CHAPTER 3

FACILITY REQUIREMENTS

Introduction

Similar to the aviation industry's evolution, the needs of Sioux Falls Regional Airport (FSD or the Airport) have changed over time. It is pivotal to plan for the near- and long-term growth, which is projected in **Chapter 2 – Aviation Activity Forecasts** of the Master Plan. This chapter serves as an evaluation of the Airport facilities' ability to accommodate current and future demand, both on the airfield and across the landside components of the Airport. Several factors are considered when determining facility needs, including:

- Spatial constraints
- Design standards
- Current and future demand
- Wind coverage
- Capacity and delay

This chapter also references other studies developed as part of the overall Master Plan effort, each of which are described below.

Air Cargo Master Plan Study

Given the rapidly changing environment for air cargo, the Airport placed special emphasis on the Master Plan's air cargo elements. Hubpoint Strategic Advisors, LLC (Hubpoint), an aviation industry consultancy firm with long held experience in the air cargo industry, led the Air Cargo Master Plan study to accomplish the following objectives:

- Assess the current situation for air cargo at FSD.
- Analyze the regional air cargo market.
- Determine the future implications for air cargo at FSD in terms of infrastructure and facilities requirements.

The Air Cargo Master Plan, located in **Appendix B**, describes the methodology and results of Hubpoint's analysis. The study provides context on the air cargo industry and relevant markets to put the findings in proper perspective. The report includes future air cargo activity projections and development scenarios that inform this chapter's air cargo section.

Terminal Planning Study

During development of the Master Plan, it became apparent the terminal area analysis scoped for the Master Plan would be insufficient to achieve FSD's goals with respect to implementation of near-term terminal projects. The preferred method to adequately analyze terminal facility requirements, and alternatives to meet those needs, was development of a standalone Terminal Planning Study (TPS). A TPS is a comprehensive report that provides guidelines for improvement of the airport terminal building, the terminal apron, and vehicle access. A Terminal Planning Study for FSD is located in **Appendix C**. Section 4 of the TPS, *Terminal Programming*, identifies terminal facility requirements anticipated for FSD through the year 2041. The capacity of the existing terminal is described and assessed against aviation demand planning activity levels, providing the basis for recommendations regarding appropriate sizes of terminal building components and aircraft parking layout. This analysis determines requirements for future facility improvements based on industry standards and guidelines developed by the FAA and TSA.

Requirements for airside and landside facilities will be further analyzed in **Chapter 5 – Alternatives***.* Determining the highest and best use of limited developable available space will be critical as aviation activity and facility needs at FSD increase.

FSD's functional areas are depicted on **Figure 3-1**. Development constraints are shown on **Figure 3-2**.

Figure 3-1 **Functional Areas**

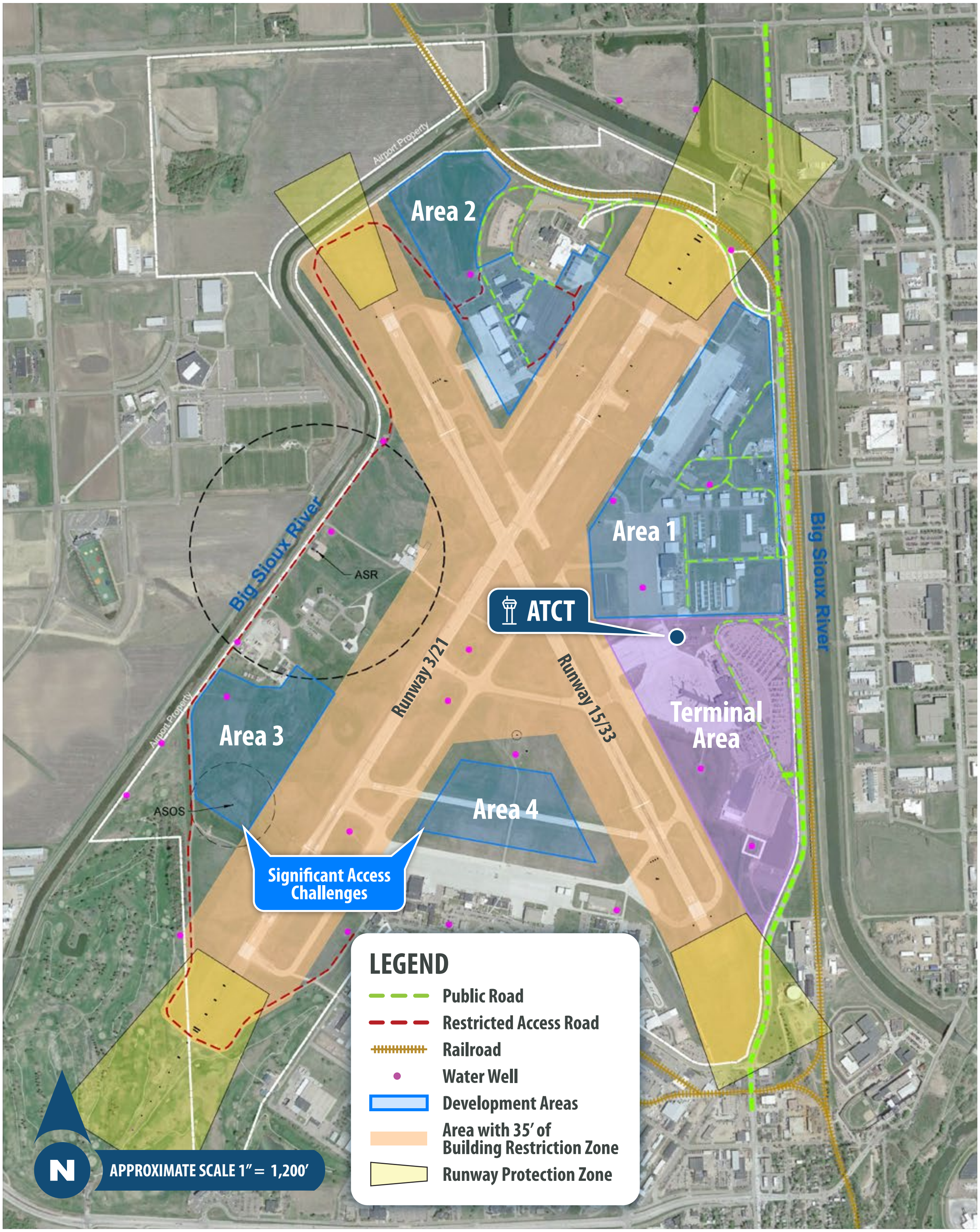


Figure 3-2 Development Constraints

For the completion of this chapter, Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5300-13B, *Airport Design*, was referenced and is considered the guideline for the chapter wherein airport design standards, predominantly dependent on Runway Design Code (RDC), are defined. In the conclusion of **Chapter 2 – Aviation Activity Forecasts** the most demanding aircraft groups with a comparatively high number of operations include C-IV and D-III aircraft. Each of these groups surpass the 500 annual operations requirement to be considered the critical aircraft, resulting in an overall RDC of D-IV for FSD.

The RDC defines the design standards that apply to a given runway based on the Aircraft Approach Category (AAC), the Airplane Design Group (ADG), and the minimum runway visibility expressed as runway visual range (RVR). RDC components are shown in **Table 3-1**. The RVR relates to the instrument approach minimums, rather than the design aircraft, and its values represent feet of forward visibility that have statute mile equivalents. Lower RVR numbers mean an airport is capable of remaining open to properly equipped aircraft in low visibility conditions.

Table 3-1 Runway Design Code (RDC) Components

Aircraft Approach Category (AAC)		
Approach Category	**Approach Speed**	
A	Approach speed less than <91 Knots	
B	Approach speed >91 knots, but <121 knots	
C	Approach speed >121 knots, but <141 knots	
D	Approach speed >141 knots, but <166 knots	
E	Approach speed >166 knots	
Airplane Design Group (ADG)		
Design Group	**Wingspan (Feet)**	**Tail height (Feet)**
I	< 49'	< 20'
II	49' to < 79'	20' to < 30'
III	79' to < 118'	30' to < 45'
IV	118' to < 171'	45' to < 60'
V	171' to < 124'	60' to < 66'
VI	124' to < 262'	66' to < 80'
Approach Visibility Minimums		
RVR (Feet)	**Flight Visibility Category (statute mile)**	
VIS	Visual Approach Use Only	
5000	Not lower than 1 mile	
4000	Lower than 1 mile, but not lower than ¾ mile	
2400	Lower than ¾ mile, but not lower than ½ mile	
1600	Lower than ½ mile, but not lower than ¼ mile	
1200	Lower than ¼ mile	

Source: FAA AC 150/5300-13B, Airport Design
Notes: RVR = Runway Visual Range
VIS = Visibility

General Aviation (GA) aprons and taxilanes will be evaluated, referencing the design standards of the most demanding GA aircraft to use the area. Though the functional areas will be planned to the most demanding aircraft design standards, aircraft with RDCs other than that of the critical aircraft are not prohibited from operating at the Airport.

3.1 AIRSIDE FACILITIES REQUIREMENTS

As discussed in the *Existing Conditions Inventory* chapter, airside facilities include runways, taxiways, and aprons. Runways and taxiways are evaluated in this section; aprons are evaluated as part of analysis for terminal, air cargo, and GA areas. Airside facilities analysis includes factoring wind conditions and calculating required runway length. When determining facility needs, it is important to assess airside facility needs first as the runway system drives airfield layout.

3.1.1 Airfield Orientation

Surface wind conditions – direction and speed – generally determine the necessary runway system alignment and configuration. Wind conditions affect all aircraft to varying degrees; however, the ability to land and takeoff in crosswind conditions differs according to pilot proficiency and aircraft type. Typically, the smaller the aircraft, the more it is affected by crosswinds.

The FAA provides limitations on crosswind components for aircraft. The allowable crosswind component used to compute the wind coverage for a runway or combination of runways is based on the RDC, as shown in **Table 3-2**.

Table 3-2 Crosswind Limitations per Runway Design Code

RDC	Allowable Crosswind Component
A-I and B-I	10.5 knots
A-II and B-II	13 knots
A-III, B-III, C-I through D-III D-I through D-III	16 knots
A-IV and B-IV C-IV through C-VI D-IV through D-VI E-I through E-VI	20 knots

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

Wind coverage is the percent of time crosswind components are below an acceptable velocity. The desirable wind coverage for an airport is 95 percent, based on the total numbers of weather observations. If a single runway cannot provide 95 percent wind coverage, a crosswind runway may be eligible for FAA funding.

