minimums may apply if the climb gradient increased to 201 feet per nautical mile or with a normal climb gradient if takeoff occurs 1,100 feet prior to the departure end of the runway (DER). The ADSS #7 for Runway 4 was found to have 1,285 obstacles, and the ADSS #7 for Runway 22 was found to have 178 obstacles.

Recommendation: Where possible, it is recommended that obstructions be removed or lighted. Additional analysis will occur as part of the Airport Layout Plan set development, where existing and future conditions will be analyzed, and obstruction removal recommendations will be provided.

5.2.14. Airfield Facility Requirements Summary

A summary of the key requirements identified can be found in **Table 5-9**.

Table 5-9: Summary of Airside Facility Requirements

Item/ Facility	Existing Facility or Capacity	Ultimate Requirement	Recommendation
Runway Length	RWY 4-22: 5,500′ RWY 10-28: 3,109′	RWY 4-22: 7,000′ RWY 10-28: 3,200′	RWY 4-22: Extend 1,500′ RWY 10-28: Extend 91′
Runway Width	RWY 4-22: 150′ RWY 10-28: 75′	RWY 4-22: 100′ RWY 10-28: 75′	None, however additional runway width would require alternate funding sources.
Runway Safety Areas	RWY 4-22 Length: 300′ RWY 4-22 Width: 150′ RWY 10-28 Length: 240′ RWY 10-28 Width: 120′	RWY 4-22 Length: 1,000′ RWY 4-22 Width: 500′ RWY 10-28 Length: 240′ RWY 10-28 Width: 120′	RWY 4-22 Length: Extend 700′ RWY 4-22 Width: Extend 350′ RWY 10-28: Review RSA Overlap with Runway 4-22
Runway Object Free Area	RWY 4-22 Length: 300′ RWY 4-22 Width: 500′ RWY 10-28 Length: 240′ RWY 10-28 Width: 400′	RWY 4-22 Length: 1,000′ RWY 4-22 Width: 800′ RWY 10-28 Length: 240′ RWY 10-28 Width: 400′	RWY 4-22 Length: Extend 700′ RWY 4-22 Width: Extend 300′ RWY 10-28: None
IAPs	RWY 4-22: RNAV (GPS), VOR Runway 10-28: None	RWY 4-22: RNAV (GPS), VOR Runway 10-28: RNAV (GPS)	Instrument approach for Runway 10-28
Taxiways	Non-standard conditions	Meet FAA standards / Full or partial length parallel for Runway 4-22	Correct geometry issues / Full or partial-length parallel taxiway
Airfield Lighting and Signage	All runways: MIRL All taxiways: MITL	All runways: MIRL All taxiways: MITL	Install taxiway lighting along Taxiway M
Approach Lighting	Runway 4: MALS, REIL Runways 22, 10, 28: REIL	Same	None

Source: FAA Form 5010-1; McFarland Johnson analysis, 2021. Note: RWY is runway

5.3. LANDSIDE FACILITY REQUIREMENTS

GED is an important center for GA activity. GA facilities must be able to serve a wide range of aircraft, from small, privately-owned aircraft used for recreational travel, to small- and medium-sized corporate aircraft such as Gulfstream and Challenger business jets.

This section discusses the requirements for each of the landside GA elements, or those outside of the runways and taxiways. Requirements for landside facilities at the Airport were determined based on data collected during Chapter 2, *Inventory*, Chapter 4, *Aviation Forecasts*, as well as FAA standards. The following facilities were examined:

- Aircraft Hangars
- Aircraft Parking Aprons
- General Aviation Terminal/Administration Building
- Automobile Parking Demand

5.3.1. Aircraft Hangars

GA hangar requirements are calculated based on the size and quantity of aircraft based at an airport. While each aircraft will vary in size, the following area estimates were used to calculate the approximate hangar space requirements for aircraft based at GED:

- 1,200 square feet (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 an approximate based aircraft growth rate of 1.7 percent.

Table 5-10 shows the forecast based aircraft. The overall hangar requirements are displayed in **Table 5-11**, and **Table 5-12**. It is assumed that 30 percent of single-engine based aircraft will be stored in T-hangars, 40 percent in conventional hangars, and 30 percent on tie-downs. It is anticipated that 20 percent of multi-engine aircraft will park in T-hangars, 60 percent in conventional hangars, and 20 percent on tie-downs. Jets will all be based in conventional hangars and 50 percent of rotor aircraft will be in conventional hangars and 50 percent on tie-downs.

