Chapter Four
Facility Requirements

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4.1. Introduction

This chapter describes the facility requirements needed to accommodate the base case and "athletic charter" demand forecasts for year 2025. The sections of this chapter are intended to:

- Describe relevant design criteria
- Present airfield requirements in context of the critical aircraft identified in Chapter Three (the ERJ 135).
- Review NAVAID requirements
- Identify passenger terminal requirements
- Parking and airport access
- Identify general aviation and corporate facility requirements
- Identify ARFF requirements to comply with Part 139
- Review obstructions issues
- Describe the parameters to justify an Air Traffic Control Tower
- Miscellaneous requirements for the airport

4.2. Airport Reference Code

FAA Advisory Circular 150/5300-13 Airport Design outlines airport design guidelines. Primarily aimed at maintaining airport safety and efficiency, these guidelines help ensure that facilities at a given airport will match the requirements of the type of aircraft actually using (or forecast to use) the airport on a regular basis. For example, an airport serving Boeing 747's will need wider runways, bigger safety areas, etc than will an airport serving small single engine aircraft. In addition to aircraft type, airport design is also affected by the existing or planned approach visibility minimums for each runway.

To match aircraft type to the appropriate facility requirements, an Airport Reference Code (ARC) is applied to each runway. An ARC is most often determined based upon the Approach Category (grouping by approach speed) and the Airplane Design Group (ADG - grouping by wingspan) of aircraft using or expected to use the airport on a regular basis (at least 500 operations a year); though the FAA also considers local characteristics when approving applied criteria.

4.2.1. Approach Category

The current approach category applied to Runway 12-30, the primary runway, is "C". This approach category includes many medium-sized commercial aircraft such as the Boeing 737, the Airbus 320 and some regional jets, as well as a wide variety of business jets. The current and anticipated future commercial service aircraft is the Beech 1900, which is a "B" aircraft.

Looking to the future, it is anticipated in the SDSU Athletic Charter forecast case that regional jet charter activity will increase. Also, business jet use could increase as corporate interest in airport hangar facilities continues. Though the forecast does not indicate that category "C" aircraft will achieve the 500 operations a year, it is possible that the activity levels of "C" aircraft will result in

more than 500 annual operations, especially if SDSU-related activity grows more than is currently forecast.

Therefore, this Master Plan recommends that the criteria associated with category "C" aircraft continue to be applied to the primary runway. Maintaining the "C" designation will help ensure continued high levels of airport safety and efficiency and will allow greater flexibility to meet future needs.

The current approach category assigned to Runway 17-30, the crosswind runway, is "B". Given that the crosswind runway's role in airport operations is not anticipated to change in the future, the criteria associated with category B should continue to be applied to this runway. **Table 4-1** shows the thresholds for the approach categories.

Table 4-1 Aircraft Approach Category

	Knots
A	Speed less than 91 knots.
B	Speed 91 knots or more but less than 121 knots.
C	Speed 121 knots or more but less than 141 knots.
D	Speed 141 knots or more but less than 166 knots.
E	Speed 166 knots or more.

4.2.2. Airplane Design Group

The current ADG applied to the primary runway is ADG-III. Like approach category C, ADG-III includes the Boeing 737, the Airbus 320, and many regional and corporate jets.

The forecast does not indicate that the activity resulting from the Athletic Charter scenario and increased corporate jet use will meet the 500 operations threshold. Nonetheless, as was the case with the approach category, this Master Plan recommends that ADG-III continue to be applied.

The current ADG assigned to the crosswind runway is ADG-I. Given that the crosswind runway's role in airport operations is not anticipated to change in the future, the criteria associated with at least ADG-I should continue to be applied to this runway. If it is feasible to upgrade the Runway to ADG-II, this should be considered to improve the usability of this runway.

See ***Table 4-2*** and ***Figure 4-1*** for key planning standards for various ADG classifications.

Table 4-2 Aircraft Design Group

	Wingspan
I	Up to but not including 49 feet.
II	49 feet up to but not including 79 feet.
III	79 feet up to but not including 118 feet
IV	118 feet up to but not including 171 feet
V	171 feet up to but not including 214 feet
VI	241 feet up to but not including 262 feet

FAA Airfield Planning Criteria

Aircraft Design Group	Typical Aircraft		Active at BKX? Current	Active at BKX? Future	Runway Width	Taxiway Width	Separations: Runway to Taxiway	Separations: Taxiway to Taxiway	Separations: Taxiway to Fixed or Movable Object
I		Beech Bonanza Cessna 172 Piper Navajo	*Yes*	*Yes*	60 (1)	25	150 (5)	69	44.5
II		Beechcraft Super King Air Beechcraft 1900 Canadair Regional Jet Cessna Citation III Embraer 145 Gulfstream IV Jetstream 41 Saab 340	*Yes*	*Yes*	100 (2)	35	300 (6)	105	65.5
III		Airbus 320 Avroliner RJ 85 Boeing 727 Boeing 737 De Havilland DHC-8 McDonnell Douglas MD-80	*No*	*Yes*	100/150 (2&3)	50/60 (4)	400 (6)	152	93
IV		Airbus 300 Boeing 757 Boeing 767 McDonnell Douglas DC-8 McDonnell Douglas DC-10 McDonnell Douglas MD-11	*No*	*No*	150 (2)	75	400 (6)	215	129.5
V		Airbus 340 Boeing 747 Boeing 777	*No*	*No*	150 (2)	75	400 (6)	267	160
VI		Airbus 380 Lockheed C-5B	*No*	*No*	200 (2)	100	600 (6)	324	193

Notes:
(1) For visual runways, approach speed less than 121 knots.
(2) For instrument runways, approach speeds less than 166 knots.
(3) 150-ft. width for aircraft with greater than 150,000 lb. takeoff weight.
(4) Design Group III aircraft with wheelbase equal to or greater than 60 ft. require 60-foot width.
(5) For visual runways, aircraft under 12,500 lbs.
(6) For instrument runways.

4.3. Airfield

The number of runways and their respective orientation is a function of wind coverage as well as requirements to fulfill particular airport capacity needs. In the case of Brookings, the capacity needs of the airport are such that operations through the forecast period will be driven by the SDSU student pilot program and general aviation activity, and to a lesser extent charter activity. Commercial service is expected to remain an immaterial component of total operations.

4.3.1. Wind Coverage

Aircraft perform best when they can take off and land as directly into the wind as possible. Hence, it is important to plan for a primary runway that is aligned to optimize that predominant wind direction. No matter how well the primary runway is aligned in relation to predominant winds, there will still be times when wind direction is not aligned with the primary runway. An additional runway, often aligned perpendicular or nearly perpendicular to the primary runway, allows aircraft to operate when wind conditions do not favor the primary runway.

The FAA has developed guidance to help determine whether a crosswind runway is justified. That guidance states that when the primary runway does not provide adequate coverage at least 95% of the time for aircraft needing a crosswind on a regular basis (at least 500 times a year), a crosswind runway may be justified.

Because larger, heavier and more powerful aircraft need a crosswind runway less often than smaller, lighter and less powerful ones, different winds speeds are used in the crosswind runway analysis for different aircraft. These different wind speeds are called crosswind components. The FAA recommends that the criteria depicted in the table below be applied:

Table 4-3 Crosswind Components

Crosswind Component	Airport Reference Code
10.5 knots	A-I, B-I
13 knots	A-II, B-II
16 knots	A-III, B-III, C-I through D-III
20 knots	A-IV through D-VI

The following table depicts the coverages at Brookings for the different crosswind components The 20 knot component was not used due to the fact that aircraft that large are not anticipated to use the Airport on a regular basis.

