Chapter 4.0 – Facility Requirements

Having inventoried the existing infrastructure and forecasted demand, determining airport facility requirements is the next essential step in the airport master planning process. The purpose of this chapter, "*Facility Requirements"* is to determine whether the airport can accommodate the forecasted demand. If it cannot, the alternatives analysis will determine the extent of new or expanded facilities that are needed to meet the demand identified in the *Airport Role and Forecasts*.

To the reader the title implies that these are the facilities "required" to maintain a viable and safe airport. It is true that in an ideal world providing for the requirements to meet the projected demand is a reasonable expectation. On the other hand, the physical and/or financial resources available may not allow an airport to fully develop under the circumstances. Nonetheless, before the planning can take place to achieve what is "doable" it is important to understand the ultimate facility requirements scenario. Facility requirements are calculated dimensional quantities that assist in the development of airport alternatives and necessary improvements to the airport in order to meet the forecasted demand throughout the planning period. To this end the *Facility Requirements* chapter compares the forecasts, to the latest airport industry standards and FAA design guidance. The end result is a list of facility needs.

The assessment of facility requirements includes such major components as:

- Airfield pavement improvements (runway, taxiway and apron);
- Building improvements (terminal, hangar and maintenance);
- Support Equipment improvements (ARFF and snow removal trucks);
- Navigational equipment and lighting improvements; and
- Airport Access and automobile parking improvements.

Airport facility improvements are justified for several reasons:

- To meet the existing or forecasted demand of the facility. The term "demand" can refer to the level of activity (e.g. based aircraft) and type of activity (e.g. general aviation);
- To meet FAA design standards or criteria, including new or recently modified standards. Most relate to enhancing airport safety;
- To insure a well maintained facility; and
- To enhance operational efficiency.

This Chapter determines what is required to potentially upgrade, expand, extend, abandon and/or otherwise modify existing facilities. The results of the analysis in this chapter determine the facility requirements which are an integral part of the subsequent evaluation that is the *Alternatives Analysis*.

In summary this Chapter introduces a list of needs but it does not produce a plan.

4.1 Airport Runway and Taxiway System Analysis

In this section, the requirements of the airport runway and taxiway system are analyzed for their ability to meet the needs of users. The main objective is to provide a runway and taxiway system that meets FAA standards while providing for a safe and efficient airfield. As is the case throughout this segment of the master plan process, facility requirements must be analyzed in detail before they are recommended as airport improvements on the approved Airport Layout Plan (ALP).

4.1.1 Airport Design Aircraft

As stated previously, the definition of the Airport Reference Code (ARC) as defined by the FAA is a coding system used to relate airport design criteria to the operational and physical characteristics of the aircraft currently using or projected to use the airport. The critical aircraft is that aircraft with the most demanding (i.e. largest) critical dimensions and highest approach speed that consistently (at least 500 operations per year) uses the airport. Examples of aircraft that typically operate at North Central State Airport (SFZ) and their associated ARC were identified in Chapter 3 – Airport Role and Forecasts. SFZ has an ARC of B-II for Runway 5/23 and B-I for Runway 15/33.

Except for Runway 15-33, the FAA airport design standards for a B-II category will be applied throughout this facility requirements section. These standards will be compared to the existing infrastructure (runways, taxiways, aircraft parking aprons and approach configurations) to determine where improvements need to be made.

4.1.2 Airport Design Standards

Airport design standards are used to properly size and locate airport facilities. There are three types of standards:

1. Dimensional (e.g. required width and length of runways and taxiways);
2. Clearance (e.g. required clearances between runways, taxiways, and other facilities); and
3. Operational (described below).

These standards are identified and defined in FAA AC 150/5300-13, *Airport Design*.

4.1.3 Operational Safety Standards

The airport must provide a safe operating environment for aircraft. The FAA AC 150/5300-13, *Airport Design* establishes protection areas around the runways to help ensure such an environment. These areas are:

- Runway Safety Areas (RSA) – The RSA is a prepared surface that surrounds the runway (and extends a specified distance beyond it) that is clear of obstructions. The intent of the RSA is to ensure that aircraft leaving the runway surface either on the sides or a result of an overrun or undershoot sustains minimal damage and also reduces the risk of injury to passengers.

- Runway Protection Zone (RPZ) – The RPZ is a trapezoidal area located off each runway end. Where feasible and prudent the RPZ should be owned by the airport owner and kept clear of obstructions to enhance the protection of people and property on the ground and provide a clear approach surface for the aircraft.

- Object Free Area (OFA) – The OFA is the area on the ground area surrounding runways, taxiways and taxilanes which must be clear of objects except for those whose location is required by function.

- **Runway Visual Zone (RVZ) –** The RVZ is an area maintained free and clear of obstructions for the purposes of providing an unobstructed view of aircraft arriving to/from the intersection of the two runways at SFZ. This is a diamond shaped area depicted on the Airport Layout Plan and the size is a function of the distance from the runway threshold to the intersection point of the two runways.

4.1.4 Airport Design Standards

The FAA's AC 150/5300-13, *Airport Design* defines the airfield dimensional standards associated with different aircraft classifications. Tables 4.1 and 4.2 summarize these standards for a B-I and B-II ARC. The dimensional and clearance standards for the airside areas are presented in Table 4.1. The operational safety standards are presented in Table 4.2.