To determine crosswind coverage at a specific airport, it is preferable to use 10 years of historical wind data. Historical data from the Airport's Automated Surface Observing System (ASOS) was referenced for the wind coverage analysis. **Table 3-3** provides the resulting runway wind coverage at FSD.

Table 3-3 All-Weather Wind Coverage

Crosswind Component	Rwy 3/21	Rwy 15/33	Rwy 9/27	*All Rwys*	*3/21 & 15/33*
10.5 knots	80.32%	91.52%	79.54%	***99.73%***	***96.79%***
13 knots	87.83%	95.84%	87.46%	***99.96%***	***98.88%***
16 knots	94.67%	98.63%	NA	***99.69%***	***99.69%***
20 knots	98.29%	99.62%	NA	***99.95%***	***99.95%***

Source: FSD Automated Surface Observing System for the period of 2011-2020 (Accessed via FAA's Airport Data and Information Portal [ADIP].)

The Airport's runways currently provide adequate wind coverage. Without Runway 9/27, the desired 95 percent wind coverage for all aircraft classifications will still be met (96.79% for the 10.5 knot crosswind component); therefore, Runway 9/27 may not be eligible for federal funding. FSD is planning to decommission Runway 9/27 prior to the time when major pavement maintenance or reconstruction is required.

Runway 3/21 is considered the primary runway at FSD due to available instrument approach procedures and runway length. The runway is not able to provide 95% wind coverage for the 10.5-, 13-, and 16-knot crosswind components which supports maintaining Runway 15/33 to accommodate C-III and D-III aircraft.

3.1.2 Airfield Capacity

The FAA defines airfield capacity in Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*, as "the maximum number of aircraft operations that a given airport configuration can accommodate during a given time interval of continuous demand." Several factors affect this derived level of capacity, including weather conditions, the configuration of runways and exit taxiways, types of aircraft utilizing a facility, time of day, and the capacities of air traffic control facilities handling the procedures.

The analysis summarized in this section was conducted using AC 150/5060-5 to estimate and evaluate the following airfield capacity metrics:

- **Annual Service Volume (ASV).** An estimate of an airport's annual capacity that accounts for runway use, aircraft mix, weather conditions, and other factors that would be encountered over the course of a year. The ASV also assumes an acceptable level of aircraft delay as described in FAA AC 150/5060-5, which is used in this analysis.
- **Peak hourly capacity.** The maximum number of aircraft operations that can occur on an airport in an hour, given specified weather conditions.

Long-term planning requires the Airport to assess its ability to meet forecasted demand. Once the ASV has been calculated and compared to the forecasts of future demand, capital improvement needs can be determined, including the need for land acquisition or operational capacity expansion, including the addition of runways or extending and improving existing runways.

The remainder of this section provides a summary of the estimate for the Airport's annual operational capacity, compares it to forecasted growth, and determines whether capacity improvements are needed to accommodate forecasted growth.

Current guidelines from the FAA National Plan of Integrated Airport Systems (NPIAS) direct airport sponsors to consider airfield capacity improvements when activity reaches 60 to 75 percent of an airport's ASV. This guidance is conservative and allows adequate lead time for environmental reviews, land purchases, and other necessary actions that can take up to 10 years or more to complete and could theoretically place activity at 80 percent of the ASV by the time improvements are implemented.

When considering both air carrier runways, FSD's ASV is 176,239 annual operations. Since the AC does not provide guidance for estimating change in ASV over time, a typical airfield capacity analysis fixes ASV at a given number (such as 176,239 operations) throughout the planning period, instead of fluctuating with operational demand. **Table 3-4** compares FSD's forecast operations to ASV. The preferred forecasts in the table – and those presented in Chapter 2, *Aviation Activity Forecasts* – result in 48 percent of ASV being reached by the end of the planning period. Therefore, no capacity improvements are expected to be needed during the 20-year planning period.

Table 3-4 Forecasted Operations as a Percentage of ASV

Year	Annual Operations	ASV	% of ASV
2021	61,628	176,239	35%
2026	70,310	176,239	40%
2031	74,854	176,239	42%
2036	79,653	176,239	45%
2041	84,637	176,239	48%

Source: AC 150/5060-5, Airport Capacity and Delay, Mead & Hunt.
Note: ASV = Annual Service Volume.

3.1.3 Dimensional Criteria

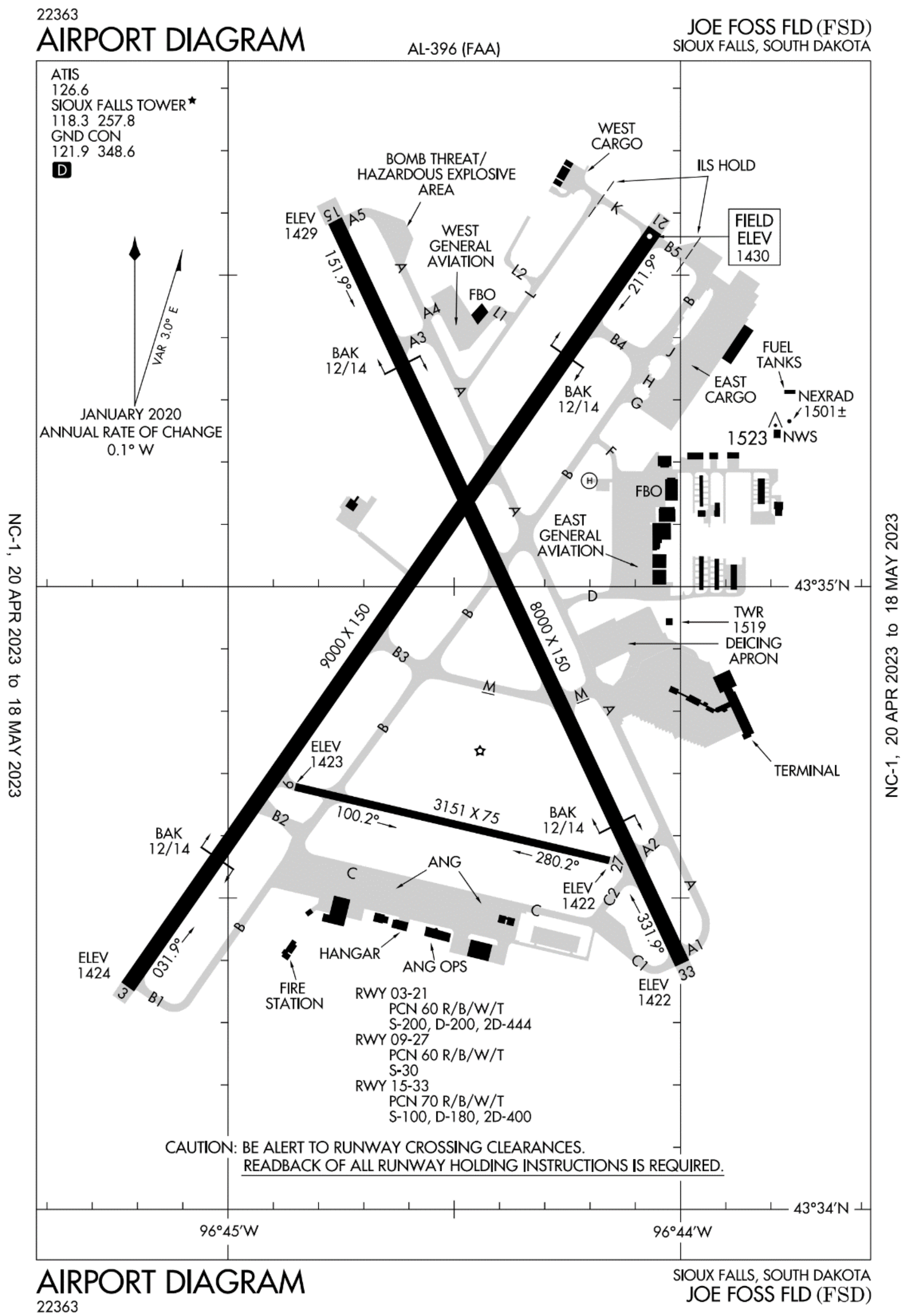
Runway Length

Runway length requirements at an airport are determined by the specific operational requirements of the aircraft serving it. Furthermore, runway length requirements for a specific aircraft directly relate to the aircraft's unique performance characteristics. Aircraft performance is further affected by factors such as airport elevation, temperature, and air density. Air density affects aircraft performance through both thrust and airflow over the wing. Thinner air does not produce as much forward aircraft momentum and decreases air movement over the wing, requiring increased airspeed to produce the same amount of lift. Therefore, the thrust and airflow required to depart the runway when the air is less dense will increase an aircraft's takeoff distance as elevation and temperature increase.

AC 150/5235-4B, Runway Length Recommendations for Airport Design, states that aircraft performance should be evaluated using the mean daily maximum temperature of the hottest month of the year at the airport elevation. Based on temperature data measured by equipment on the airfield at FSD, the average maximum temperature of the hottest month is 85.3 degrees Fahrenheit and usually occurs in July. The airport elevation at FSD is reported as 1,430 feet above mean sea level (MSL). Current runway lengths and airport facilities at FSD are illustrated in **Figure 3-3**.

In an ideal operating environment, aircraft can operate at maximum takeoff weight (MTOW) to and from the airfield in all scenarios. Operating at or near MTOW allows air carriers to maximize the utility of their aircraft by carrying as many passengers, as much cargo, and as much fuel as possible. However, as runway length decreases, or as temperature and elevation increase, greater demand is placed on the aircraft and, as a result, the weight of passengers, cargo, and fuel is often reduced to compensate and ensure safe operating performance on the available runway length.

Figure 3-3 Airport Diagram



Source: Federal Aviation Administration.

Air Carrier Fleet

The fleet mix at FSD is diverse and demanding – there are 18 direct passenger flights at the Airport which provide connectivity for the local community to the rest of the country. In addition, FedEx conducts operations to Memphis, Tennessee while UPS has conducts flights to Ontario, California, Louisville, Kentucky, and Calgary, Alberta, Canada. An in-depth analysis of cargo operations and cargo forecast at the Airport are available in the Air Cargo Master Plan Study in **Appendix B**.

This level of activity is bolstered by a variety of aircraft. When the average number of operations between 2017 and 2019 are considered, 17 different aircraft averaged at least 100 annual operations. The most demanding aircraft that commonly operate at the Airport are the primary influence of runway length and representative aircraft for passenger and cargo operations were selected for evaluation. **Table 3-5** presents a summary of these aircraft along with their design, capacity, and operating characteristics and their average annual operations from 2017-2019.