Table 4-4 All Weather Wind Coverage

Wind Speed	Airport Reference Code	Runway 12-30	Runway 17-35	Both Runways
10.5	A-I and B-I	90.19%	90.23%	97.55%
13	A-II and B-II	94.96%	94.77%	99.06%
16	A-III, B-III, and C-I through D-III	98.43%	98.29%	99.74%

As can be seen, the coverage on the primary runway increases as the aircraft get larger and more powerful. At 16 knots, a crosswind runway does not appear to be justified. However, at Brookings

it is the relatively small aircraft training aircraft that the SDSU program uses that will need the crosswind runway the most. Coverage at their recommended component (10.5 knots) is just slightly over 90%. Since there are more than 500 operations of this type of aircraft annually, a crosswind is justified. The coverage is also below 95% for aircraft falling into the 13 knot crosswind component category, so if these aircraft ever need to use the crosswind at least 500 times a year, a longer and wider crosswind runway would be justified, as will be discussed below.

4.3.2. Wind Coverage in Poor Weather Conditions

While the Runway 30 ILS provides adequate wind coverage during poor weather, it is lower than is typically the case. For example, if the precision approach was placed on the Runway 12 end, coverage would be improved, as is shown in ***Table 4-5.***

Table 4-5 Wind Coverage in Precision IFR Weather

Runway	Knots	Precision IFR Weather 200 < Ceiling < 400 Visibility > ½ Mile
12	16	38%
30	16	67%

Recent weather information obtained from NOAA shows that an ILS on a different alignment could provide improved wind coverage during those times when ILS use is necessary. Options for improving IFR-condition wind coverage will be discussed further in Chapter Five.

4.3.3. Airfield Capacity Requirements

An airfield system's capacity is determined by a multitude of various factors, including prevailing winds and associated orientation of runways, number of runways, taxiway system, fleet mix, operational characteristics of based aircraft and weather conditions.

The Annual Service Volume (ASV) for a given airport is the annual level of aircraft operations that can be accommodated with minimal delay. For example, for an airport with annual operations below its ASV, delay is minimal within one to four minutes per operation. Anything above four minutes of delay per operation can result in increased congestion that can adversely tax airfield capacity. Brookings' ASV is currently calculated to be 230,000, which is well above its current and projected (2025) annual operations of 28,369 and 32,722 respectively. From the FAA AC 150/5060-5 (Airport Capacity and Delay), Brookings' average hourly capacity was estimated to be 98 operations during VFR conditions and 59 operations during IFR conditions.

Brookings has adequate runway capacity to support the base case and SDSU Athletic Charter case forecast scenario. This means that as a driver for airport improvement at Brookings, airfield capacity will not be a contributing factor.

4.3.4. Runway Length

Primary Runway

When determining runway length for a particular runway, the performance of the critical aircraft is analyzed in context to temperature, airport elevation, runway gradient, and runway surface conditions. The techniques are outlined in FAA Advisory Circular 150/5325-4B, Runway Length Requirements for Airport Design, and are used in this master plan.

AC 150/5325-4B outlines three steps for determining runway length requirements:

- Identify critical aircraft (or family of aircraft)
- Identify the aircraft within this family which will require the longest runway length
- Determine runway length requirements using AC resources or aircraft manufacturer information.

Regional jets was identified as the planning category for the primary runway assuming the Athletic Charter forecast scenario which has a reasonable chance of exceeding 500 operations per year. Larger A320 aircraft may be chartered by SDSU for football games or may be utilized by opposing teams, but these would not exceed the 500 operations criteria and hence are not considered critical for facilities planning, but their performance requirements were included in the evaluation.

For regional jets, the FAA recommends that aircraft performance manuals be used to determine runway length requirements. Using these manuals, aircraft performance at a given airport is approximated by taking the airport elevation (1,647') and the mean maximum temperature of the hottest month (85 degrees Fahrenheit) and applying them to performance curves provided in the manuals. It is important to note that these performance curves are not intended to give actual operating runway length requirements, but rather a reasonably accurate length requirement to be used for informational and planning purposes.

Using ERJ-135 performance curves, it was determined that a 5,500-foot runway (269 feet longer than the existing runway) would allow the ERJ-135 to take off at 95% of its maximum load capacity (MTOW 44,000lbs). This length will also handle general aviation aircraft as well as Beech 1900 commercial aircraft. See ***Figure 4-2.***

Airport Elevation 1647MSL
EOR 12 Elevation 1608MSL
EOR 30 Elevation 1629MSL
100' Runway Width
Bituminous Surface

ERJ-135 Performance Curve

EMB135 EMBRAER AIRPORT PLANNING MANUAL

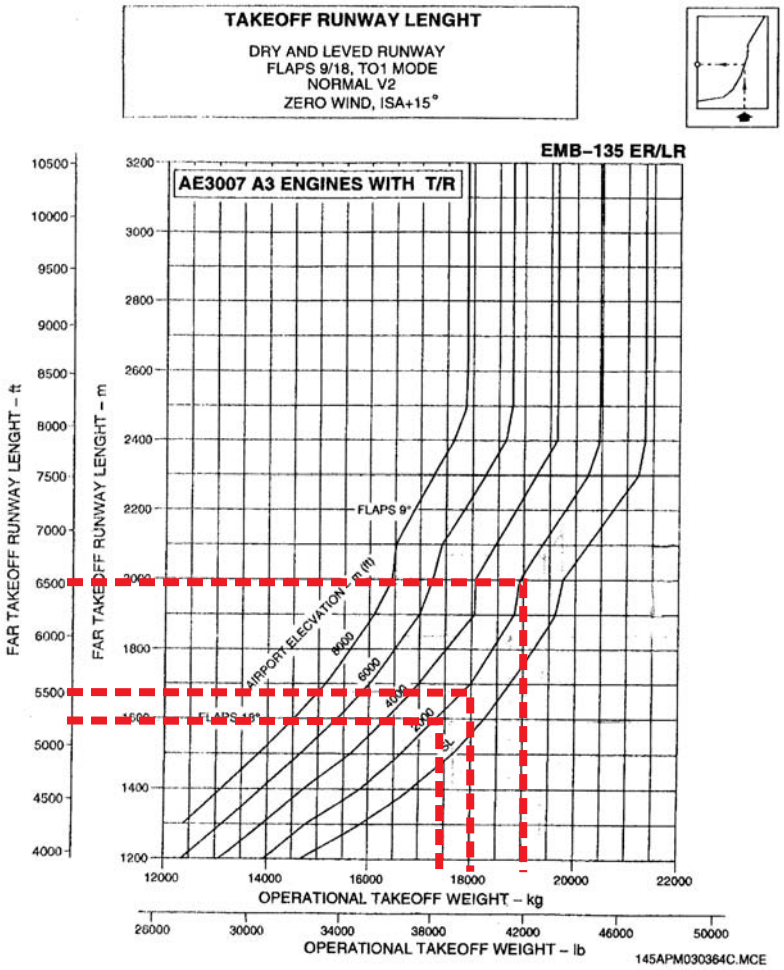
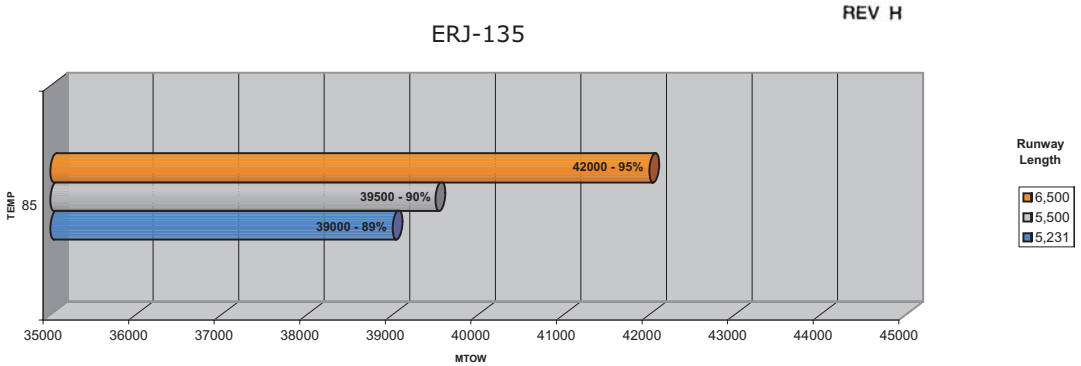