Table 4.1
Design Airside Standards

Airfield Component		B-I Dimensions	B-II Dimensions
Runway Width		60'	75'
Runway Centerline to:	Parallel Taxiway Centerline	225'	240'
	Nearest Aircraft Parking Area	200'	250'
Taxiway Width		25'	35'
Taxiway Centerline to:	Parallel Taxiway	69'	105'
	Fixed or Movable Object	44.5'	65.5'

Source: FAA AC 150/5300-13 Airport Design

Table 4.2
Operational Safety Standards

Airfield Component		B-I Dimensions	B-II Dimensions
Runway Safety Area (RSA)	Width	120'	150'
	Length Beyond RY End	240'	300'
Runway Protection Zone (RPZ)	Inner Width	500'	500'
	Outer Width	700'	700'
	Length	1,000'	1,000'
Object Free Area	Width	400'	500'
	Length Beyond RY End	240'	300'

Source: FAA AC 150/5300-13 Airport Design

4.1.5 Airfield Capacity

The capacity analysis can be described as a measurement of the airfields ability, based on its current configuration, to handle a predetermined number of aircraft operations in a given period. The analysis also evaluates the delays that arise from the absence of adequate capacity. It is defined in terms of "Annual Service Volume" (ASV). The level of aircraft activity that can be accommodated at an airport is mainly a function of the runway configuration. The number, length, and orientation of the runways are important factors in determining an airport's operational capacity.

The analysis of the runway and taxiway system at SFZ was based upon methodologies in FAA AC 150/5060-5 *Airport Capacity and Delay* utilizing the results of the analysis conducted in the last master plan effort and the Rhode Island State Airport System Plan (RISASP). Table 4.3 below identifies the Annual Service Volume (ASV) calculations conducted in the aforementioned studies.

Table 4.3
Previous ASV Calculations

Study	ASV Operations
2001 Airport Layout Plan Update	230,000
2004 Rhode Island State Airport System Plan	200,000

Since the airport configuration has not changed since either of these studies was completed, this master plan effort will utilize the more recent, conservative 200,000 ASV calculation. As a result of the projected high growth demand for this master plan effort not exceeding 52,961 annual aircraft operations in the planning period, SFZ demand to capacity ratio for the current and future is calculated in the following table.

Table 4.4
SFZ Demand to Capacity Ratio

Year	Actual (2007) Forecasted (2027) Operations	ASV Operations	Demand to Capacity Ratio
2007	27,181	200,000	13.6%
2027	52,961	200,000	26.5%

The FAA utilizes a demand to capacity ratio of an airport's estimated ASV of approximately 60% to determine when an airport may experience operational delays. When an airport approaches this 60% target, planning for improving airport's capacity should be initiated. As is shown in Table 4.4 above, the SFZ ratio is well below the 60% target number throughout the planning period. It can therefore be concluded at this stage that improvements to increase airfield capacity are not envisioned during the 20-year planning period. On the other hand considering a parallel taxiway for Runway 15/33 to reduce the potential for runway incursions may also improve efficiency and capacity. This option will be evaluated in the alternatives analysis.

4.1.6 Wind Coverage

FAA Advisory Circular 150/5300-13, Change 1, *Airport Design*, states that an airport's runways should be oriented such that aircraft can take-off and land into the prevailing wind with minimal crosswind exposure. The Advisory Circular also states that a single runway, or a runway system, should provide 95% wind coverage. Thus, the goal is to achieve 95% coverage or better. The FAA also recommends that a crosswind runway should be made available when the primary runway provides less than 95% wind coverage for any aircraft forecast to use the airport on a regular basis. The 95% wind coverage is computed on the basis of the crosswind component not exceeding 13 knots for ARC B-II Runway 15/33, and 10.5 knots for ARC B-I Runway 5/23.

Wind coverage is calculated using a wind rose, which graphically depicts wind data collected from the National Oceanographic and Atmospheric Administration (NOAA). The wind rose is essentially a compass rose with graduated concentric circles representing wind speed. Each box in the wind rose represents a compass direction and, when filled, indicates the percentage of time wind travels in that direction at that speed.

Since the last standard wind analysis for SFZ utilized wind data between June 1956 and May 1961, a new wind rose was developed for this AMP which utilized the most current weather data available for Pawtucket, Rhode Island. The period of data was between 1999 and 2008. The wind roses are computed based on the following three categories:

- Visual Flight Rules (VFR) – (ceiling 1,000' and visibility 3 miles)
- Instrument Flight Rules (IFR) – (ceiling less than 1,000' and visibility less than 3 miles)
- All Weather – VFR and IFR combined

The new SFZ wind rose for each runway for the above categories are attached herein.

Table 4.5
13 Knot Wind Analysis – Percent Coverage

Runway Identifier	IFR (%)	VFR (%)	ALL WEATHER
05/23	98.87	96.50	96.88
15/33	90.75	96.75	95.99
Combined 05/23 and 15/33	99.89	99.58	99.62

Source: 2008 Airport Layout Plan Update

Based on this wind data, the current runway configuration at SFZ provides enough wind coverage to meet the FAA guideline of 95% all weather wind coverage. For both runways under VFR conditions the combined coverage is 99.58%, and for both runways under IFR conditions the combined coverage is 99.89%. The all weather combined wind rose will be depicted on the Airport Layout Plan and supported by a table that identifies the percentage of wind coverage for each runway, for all three weather categories.

4.1.7 Runway Length Analysis

The length of runway required is based on standards presented in FAA AC 150/5300-13, *Airport Design*, Chapter 2, and FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*. The recommended length for a primary runway at an airport is based on procedures contained the Advisory Circulars and data collected in the Master Planning efforts which ultimately assist the airport in determining the recommended runway lengths for a selected list of critical design airplanes. The aircraft, or family of aircraft, that use the airport on a regular basis are important when evaluating runway length. Aircraft that utilize the airport on a regular basis (minimum 500 itinerant operations per year) a, must be considered. Additional factors considered include critical aircraft approach speeds, maximum certificated takeoff weight, useful load and length of haul, the airport's field elevation above sea level, the mean daily maximum temperature at the airfield, and typical runway surface conditions which have an impact on the operational characteristics of the aircraft.

The runway length analysis for SFZ was performed using FAA Airport Design Computer Program 4.2D and procedures outlined in FAA AC 150/5300-13. The program includes an aircraft fleet profile designed to be representative of the small and large aircraft that comprise the general aviation aircraft fleet in the United States. For SFZ, the program identified a recommended maximum runway length for the major aircraft (i.e., 100% of the aircraft fleet) as follows:

- 3,720 feet for small aircraft (less than 10 passenger seats).
- 4,230 feet for small aircraft (10 or more passenger seats).
- 5,410 feet will accommodate 100 percent of large aircraft (60,000 pounds or less) at 60 percent useful load. There are occasions however, when the payload of a specific aircraft may be higher than 60 percent, and may even approach the maximum practical payload of 90 percent.