A total conventional hangar space of approximately 111,300 SF is available for aircraft storage. In addition to the conventional hangars, there are three T-hangar buildings located on Airport property with a total of 21 individual units and a total area of 23,230 SF. There is a stand-alone T-hangar, a T-hangar with nine (9) units, and a T-hangar with eleven (11) units. There are currently 51 individuals on a waiting list for T-hangars at the Airport. There are also three (3) conventional hangars dedicated to ALOFT AeroArchitects which were not counted in this analysis as this is a maintenance repair and overhaul (MRO) company, and aircraft are not stored in their hangars.

Recommendation: As can be seen in the tables below, there is a current need for 44 additional T-hangar units and a future need for 48 T-hangar units. The surplus of 67,140 SF of conventional hangar space should be used to meet the existing shortage, however as demand for larger aircraft increases, there will be a shortage of 48 individual hangars by 2038. It is recommended the Airport plan for an additional 48 T-hangars to meet future demand. Additionally, a building optimization effort should be considered as part of future airport development. Remodeling or replacing

Table 5-10: Forecast of Based Aircraft

Year	Single	Multi	Jet	Helicopter	Other	Total
2018	40	11	3	6	1	61
Forecast						
2023	42	12	4	7	1	66
2028	45	13	6	7	1	72
2038	51	15	10	8	1	85

Source: McFarland Johnson analysis, 2020.

Table 5-11: Forecast of Based Aircraft in Conventional Hangars

Year	Single	Multi	Jet	Helicopter	Other	Total
2018	16	7	3	3	1	30
Forecast						
2023	17	7	4	4	1	33
2028	18	8	6	4	1	37
2038	20	9	10	4	1	44

Source: McFarland Johnson analysis, 2020.

Table 5-12: Forecast of Based Aircraft in T-hangars

Year	Single	Multi	Jet	Helicopter	Other	Total
2018	12	3	0	0	0	14
Forecast						
2023	13	4	0	0	0	15
2028	14	4	0	0	0	17
2038	15	5	0	0	0	18

Source: McFarland Johnson analysis, 2020.

Table 5-13: Conventional Hangar Space Requirements

	2018	2023	2028	2038
Aircraft	30	33	37	44
Hangar Demand (SF)	44,160	50,400	59,600	76,400
Existing Facility (SF)	111,300	111,300	111,300	111,300
Surplus/(Deficit)	67,140	60,900	51,700	34,900

Source: McFarland Johnson analysis, 2020.

Table 5-14: Hangar Wait List Calculations

	2018	2023	2028	2038
T-hangars Occupied	14	15	17	18
Waiting List	51	51	51	51
Total	65	66	68	69
Available Units	21	21	21	21
Surplus/(Deficit)	(44)	(45)	(47)	(48)

Source: McFarland Johnson analysis, 2020.

hangars in poor condition, reconfiguring hangars to support large jets, and strategically placing tenants will enhance the Airport's use of existing facilities and improve the occupancy rate.

5.3.2. Aircraft Parking Aprons

Four components typically determine the required apron area for GA 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 the apron required to meet the forecasted level of general aviation activity at the Airport.

Based Aircraft Parking

Based aircraft apron parking requirements were developed in the *Aircraft Hangars* section because they are a factor in determining hangar requirements. The Airport has a total of 19 marked tie-down spaces available for based aircraft parking with additional open parking areas available for flexible use. Additional parking areas include hangars, the terminal apron, and the overnight apron.

Recommendations: Should additional tie-downs be needed, the Airport will construct them. Continued pavement maintenance is recommended throughout the planning period.

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 half of the operations are arrivals.
- Assume that approximately 75 percent of these aircraft will require transient parking space during 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 varied sizes.

Table 5-15 presents the results of these computations. Per the above methodology, approximately 3,600 square yards (SY), or 32,400 SF, of apron space will be required for transient aircraft parking through the end of the planning period.

Transient aircraft typically do not share apron parking areas with based aircraft on the terminal apron. However, the construction of a full-length parallel taxiway, away from the based aircraft parking area, will also reduce required taxiway safety and object free areas and will allow for additional flexibility in aircraft parking.

The total apron area for tie-down and other apron parking areas is approximately 7,000 SY. The sum of required based and transient aircraft parking positions is 31 in 2038, which can be accommodated on the current apron areas and therefore meets the planning period forecast.

Table 5-15: 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 (SY)
2018	23	12	9	7	2,800
2023	25	13	10	8	3,200
2028	27	14	11	8	3,200
2038	31	16	12	9	3,600

Source: McFarland Johnson analysis, 2020.