Figure 3.3.2 - FAR Takeoff Runway Length Requirements - ISA + 15°C Conditions Sheet 1

REV H



Airport development concepts should also consider an ultimate extension to 6,500 feet. This length would achieve 98% of the maximum load capacity for the ERJ-135 and better serve larger corporate and charter aircraft.

A 6,500' runway would also better accommodate another group of aircraft beginning to use the airport on a more frequent basis – corporate and other high performance aircraft. From July 2004 to July 2005, this type of aircraft accounted for nearly 5% of all non-SDSU general aviation traffic. This trend towards increasing corporate aviation is being seen nationwide and is only expected to increase as the new light jets come on line within the next decade. This type of aircraft, generally compassing B-II to C-III aircraft, can require upwards of 7,000 feet of runway, so the ultimate 6,500-foot length will better match their performance needs than a 5,500-foot runway.

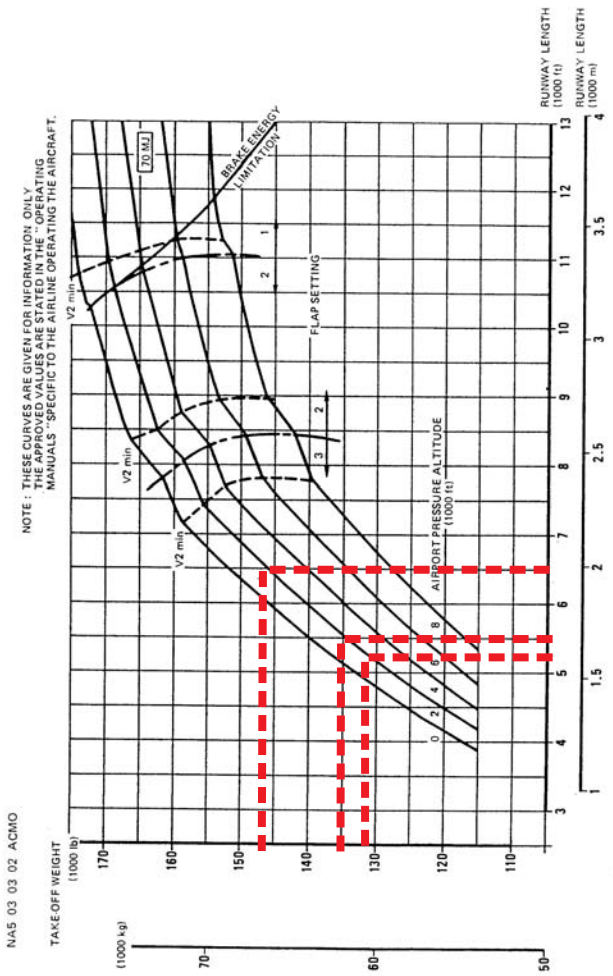
The requirements for the A320 (approximate MTOW 166,400lbs) were also considered. A runway length of 5,500 feet would achieve 87% of the maximum load capacity; while a total runway length of 6,500 feet would achieve 93% of the maximum load capacity (see ***Figure 4-3***). Each alternative was scored based on its ability to meet these runway length requirements. While regular (at least 500 operations a year) A320 use would require a 150' runway and greater pavement strength, these improvements are not recommended due to the relatively infrequent forecast A320 operations. A320s would also be limited in the areas of the airfield they could taxi in due to their larger wingspan. Future planning should seek to ensure that group III aircraft have access to, at a minimum, the Passenger and FBO Terminals and any fueling and deicing areas.

Airport Elevation 1647MSL
EOR 12 Elevation 1608MSL
EOR 30 Elevation 1629MSL
100’ Runway Width
Bituminous Surface

A320 Performance Curve

A320

AIRPLANE CHARACTERISTICS



3.3 F.A.R.TAKE OFF RUNWAY LENGTH REQUIREMENTS
3.3.2 ISA +15°C (59°F) CONDITIONS
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Chapter 3.3.2
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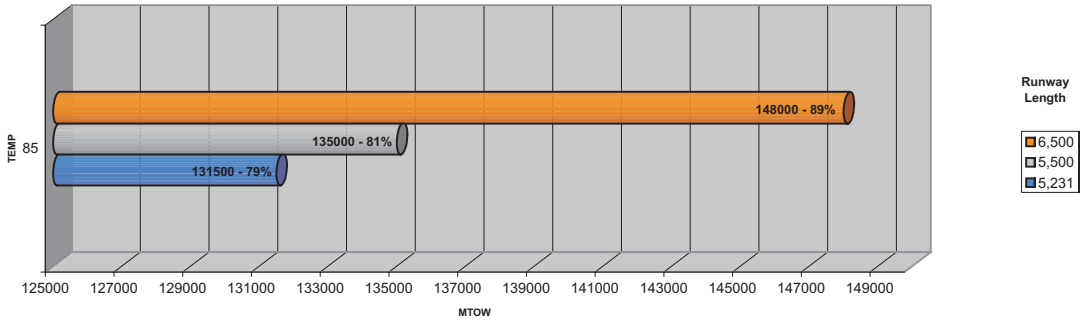
A320



Crosswind Runway
According to FAA AC 150/5325-4B, crosswind runway length requirements are determined differently than the primary runway length requirements. If the crosswind runway is designed to accommodate the same aircraft as the primary runway, it should be the same length as the primary. If it is designed for different (typically smaller) aircraft, it should be designed to accommodate the needs of 100% of the aircraft that need to use it. Finally, if the FAA has funded the construction of a crosswind runway at a given length, they may require that this length be maintained.

A crosswind runway length at an airport like Brookings should be 100% of the recommended runway length for aircraft that need the crosswind. Using guidance contained in the AC, small aircraft with approach speeds of 50 knots or more and less than 10 passenger seats was chosen as the design aircraft family. These are by and large 'utility' (less than 12,500 pounds) A-I and B-I aircraft. No larger aircraft are forecast to meet the 500 itinerant annual operations for the crosswind runway.