The term *useful load* for this planning purpose refers to the difference between the maximum allowable structural gross weight and the operating empty weight of the aircraft in question. FAA guidelines require the selection of 60 percent or 90 percent useful load to be based on the length of haul and service needs of the critical design aircrafts, and note that the 60 percent useful load table is to be used for those airplanes operating with no more than a 60 percent useful load factor. This planning effort assumed that most aircraft will be operating at or near the 60 percent useful load factor.

Table 4.6 defines the runway length requirements developed using the FAA program and reflects runway lengths for small airplanes and large airplanes (with both 60 percent and 90 percent useful loads).

Using the "Airport Input Data" noted in Table 4.6 the runway length requirements produced by the FAA computer program, shows that the existing 5,000 feet length of the primary Runway 5-23 is adequate to accommodate 100% of the small aircraft fleet as well as the critical design aircraft for Runway 5-23.

Table 4.6
Aircraft Runway Length Requirements

Airport Input Data	
Airport Elevation (MSL)	441 feet
Mean daily temperature of the hottest month	83.0 F degrees
Maximum difference in runway centerline elevation	15 feet
Length of haul for airplanes of more than 60,000 pounds	500 miles
Runway Length Recommended for Airport Design	
Small airplanes with less than 10 passenger seats:	
75% of these small airplanes	2,570 feet
95% of these small airplanes	**3,110 feet**
100% of these small airplanes	3,720 feet
Small airplanes with 10 or more passenger seats	4,230 feet
Large airplanes of 60,000 pounds or less:	
75% of these large airplanes at 60 percent useful load	4,820 feet
75% of these large airplanes at 90 percent useful load	6,410 feet
100% of these large airplanes at 60 percent useful load	5,410 feet
100% of these large airplanes at 90 percent useful load	8,020 feet
Airplanes of more than 60,000 pounds	5,170 feet

Source: FAA Airport Design Computer Program 4.2D.

As a result of the above findings, the runway length calculation from the FAA program for small aircraft was checked against the runway requirements for the Airport's family of critical aircraft (ARC B-II), as defined in the Airport Role and Forecasts, to determine if special circumstances would require additional runway length. The critical aircraft for runway 5-23 are the Falcon 50 Jet and other representative aircraft that use SFZ including piston type aircraft such as the Piper Navajo and turboprop aircraft such as the Beech King Air. As discussed in Chapter 2, new small jet aircraft (i.e., micro-jet) are currently being developed by several manufacturers and are designed to operate at airports with capabilities less than typical air carrier airports.

Table 4.7
Runway Length Requirements – SFZ Representative Aircraft

Aircraft	Approximate Runway Length Required[1]
Cessna 172Q Cutlass	1,690 feet
Piper PA-31-300 Navajo	1,950 feet
Piper PA-23 F Turbo Aztec	1,980 feet
Beechcraft 58 Baron	2,101 feet
Raytheon King Air C-90	2,261 feet
Cessna Caravan 208B	2,840 feet
Dassault Falcon 50	4,890 feet

[1] Runway length assumes clearing a 50 foot obstacle in standard weather conditions.

Source: Manufacturer Data and Rising Up Aviation Performance Database www.risingup.com/planespecs/

Table 4.7 indicates all representative aircraft operating under standard conditions (sea level, 59.0°F, and barometric pressure of 29.92) can operate in and out of SFZ with the current runway length. Poor weather and hotter temperatures will increase the runway length required and limit some of these aircraft from operating at the airport during such conditions.

The secondary, or crosswind, runway is intended to complement a primary runway where less than the recommended 95 percent wind coverage is provided for the airplanes forecast to use the airport on a regular basis. Based on the wind analysis for SFZ, the existing secondary Runway 15-33 provides for the small aircraft that routinely operate at the Airport. Based on FAA's guideline it is recommended that a cross-wind runway length should be at least 80% of the primary runway, in this case 4,000 feet. **Runway 15/33 is currently 3,210 feet and does not achieve the recommended crosswind runway length.**

Considering both the excellent wind coverage for Runway 5-23 (almost 97% VFR coverage and almost 99% IFR coverage) and the runway length required for the most typical aircraft that use SFZ, it is reasonable to assume that an extension of the crosswind runway is not essential at this time. Given the poor cost versus benefit ratio, the priority for pursuing funding for such a project would be very low.

4.1.8 Runway / Taxiway Width and Separation Standards

Design standards for taxiways include recommendations for taxiway width; taxiway curves; minimum separation distances, and parallel taxiways. The Airport was designated a B-I for Runway 15/33 and a B-II for Runway 5/23. In prior planning, much of the infrastructure has been designed and constructed to meet these standards. The existing runway and taxiway infrastructure at SFZ meet or exceed the required dimensional standards and separation requirements as shown in **Table 4.8**. Since the existing dimensional standards for Runway 5/23 exceed those that are required for a B-II runway, should the FAA provide funds to rehabilitate the runway in the future, the airport may be responsible for those funds required to rehab any pavement in excess of B-II dimensional standards. Because Runway 5/23 already meets the dimensional standards for a precision instrument runway, it is good planning to maintain the 100 feet width, and protect for the development of a future precision approach.

Table 4.8
SFZ Runway Design Standard Compliance

Airfield Component	Dimensional Standards	Existing Condition	Meets Standard
Runway Width			
- 15/33 (B-I)	60'	75'	Yes
- 05/23 (B-II)	75'	100'	Yes
Runway Centerline to:			
- 15/33 to Taxiway A	225'	230'	Yes
- 05/23 to Taxiway B	240'	350'	Yes
- 05/23 to Aircraft Parking Apron	250'	400'	Yes
Taxiway Width			
- Taxiway A	25'	40'	Yes
- Taxiway B	35'	50'	Yes
- Taxiway C	35'	50'	Yes
- Taxiway D	35'	50'	Yes

Source: FAA AC 150/5300-13 Airport Design and Consultant Calculations

4.1.9 Runway / Taxiway / Apron Pavement Conditions

As documented in the Baseline Conditions of this Master Plan, the pavement condition was visually inspected and reconciled with record drawings for the Airport. Table 4.9 summarizes the pavement conditions found when inventoried.