Table 3-5 Fleet Mix

Aircraft	Runway Design Code	Seats	Average Operations (2017 – 2019)	Maximum Takeoff Weight (pounds)
Embraer 175	C-III	74	1,080	82,673
CRJ 900	C-III	76	2,032	82,500
Airbus A319	C-III	142	1,649	166,449
Boeing 737-800	D-III	177	385	155,500
Boeing 757-200	C-IV	Cargo	1,013	255,000
Boeing 767-300	C-IV	Cargo	434	408,000

Source: Traffic Flow Management System Counts database; Mead & Hunt.

Runway Length Determination

The first step when determining the relevant departure weight for an aircraft is to determine the haul length. AC 150/5325-4B, Section 403.c(2) divides operations into short-haul and long-haul depending on the relationship of an aircraft's operating weight to its payload and range. If the haul length exceeds the distance at which fuel requirements place any limitation on payload – also known as the payload break point (PBP) – the flight is considered a long-haul flight and for planning purposes the operating weight of the aircraft should be set to the MTOW. If haul length does not exceed the PBP, the operation is considered a short-haul operation and the "actual operating takeoff weight" of the aircraft should be used.

Table 3-6 presents the PBP for each selected aircraft, arranged according to aircraft size (smallest to largest). These aircraft currently conduct typical operations to destinations within their PBP. These operations are then considered a short-haul flight and their actual departure weight should be estimated to determine runway length needs.

Table 3-6 Payload Break Point per Aircraft

Aircraft	Payload Break Point Range (Nautical Miles)	Frequented Destination	Destination Distance (Nautical Miles)	Destination Percent of PBP Range
Embraer 175	2,080	Denver, CO	420	20%
CRJ 900	1,040	Phoenix, AZ	939	90%
Airbus A319	2,600	Sanford, FL	1,159	45%
Boeing 737-800	2,050	Bullhead City, AZ	968	20%
Boeing 757-200	2,300	Memphis, TN	600	26%
Boeing 767-300	4,200	Ontario, CA	1,128	27%

Source: US DOT T100 Database; Aircraft Planning Manuals.

The fuel burn calculation for each aircraft was determined by using the gallons per hour burn based on the duration of the trip. This was added to fuel required for a one-hour alternative and a fifteen-minute holding time. Each step of the total fuel burn calculation can be seen in **Table 3-7**. The total amount of fuel burn is then be added to the maximum zero fuel weight of the aircraft in **Table 3-8** to determine the actual takeoff weight for specific short-haul routes. The estimated takeoff weight is also compared to the maximum takeoff weight. One exception to the clear short-haul flights is the CRJ900, whose operations are verging on the PBP of the aircraft; fuel calculation shows that it would likely operate at or near its MTOW.

Table 3-7 Total Fuel Burn Calculation

Aircraft	Fuel Burn/Hr (pounds)	Trip Time (Minutes)	One-Hour Alternative	15-Minute Hold	Trip Fuel Burn	Total Fuel Burn
Embraer 175	4,250	77	4,250	1,063	5,454	10,767
CRJ 900	4,522	150	4,522	1,131	11,305	16,958
Airbus A319	5,234	164	1,334	1,309	14,306	20,849
Boeing 737-800	5,780	72	5,780	1,445	6,936	14,161
Boeing 757-200	8,119	93	8,119	2,030	12,585	22,734
Boeing 767-300	10,887	172	10,887	2,722	31,209	44,817

Source: Aircraft Planning Manuals; Mead & Hunt.

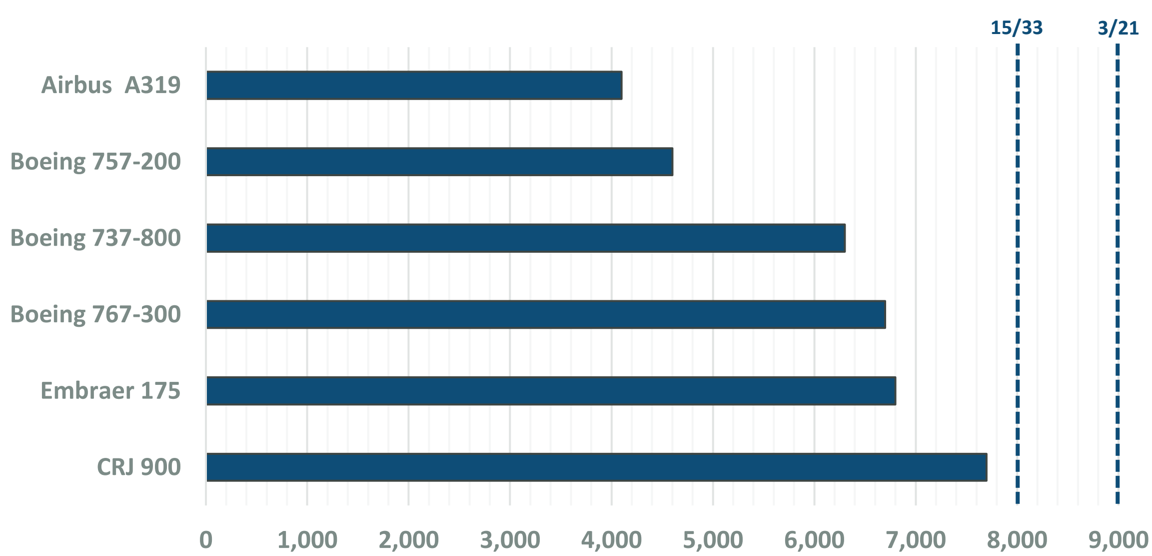
Table 3-8: **Estimated Takeoff Weight**

Aircraft	Total Fuel Burn	Maximum Zero Fuel Weight	Takeoff Weight	Maximum Takeoff Weight
Embraer 175	10,767	69,886	80,653	82,673
CRJ 900	16,958	70,000	86,958	82,500
Airbus A319	20,849	125,663	130,977	166,499
Boeing 737-800	14,161	138,300	152,461	155,500
Boeing 757-200	22,734	184,000	206,734	255,000
Boeing 767-300	44,817	309,000	353,817	412,000

Source: Aircraft Planning Manuals; Mead & Hunt.
Note: As the CRJ 900 operates near its payload break point (PBP) range and its fuel calculation shows it departing just over maximum takeoff weight (MTOW), its actual MTOW was used for runway length calculations.

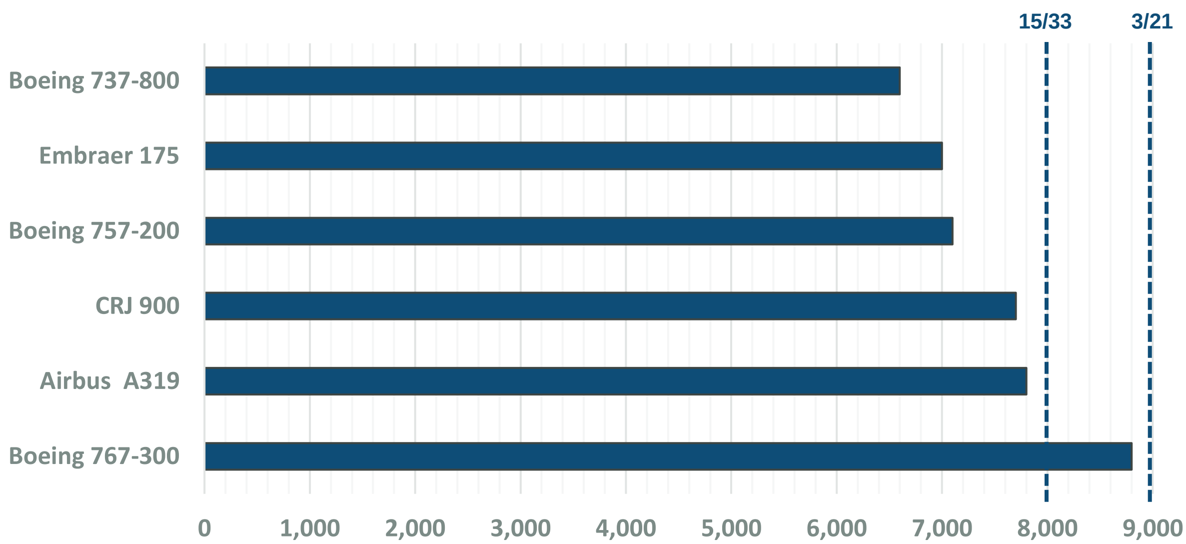
Aircraft planning manuals were then consulted to determine the runway length required for the specific short-haul routes shown in **Figure 3-4**. As expected, an aircraft operating closer to its PBP will require a longer runway length. The CRJ 900 is operating close enough to this point that it is considered to be departing at MTOW. The Embraer 175, while also a regional jet, currently conducts the shortest regularly scheduled passenger flight to Denver, Colorado. This route of 420 nautical miles is only 20 percent of its PBP range of 2,080 nautical miles. Therefore, this is one of the least demanding routes this aircraft conducts and service to other cities would require considerably longer runway lengths.

Figure 3-4 **Specific Short-Haul Runway Lengths**



This same phenomenon is present in many of the other aircraft operating at FSD as well. The Embraer 175, Boeing 737-800, Boeing 757-200, and Boeing 767-300 all operate at less than 30 percent of their PBP range. In short, existing flights do not always use the full range of the aircraft. If more markets are made available from FSD, then the runway length needs of these aircraft would likely increase significantly. This is shown in Figure 3-5, where each aircraft is departing at their MTOW.

Figure 3-5 MTOW Runway Lengths



Existing routes place considerable demand on the runway lengths at FSD. The CRJ 900, due to the length of its current route, requires nearly 8,000 feet of runway and is closely followed by the Embraer 175 and Boeing 767-300. However, accounting only for the existing routes ignores the flexibility that an airport should offer. The existing runway length is adequate for the Boeing 767-300, one of the most demanding aircraft operating at FSD, to depart at its MTOW. During hotter periods of the summer, the demand for runway length also goes up considerably.

Constraints surrounding the airfield restrict FSD's ability to extend its runways; however, based on the analysis in this section, existing runway lengths at FSD generally meet the needs of the Airport and its users, both currently and throughout the planning period.

Runway 15/33 Classification

Runway 15/33 is considered a D-IV runway even though Primary Runway 3/21 meets the 95% wind coverage requirement for 20-knot crosswind component that includes D-IV aircraft. Runway 15/33 sees significant use by D-IV cargo aircraft such as the Boeing 767 and the Airbus A300 due to its favorable orientation.