Using the appropriate figure, a runway length requirement of slightly more than 3,600' (vs. the current 3,599') was calculated (see ***Figure 4-4***). An elevation of 1647' MSL and a temperature of 85 degrees Fahrenheit were used. The 95% category on the figure was used because it is for "airports that are primarily intended to serve medium size population communities with a diversity of usage and a greater potential for increased aviation activities" (paragraph 205 of the AC). Therefore, the current crosswind length is justified.

Even though it meets the length requirements for forecast traffic, an ultimate extension to accommodate B-II aircraft should be planned for. The grouping "Small Airplanes Having 10 or More Passenger Seats" from the AC will accommodate many of these aircraft. The length requirement for these aircraft is slightly over 4,400 feet (see ***Figure 4-5)***. A B-II classification will also serve to make the runway more useable should the nationally anticipated increase in light jet and twin engine aircraft operations impact Brookings.

While it is unlikely that 4,400 foot crosswind runway length could be achieved at the current airport site, an incremental extension should be considered. This will be analyzed further in the Development Concepts chapter. It should also be noted that by increasing the Runway to a B-II, the RPZ should also be increased. See the table below for details.

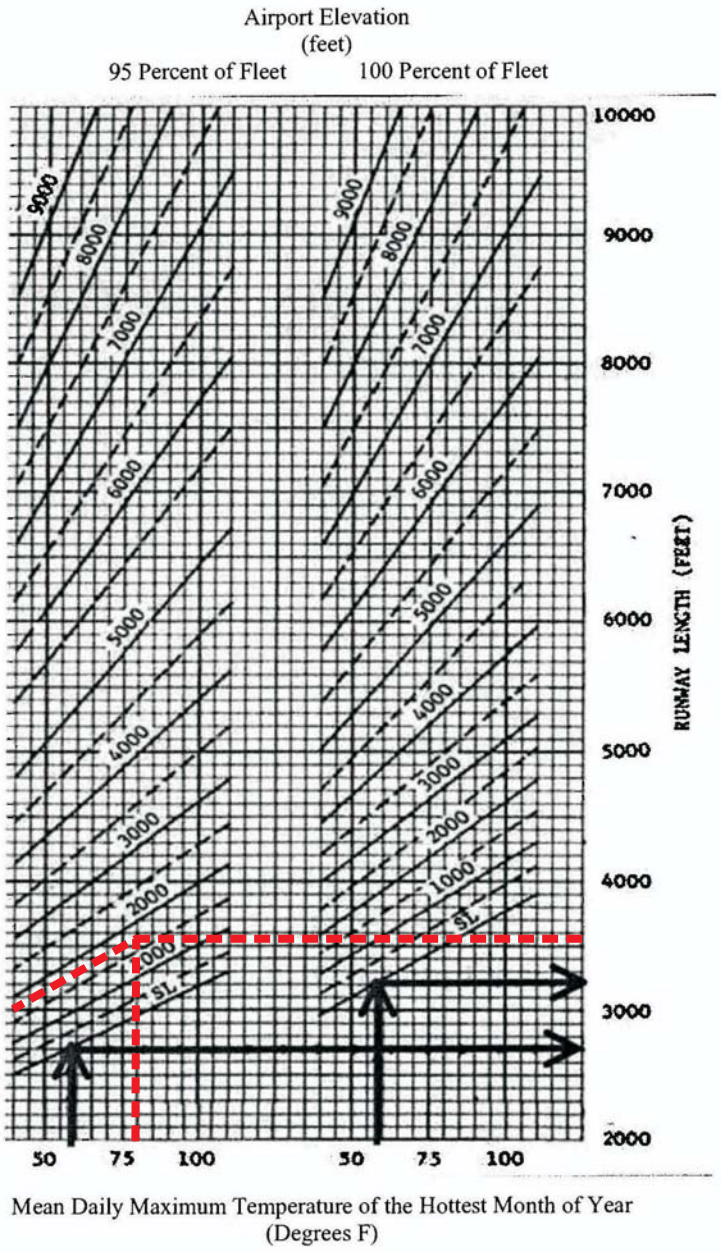
Table 4-6 Runway Protection Zone Dimensions

Runway	Dimensions
Runway 17 – existing	250' x 1,000' x 450'
Runway 35 – existing	250' x 1,000' x 450'
Runway 17 – ultimate	500' x 1,000' x 700'
Runway 35 – ultimate	500' x 1,000' x 700'

Dimensions are (inner width) x (length) x (outer width)

A-I and B-I Crosswind Runway Length Requirements

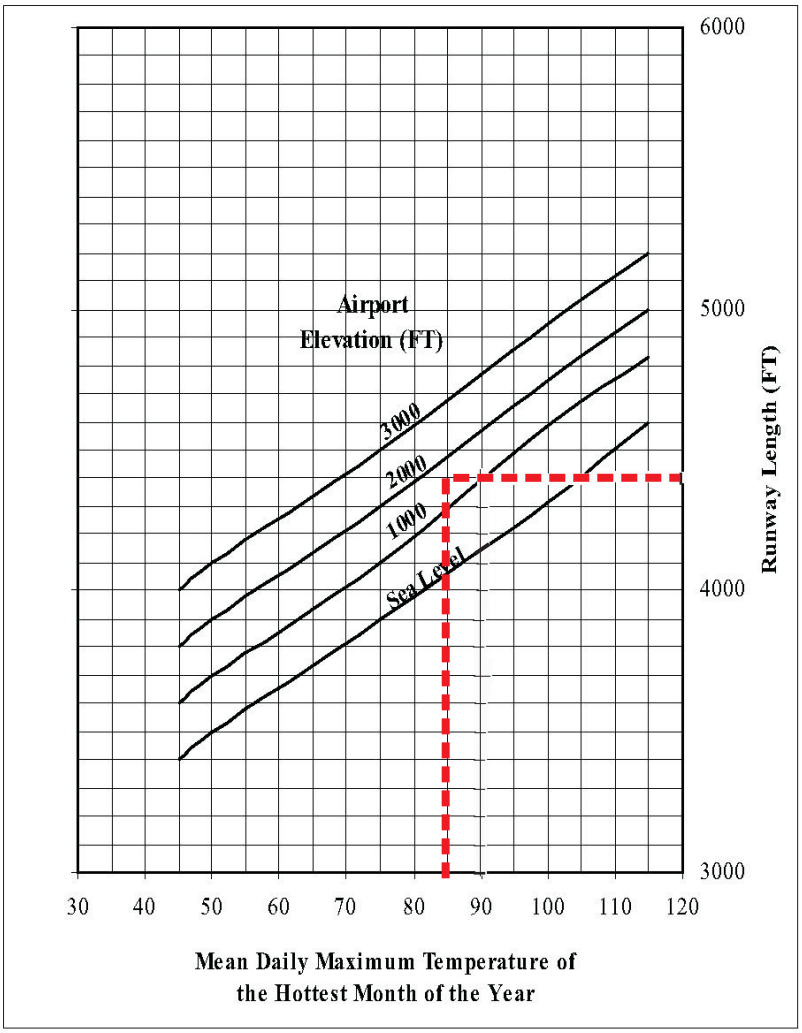
Figure 2-1. Small Airplanes with Fewer than 10 Passenger Seats
(Excludes Pilot and Co-pilot)



Note:
FAA example is shown in black. Red represents data for Brookings Regional Airport.