Table 4.9
SFZ Runway / Taxiway/ Apron Pavement Condition

Airfield Component	Rehabilitated	Condition
Runway 5/23	2006	Excellent
Runway 15/33	2002	Good
Runway Intersection	2006/2002	Good
Taxiway A	2007	Excellent
Taxiway B	N/A	Fair
Taxiway C	N/A	Fair-Excellent
Taxiway D	N/A	Fair-Excellent
Aircraft Parking Apron	N/A	Poor-Fair

This information will be utilized in the alternatives analysis to determine the priority of pavement rehabilitation along with the other needs that result from the process.

Additional Taxiway Needs – Runway 15/33 does not have a full length parallel taxiway. It is recommended that the alternatives analysis look at extending the existing parallel taxiway to Runway 15. This will ensure that airport operations are adequately supported. Although the current partial parallel taxiway may adequately support aircraft operations today, the primary objective of extending Taxiway "A" is to reduce the amount of time aircraft "back taxiing" on the runway which in turn reduces the potential for runway incursions and thereby improves airport safety. Having a full length parallel taxiway to the ends of all runways is an especially useful safety feature at airports where an Air Traffic Control Tower does not exist. Issues associated with extending Taxiway "A" will be analyzed in the alternatives analysis of this Master Plan.

4.1.10 Runway Safety Areas (RSA)

The RSA is a prepared surface that is clear of obstructions, structures, roads, and parking areas. The RSA must be clear of obstructions and graded to remove any hazardous surface variations. Adequate grading or storm sewers should exist in these areas to prevent water accumulation, and under all conditions, runway safety areas should be capable of supporting aircraft without causing structural damage or the risk of serious injuries to passengers. FAA approach lighting is permitted provided they are mounted on frangible couplings.

All the RSA meet the standards required by the FAA. They are, 150 feet wide by 300 feet beyond the runway end Runway 5-23 and 120 feet wide by 240 feet beyond the runway end for Runway 15-33.

4.1.11 Object Free Area (OFA)

The Object Free Area (OFA) should be clear of objects except for whose location is required by function. The OFA for Runway 5-23 is 500 feet wide and centered along runway the centerline. The OFA also extends 300 feet beyond the runway end. The OFA for Runway 15-33 is 400 feet wide, centered along runway the centerline and extends 240 feet beyond the runway end.

The OFA is free of objects and therefore meet FAA standards. The impact of any changes to the OFA as a result of airfield improvements will be considered in the alternatives analysis.

4.1.12 Runway Visibility Zone (RVZ)

The RVZ is an area formed by imaginary lines connecting the visibility points of two runways. The visibility point of a particular runway is determined by runway characteristics outlined in Chapter 5 of FAA AC 150/5300-13. Within the RVZ, an unobstructed line of sight from any point five feet above one runway centerline to any point five feet above an intersecting centerline must be protected for. A clear line of sight between the ends of intersecting runways is recommended.

The RVZ as displayed on the existing Airport Layout Plan encompasses a portion of the existing aircraft parking apron and fuel tanks. The alternatives analysis will examine alternatives that could result in either a modified RVZ or additional aircraft parking areas outside of the existing RVZ.

4.1.13 Runway Protection Zones (RPZ)

The primary function of the RPZ is to enhance the protection of people and property on the ground. The RPZ is trapezoidal in shape and centered about the extended runway centerline. Dimensions of the RPZ for a particular runway end are a function of the type of aircraft and the approach visibility minimum associated with that runway end. These zones, to the greatest extent possible, should be controlled by the airport owner and should be clear of obstructions. The FAA Grant Assurances requires that the airport sponsor do all that is feasible and prudent to maintain a clear RPZ by purchasing the property or by acquiring avigation easements.

- Runway 05 RPZ – This RPZ is approximately 90 percent within airport property. Of the 10 percent of the RPZ that is not encompassed within the property line, there exists just one residence that would need to be acquired by the airport to gain control over the entire RPZ. The Airport currently has an easement with the property owner for obstruction removal.

- Runway 23 RPZ – With the exception of a small portion of the southwest quadrant, the RPZ for Runway 23 is mostly situated in the Town of Lincoln. Approximately 50 percent of this RPZ is outside of the airport property line and completely encompasses four commercial buildings and a portion of a fifth building. This RPZ extends across Albion Road. Obstruction removal within in April 2009.

- Runway 15 RPZ – This RPZ meets FAA standards and is wholly contained within the existing airport property.

- Runway 33 RPZ – The Runway 33 RPZ is nearly 100 percent on airport property, with the exception of a small portion of the southwestern corner of the RPZ. A large part of this RPZ extends over a pond on the approach to Runway 33.

The alternatives analysis will consider the practicality of making improvement to the RPZ to meet the FAA requirements.

A graphical depiction of the surfaces described above can be found in Figure 4.1.

4.1.14 NAVAID, Visual Aids, and Instrument Approaches

A NAVAID is a communication or electronic facility providing either enroute information or approach guidance information to the airport during both good and poor weather conditions. As the name implies, visual aids provide a pilot with visual guidance to and from the airport. In conjunction with each other, they determine the approach procedure defined by FAA in procedure charts developed for a particular runway. The NAVAID and Visual Aid equipment at SFZ were discussed in Chapter 1 as a part of the inventory analysis. Instrument approaches are analyzed to determine if any improvements can be made to increase the safety and availability of the airport to the user. Improvements to navigational aids provide pilots with lower visibility and decision height minimums which ultimately result in a more reliable airport. NAVAID facilities are typically constructed and maintained by FAA. To qualify for these facilities FAA has established specific parameters which are identified in the Airways Planning Standards.