Runway 15/33's existing length and width is justified by regular use from C/D-III aircraft in the 16-knot wind coverage category. The current 8,000' length supports operations by the Bombardier CRJ-900 (see **Figure 3-4** above) and F-16 operations conducted by the SDANG. The SDANG has confirmed a minimum of 8,000' is required to operate on FSD's runways. The existing 150' runway width is necessary to meet design standard requirements for C/D-III aircraft with maximum takeoff weights over 150,000 pounds like the Airbus A319/A320 series, and Boeing 737-800 aircraft.

Runway Design Standards

Runway design standards depend on the RDC, consisting of three components: the AAC, ADG, and visibility minimums. Visibility minimums associated with a particular runway can vary; therefore, so do the RDCs. Runway design criteria is susceptible to change from shifts in RDC such as ADG or visibility minimums. Runway 9/27 meets design standards for B-II-5000 and will not be discussed in detail as the runway is expected to be decommissioned in the near-term.

Runway 3/21 is a D-IV runway with visibility minimums categorized as lower than ¾-mile for both ends. Runway 15/33 is considered a D-IV runway with visibility minimums not lower than ¾-mile for the Runway 33 end and not lower than 1-mile for the Runway 15 end. Existing design standards for Runway 3/21 are listed in **Table 3-9**, standards for Runway 15 are listed in **Table 3-10**, and standards for Runway 33 in **Table 3-11**.

Table 3-9 **Runway 3/21 D-IV Design Standards**

Design Standard	Visibility Minimums Lower Than ¾ Mile	Runway 3	Runway 21
Runway Design			
Runway width	*150 ft*	150 ft	150 ft
Shoulder width	*25 ft*	*25 ft*	*25 ft*
Blast Pad Dimensions	*200 x 200 ft*	*200 x 200 ft*	*200 x 200 ft*
Runway Protection			
Runway Safety Area (RSA)			
Length beyond departure end	*1,000 ft*	*1,000 ft*	*1,000 ft*
Length prior to threshold	*600 ft*	*600 ft*	*600 ft*
Width	*500 ft*	*500 ft*	*500 ft*
Runway Object Free Area (ROFA)			
Length beyond runway end	*1,000 ft*	*1,000 ft*	*1,000 ft*
Length prior to threshold	*600 ft*	*600 ft*	*600 ft*
Width	*800 ft*	*800 ft*	*800 ft*
Runway Obstacle Free Zone (ROFZ)			
Length beyond runway end	*200 ft*	*200 ft*	*200 ft*
Width	*400 ft*	*400 ft*	*400 ft*
Precision Obstacle Free Zone (POFZ)			
Length beyond runway end	*200 ft*	*200 ft*	*200 ft*
Width	*800 ft*	*800 ft*	*800 ft*
Runway Protection Zone (RPZ) [1]			
Length	*2,500 ft*	***2,500 ft***	***2,500 ft***
Inner width	*1,000 ft*	***1,000 ft***	***1,000 ft***
Outer width	*1,750 ft*	***1,750 ft***	***1,750 ft***
Runway Separation (runway centerline to:)			
Holding position	*265 ft*	***Varies***	***Varies***
Parallel taxiway centerline	*400 ft*	*400+ ft*	*400+ ft*
Aircraft parking area	*500 ft*	*800 ft*	*700 ft*

Note: Red text in table indicates a design deficiency.
[1] Incompatible land uses exist for both ends of the runway.

Table 3-10 Runway 15 D-IV Design Standards

Design Standard	Visibility Minimums Not Lower Than 1 Mile	Runway 15
Runway Design		
Runway width	*150 ft*	*150 ft*
Shoulder width	*25 ft*	***None***
Blast Pad Dimensions	*200 x 200 ft*	*200 x 200 ft*
Runway Protection		
Runway Safety Area (RSA)		
Length beyond departure end	*1,000 ft*	*1,000 ft*
Length prior to threshold	*600 ft*	*600 ft*
Width	*500 ft*	*500 ft*
Runway Object Free Area (ROFA)		
Length beyond runway end	*1,000 ft*	***740 ft***
Length prior to threshold	*600 ft*	*600 ft*
Width	*800 ft*	*800 ft*
Runway Obstacle Free Zone (ROFZ)		
Length beyond runway end	*200 ft*	*200 ft*
Width	*400 ft*	*400 ft*
Precision Obstacle Free Zone (POFZ)		
Length beyond runway end	*200 ft*	*200 ft*
Width	*800 ft*	*800 ft*
Runway Protection Zone (RPZ) [1]		
Length	*1,700 ft*	*1,700 ft*
Inner width	*500 ft*	*500 ft*
Outer width	*1,010 ft*	*1,010 ft*
Runway Separation (runway centerline to:)		
Holding position	*265 ft*	***Varies***
Parallel taxiway centerline	*400 ft*	*400 ft*
Aircraft parking area	*500 ft*	*500+ ft*

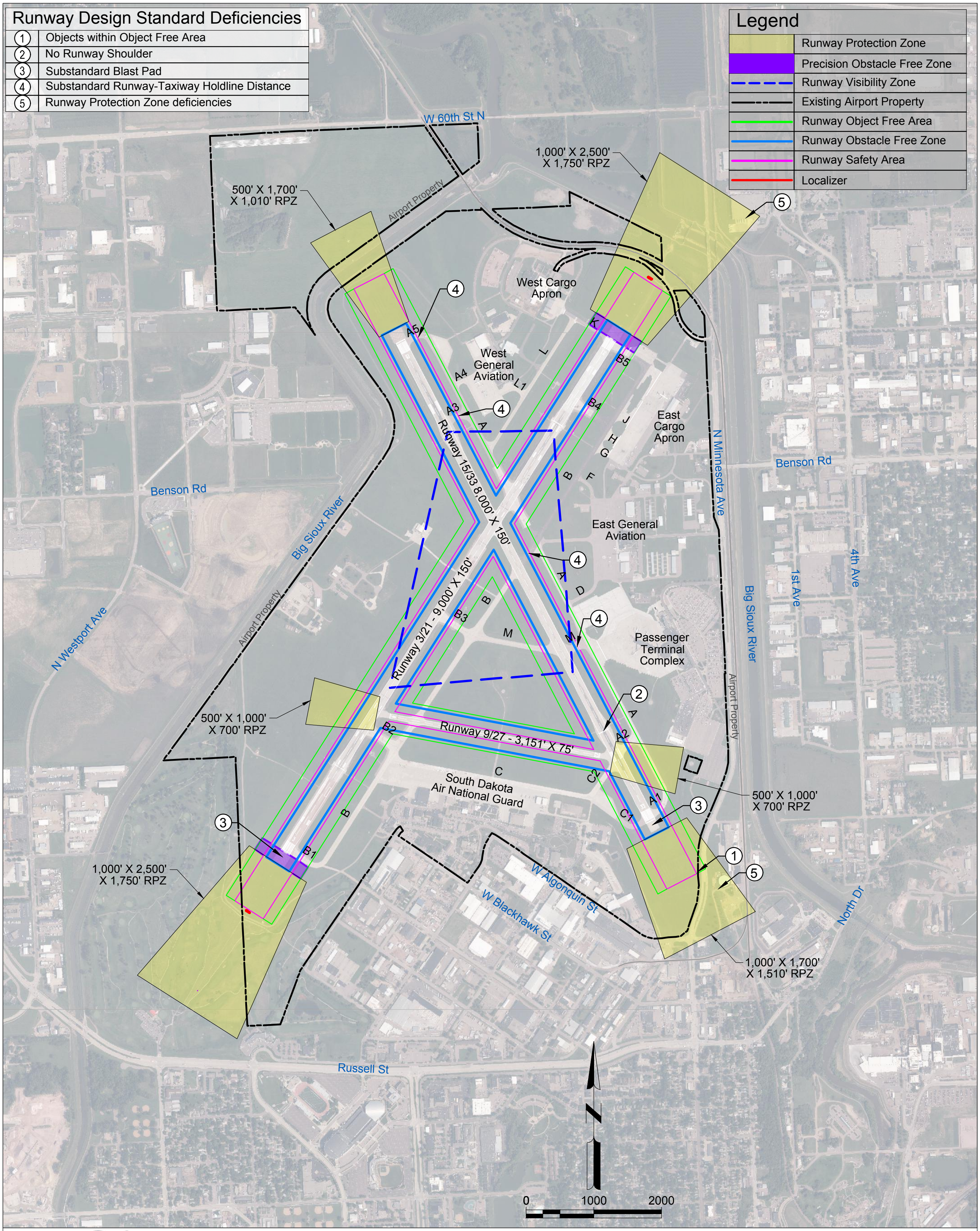
Note: Red text in table indicates a design standard deficiency.

Table 3-11 **Runway 33 D-IV Design Standards**

Design Standard	Visibility Minimums Not Lower Than ¾ Mile	Runway 33
Runway Design		
Runway width	*150 ft*	*150 ft*
Shoulder width	*25 ft*	***None***
Blast Pad Dimensions	*200 x 200 ft*	***150 x 150 ft***
Runway Protection		
Runway Safety Area (RSA)		
Length beyond departure end	*1,000 ft*	*1,000 ft*
Length prior to threshold	*600 ft*	*600 ft*
Width	*500 ft*	*500 ft*
Runway Object Free Area (ROFA)		
Length beyond runway end	*1,000 ft*	*1,000 ft*
Length prior to threshold	*600 ft*	*600 ft*
Width	*800 ft*	*800 ft*
Runway Obstacle Free Zone (ROFZ)		
Length beyond runway end	*200 ft*	*200 ft*
Width	*400 ft*	*400 ft*
Precision Obstacle Free Zone (POFZ)		
Length beyond runway end	*200 ft*	*200 ft*
Width	*800 ft*	*800 ft*
Runway Protection Zone (RPZ) [1]		
Length	*1,700 ft*	***1,700 ft***
Inner width	*1,000 ft*	***1,000 ft***
Outer width	*1,510 ft*	***1,510 ft***
Runway Separation (runway centerline to:)		
Holding position	*265 ft*	***Varies***
Parallel taxiway centerline	*400 ft*	*400 ft*
Aircraft parking area	*500 ft*	*500+ ft*

Note: Red text in table indicates a design deficiency.
[1] Incompatible land uses exist.

Runway design standard deficiencies are shown in **Figure 3-6** and discussed in in the following sections. **Chapter 5 – Alternatives** will consider instrument approach improvement alternatives which may change future design standard requirements.