Recommendations: No additional apron is required for transient aircraft parking positions. Pavement rehabilitation may need to occur during the planning period. Areas in poor condition will likely need to be rehabilitated or reconstructed during the planning period.

Aircraft Fueling Apron

Planes are currently fueled by FBO-owned trucks which have adequate space for aircraft fueling.

Recommendations: There are no recommendations for additional pavement space for aircraft fueling.

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 are most closely associated with the provision of space in front of conventional hangars. For Tie-downs, small hangars, and T-hangars which serve mostly ADG I aircraft, the taxilane object free area (TLOFA) requirement is 79 feet wide. For larger aircraft in the ADG II group, the TLOFA requirement is 115 feet wide. Currently, the separations between buildings, tie-downs, and taxilanes are adequate.

Recommendations: There are no recommendations for additional staging and maneuvering areas.

5.3.3. General Aviation Terminal/Administration Building

The *Forecasts* chapter identifies a demand for 29 peak-hour operations to occur throughout the planning period, of which approximately 13 are forecast to be itinerant operations. Within Airport Cooperative Research Program's (ACRP) *Guidebook on General Aviation Facility Planning* (ACRP Report 113), it is recommended to assume 2.5 passengers per peak hour operation, and an average square footage per person of 100 to 150 SF per peak hour passenger is recommended. Therefore, 3,250 to 4,875 SF should be set aside for waiting areas, restrooms, pilot lounges, vending, and flight planning. The FBO at the Airport currently provides these facilities and is expected to do so throughout the planning period, however there are no Airport administrative spaces within the terminal building.

Recommendation: Within the planning period, 3,250 to 4,875 SF should be set aside for a GA terminal. This includes seating, telephones and computers, and other services that pilots may need for flight planning and for passengers to spend time. Of the 6,150 SF in the existing terminal, approximately 2,346 SF are available for these functions and are currently provided by the FBO on the airfield. While not within these dedicated areas, spaces within the existing restaurant can also be used for the functions typically provided by a GA Terminal. When adding the public restaurant spaces (approximately 1,900 SF), the existing facility requirement is met with 4,246 SF available. However, the future facility requirement is not met, and an expansion of the terminal should be considered in the development alternatives. Should the non-public restaurant spaces become available in the future, these spaces could be converted to public use to mitigate any future expansion requirements. Also, consideration should be given to the addition of office space for Airport administration functions.

5.3.4. Automobile Parking Demand

Automobile parking for general aviation users at GED consists of two parking lots for public use and multiple parking locations for private use at many of the Airport's leased hangars. The main parking lot is located directly adjacent to the general aviation terminal building and has 45 paved parking spaces, including four (4) handicap spaces. There is an additional public parking lot located across from Rudder Lane with 26 spots. Individual hangar units located off Rudder Lane also provide space for automobile parking, some with designated parking spots. There are approximately 100 parking spaces available for hangar users.

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 GA operation and automobile parking requirements for GA operations were determined as follows:

- Determine the number of peak hour operations from Chapter 4, *Aviation Forecasts*.
- Determine the number of peak hour pilots and passengers by multiplying the number of peak hour operations by 2.5.
- Multiply by a contingency factor of 1.10.

Additionally, adequate vehicle parking must be provided for the restaurant inside the terminal building. Per the zoning laws of the Town of Georgetown Delaware, eating establishments and bars or nightclubs must provide one (1) space for each 50 SF assigned for patron use, plus 1 space per 2 employees on the largest shift. Per the Airport manager, there is approximately 1,900 SF of patron restaurant space and 12 employees are working on the largest shift. As such, the Airport needs to provide 44 additional vehicle restaurant parking spaces.

Table 5-16 shows the GA automobile parking need for the planning period.

Recommendation: With 71 public parking spots and a future demand of 124 parking spots, additional space will be required. Chapter 6*, Alternatives Analysis* will explore options to provide adequate vehicle parking throughout the planning period.

Table 5-16: GA Automobile Parking Requirements

Year	Peak Hour Operations	Pilot and Passenger Parking Demand	Contingency	Restaurant Parking	Total GA Parking Demand
2018	21	53	5	44	102
2023	23	58	6	44	108
2028	25	63	6	44	113
2038	29	73	7	44	124

Source: McFarland-Johnson analysis, 2021.