Instrument approaches are generally designed so that an aircraft can navigate to and land safely at an airport in poor weather conditions. Instrument approaches are achieved by means of radio, Global Position System (GPS), or an internal navigation system. Approach procedures are classified into various categories to include a precision approach, precision Approach Procedure with Vertical guidance (APV) and non-precision approaches. A precision approach is an instrument approach that provides the pilot with both lateral and vertical guidance information. An APV approach is an instrument approach that provides the pilot both course and vertical path guidance information, but has different standards than those that apply to Instrument Landing System (ILS) performance standards. A non-precision approach provides the pilot with course information only. By moving towards greater levels of precision the safety of the approach is greatly enhanced under adverse weather conditions.

Several types of precision instrument approach technologies are available to airports. They include systems such as an Instrument Landing System (ILS), Microwave Landing System (MLS), GPS (with vertical navigation via Wide Area Augmentation System (WAAS)/Local Area Augmentation System (LAAS)). APV approach technologies include the WAAS based Localizer Performance with Vertical Guidance (LPV), Lateral Navigation/Vertical Navigation (LNAV/VNAV) and Barometric Vertical Navigation (Baro-VNAV) approaches. Non-precision approach technologies include the VHF Omni-directional Radio Range (VOR), Non-Directional Beacon (NDB), Localizer (LOC), LDA Simplified Directional Facility (SDF) or Radio Navigation (RNAV). All of these types of technologies have allowed the Federal Aviation Administration (FAA) to design a variety of approach procedures to help ensure the safety of aircraft during various phases of flight and poor weather conditions.

FAA funding for a new NAVAID and approach procedure is based upon demonstrating the associated need, practicality, safety benefits, and expected aviation activity at the airport. In developing a new approach procedure, the FAA considers the accuracy of the navigational aid, obstructions to the Part 77/TERPS airspace surfaces, an airport's landing surface (runway length, lighting, markings, design criteria, etc.), and other factors as outlined in the FAA's Advisory Circular 150/5300-13, Airport Design. It is important to note that the FAA indicates a significant reduction in minima (i.e. ¼ mile reduction in visibility and/or 50 foot reduction in decision altitude or minimum descent altitude) would constitute a new approach procedure.

The following table identifies the instrument approaches at SFZ, as well as the visibility minimums applicable for each approach.

Table 4.10
SFZ Instrument Approaches

Runway	Instrument Approach	Visibility Minimums
5	Non-Precision (GPS)	Category A or B Aircraft: ¾ mile Category C Aircraft: 1 ¼ mile
23	Non-Precision (GPS)	Category A or B Aircraft: 1 mile Category C Aircraft: 1 ¼ mile
5	Non-Precision (Localizer)	Category A, B or C Aircraft: ¾ mile

Source: AirNav

GPS and other GPS augmented technology (WAAS/LAAS) can ultimately provide the airport with the capability of establishing new instrument approaches at minimal cost because the installation and maintenance of costly ground-based transmission equipment is not required. To accommodate these type approaches, the airport landing surface must meet specific standards as outlined in FAA AC 150/5300-13, *Airport Design*. The FAA requires that the airport must have a minimum runway length of 3,200 feet. However, in order to achieve the lowest possible minimums with a GPS augmented approach (i.e. LPV), 4,200 feet of runway is required. SFZ meets this requirement. Based on current airport infrastructure, and assuming there are no obstructions as defined by a FAA aeronautical study, the lowest minimums achievable to Runway 5 are a 400 foot ceiling height and ¾ mile visibility.

It is a FAA national initiative to promote GPS based precision approaches at general aviation airports. This Master Plan included a special study (see Chapter 2) to evaluate the feasibility analysis for a precision approach at SFZ. The analysis examined the requirements and benefits of an LPV approach to Runway 5. The initial findings of the feasibility study determined that SFZ is a viable candidate for an LPV approach. To achieve the greatest benefit from an LPV approach to Runway 5, which is a 250 foot decision height and ½ mile visibility (lowest possible minimums) the following is required at SFZ:

- LPV Aeronautical Survey for Runway 5.
- Removal of all obstructions that penetrate the applicable imaginary surfaces.
- Upgrading to precision runway markings.
- Upgrading the approach lighting system from a MALSF to a MALSR (doing so would add 1,000 feet to the approach lighting system and require land acquisition). This is not a LPV requirement, but would it reduce the visibility minimums by a ¼ mile.

The following tables indicate the necessary Height Above Touchdown (HAT), runway length, runway markings, approach lighting, and design criteria required to implement a new instrument approach.

Table 4.11
Approach Procedure with Vertical Guidance – Approach Requirements

Visibility Minimums	<3/4-statute mile	<1-statute mile	1-statute mile	>1-statute mile
Height Above Touchdown	250	300	350	400
TERPS Paragraph 251	34:1 clear	20:1 clear	20:1 clear or penetrations lighted for night minimums (see AC 70/7460-1)	
Precision Object Free Zone	Required	Recommended		
Airport Layout Plan	Must be on approved ALP			
Minimum Runway Length	4,200 ft. paved	3,200 ft. paved	3,200 ft.	
Runway Marking	precision	Non-precision	Non-precision	
Runway Edge Lights	HIRL/MIRL		MIRL/LIRL	
Parallel Taxiway	Required		Required	
Approach Lights	Required – ODALS/MALS,SSALS		Recommended	
Runway Design Standard	APV OFZ Required			

Source: Federal Aviation Administration, Advisory Circular 150/5300-13, Chg 12, Airport Design, 1/03/08.