SIOUX FALLS REGIONAL AIRPORT JOE FOSS FIELD

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MAY 2023

RUNWAY DESIGN STANDARDS

Mead & Hunt

FIGURE 3-6

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Runway Shoulders

AC 150/5300-13B states that, as D-IV runways, paved runway shoulders are required for Runway 3/21 and 15/33. Paved shoulders prevent blast erosion and accommodate all vehicles and aircraft that may pass outside the runway pavement. Runway shoulders were added to Runway 3/21 during a recent reconstruction project; shoulders for Runway 15/33 pavement should be added when pavement requires reconstruction.

Runway Blast Pads

The blast pad for Runway 33 should be increased in size from 150 feet by 150 feet to 200 feet by 200 feet to meet the requirements of AC 150/5300-13B.

Runway Object Free Areas (ROFA)

ROFA are centered on the runway centerline. Above-ground objects in the ROFA are prohibited from protruding above the nearest point of the Runway Safety Area (RSA) unless for air navigation or aircraft ground maneuvering purposes.

The ROFA beyond the Runway 15 departure end (Runway 33 arrival end) does not currently meet design standards. The Airport perimeter fence penetrates the eastern edge of the ROFA at approximately 740 feet beyond the runway end (260 feet short of the 1,000-foot requirement). The fence was relocated to maximize the ROFA without impacting Minnesota Avenue. Approximately 180 linear feet of Minnesota Avenue is located within the southeast corner of the ROFA.

Chapter 5 – Alternatives will review potential options to mitigate Runway 15/33 OFA issues.

Runway Protection Zones (RPZ)

RPZ are trapezoidal areas located beyond the runway ends in the approach and departure area. The function of an RPZ is to protect people and property on the ground. Airport sponsors are encouraged to own the property within the RPZ whenever possible and to keep the RPZ clear of incompatible objects and activities. Development discouraged within RPZs includes public roads, structures, and places of public assembly.

Public roads, railroads and buildings are located within the approach RPZs to Runway 21 and 33. Recreational trails are located within the RPZ to Runway 15 and 21. FSD controls the RPZs for Runway 9, 27 and 15, and has an avigation easement for the Runway 3 RPZ. FSD does not fully control Runway 33 and Runway 21 RPZs.

Runway Centerline to Holding Position

The minimum distance for Runway 3/21 and Runway 15/33 hold lines is 265 feet from the runway centerline. This number is derived from the baseline standard of 250 feet plus adjustments for FSD's elevation. (for D-IV aircraft, the hold line distance is increased one foot for each 100 feet above mean sea level). Hold lines located less than 265 feet from the runway centerline should be relocated to meet compliance standards.

Taxiway Design

AC 150/5300-13B provides guidance on design standards, recommended practices, and design considerations for taxiways and taxilanes. Taxiways provide defined path established for the taxiing of aircraft from one part of an airport to another while taxilanes are designed for low speed and precise maneuvering of aircraft. Taxiway design standards based on ADG are shown in **Figure 3-7** and standards based on Taxiway Design Group (TDG) are shown in **Figure 3-8**.

The Boeing 767, an ADG-IV, TDG-5 aircraft, is considered the critical aircraft for the taxiway system.

Figure 3-7 Taxiway Design Standards based on ADG

Item	ADG					
	I	II	III	IV	V	VI
Taxiway and Taxilane Protection						
TSA (maximum ADG wingspan)	49 ft (14.9 m)	79 ft (24.1 m)	118 ft (36 m)	171 ft (52 m)	214 ft (65 m)	262 ft (80 m)
TOFA [2]	89 ft (27.1 m)	124 ft (38 m)	171 ft (52 m)	243 ft (74 m)	285 ft (87 m)	335 ft (102 m)
TLOFA [2]	79 ft (24.1 m)	110 ft (34 m)	158 ft (48 m)	224 ft (68 m)	270 ft (82 m)	322 ft (98 m)
Taxiway and Taxilane Separation						
Taxiway centerline to parallel taxiway centerline [1]	70 ft (21.3 m)	101.5 ft (30.9 m)	144.5 ft (44 m)	207 ft (63 m)	249.5 ft (76.1 m)	298.5 ft (91 m)
Taxiway centerline to fixed or movable object [2]	44.5 ft (13.6 m)	62 ft (18.9 m)	85.5 ft (26.1 m)	121.5 ft (37 m)	142.5 ft (43 m)	167.5 ft (51 m)
Taxilane centerline to parallel taxilane centerline [1]	64 ft (19.5 m)	94.5 ft (28.8 m)	138 ft (42 m)	197.5 ft (60.2 m)	242 ft (74 m)	292 ft (89 m)
Taxilane centerline to fixed or movable object [2]	39.5 ft (12.2 m)	55 ft (16.8 m)	79 ft (24.1 m)	112 ft (34 m)	135 ft (41 m)	161 ft (49 m)
Wingtip Clearance						
Taxiway wingtip clearance	20 ft (6.1 m)	22.5 ft (6.9 m)	26.5 ft (8.1 m)	36 ft (11 m)	35.5 ft (10.8 m)	36.5 ft (11.1 m)
Taxilane wingtip clearance	15 ft (4.6 m)	15.5 ft (4.7 m)	20 ft (6.1 m)	26.5 ft (8.1 m)	28 ft (8.5 m)	30 ft (9.1 m)

Source: FAA AC 150/5300-13B.

Figure 3-8 Taxiway Design Standards based on TDG

Item	TDG							
	1A	1B	2A	2B	3	4	5	6
Taxiway/Taxilane Width [1]	25 ft (7.6 m)	25 ft (7.6 m)	35 ft (10.7 m)	35 ft (10.7 m)	50 ft (15.2 m)	50 ft (15.2 m)	75 ft (22.9 m)	75 ft (22.9 m)
Taxiway Edge Safety Margin [1]	5 ft (1.5 m)	5 ft (1.5 m)	7.5 ft (2.3 m)	7.5 ft (2.3 m)	10 ft (3 m)	10 ft (3 m)	14 ft (4.3 m)	14 ft (4.3 m)
Taxiway Shoulder Width [2]	10 ft (3 m)	10 ft (3 m)	15 ft (4.6 m)	15 ft (4.6 m)	20 ft (6.1 m)	20 ft (6.1 m)	30 ft (9.1 m)	30 ft (9.1 m)
Taxiway/Taxilane Centerline to Parallel Taxiway/Taxilane Centerline w/180 Degree Turn	See Table 4-6 and Table 4-7.							

Source: FAA AC 150/5300-13B.

Taxiway locations are depicted on the airport diagram provided in **Figure 3-3**. Major taxiways are labeled A through M while connector taxiways include a numeric character: A1, A2, and others.

Taxiways 75 feet wide can accommodate the TDG-5 design aircraft. Connector taxiways G, H, J and some exit taxiways from the runway currently exceed this width standard. Taxiways serving the GA areas (Taxiways D, F, K, and L) are 50 feet wide and designed to TDG-3 standards.

- Taxiway A is a 75-foot-wide, full-length parallel taxiway to Runway 15/33. Four connecting taxiways designated A1 through A4 provide entry and exit from the runway.
- Taxiway B is a 75-foot-wide, full-length parallel taxiway to Runway 3/21. This taxiway centerline varies in distance from the adjacent runway centerline. Five connecting taxiways designated B1 through B5 provide entry and exit from the runway.
- Taxiway C was a parallel taxiway for Runway 9/27 but is only available for use by the military to access the SDANG apron.

FSD has taken steps since the prior Master Plan to eliminate identified “hot spots”, an area on the Airport susceptible to increased incidents due to airfield geometry, (Taxiway E has been removed to reduce incidences) and to construct taxiway shoulders for pavement utilized by ADG-IV aircraft when associated pavement is subject to reconstruction.

Chapter 5 – Alternatives will review taxiway standards and recommended practices detailed in AC 150/5300-13B and consider whether taxiway configurations depicted on the current Airport Layout Plan should be altered to improve efficiency or better accommodate proposed development. New development areas and reconfiguration of existing development (terminal area, East Cargo, East GA, and other areas) will require new taxiway/taxilane infrastructure and reconfiguration of existing taxilanes. The design standards to be met will depend on the critical aircraft anticipated for different development areas.

3.1.4 Airfield Pavement Condition

Grant assurances require airports using federal funds for airfield pavement projects to create a pavement maintenance management program (PMMP) to maintain a safe and operable pavement system. Every three years, South Dakota Department of Transportation (SDDOT) Aeronautics assists South Dakota airports with pavement evaluation and management inspections. SDDOT Aeronautics' consultant conducted a pavement condition evaluation at FSD in 2021 using the Pavement Condition Index (PCI) methodology in accordance with FAA AC 150/5380-6C, *Guidelines and Procedures for Maintenance of Airport Pavements*, and ASTM International's D5340, *Standard Test Method for Airport Pavement Condition Index Surveys*.

A PCI survey consists of dividing pavement sections into a series of sample units, randomly inspecting sample units, and collecting the distress data within the sample units to assess the overall pavement deterioration. Pavement deterioration is based on the type, severity, and number of distresses present in the sample section. This information is then used to formulate a composite index numerical value, ranging from 0 (failed) to 100 (excellent), that represents the overall pavement condition.

Typically, pavements with PCIs above 70 will benefit from preventive maintenance, such as patching, crack sealing, and joint sealing. Pavements with PCIs between 41 and 70 typically require a major rehabilitation, such as a surface treatment or a thin overlay. Pavements that have deteriorated to a PCI of 40 or below often require a full-depth reconstruction or thick overlay. Major rehabilitation/reconstruction is recommended for any PCI value below the PCI critical thresholds. Critical thresholds differ between runways, taxiways, and aprons and whether the pavement serves GA or commercial service operations.

PCI maps for FSD are presented in **Appendix A**. **Chapter 6 – Facilities Implementation** will analyze pavement condition and projected timing of needed repairs over the planning period.

3.2 Instrument Approach Procedures

Airport access can be improved by reducing the ceiling and/or visibility minimums associated with instrument approach procedures (IAPs). An airport's ability to improve approach capability is dependent on many factors, including airspace obstacle clearance, marking, lighting, and other design standard requirements. There are no known obstructions to AC 150/5300-13B approach surfaces currently applicable to FSD runways.

The actual improvement in terms of airport accessibility is dependent on the category of aircraft operating at FSD and the ability of aircraft to use available IAPs. Larger aircraft can handle greater crosswinds and therefore take advantage of Runway 3/21's lower approach minimums to a greater degree than smaller aircraft, which are more susceptible to crosswinds that do not favor Runway 3/21 options. Aircraft equipped with global positioning systems (GPS)/Wide Area Augmentation System (WAAS) receivers can take full advantage of localizer performance with vertical guidance (LPV) approach procedures.