5.4. SUPPORT FACILITY REQUIREMENTS

This section addresses the facility requirements associated with facilities that fulfill support functions at the Airport. These support functions include the following:

- Aircraft Rescue and Fire Fighting (ARFF)
- Airfield Maintenance Facility and Equipment
- Fuel Facilities
- Utilities

5.4.1. Aircraft Rescue and Fire Fighting (ARFF)

ARFF regulations do not pertain to Delaware Coastal Airport, as they are only required for airports with FAR (Federal Aviation Regulations) Part 139 certification. Fire protection for the Airport is provided by the Georgetown Fire Company Station 77, located approximately two miles from the Airport.

Recommendation: There are no recommendations for aircraft rescue and fire-fighting services at the Airport.

5.4.2. Airfield Maintenance Facility

The airfield maintenance equipment owned by GED is stored in or outside of a maintenance equipment storage facility that has direct access to the terminal apron. GED owns several maintenance equipment vehicles as described in Chapter 2, *Inventory*. It is important to note that the County has contract services with two local private companies that assist with snow removal in the case of heavy snowfall. The existing maintenance equipment building has adequate storage space for vehicles.

Recommendations: There is no recommendation for additional airfield maintenance facilities.

5.4.3. Fuel Facilities

The Airport's fuel facilities are detailed in Chapter 2, *Inventory*. The Airport's FBO, Georgetown Air Services, owns four (4) above-ground fuel storage tanks and four (4) trucks, ALOFT AeroArchitects owns one above-ground storage tank and one fuel truck, and the Airport owns two (2) above-ground storage tanks. The fuel facilities owned by ALOFT AeroArchitects are not representative of the fuel facility requirements of the Airport since they are owned privately and used solely for fueling operations in support of ALOFT AeroArchitects. Georgetown Air Services owns a 10,000-gallon Jet-A fuel tank, a 10,000-gallon 100LL Avgas tank, a 5,000-gallon Jet-A truck, a 2,000-gallon Jet-A truck, a 1,200-gallon 100LL truck, and a 5,000-gallon 100LL truck.

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

5.4.4. Utilities

Utilities are detailed in Chapter 2, *Inventory*. There were no deficiencies identified.

Recommendations: There is no recommendation for utility infrastructure.

5.5. SUMMARY OF FACILITY REQUIREMENTS

The facility requirements recommended for the Airport are summarized in **0.** Although not all improvements recommended throughout this chapter are provided in **0**, the table highlights the key improvements that are recommended for existing and ultimate development through the planning period (2038).

Table 5-17: Summary of Airport Facility Requirements

Item/Facility	Existing	Ultimate Requirement	Recommendation
Runway Length	RWY 4-22: 5,500’ RWY 10-28: 3,109’	RWY 4-22: 7,000’ RWY 10-28: 3,200’	RWY 4-22: Extend 1,500’ RWY 10-28: Extend 91’
Runway Width	RWY 4-22: 150’ RWY 10-28: 75’	RWY 4-22: 100’ RWY 10-28: 75’	None, however additional runway width would require alternate funding sources.
Runway Safety Areas	RWY 4-22 Length: 300’ RWY 4-22 Width: 150’ RWY 10-28 Length: 240’ RWY 10-28 Width: 120’	RWY 4-22 Length: 1,000’ RWY 4-22 Width: 500’ RWY 10-28 Length: 240’ RWY 10-28 Width: 120’	RWY 4-22 Length: Extend 700’ RWY 4-22 Width: Extend 350’ RWY 10-28: Review RSA Overlap with Runway 4-22
Runway Object Free Areas	RWY 4-22 Length: 300’ RWY 4-22 Width: 500’ RWY 10-28 Length: 240’ RWY 10-28 Width: 400’	RWY 4-22 Length: 1,000’ RWY 4-22 Width: 800’ RWY 10-28 Length: 240’ RWY 10-28 Width: 400’	RWY 4-22 Length: Extend 700’ RWY 4-22 Width: Extend 300’ RWY 10-28: None
Instrument Approaches	RWY 4-22: RNAV (GPS), VOR Runway 10-28: None	RWY 4-22: RNAV (GPS), VOR Runway 10-28: RNAV (GPS)	Instrument approach for Runway 10-28
Taxiways	Non-standard conditions	Meet FAA standards / Full or partial length parallel for Runway 4-22	Correct geometry issues / Full or partial-length parallel taxiway
Airfield Lighting and Signage	All runways: MIRL All taxiways: MITL	All runways: MIRL All taxiways: MITL	Install taxiway lighting along Taxiway M
Approach Lighting	Runway 4: MALS, REIL Runways 22, 10, 28: REIL	Same	None
T- Hangars	21 Units	69 Units	Construct 48 Units
Automobile Parking	71 Spaces	124 Spaces	Add 53 Spaces

Source: McFarland Johnson analysis, 2021.