Table 4.12
Non-Precision Approach Requirements

Visibility Minimums	<3/4-statute mile	<1-statute mile	1-statute mile	>1-statute mile	Circling
Height Above Touchdown	300	340	400	450	Varies
TERPS Paragraph 251	34:1 clear	20:1 clear	20:1 clear or penetrations lighted for night minimums (see AC 70/7460-1)		
Airport Layout Plan	Required				Recommended
Minimum Runway Length	4,200 ft. paved	3,200 ft. paved	3,200 ft.		
Runway Marking	Precision	Non-precision			Visual (Basic)
Runway Edge Lights	HIRL/MIRL		MIRL/LIRL		MIRL/LIRL (Required only for night minima)
Parallel Taxiway	Required		Recommended		
Approach Lights	MALSR, SSALR, or ALSF Required	Required – ODALS/MALS,SSALS, SALS	Recommended – ODALS/MALS,SSALS, SALS		Not Required
Runway Design Standard	< ¾-statute mile approach visibility	≥ ¾-statute mile approach visibility minimums			Not Required

Source: Federal Aviation Administration, Advisory Circular 150/5300-13, Chg 12, Airport Design, 1/03/08.

The lower the minimums and the more precise an instrument approach the larger the area that must be protected against obstacles. Essentially, lower minimums are achieved by increasing precision of the navigational system and removing obstructions.

The final determination for the feasibility of implementing any new instrument approach procedure resides with the FAA Flight Procedures Office. The airport must coordinate with the FAA at the onset and the FAA will ultimately certify the new procedure.

4.2 General Aviation (GA) and Support Facilities Analysis

This analysis examines GA Support components such as; terminal/administrative, aircraft parking (apron), and hangar space, and other areas. It will estimate the facility demand and compare it with existing facilities to determine future needs for:

- GA Terminal Building (Current and Former)
- Apron and Hangar Space Requirements
- Fuel Storage Facilities
- Maintenance Equipment Storage
- Airport Utilities
- Access Roadways and Automobile Parking
- Maintenance and Snow Removal Equipment

4.2.1 GA Terminal Building (Current and Former)

The current general aviation airport terminal is situated centrally on the main aircraft parking apron adjacent to Taxiway "B" with a large conventional aircraft hangar attached to the northeastern side. The terminal area encompasses approximately 7,000 square feet. As mentioned within the inventory chapter, the interior of the terminal building has been recently remodeled and consists of a reception area, passenger lounge, pilots lounge, conference rooms, pilots briefing room, and FBO offices. This area houses Landmark Aviation and office space for airport administration. Possible reuse capabilities of the former terminal building will be addressed in the Alternatives Analysis.

The FAA has developed methods of estimating general aviation terminal requirements. The method, found in FAA A/C 150/5300-13, *Airport Design*, relates peak period activity to the size of functional areas within the building. Table 4.13 sets forth the recommended square footage requirements per pilot/passenger.

Table 4.13
General Aviation Terminal Building Area Requirements

Terminal Functional Areas	Area Per Peak Hour Pilot/Passenger
Waiting Lounge	15.0 sq. ft.
Management/Operations	3.0 sq. ft.
Public Conveniences	1.5 sq. ft.
Concession Area	5.0 sq. ft.
Circulation, Storage, HVAC	24.5 sq. ft.
Total	**49.0 sq. ft.**

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

Using the standards in Table 4.13 above, the recommended terminal building size was determined and presented in Table 4.14 below. The peak day is calculated by dividing the peak month's operations by the number of days within that month. Since August has been determined to be the peak month, the total operations for the month are divided by 31 days, and using the generally accepted level of peak hour operations of 15% of the design day operations. Based on the annual number of operations in 2007, 27,181, at 15% for August (4,077), divided by 31 days, the historical peak day is calculated to be 131 operations, and peak hour to be 20 operations. The peak hour pilot/passengers were derived by assuming 1.5 passengers and pilots per peak period operation, which is a reasonable assumption for airports such as SFZ.

Table 4.14
Recommended Terminal Building Area Requirements

Year	Peak Hour Operations	Peak Hour Pilot and Passengers	Terminal Building Area
2007	20	35	1,715 sq. ft.
2012	24	36	1,764 sq. ft.
2017	29	44	2,156 sq. ft.
2027	38	57	2,793 sq. ft.

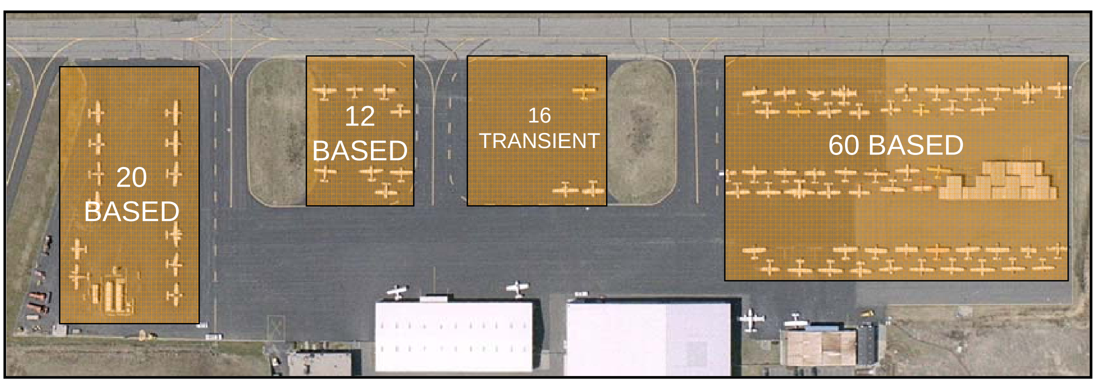
Source: The Louis Berger Group, Inc. Calculations

The condition of the terminal facility is classified as excellent and meets the facility objectives set forth by the FAA. Presently, there exists no immediate need to increase the size of the facility.

4.2.2 Apron and Hangar Space Requirements

Aprons provide parking for aircraft, and provide access to terminal facilities, fueling, and surface transportation. There are two types of aprons to consider in determining apron requirements. Transient aprons and aprons for based aircraft. To promote efficient aircraft operations and because the actual number and type of based aircraft is known, it is recommended that aprons used for based aircraft be located separately from those for transient aircraft

Figure 4.2 – Existing Apron Space Capacity



Currently, SFZ has a paved aircraft apron with 108 tie-downs as depicted in the figure above which is used for both based and transient aircraft. Additionally, there are 4 tie-downs located at the Rossetti hangar. This section looks to define the apron requirements for SFZ as they relate to the forecasted high growth scenario of based aircraft and the peak day design requirements for transient aircraft.