B-II Crosswind Runway Length Requirements

Figure 2-2. Small Airplanes Having 10 or More Passenger Seats
(Excludes Pilot and Co-pilot)

Representative Airplanes	Runway Length Curves
Raytheon B80 Queen Air **Raytheon** E90 King Air **Raytheon** B99 Airliner **Raytheon** A100 King Air (Raytheon formerly Beech Aircraft) **Britten-Norman** Mark III-I Trilander **Mitsubishi** MU-2L **Swearigen** Merlin III-A **Swearigen** Merlin IV-A **Swearigen** Metro II	**Note:** For airport elevations above 3,000 feet (915 m), use the 100 percent of fleet grouping in figure 2-1. 

4.3.5. Runway Width

The FAA establishes 100 feet as the required width for a runway supporting ADG III. The primary runway meets this requirement. The crosswind runway, an ADG I runway, meets the 60-foot width requirement. In keeping with what was discussed under Crosswind Runway Length, an ultimate runway width of 75' should be planned for to meet B-II requirements.

4.3.6. Runway Shoulders

Runway shoulders are intended to provide a transition surface between the runway pavement and the adjacent surface, to support aircraft running off the pavement, provide blast protection, and enhance erosion control and drainage. For Aircraft Design Group III, the required shoulder width is 20 feet for the primary runway and 10 feet for the crosswind. Future runway improvements should ensure that these shoulders are provided for.

4.3.7. Runway Blast Pads

Blast pads are recommended by the FAA for blast and erosion control, and are located at the ends of runways. ADG III aircraft require a 200 foot long and 140 foot wide pad. The existing runways do not have paved blast pads but instead have turf cover (200' length). The FAA recognizes paved blast pads as a recommendation and yields to the discretion of the local airport manager.

4.3.8. Runway Safety Areas

The RSA for Runways 12 and 30 at Brookings meets FAA requirements for ARC-III (1,000 feet beyond the runway end, and 500 feet wide). For Runways 17 and 35, the RSAs are consistent with ADG I and are 120 feet wide and 240 feet beyond the runway end. An upgrade to B-II would require an RSA that is 150 feet wide and 300 feet beyond the runway end.

4.3.9. Runway Object Free Area

The Runway Object Free Area (ROFA) is centered on the runway centerline and should be clear of any above ground objects protruding into the runway safety area edge elevation. The only exception to this rule is related to objects necessary for air navigation or aircraft ground movement. The ROFA is clear off of every runway end with the exception of Runway 12. This runway end has the DM & E railroad located within the ROFA which extends 1,000 feet beyond the runway end and has a uniform with of 800 feet. This is considered a Federal Aviation Safety violation because it is not a part of air navigation or aircraft ground movement. This deficiency will be addressed in the concepts chapter.

An upgrade to B-II for the crosswind would increase the ROFA from 250 feet wide and 240 feet beyond the runway ends to 500 feet wide and 300 feet beyond the runway ends.

4.3.10. Runway Obstacle Free Zone

The Runway Obstacle Free Zone (OFZ) is a defined airspace centered above the runway and extends 200 feet beyond each runway end. The width varies depending on the characteristics of the runway's critical aircraft. For Brookings it is 400 feet.

In the same manner, the inner-approach OFZ is centered on the approach area, and applies only to runways with approach lighting systems (Runway 30). It begins 200 feet from the runway threshold at the same elevation as the threshold, and extends 200 feet beyond the last approach light. The width is the same as the runway OFZ and has a 50:1 slope.

The inner-transitional OFZ is that airspace along the sides of the runway OFZ and inner-approach OFZ, and applies to runways with less than ¾ mile visibility minimums. Separate criteria apply depending upon if a Cat I or II/III runway is present. In the case of Brookings (CAT I for Runway 30), the inner-transitional OFZ starts at the edges of the runway OFZ and inner-approach OFZ, rises vertically for a given height 46 feet, then slopes 6:1 out to 150 feet above the airport elevation. No penetrations to the inner-transitional OFZ for Runway 30 were identified.

4.3.11. Runway Pavement Strength

At slightly over 44,000 pounds maximum take-off weight, the ERJ 135 will not require any upgrades to the pavement strength on the primary runway. Should the crosswind runway ever be upgraded to a B-II runway, further study of that runway's pavement will be needed to determine the extent of any needed upgrades.

4.3.12. Runway Requirements Summary

Existing commercial service with the Beech 1900 and some current corporate jet activity are generally supported with the existing runway length. Future plans should include a runway length of 5,500 to better accommodate the athletic charter traffic aircraft. Existing commercial service with the Beech 1900 and some current corporate jet activity are generally supported with the existing runway length. Long-term planning should allow for a 6,500-foot runway.

Given the existing zoning issues on the Runway 30 approach and the limitations on the Runway 12 end, any runway extension may be difficult to achieve with the runway on its current alignment. It is with this sensitivity that the alternative concepts are later identified, screened and decided upon.

4.3.13. Taxiway Requirements

ADG III criteria for taxiway width are 50 feet. Taxiway A (parallel taxiway to Runway 12-30) is currently 50 feet wide, and Taxiway B (the connector taxiway between Runways 17-35 and 12-30) is 25 feet wide. Given that Runway 12-30 is ADG III and Runway 17-35 is ADG I, this criteria is met. For future development options, an upgrade in width of Taxiway B will be reviewed to improve runway access and provide increased airfield movement flexibility.

Additionally, only Runway 12-30 is currently serviced by a full length parallel taxiway A. AC 150/5300-13 recommends that both runways have parallel taxiways, and these planning criteria will be reviewed for applicability in the development of alternatives. This would make airfield movement more efficient and reduce the possibility of runway incursions.

For ADG III aircraft, the recommended runway centerline-to-taxiway centerline separation is 400 feet. For Taxiway A and Runway 12-30, this separation distance is currently 387.5 feet and therefore does not meet this criteria. This will be addressed in the Development Concepts chapter.

Taxiway turnoffs should be present to facilitate aircraft exit off of the supported runway, to reduce incursions and minimize time on runway. Taxiway A currently provides this functionality for Runway 12-30, and AC 150/5300-13 guidance will be utilized for proposed future parallel taxiway systems within the alternatives concepts discussed in subsequent chapters of this master plan.

Due to the low volume of traffic at Brookings, it is not recommended that special provisions for bypass taxiways and hold pads be proposed; these tend to be planning criteria reserved for high traffic commercial service airports.

Paved or stabilized shoulders are recommended along taxiways. ADG III aircraft would require 20 foot shoulders. Brookings currently does not have shoulders on its taxiways.

The Taxiway OFA for ADG III aircraft is 186 feet, and for ADG I it is 89 feet. Brookings appears to comply with these criteria in terms of OFA obstructions in most areas with the exception of the general aviation hangar area.

4.4. NAVAIDS

As noted in Chapter Two, Runway 30 has an Instrument Landing System (ILS) with a MASLR and ½ mile approach visibility. Additionally, Runway 12 has a GPS approach which affords one mile visibility minimums for Category A-C aircraft (2020 foot ceiling), and Runway 30's GPS approach provides visibility minimums ranging between ½ and 1 mile for Category A through D (2080 foot ceiling). Finally, the VOR approach to Runway 12 provides between one and two mile visibility minimums for ceilings between 2140 and 2200 feet, depending upon category of aircraft and approach type (circling or S-12).