FSD has Category I precision instrument approach procedures for Runway 3/21. Category I minimums have a height above touchdown (HAT) or minimum descent altitude not lower than 200 feet and with either a visibility of not less than ½ statute mile, or a runway visual range (RVR) of not less than 1,800 feet. The approaches are supported by an instrument landing system (ILS) and a medium-intensity approach lighting system with runway alignment indicator lights (MALSR). The ILS consists primarily of glideslope and localizer antennas, which provide vertical and horizontal course guidance, respectively, to approaching aircraft. The MALSR provides visual confirmation of the runway centerline for pilots on approach to the runway and consists of a series of light bars preceded by a bank of sequenced flashing lights. The ILS and MALSR are often used during poor visibility such as at night and during inclement weather.

Runway 21 has the best available IAP. The approach to Runway 21 has a 200-foot decision height and accommodates reduced minimums (1,800 feet DH as compared to 2,400 feet) due to the installation of an RVR sensor at the touchdown zone, runway centerline lighting, and touchdown zone lighting. If FSD were to pursue Category II approaches, a benefit-cost analysis (BCA) would need to be completed along with updates to the existing MALSR lighting system to an approach lighting system with sequenced flashing lights (ALSF) and other facility upgrades and additions.

Several types of non-precision approaches are available at FSD including area navigation (RNAV), GPS, and very-high frequency omnidirectional range (VOR) approaches. These are further described in **Table 3-12**.

Table 3-12 Instrument Approach Procedures

Approach Procedure	Type	Threshold Crossing Height (Feet)	Decision Height (Feet)	Visibility Minimum[1] (Statute miles)
HI-ILS or LOC RWY 03	ILS	54	250	½
ILS or LOC RWY 03	ILS	54	250	½
RNAV (GPS) RWY 03	LPV	54	250	½
HI-ILS or LOC RWY 21	ILS	49	200	½
ILS or LOC RWY 21	ILS	49	200	½
RNAV (GPS) RWY 21	LPV	49	200	½
RNAV (GPS) RWY 15	LPV	48	410	1 1/8
VOR or TACAN RWY 15	VOR	46	491	1 3/8
HI-TACAN RWY 15	VOR	46	491	1 3/8
RNAV (GPS) RWY 33	LPV	45	305	7/8
VOR or TACAN RWY 33	VOR	42	516	1 3/8
RNAV (GPS) RWY 09	LPV	49	456	1
RNAV (GPS) RWY 27	LPV	40	536	1

Source: Federal Aviation Administration (https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/dtpp/).
Notes:
1) HI = High Altitude Approach (military)
2) ILS = Instrument Landing System
3) LOC = Localizer
4) RWY = Runway
5) RNAV = Area Navigation
6) GPS = Global Positioning System
7) VOR = Very-high Frequency Omnidirectional Range
8) TACAN = Tactical Air Navigation System
9) LPV = Localizer performance with vertical guidance

An RNAV GPS approach allows for a straight-in approach without ground-based equipment such as a VOR, glideslope, or localizer. According to AC 150/5300-13B, a non-precision instrument approach is a straight-in instrument approach procedure that provides course guidance, with or without vertical path guidance, with visibility minimums not lower than ¾-mile (4000 RVR).

Precision approaches and non-precision approaches with vertical guidance are flown to a decision altitude (DA) at which a missed approach must be initiated if the required visual reference to continue the approach has not been established. A non-precision approach without vertical guidance is flown to an MDA, which is the lowest authorized altitude on an approach that does not have vertical guidance. For the purposes of this facility requirements analysis, both the MDA and the DA are synonymously referenced as the approach decision height (DH), measured in feet above the runway threshold elevation.

[1] Minimums for Category C/D aircraft applied to approaches with separate Category A/B minimums. Runway 9/27 instrument approach procedures are not available to Category C/D aircraft.

Chapter 5 – Alternatives will consider options for enhancing approaches to FSD, specifically for Runway 15/33. Enhancements to the Runway 33 approaches are critical given prevailing winds during instrument meteorological conditions (IMC) and major snow events.

3.3 Commercial Passenger Terminal

As stated, a standalone Terminal Planning Study was undertaken to better analyze terminal facility requirements and alternatives to meet existing and future facility needs. The Terminal Planning Study is located in **Appendix C**. Section 4 of the TPS, *Terminal Programming*, identifies terminal facility requirements anticipated for FSD through the year 2041. Excerpts from the study are provided below along with additional analysis for terminal area support facilities.

3.3.1 TPS Requirements Summary

Overall, the future demand calls for the existing terminal facility to expand by an additional 75,000 square feet to accommodate a peak hour of 685 enplanements and a 14-gate concourse. These requirements are the foundation for the development of various alternatives in the terminal area. The concourse will be a primary focus area during concept development as this area requires the most significant expansion with the recommendation to add seven gates over the planning horizon.

Additionally, the ticketing and baggage make-up areas will be of significant focus as airlines begin replacing their current fleet with larger aircraft. This will have significant impacts on the peak hour and the demand for space in these areas of the terminal. Lastly, adding concessions and support/delivery space post-security will be evaluated to accommodate the growing gate demand. **Table 3-13** lists terminal requirements detailed in the Terminal Planning Study.

3.3.2 Additional Terminal Considerations

FSD has indicated de-icing facility expansion should be considered as terminal concepts are developed. Currently, there are two parking positions for aircraft to de-ice on the north end of the terminal apron with potential to add a spot north of the existing positions before encroaching on the East GA area. Development alternatives will consider additional options for de-icing expansion.

While significant investment in parking expansion has occurred and is occurring[2], options to expand terminal parking north of the existing access loop should be considered. Access relocation would require displacement and reconfiguration of East GA development.

[2] Construction of a parking garage east of the terminal is currently underway.

Table 3-13 Terminal Requirements

Terminal Functions	Units	Terminal Requirements					
		Existing	2021	2026	2031	2036	2041
Enplanements		506,211	506,211	718,232	803,692	894,468	987,480
Check-In Hall							
Full-service counter positions	Ea.	38	21	30	34	34	38
Check-in area (includes active check-in)	Sf.	1,899	1,050	1,500	1,700	1,700	1,900
Check-in queue area	Sf.	3,367	3,008	3,961	4,390	4,705	5,089
Kiosks positions	Ea.	4	4	12	14	14	16
Kiosks footprint area	Sf.	0	176	528	616	616	704
Bag-drop position	Ea.	0	5	6	7	7	8
Bag-drop position area	Sf.	0	290	348	406	406	464
Bag-drop queuing area	Sf.	0	400	480	560	560	640
Airline ticket office area	Sf.	6,413	5,250	7,500	8,500	8,500	9,500
Subtotal	**Sf.**	**11,679**	**10,174**	**14,317**	**16,172**	**16,487**	**18,297**
Outbound Baggage Screening and Baggage Make-up							
Number of Level 1 EDS units	Ea.	3	3	4	4	4	5
Level 1 EDS area	Sf.	Included	2,400	3,200	3,200	3,200	4,000
Number of Level 2 OSR stations	Ea.	2	1	2	2	2	2
Level 2 OSR area	Sf.	Included	40	80	80	80	80
Number of Level 3 ETD units	Ea.	Included	1	1	2	2	2
Level 3 ETD area	Sf.	Included	100	100	200	200	200
Baggage screening circulation	Sf.	Included	762	1,014	1,044	1,044	1,284
TSA baggage screening room	Sf.	4,409	3,302	4,394	4,524	4,524	5,564
Outbound baggage make-up area	Sf.	15,630	8,100	16,200	16,200	16,200	18,225
Subtotal	**Sf.**	**20,039**	**11,402**	**20,594**	**20,724**	**20,724**	**23,789**
Security Screening Checkpoint							
Checkpoint lanes	Ea.	2	3	4	4	4	5
Checkpoint screening area	Sf.	6,437	3,600	4,800	4,800	4,800	6,000
Checkpoint queue area	Sf.	2,500	1,800	2,400	2,400	2,400	3,000
Checkpoint exit lane	Sf.	678	600	600	600	600	600
U.S. Customs Border and Protection	Sf.	2,820	2,820	2,820	2,820	2,820	2,820
Subtotal	**Sf.**	**12,435**	**8,820**	**10,620**	**10,620**	**10,620**	**12,420**
Departure Lounge.							
Gates	Ea.	7	10	11	12	13	14
Departure Lounge	Sf.	10,062	29,530	32,483	35,436	38,389	41,342
Subtotal	**Sf.**	**10,062**	**29,530**	**32,483**	**35,436**	**38,389**	**41,342**
Baggage Claim and Inbound Baggage Handling							
Number of carousels	Ea.	3	Sf.	2	3	3	3
Claim area (carousels)	Sf.	8,982	Sf.	6,000	9,000	9,000	9,000
Baggage service offices	Sf.	655	Sf.	750	750	1,000	1,000
Inbound baggage offload area	Sf.	7,871	Sf.	6,000	6,000	6,000	6,000
Subtotal	**Sf.**	**17,508**	**12,655**	**12,750**	**15,750**	**16,000**	**16,000**

Source: Mead & Hunt.
Notes:
1) Ea. = Each
2) Sf. = Square feet
3) EDS = Explosive Detection Systems
4) OSR = On-Screen Resolution
5) ETD = Explosive Trace Detection
6) TSA= Transportation Security Administration