The design aircraft for the airport terminal and apron areas correspond to Airplane Design Group II. Other assumptions to estimate general aviation facility requirements are:

- For planning purposes airplanes using tie-down (apron) spaces are assumed to require 2,700 square feet (300 sy) per based aircraft and 3,240 sq. ft. (360 sy) per itinerant aircraft. These estimates include area for taxiing.

- Using the results of the user survey, combined with the estimated waiting list for aircraft parking provided by Landmark and experience at other airports, the number of based aircraft that would use T-hangars was estimated.

4.2.3 Aircraft Apron Parking Requirements

The aircraft apron parking requirements for based and itinerant aircraft are calculated in the tables below. The current conditions at SFZ show that approximately 70% of based aircraft utilize apron tie down space, while approximately 30% of based aircraft utilize hangar space. This ratio was applied to the forecasted number of based aircraft through the planning period of 2027 to determine apron and hangar requirements. For planning purposes, the requirements assumed that 100% of based multi-engine aircraft will be stored in aircraft hangars. The requirements assumed the high growth scenario in order to maximize the potential facilities required to meet the projected demand.

Table 4.15
Based Aircraft Apron Parking Requirements

Based Aircraft	2007	2012	2017	2027
Single-Engine	81	91	108	159
Requirements @ 300 sq. yds.	24,300	27,300	32,400	47,700
Helicopter	0	0	0	2
Requirements @ 360 sq. yds.	0	0	0	720
Total SY	24,300	27,300	32,400	48,420

Source: The Louis Berger Group, Inc. Calculations

To derive the itinerant aircraft apron parking requirements, the Average Day of the Peak Month was used. The forecast section determined the month to be August, averaging 15% of the annual operations. This percentage was applied to the existing and annual operations numbers and then divided by 31 to represent a Peak Day. Itinerant Peak Day operations were then assumed to be 20% of the operations, based on historical records. It was then assumed that approximately 50% of the Peak Day Itinerant traffic will need a parking space. The results are shown in the following table.

Table 4.16
Itinerant Aircraft Apron Parking Requirements

Year	Average Peak Day Itinerant Operations	Average Peak Day Itinerant Aircraft	Required Itinerant Apron
2007	26	13	4,680
2012	32	16	5,760
2017	38	19	6,840
2027	51	26	9,360

Source: The Louis Berger Group, Inc. Calculations

Table 4.17
Based and Itinerant Aircraft Apron Parking Requirements

	2007	2012	2017	2027
Based Aircraft Apron	24,300	27,300	32,400	48,420
Itinerant Aircraft Apron	4,680	5,760	6,840	9,360
Sub-total	28,980	33,060	39,240	57,780
Existing Area	38,966	38,966	38,966	38,966
Surplus (Deficiency)	9,986	5,906	(274)	(18,814)

Source: The Louis Berger Group, Inc. Calculations

These aircraft apron requirements will be considered with aircraft hangar and t-hangar assumptions in the Alternatives Analysis. Additionally, the existing conflict with the Runway Visibility Zone (RVZ) will also be considered.

4.2.4 Hangar Space Requirements

Weather conditions, security, investment incentives, and the preference of aircraft owners is often what determines the proportional amount of aircraft storage at an airport to the number of based aircraft. Throughout airport development, as the number of based aircraft changes, the proportion of available indoor aircraft storage usually changes as well. Thus, aircraft hangar storage requirements are based on the number and type of based aircraft. It is assumed that each based aircraft will require 1,500 sf. of hangar space. Since the number and type of itinerant aircraft that will require overnight hangar storage is unknown, for planning purposes it is assumed that 20% of the average peak day of itinerant aircraft will require hangar space. Typically, itinerant aircraft requesting overnight hangar storage are of the multi-engine and larger aircraft type. For planning purposes, it is assumed that on average, itinerant aircraft will require 2,500 sf. of hangar space. This is shown in Table 4.18.

As identified in the inventory of airport infrastructure, SFZ has 4 conventional hangars on the airport and a 6-Unit T-hangar facility located on the aircraft parking apron. Since facility requirements are unconstrained, the total hangar space includes that of all existing hangar facilities, despite their current use or function. The total area of conventional hangar space for aircraft storage is approximately 63,500 square feet.

Based on discussions with RIAC, Landmark, and airport personnel, as well as based aircraft owner survey results, there exists a significant demand for aircraft hangar storage at the airport. In fact, some based aircraft owners attributed "lack of hangar space" for considering the relocation of their base of operation from SFZ to an alternative airport. However, the "lack of hangar space" isn't entirely accurate considering that the total available hangar space at SFZ is sufficient to accommodate the aircraft on the airport's hangar waiting list. Consequently, one can assume that when based aircraft owners site the lack of hangar space, what they may be referring to is the lack of desirable hangar space in terms of particular characteristics, i.e. T-hangars, cold conventional hangar storage, heated conventional hangar storage, etc. There is currently a list of 9 based aircraft waiting for hangar space.

The alternatives analysis should look at the placement and development of both new aircraft apron space, along with the development of additional T-hangar units to meet existing demand levels. In addition, alternatives should also look at where additional conventional hangars could be built should the need arise during the planning period or in the case RIAC is presented a proposal from an outside interest looking to develop a parcel on the airport.