The existing Automated Weather Observing System (AWOS) has had reliability issues and will require enhancement or upgrade. The AWOS provides ceiling, temperature, and visibility information to aircraft arriving at or departing from the airport. The reliability issues associated with this instrument need to be addressed regardless of what development concept is chosen, especially because commercial air service relies on AWOS information. This Master Plan recommends that the Airport Sponsor contact the AWOS owner and investigate what is causing the outages and whether some other type of weather observing system would be better suited to the conditions at the Airport.

In the future there may be some applicability for a precision GPS approach possibly with WAAS (Wide Area Augmentation System) at Brookings. FAA is developing the WAAS program for use in precision flight approaches. Currently, GPS alone does not meet the FAA's navigation requirements for accuracy, integrity, and availability. WAAS corrects for GPS signal errors caused by ionospheric disturbances, timing, and satellite orbit errors. WAAS accuracy is within approximately 10 feet, as compared to upwards of 330 feet. The technology is still being reviewed by the FAA.

4.5. Passenger Terminal

4.5.1. Aircraft Parking Position Requirements

Within the forecast period, commercial service at Brookings is not expected to grow beyond its current single carrier operation. Only one aircraft is on the ground at a given time. Therefore, a single ADG-II parking position is required. However, in the context of the athletic charter scenario, it is probable that the passenger terminal will need to accommodate one commercial service and one charter aircraft at the same time. In addition, the timing of these charter flights will vary, and could result in the need for a total of three parking positions (two ADG-III and one

ADG-II). Sensitivity will be towards the location of the FBO in alternative concepts, so one of these parking positions may be co-located.

The northwestern terminal area apron, as noted in Chapter Two, is in poor condition and has drainage issues. To the southeast toward Big Sioux's complex, the bituminous pavement is of unknown composition, but in very good condition. This area would be redone if the terminal building area is redeveloped. The Big Sioux apron/tie-down area is in excellent condition.

4.5.2. Terminal Building

As described in Chapter Two, the existing terminal building has 1,780 of usable square feet (see **Figure 4-5**). The functional layout is simple and can accommodate only one airline. The ticket counter with two transaction positions is also accommodating an Explosive Trace Detection (ETD) machine. There is a small lobby area able to accommodate about 10 passengers. The airline operations area has a small 102 square foot office and an adjoining baggage storage area. The main lounge, approximately 646 square feet, accommodates passenger screening equipment, small vending machine area, restrooms, and a utility room.

The existing facility meets the typical airline requirements for a commuter airline one-gate station. The base case forecast projects that Brookings will not see materially greater commercial airline service in the forecast period due to its proximity to Sioux Falls and that commercial service drive peak hour enplanements and deplanements will not reach available seat capacity currently provided by Mesa Airlines (Beech 1900, 19 seats). Despite this, the passenger and baggage screening areas cause circulation issues. Therefore, this Master Plan recommends increases in these areas to address circulation deficiencies in the pre-checkpoint circulation area.

While some thought was given to using the terminal building to process some of the charter activity, security issues could make this impractical. If these could be adequately addressed with the TSA, such charter use of the terminal would be appealing, especially if the terminal building became the focus of a redeveloped airport and show cased entry into the City of Brookings. If this did happen, the peak hour numbers would have to be modified to comply with the athletic charter scenario and additional terminal area planned for.

In ***Table 4-7***, the existing and proposed square footage for a new terminal building is outlined. This Master Plan compared existing peak hour enplanement and deplanements against current terminal capacities. Then forecast growth for the athletic charter scenario was added Deficiencies such as room for new TSA security process and circulation were addressed. Lastly, comparable terminal facilities were reviewed to ensure the appropriateness of the planning factors used.