Terminal Functions	Units	Terminal Requirements					
		Existing	2021	2026	2031	2036	2041
Enplanements		506,211	506,211	718,232	803,692	894,468	987,480
Concessions							
Pre-secure concessions							
Food & Beverage	Sf.	4,207	1,610	2,284	2,556	2,844	3,140
Retail	Sf.	924	623	883	989	1,100	1,215
Concessions Support and Storage	Sf.	3,250	1,116	1,584	1,772	1,972	2,177
Post-secure concessions							
Food & Beverage	Sf.	4,528	3,756	5,329	5,963	6,637	7,327
Retail	Sf.	786	1,453	2,061	2,307	2,567	2,834
Concessions Support and Storage	Sf.	1,011	1,302	1,848	2,067	2,301	2,540
Rental car concessions							
Rental car offices	Sf.	1,760	1,100	1,100	1,100	1,100	1,100
Queuing area	Sf.	0	880	880	880	880	880
Subtotal	**Sf.**	**16,466**	**11,840**	**15,969**	**17,634**	**19,402**	**21,214**
Restrooms							
Pre-security men fixtures	Fixtures	12	9	11	11	12	13
Pre-security women fixtures	Fixtures	7	12	14	14	15	17
Pre-security restroom area	Sf.	1,231	1,640	1,950	1,950	2,090	2,300
Post-security men fixtures	Fixtures	11	8	11	12	13	15
Post-security women fixtures	Fixtures	10	10	14	15	17	19
Post-security restroom area	Sf.	1,548	1,539	2,129	2,269	2,479	2,759
Mother's Nursing Stations	Sf.	30	60	60	60	60	60
Animal service relief area	Sf.	109	109	109	109	109	109
Subtotal	**Sf.**	**2,918**	**3,348**	**4,248**	**4,388**	**4,738**	**5,228**
Men's fixtures		**23**	**17**	**22**	**23**	**25**	**28**
Women's fixtures		**17**	**22**	**28**	**29**	**32**	**36**
Support Functions							
TSA administration and staff support	Sf.	2,149	3,000	3,000	3,000	3,000	3,000
Operations and maintenance	Sf.	12,996	13,352	15,870	16,941	17,676	18,961
Loading Dock	Sf.	0	2,500	2,500	2,500	2,500	2,500
Airport administrative areas	sf	5,200	6,397	7,276	7,489	8,116	8,349
Lounge/Play Area/Additional Seating	Sf.	2,296	3,304	4,388	4,551	4,724	4,903
Subtotal	**Sf.**	**22,641**	**28,553**	**33,034**	**34,481**	**36,016**	**37,712**
Circulation							
Public Circulation	Sf.	26,006	27,442	27,442	27,442	27,442	27,442
Secure Public Circulation	Sf.	10,039	12,169	13,533	14,725	15,954	17,211
Non-Public Circulation	Sf.	3,751	5,598	7,242	7,558	7,738	8,374
Meeters/Greeters	Sf.	3,175	1,463	2,078	2,326	2,588	2,858
Subtotal	**Sf.**	**42,971**	**46,672**	**50,296**	**52,051**	**53,722**	**55,885**
Other Areas							
Vertical circulation	Sf.	7,521	7,385	8,801	9,388	9,789	10,504
Building Systems and Utilities	Sf.	15,966	13,945	16,574	17,693	18,460	19,803
Subtotal	**Sf.**	**23,487**	**21,330**	**25,375**	**27,081**	**28,250**	**30,307**
TOTAL AREA		**180,206**	**184,324**	**219,686**	**234,337**	**244,348**	**262,194**
Estimated **surplus** or **(deficiency)** compared with existing facility			(4,118)	(39,480)	(54,131)	(64,142)	(81,988)

3.4 Air Cargo

Analysis of existing and future cargo facility needs relied heavily on input from local and corporate cargo carrier staff, along with future projections and scenarios provided in the *Air Cargo Master Plan Study* located in **Appendix B**. These discussions included generalized requirements for cargo operators based on industry metrics. Alternatives developed will need to balance the needs of existing and potential mainline entrants with the needs of cargo feeders. A major consideration will be the adequacy of the East Cargo and East General Aviation areas to accommodate projected needs. Options for cargo operations to occur in the undeveloped area west of the South Dakota Army National Guard (SDARNG) (northwest of the West GA Area) may also be considered in alternatives development.

3.4.1 Generalized Requirements

For decades, airport planners commonly used a metric of one annual ton of cargo for each square foot of air cargo warehouse. The Transportation Research Board (TRB) of the National Academy of Sciences wanted to research the rates of use in more contemporary operating environments and to provide direction more suitable for the diversity of cargo operators. As a result, the TRB sponsored completion of Airport Cooperative Research Program (ACRP) Report 143: *Guidebook for Air Cargo Facility Planning & Development*, last modified in October 2016 (referred to herein as the *ACRP Cargo Guidebook*).

The ACRP Cargo Guidebook provides a centralized set of guidelines for airports and planners to follow when designing and planning air cargo facilities. Drawing upon industry metrics such as cargo throughput, survey responses, airport size, and domestic versus international orientation, amongst others, the ACRP provides guidelines for how much space should ideally be allotted to cargo facilities – buildings, aprons, and more.

The ACRP Cargo Guidebook uses the following capacity ratios for integrated express carriers:

- **Cargo Building:** 0.92 tons per square foot
- **Cargo Ramp:** 0.19 tons per square foot
- **GSE Storage:** 0.57 tons per square foot

Based on 2021 data, FedEx carried approximately 55 percent of FSD's cargo tonnage while UPS carried 45 percent.[3] The share of tonnage may change over the planning period, and a simple 50/50 split between FedEx and UPS was applied for ACRP Guidebook projections for the remainder of the 20-year planning period, as depicted in **Table 3-14**.

[3] FSD currently sees negligible belly cargo on passenger aircraft.

Table 3-14 ACRP Cargo Guidebook Calculations (FedEx & UPS)

Year	2021	2026	2031	2036	2041
Tonnage	40,356	56,288	69,553	80,008	89,361
Apron Space (Sf.)	**212,400**	**296,253**	**366,068**	**421,095**	**470,321**
FedEx	116,820	148,126	183,034	210,547	235,161
UPS	95,580	148,126	183,034	210,547	235,161
Building Space (Sf.)	**43,865**	**61,183**	**75,601**	**86,965**	**97,132**
FedEx	24,126	30,591	37,801	43,483	48,566
UPS	19,739	30,591	37,801	43,483	48,566
Ground Support Equipment Space (Sf.)	**70,800**	**98,751**	**122,023**	**140,365**	**156,774**
FedEx	38,940	49,375	61,011	70,182	78,387
UPS	31,860	49,375	61,011	70,182	78,387

Source: Airport Cooperative Research Program, Report 143: Guidebook for Air Cargo Facility Planning & Development, October 2016; Mead & Hunt.
Note: Sf. = Square feet.

3.4.2 Air Cargo Development Areas & Assumptions

The following guiding principles and assumptions were applied to facility requirements.

Air Cargo Areas (North & South)

FedEx (North) analysis and concept development is primarily separated from UPS and new entrant analysis (South). Meetings with FedEx included detailed discussions regarding fleet mix, potential for facility expansion, and building space needs. FedEx facilities are located on the north end of the East Cargo Apron and facility expansion to accommodate growth would likely be accommodated by expansion farther north, away from other operators. FedEx feeder operators are highly integrated with FedEx mainline operations and expansion needs would likely be accommodated by northern expansion as well.

Space Need Assumptions

Discussions with a third-party developer involved in construction of numerous cargo facilities indicated a trend toward depth of at least 150 feet for new facilities. A minimum landside depth of 250 feet between cargo buildings and access roads should be planned to accommodate adequate vehicle flow and parking. The following sections review existing and future requirements for FedEx, UPS, and feeder operators as well as potential requirements for new cargo operator entrants detailed in **Appendix B**.

3.4.3 FedEx/North Air Cargo

FedEx facility needs are primarily based on discussions with local and corporate FedEx staff. The consensus is FedEx facilities are mostly sufficient for existing needs and the ability to expand facilities to the north should accommodate future facility needs.

Apron

FedEx indicated two parking positions for mainline aircraft is sufficient for the foreseeable future, but a flexible space for situations when aircraft experience maintenance issues would be ideal.

FedEx has indicated the new Cessna SkyCourier aircraft will be joining the fleet soon and will likely replace some Cessna Caravan aircraft. Parking and maneuvering space needs for these aircraft should be considered for future development concepts. ATR-42-300 aircraft usage at FSD is expected to continue.

Cargo Building

Future expansion of the existing cargo building would likely need to be to the north given the layout of the existing building and areas available for expansion. The south half of the building currently occupied by Same Day/Matheson would not be suitable for the type of expansion needed. The next leap in facility size would be driven largely by an upguage in sorting equipment. The next likely equipment upguage would require an overall facility size closer to 50,000 square feet. This is nearly identical with ACRP Cargo Guidebook metrics assuming a 50/50 split for baseline tonnage projections over the planning period. ACRP Cargo Guidebook metrics depicted in **Table 3-14** indicate approximately 49,000 square feet of building space needs for FedEx by 2041. Building expansion would likely continue at the current 100-foot depth based on conversations with FedEx representatives, resulting in a recommended planned building footprint of 500 feet by 100 feet.

Ground Service Equipment (GSE) Space & Other Facilities

FedEx has approximately 80,000 square feet of apron space available for GSE storage. While GSE space is currently considered adequate, building expansion to the north would displace roughly 30,000 square feet of GSE space which would need to be accounted for in projections for future GSE needs.

According to the ACRP Cargo Guidebook, FedEx currently requires approximately 39,000 square feet of GSE space based on cargo tonnage data for 2021; this is presented in **Table 3-14**. Space needs double to approximately 78,000 square feet by the end of the planning period assuming FedEx's future share of FSD tonnage is split 50/50 with UPS.

3.4.4 UPS/South Air Cargo

UPS facility needs are primarily based on feedback from local and corporate UPS staff. Additional insight was gathered from a cargo facility development company unaffiliated with UPS or FedEx regarding industry trends. The consensus was a reconfiguration to accommodate a cargo building adjacent to the cargo apron would be preferrable to the current configuration. Now, UPS mainline aircraft park on the apron parallel to the runway with the cargo building located off-apron, approximately 200 yards from the apron's eastern edge.

Apron

UPS indicated parking positions to simultaneously accommodate two Boeing 767F aircraft should be sufficient for the foreseeable future. UPS representatives indicated there may be occasions when more than two mainline aircraft would be on the apron at the same time; however, this would be atypical and likely driven by mechanical or other issues. A flexible space, similar to that suggested by FedEx meetings, would be helpful in these rare situations.

Development concepts should consider parking space needed to park two Boeing 767F aircraft nose-in toward a future on-apron cargo facility. A minimum 112-foot clearance from taxilane centerline to fixed or movable objects is required for ADG-IV aircraft like the Boeing 767.

Cargo Building

UPS provided a cargo facility drawing that was previously developed with a building footprint of approximately 350 feet by 100 feet with a loading dock arm on one side, adding another 50 feet of depth to that area. While the building layout was designed for expansion at an off-apron location adjacent to the existing building, UPS indicated an on-apron facility layout would be very similar.

A building footprint of 350 feet by 150 feet is recommended to accommodate expressed UPS needs while maintaining depth flexibility. Like FedEx, *ACRP Cargo Guidebook* metrics indicate approximately 49,000 square feet of building space needs for UPS by 2041.

GSE Space & Other Facilities

Ground support equipment for UPS is stored on- and off-apron. Aerial imagery from May 2021 depicting the general location and footprint of GSE storage indicated that approximately 60,000 square feet of outdoor storage space, both airside and landside, is currently utilized by UPS. The GSE footprint was reviewed with UPS representatives, and they indicated what was shown is an accurate representation of current GSE storage.