Table 4.18
Based and Itinerant Aircraft Hangar Requirements

	2007	2012	2017	2027
Based Aircraft	35	42	50	67
Based Requirements @ 1,500 sq. ft.	52,500	63,000	75,000	100,500
Itinerant Aircraft	3	3	4	5
Itinerant Requirements @ 2,500 sq. ft.	7,500	7,500	10,000	12,500
Total Required Hangar Area	60,000	70,500	85,000	113,000
Existing Hangar Area	63,500	63,500	63,500	63,500
Surplus (Deficiency)	3,500	(7,000)	(16,500)	(49,500)

Source: The Louis Berger Group, Inc. Calculations

4.2.5 Fuel Storage Facility

There is a single designated fuel storage area consisting of two above ground storage tanks for the storage of aircraft fuels. Both the Jet A and 100LL Avgas tanks hold 12,000 gallons each. SFZ is a full-service fuel provider, with no self service fuel available. Airport equipment uses diesel fuel, which is stored in a 250-gallon above ground tank with a secondary 250-gallon above ground tank, both of which are located adjacent to the aircraft fuel storage tanks. The fuel storage requirements for SFZ are identified in the table below:

Table 4.19
Fuel Storage Requirements for SFZ

	2007	2012	2017	2027
Operations	27,181	30,289	32,310	36,765
ADPM Operations	125	140	149	169
ADPM Fuel in gallons[1]	438	490	522	592

[1] A 3.5 gallon per operation figure was assumed.
ADPM = Average Day, Peak Month (Assumes 14.28% for Peak Month, divided by 31 days for August: See Forecast Chapter)

Source: The Louis Berger Group, Inc. Calculations

Airport user survey results support the addition of a self fueling station to dispense 100LL Avgas fuel on the airport. The addition of a self service fueling station would provide 24 hour access to fuel and provide aircraft operators access after normal business hours. Experience at airports similar to SFZ suggests that this would be a beneficial service to its customers. Provided the airport successfully manages consumption levels and schedules routine fuel deliveries based on observations and historical data, existing tank capacities will be capable of accommodating future demand for this planning period.

The current location of the fuel farm penetrates the Runway Visibility Zone and relocating of the facility will be considered in the alternatives analysis.

4.2.6 Maintenance Equipment and Storage

The current airport infrastructure at SFZ does not provide for the storage of maintenance vehicles or Snow Removal Equipment (SRE). All such equipment sits outside on a year round basis. In the absence of appropriate storage the wear and tear on the SRE is increased. The alternatives analysis will make recommendations in terms of site selection and building specifications that could adequately store equipment necessary for snow removal and airfield maintenance equipment.

4.2.7 Airport Utilities

As stated in the baseline conditions, electrical service at SFZ is supported by National Grid. With the exception of the FBO and adjoining hangar, emergency electrical power is provided to the entire airfield by the airport's generator, located east of the old terminal building. The alternatives chapter will look at the status of a new generator that serves the FBO and white hangar. No changes to water and sewer services are anticipated, however the alternatives will also address any utility issues at the airport should they arise.

4.2.8 Access Road and Automobile Parking Analysis

SFZ is accessed via the Albion Road and Jenkes Hills road which serve as east-west connector roads to Route 146. Presently, these access roads are in a state of good repair, provide efficient traffic flow to the airport and have adequate signage. However, since terminal operations have relocated to the Landmark Hangar, automobile parking at the old terminal location is still utilized to meet parking demand.

Figure 4.3 – Existing Automobile Parking Capacity

As seen in **Figure 4.3**, due to the grade difference between the old terminal parking area and the new terminal location, access from the old terminal parking area to the Landmark terminal is inadequate. Automobile parking areas should allow for the proper number of parking spaces for the buildings they serve. The alternatives analysis will examine improvements to automobile parking as well as alternatives for pedestrian routes between the two parking areas. Current automobile parking capacity at SFZ is 82 spaces, 27 of which mainly serve the new terminal building and are located in along the roadway, as shown in the figure. Should direct access between the old and new parking areas be constructed, the total capacity of automobile parking will be sufficient to serve both the old and new terminal buildings throughout the planning period.

4.3 Summary of Airport Facility Requirements

The following table and bulleted lists summarize the requirements to be addressed as part of the Alternatives Analysis section of this master plan effort.

Table 4.20
Summary of Airport Facility Requirements

	2012	2017	2027
Based Aircraft Apron (Sq. Yds.)	27,300	32,400	48,420
Itinerant Aircraft Apron (Sq. Yds.)	5,760	6,840	9,360
Sub-total	33,060	39,240	57,780
Existing Apron Area (2007) - Sq. Yds.	38,966	38,966	38,966
Apron Surplus (Deficiency)	5,906	(274)	(18,814)
Based Aircraft Hangar (Sq. ft.)	63,000	75,000	100,500
Itinerant Aircraft Hangar (Sq. ft.)	7,500	10,000	12,500
Sub-total	70,500	85,000	113,000
Existing Hangar Area (2007)	63,500	63,500	63,500
Hangar Surplus (Deficiency) - Sq. ft.	(7,000)	(16,500)	(49,500)

Source: The Louis Berger Group, Inc. Calculations

The facility requirements have determined areas to be considered in the alternatives analysis given the forecasted demand with no constraints. The following provides a list of improvements to be considered in the alternatives analysis:

Airfield efficiencies can be gained from infrastructure improvements such as a full parallel taxiway as well as improved instrument approach procedures and meeting FAA standards to ensure a clear line of sight from intersecting runways. Considerations should include:

1. A full parallel taxiway to Runway 15-33;
2. An LPV approach to Runway 5-23; and
3. Clearing of the Runway Visibility Zone (aircraft parking and fuel farm).

Aircraft support areas such as aircraft apron and hangar space show deficiencies over the planning period. In addition, the user survey conducted indicated that airport users would like to see t-hangar development and self service fueling to be considered. Areas to consider include:

4. Additional Aircraft Apron Space by 2017 (Possibly sooner to clear the RVZ)
5. Additional Hangar Space by 2012 (most likely t-hangar or additional conventional space)
6. Self-Service Aircraft Fueling

Overall, the terminal facility utilized by Landmark meets the required needs of the airport through the planning period. Areas identified as part of this master plan to be considered in the analysis include:

7. Use and Redevelopment of the Old Terminal Facility
8. Connection of Upper and Lower Level Auto Parking Areas
9. Existing Airport Equipment Inventory and Future Equipment Needs
10. Location of a Snow Removal Equipment Building