Existing Terminal Building

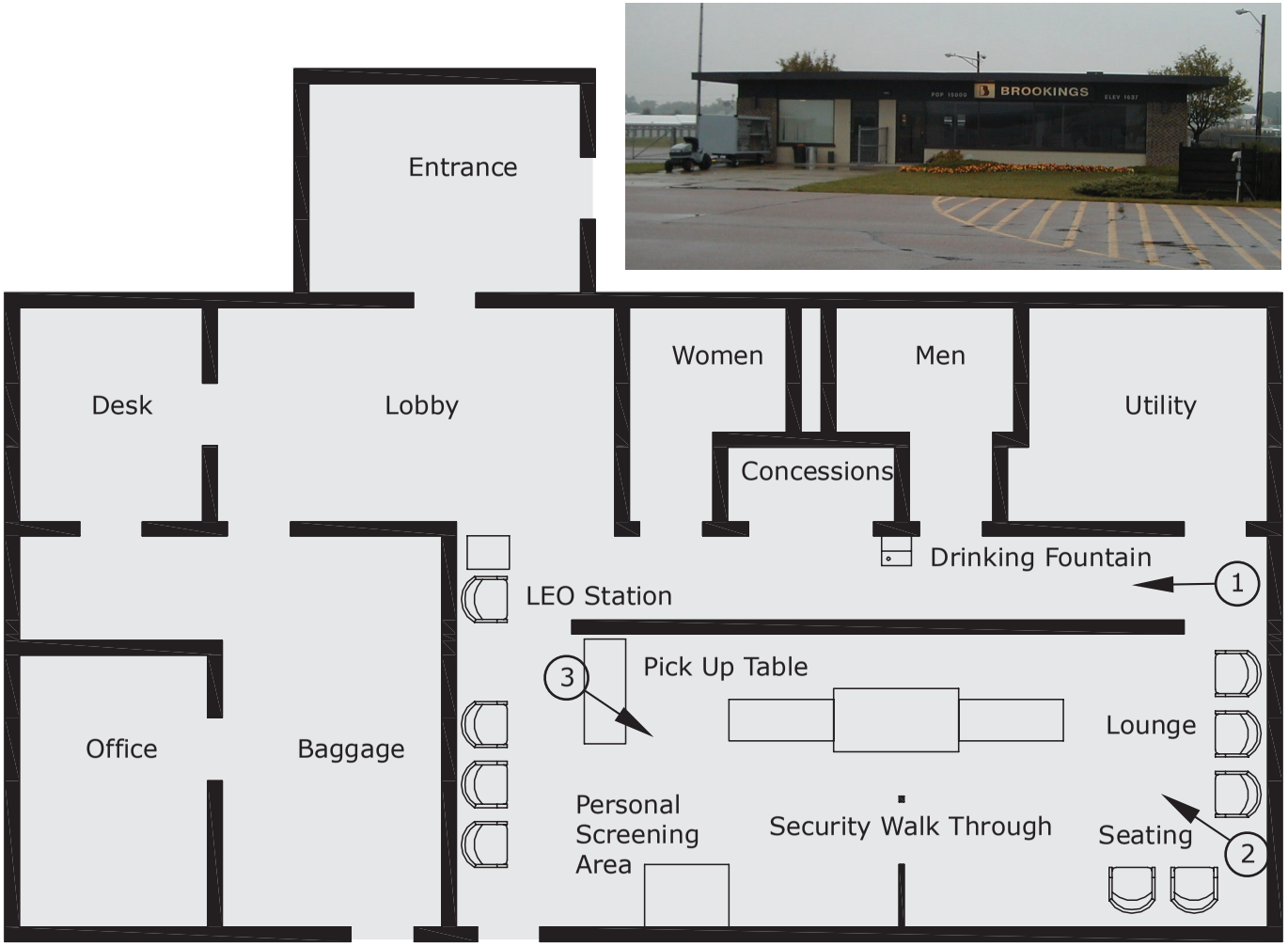


Photo 1

Photo 2

Photo 3

CITY OF BROOKINGS

Airport Master Plan

Brookings Regional Airport

Figure 4-6

HNTB

Table 4-7

BROOKINGS REGIONAL AIRPORT MASTER PLAN UPDATE

Passenger Terminal Building - Facility Requirements Summary

	2005 (Existing) Exist. Requirements		2010 Forecast	
Space	**LF**	**SF**	**LF**	**SF**
Airline Functions				
Ticket Counter (SF)		102		120
Ticket Counter (LF)	10		11	
Ticket Counter Queuing (SF)		226		350
Airline Ticket Office/Outbound Baggag		221		420
Departure Lounge (SF)		522		700
Baggage Claim (SF)		0		140
Baggage Claim (LF)	0		28	
Inbound Baggage (SF)		131		250
Clubs/VIP Room SF (SF) 1/		n/a		n/a
Subtotal Airline Functions		1,201		1,980
Concessions Space				
Food/Beverage (SF)		45		70
News/Gift/Sundry (SF)		0		50
Rental Car (SF)		0		140
Other Revenue (SF)		0		0
Subtotal Concessions Space		45		260
Federal Inspection Services 1/				
Federal Inspection Services (SF)		n/a		n/a
Subtotal FIS		0		0
Secure Public Area				
Security (SF)		199		400
Circulation (SF)		119		250
Restrooms (SF) 1/		n/a		n/a
Other (SF)		0		0
Subtotal Secure Public Area		318		650
Non-Secure Public Area				
Circulation - Ticketing (SF)		132		180
Circulation - Baggage Claim (SF)		0		140
Circulation - General (SF)		0		136
Restrooms (SF)		131		180
Other (SF)		0		0
Subtotal Non-Secure Public Area		263		636
Non-Public Area				
FAA (SF)		0		140
Airport Administration (SF)		0		180
Maintenance (SF)		0		0
Mech./Elect./Bldg. Systems (SF)		127		210
Miscellaneous (SF)		0		0
Subtotal Non-Public Area		127		530
Total All Areas		1,954		4,056

1/ Not applicable.

Legend

SF = Square Feet 5516

LF = Lineal Feet

Source: HNTB analysis

4.6. Surface Transportation and Parking

4.6.1. Public Parking Requirements

The determination of parking requirements was based upon the planning analysis of a new terminal, and reviewed passenger, employee and rental car requirements including provisions for Handicap-compliant space count. Parking for corporate and general aviation was addressed for those specific areas. ***Table 4-8*** summarizes overall parking requirements for the airport.

Employee Parking
There is currently no designated employee parking at the Airport. Dedicated spaces will be provided based upon the presence of airline staff, and TSA staff, and airport employees at the new terminal facility.

Rental Car Parking
There currently is limited rental car activity at the airport, operated by GP Auto and coordinated by Big Sioux Aviation at the FBO. This service is used approximately four times per month and is also available for commercial passengers. It is assumed that this service will be located in a future new terminal building complex.

Other Parking
There is a small parking area off of Division Avenue intended for parking of GA-based aircraft users. This will be retained and improved as necessary.

4.6.2. Airport Access and Roadway Circulation

The existing airport access is sufficient for the base case in the existing airport alignment. Other alternatives concepts will dictate new airport access schemes that will align to proposed new terminal area locations as well as corporate hangar/FBO sites on-airport.

Table 4-8

BROOKINGS REGIONAL AIRPORT MASTER PLAN UPDATE

Parking Requirements

Airline / Equipment	2010	2015	2020	2025
Employee				
Existing	3			
Required	6	6	6	6
Parking				
Existing	6			
Required	24	24	24	24
Handicapped	0			
Existing	1			
Required	2	2	2	2
Rental Car				
Existing	0			
Required	1	1	1	1
Total Existing	10			
Total Required	33	33	33	33

Source: HNTB Analysis.

4.7. General Aviation Facilities

It is expected that general aviation growth will continue to be consistent with national growth through the forecast period, though local trends could accelerate growth. Chapter Three outlined the basis of based aircraft growth at the airport, and trends toward jet and single engine piston growth. The airport is projected to grow in terms of based aircraft from 35 in 2004 to 41 in 2025. The number of single engine piston aircraft would grow from 30 to 33, and turbo-jet from zero to two. The number of ultralights would increase from two to three. The number of multi engine piston airplanes would remain constant at three.

The local climate is also indicating a strong demand for private hangars, and corporate representatives are indicating they may base more corporate aircraft at the Airport. In fact, a corporate hangar is in planning stages, east of the existing terminal building. Finally, SDSU is expected to ask Big Sioux Aviation to increase its fleet of training aircraft to support increased enrollment.

4.7.1. General Aviation Hangars

The airport currently has 35 general aviation aircraft hangared, 23 in individual hangar spaces and the remainder in Big Sioux's hangars. Total hangar space is just less than 54,000 square feet (not including Big Sioux).

The general aviation hangars are mostly pole-type with metal panel covering or pre-engineered buildings (in the case of the 4,800 sf State of South Dakota Department of Transportation/SDSU hangar), and mostly exceed 20 years in age. There are currently five blocks or groupings of general aviation hangars of which four are developed; as of fall 2004 there were 22 individual sites for lease purposes. They are of various states of condition based upon individual tenant maintenance practices, but for the most part their condition is fair to good. The current building area is susceptible to standing water during rain events as a result of inadequate drainage.

Currently 100% of Brookings' based aircraft are hangared, due to severe weather potential in the winter and reasonable lease rates. It is assumed that this practice will continue.

Despite the fact that the forecasts indicated an increase of only six based aircraft over 20 years, local trends indicate that growth might occur much sooner. The Airport Manager has identified an immediate need for four more conventional hangars, and one nested T-Hangar facility.

As mentioned briefly in the Inventory Chapter, finding space for additional hangars will be difficult. The presence of Rainbow Play Systems eliminates the possibility of any significant amount of new hangars west of the terminal building. The current hangar area is nearly completely built-up. The 35 end of the crosswind runway offers easy access off 8th Street, but placing hangars on the crosswind runway far away from the support services near the terminal area is not ideal. If hangars were constructed in this area, a parallel taxiway would need to be constructed.

The south side of the primary runway is probably the next best area, but ground access to it is limited by subdivision development. In addition, the potential building area is greatly limited by the VOR critical area (unless the VOR was relocated) and the building restriction line (BRL). In addition, any taxiway access would have to avoid the glide slope critical area.

The best place to locate new hangars will be identified in the Concepts Chapter.

It is important to note that including these hangars on conceptual plans is not a commitment to build or fund them. Rather, it is simply ensuring that should the indicated immediate demand lead to actual hangar construction, an appropriate place for them is shown in this Master Plan and subsequent ALP.

Table 4-9 Hangar Needs

	Current	Immediate Need Additional	Future Additional
Conventional Hangar	20	4	12
Nested T-Hangar	3	1	2 - 6 units
Big Sioux Hangar	12	0	2

4.7.2. Conventional/Corporate Hangars

There is currently no corporate hangar facilities on-airport, but the Brookings City Council has approved plans for the construction of a hangar for VeraSun, east of the existing terminal building. This recognizes the potential the airport has in terms of corporate hangar development to support the major manufacturers in town. The master plan forecast in Chapter Three contemplates that there might be two based jet aircraft in 2025. The alternatives concepts will identify corporate hangar growth compatible with suitable airfield access as well as airport ground transportation access. Additionally, the future corporate hangar siting (which may require VeraSun to relocate the proposed hangar) will be such that it is segregated from the general aviation hangar area to afford both optimum growth potential and recognize each group's different requirements.

4.7.3. Fixed Based Operator

Big Sioux currently operates out of a 10,416 SF, two story facility containing the standard amenities for an FBO facility (pilot lounge, weather station, pilot planning). Big Sioux's largest hangar facility is 4,300 SF, with approximately 65,000 SF of apron area not including the surface area in front of the terminal, reserved for commercial airline operations.

Based upon meetings with Big Sioux representatives, the existing facility meets the needs of the FBO operation (given its 2nd floor expansion). The alternatives concepts will review potential relocation of this facility to better align future corporate hangar areas on airport, allowing for expanded growth of the private hangar area to the east. There are is no agricultural spray activities on-airport, and none are contemplated.

4.8. Cargo Processing Facilities

Due to Brookings' geographic location to Sioux Falls, Brookings has not had material cargo handling business in the past. I-29 has provided adequate ground transportation access for overnight mail and other cargo requirements. This is not expected to change in the forecast period.

4.9. ARFF Requirements

The City of Brookings currently provides all fire coverage for the airport per the requirements of the airport's Part 139 certification. New Part 139 requirements will likely require that the City provide dedicated facilities on airport. The City is purchasing an ARFF vehicle in 2006, and the alternatives concepts will identify a site for an ARFF station. Until the ARFF station becomes a reality, a memorandum of understanding (MOU) may be required between the FAA and the City that will specifically detail the steps that the City will take for coverage of fire protection during windows of operations at the airport. This will probably involve the staging of ARFF assets at the airport on an on-call basis during specific period of time to support commercial aircraft operations. Because of the limited commercial service operations at the airport, such an MOU should be an acceptable basis for an interim solution with the FAA certification inspection staff.

4.10. Airport Traffic Control Tower

The Airport does not currently have an Airport Traffic Control Tower (ATCT). However, there has been interest historically for a tower to address concerns of safety given the high volume of student traffic at the facility, a volume that is expected to grow as the number of enrolled students in SDSU's program increases from just over 80 currently to 150 over the course of the next ten years (according to informal SDSU projections).

The FAA considers an ATCT to be a significant investment of capital and has a well-established priority system for new and relocated towers around the country. This is especially true in light of current budget restrictions. For any airport, a justification package for an ATCT would have to pass the federal Benefit Cost Analysis (BCA) criteria as outlined in "FAA Airport Benefit-Cost Analysis Guidance" issued by the Office of Aviation Policy and Plans, dated December 15, 1999. Criteria would look at the estimated benefits over a determined evaluation period. For a generic tower project this would include improved traffic flows, more efficient use of approach and departure airspace, improved schedule predictability, compliance with FAA safety standards, and other criteria. Modeling would be required to ascertain the extent of these benefits. On the other side, costs would obviously include up front capital, on-going operations and maintenance expenses, personnel costs, and related areas within the context of life cycle costing. A project with a BCA under 1.0 would not be eligible for federal funding without a special determination of eligibility. If the BCA was positive, then the FAA would ascertain the priority of the proposed tower in context to the airport's standing within the national air system, particular safety issues at the airport, and projected growth of traffic given any existing documented problems. Given the relative size of Brookings Regional Airport and its nominal air service, it is unlikely that the FAA would participate in an ATCT at BKX using federal dollars.

The alternative for Brookings would be to request a grant (using entitlement dollars) for the construction and outfitting of a tower. Such a request would have to satisfy the basic criteria as outlined below:

1. Brookings would have to become a participant in the FAA Contract Tower Program, or
2. The FAA must agree that the tower would qualify the sponsor to be eligible to participate in the Contract Tower Program, and
3. Brookings would have to certify that it would pay its share of the cost to equip, maintain and operate the airport, usually through an Operating Agreement and Cost Share

Agreement. The Program would require at least a 10% share from Brookings as well as commitment of its non-primary entitlement dollars or state apportionment dollars.

Basic siting criteria would require modeling of existing and future approach and missed approach surfaces, and a site which afforded the cab personnel with full visibility (line-of-sight) to all movement areas on the airfield (runways, taxiways, and ideally apron areas).

4.11. Miscellaneous

4.11.1. Maintenance Equipment, Facilities, and Staffing

As mentioned previously, the Airport is served by a fulltime airport manager. Given the size of the airport, and the inefficiencies generated by having certain services contracted out, the City should consider hiring at least one additional airport employee and purchasing additional equipment to assist with maintenance tasks such as snow removal, sanding, salting and mowing. This is especially true since the airport already owns much of the equipment needed for these tasks. The airport currently owns a John Deere loader, an 8' broom, and a three blade snow blower, a snow plow/sander truck, a 544H Loader with a 20' ramp plow and a Ford F4000 dump truck with sander, 12' plow blade and 8' plow wing.

Currently, the airport out-sources snow removal to a vendor under contract by the City of Brookings, and receives its grounds and building maintenance from City staff. Based on current per-plow and per-sand load prices the City is paying under the current contracts, it appears there is an opportunity for significant cost savings were the Airport properly staffed to do more of the maintenance on its own.

With the addition of the snow plow / sander truck, the delay between the start of a snow event and the start of plowing and sanding operations will be reduced significantly. Previous to the addition of this equipment, it could take up to two hours to get the operations initiated. Now, it could begin almost immediately.

There is a building on-airport for storage of on-site products and equipment to accomplish grounds maintenance (north of Big Sioux FBO complex and east of the terminal building). If the Airport starts doing more of its own work, a heated sand and salt shed should be constructed at or near the equipment storage building. It is anticipated that comparable facilities will be provided for in each alternative concept and expanded facilities will be depicted when possible.

4.11.2. Fuel Storage Areas

As described in Chapter Two, Big Sioux provides 100LL AvGas by means of one-2,000 gallon and two-6,000 gallon underground storage tanks, and Jet-A fuel through one-10,000 gallon underground tank. One 800 gallon AVGAS truck and one 2,000 gallon Jet A truck serve the facility. Given the relatively modest growth in operations forecast, fuel storage requirements are not anticipated to change greatly. Therefore, a similarly sized fueling area is assumed to be included in FBO areas in the concepts chapter. If a new FBO area is identified, the tanks should be thoroughly inspected to see if replacement tanks are warranted

4.12. Summary

Adding to the existing issues identified in Chapter Two, this chapter identified the facilities needs that will allow the Airport to meet the activity levels forecast in Chapter Three and one safety-related need.

4.12.1. Safety-related need

- Improved AWOS functionality.

4.12.2. Capacity / efficiency-related needs

- A near-term extension to 5,500 feet and an ultimate extension to 6,500 feet for the primary runway.
- An ultimate extension to 4,400 feet (or as much as feasible) and an upgrade from utility B-I to other than utility B-II (including all associated criteria) for the crosswind runway.
- The expansion and reconfiguration of the passenger terminal.
- Identify new hangar areas.
- Develop plan for Airport to reduce amount of maintenance functions that are contracted out and identify areas for expanded maintenance facilities.
- Improved wind coverage during poor weather conditions.