Based on cargo tonnage data for 2021, UPS would require approximately 32,000 square feet of GSE space according to metrics identified by the *ACRP Cargo Guidebook*. Space needs for UPS more than double to approximately 78,000 square feet by the end of the planning period assuming FedEx and UPS evenly split the 2041 tonnage projection.

Feeder Operators (UPS)

Alpine Air Express has indicated they typically have five, but up to seven, Beechcraft 1900s parked on the East Cargo Apron awaiting mainline UPS aircraft. Alpine Air Express indicated no plans to change their current aircraft fleet.

Encore Air Cargo typically has one Fairchild Metroliner parked on the East Cargo Apron awaiting mainline UPS aircraft and smaller twin-engine aircraft on the East GA Apron. Encore Air Cargo indicated no plans to change their current aircraft fleet.

Future feeder operator facility needs depend in part on displacement impacts associated with mainline aircraft parking expansion. Alternatives should explore options to maintain and expand the number of feeder aircraft parking positions.

3.4.5 Potential Air Cargo Entrants

Forecast scenarios developed as part of the Air Cargo Master Plan Study include operations by Amazon Air and a general cargo freighter.

Amazon

If Amazon Air were to operate out of FSD in the future, they would need sufficient airside and landside facilities. Such a scenario assumes Amazon operations would begin with utilization of ATR72-600F aircraft and transition to Boeing 737-800F aircraft. Therefore, adequate apron space to accommodate this larger aircraft and GSE storage should be considered. Building facilities utilized by smaller Amazon Air hubs have typically been between 30,000-35,000 square feet.

Alternatives will consider options for accommodating Amazon Air in the East Cargo Area as well as undeveloped space northwest of the West GA Area. ACRP Guidebook facility requirement projections for the Amazon Air Scenario are provided in **Table 3-15**.

Table 3-15 ACRP Cargo Guidebook Calculations (Amazon Air Scenario)

Year	2021	2026	2031	2036	2041
Tonnage	0	5,441	8,114	11,327	15,286
Apron (Sf.)	-	28,637	42,705	59,616	80,453
Building (Sf.)	-	5,914	8,820	12,312	16,615
GSE (Sf.)	-	9,546	14,235	19,872	26,818

Source: Airport Cooperative Research Program, Report 143: Guidebook for Air Cargo Facility Planning & Development, October 2016; Hubpoint and Mead & Hunt Analysis
Note: Sf. = Square feet.

General Cargo Freighter

The primary facility requirement for the General Cargo Freighter scenario would be sufficient apron space to accommodate a Boeing 757-200F aircraft. The flexible space previously discussed could serve as the primary parking option for this aircraft in this scenario.

3.4.6 Air Cargo Requirements Summary

FSD should consider expansion plans to accommodate up to six mainline cargo aircraft operating simultaneously. The plans should be phased with the ultimate configuration, including two mainline aircraft positions for FedEx, two for UPS, one for a potential entrant such as Amazon Air, and a final spot serving as a flexible parking position or to accommodate additional simultaneous operations associated with the General Cargo Freighter scenario. Adequate space for ground vehicle maneuvering should also be incorporated.

Cargo buildings should have 150 feet of depth if possible and a minimum landside depth of 250 feet between each building. Access roads should be planned to accommodate adequate vehicle flow and parking. Meeting GSE needs while satisfying other requirements may require shifting south cargo buildings to the east to allow for additional apron space.

Given the limited developable space available, mainline aircraft expansion needs to be balanced with accommodating feeder aircraft parking needs and potential East GA development needs.

3.5 General Aviation/Fixed-Base Operator (FBO) Facilities

GA facilities at FSD are divided into two areas: East GA, which includes the facilities in the northeast quadrant; and West GA, located in the northwest quadrant. The selected Master Plan forecast projects modest growth in based aircraft and growth in operations by local and itinerant GA aircraft.

3.5.1 GA Activity and Critical Aircraft

GA activities conducted at FSD include corporate travel, medical transport, flight training, business and private flights, as well as recreational flying. Different aircraft types use different GA areas. For instance, the largest corporate jets currently use and park on the West GA Apron as the East GA Apron is only able to accommodate aircraft under 60,000 pounds and does not have adequate wingtip clearance for ADG III aircraft.

Given development constraints at FSD, GA facility planning should maximize available space at FSD and analyze how different development areas can efficiently accommodate a mix of larger and smaller aircraft. While ADG I and II aircraft will be predominant users of most GA areas, alternatives should consider options to accommodate transient ADG III aircraft operations as well as the addition of ADG III aircraft being based at FSD. Each development area concept should consider the tradeoff between flexibility to accommodate the full spectrum of GA aircraft likely to operate out of FSD and the efficiency of planning development areas for specific aircraft groups.

3.5.2 Aircraft Storage Hangars

The number of hangars needed at an airport is closely related to the number of based aircraft. Some airports also offer hangars for itinerant aircraft storage, typically as a service offered by a fixed-base operator (FBO). The preferred based aircraft forecast selected in **Chapter 2 – Aviation Activity Forecasts** is shown below in **Table 3-16** with military aircraft (F-16s) removed from the counts as these aircraft will be stored within SDANG facilities. Based aircraft projections at FSD mirror national trends, as there is an existing waitlist at the Airport for jet aircraft while piston aircraft have shown less demand.

Table 3-16 Based Aircraft Forecast (Civilian)

Aircraft Type	2021	2026	2031	2036	2041
Single-Engine	55	56	57	62	65
Multi-Engine	34	36	40	43	49
Jet	4	10	14	16	18
Total Based Aircraft	**93**	**102**	**111**	**121**	**132**

Source: Mead & Hunt.

Hangar space requirement calculations focus on storage needs for new based aircraft; however, there will also be space needs for transient aircraft storage, aircraft maintenance, and other similar needs. Estimating space needs with certainty is difficult, and aircraft size and associated space needs greatly vary.

The approximate space required for each type of aircraft used for this analysis, including a five-foot buffer area surrounding aircraft, is shown in **Table 3-17**. As mentioned, single-engine, multi-engine, and jet aircraft come in a range of sizes (especially jets) and the space requirements shown provide a general indication of space needs. The 5,000 square foot space requirement for jets was developed based an aggregate of GA jet aircraft currently operating at FSD. While some larger jets may require over 10,000 square feet of hangar space, the number of aircraft of this size will be lower than the number of jets requiring 3,000 to 4,000 square feet of space. Projections through the planning period for new hangar space demand is calculated using based aircraft projections provided in **Table 3-16** and the space requirements from **Table 3-17**. These projections are shown in **Table 3-18**.

Table 3-17 Approximate Hangar Space for Aircraft Types

Aircraft Type	Examples	Approximate Square Feet
Single-engine	Cessna 172, Cirrus SR-22	1,500
Multi-engine	Piper Seneca, Beechcraft King Air	2,500
Jet	Cessna Citations, Bombardier Global Express	5,000

Source: Mead & Hunt.

Table 3-18 **Hangar Space Forecast**

Aircraft Type	2021	2026	2031	2036	2041
Total Based Aircraft (Civilian)	93	102	111	121	132
Single-Engine					
Projected Based Aircraft	55	56	57	62	65
Approximate Area per Aircraft (square feet)	*1,500*	*1,500*	*1,500*	*1,500*	*1,500*
Additional Aircraft	N/A	1	2	7	10
Additional Demand (square feet)	0	1,500	3,000	10,500	15,000
Multi-Engine					
Projected Based Aircraft	34	36	40	43	49
Approximate Area per Aircraft (square feet)	*2,500*	*2,500*	*2,500*	*2,500*	*2,500*
Additional Aircraft	N/A	2	6	9	15
Additional Demand (square feet)	0	5,000	15,000	22,500	37,500
Jet					
Projected Based Aircraft	4	10	14	16	18
Approximate Area per Aircraft (square feet)	*5,000*	*5,000*	*5,000*	*5,000*	*5,000*
Additional Aircraft	N/A	6	10	12	14
Additional Demand (square feet)	0	30,000	50,000	60,000	70,000
Total Additional Demand (square feet) **(All Types)**	**N/A**	**36,500**	**68,000**	**93,000**	**122,500**

Source: Mead & Hunt.

Over half of new hangar space demand goes toward accommodating larger (jet) aircraft. Hangar development alternatives should reflect the growing need for larger hangars. This is consistent with FBO representatives and tenants expressing a need to expand their existing hangar facilities or construct larger facilities.

Chapter 5, *Alternatives*, will review reconfiguration options for the East GA area, including improving hangar access for ADG II and III aircraft. **Chapter 5 – Alternatives** will also review West GA area expansion options, including the potential for hangar development west of the SDARNG. Expansion alternatives should plan for hangar demand beyond the levels listed in **Table 3-18**.

3.5.3 Aircraft Aprons

The West GA apron is located north of the intersection of Taxiways A and L and encompasses approximately 35,000 square yards. The concrete apron has 14 parking spaces marked for small aircraft, but can accommodate large aircraft, including heavier ADG III aircraft such as the Boeing 737.

The East GA apron is located east of the intersection of Runway 15/33 and 3/21 and encompasses approximately 70,000 square yards. The asphalt apron is accessed by Taxiways D and F. The apron previously had approximately 80 aircraft tie-down parking spaces marked for small aircraft but now has 14 parking spaces and a delineated box where aircraft can park without encroaching on apron Taxilane Object Free Area requirements for ADG II aircraft.

Apron space requirements are a function of transient and local aircraft size and frequency of operations, local operator space needs (FBOs and cargo operators), and other factors. Apron size and parking positions for both the West and East General Aviation areas are considered adequate based on conversations with Airport staff and FBOs. Alternatives will focus on options for FSD to react to different development needs as they arise. Certain development areas may have multiple potential uses and determining the highest and best use of development areas will be a focus of Chapter 5, *Alternatives*.

As mentioned, the East GA apron is unable to accommodate aircraft over 60,000 pounds and does not have adequate wingtip clearance for ADG III aircraft. Chapter 5 will include expansion concepts to accommodate larger ADG III aircraft on the East GA apron while maintaining parking positions and balancing GA apron needs with potential cargo apron needs.

3.5.4 Fueling Facilities

Both Maverick Air Center and Signature Flight Support (Signature) provide fuel sales (100 low-lead and Jet-A) with mobile fueling. Signature's fuel storage facility is located just north of the National Weather Service facility and east of the East Cargo Apron. Maverick's fuel storage facility is located north of the East Cargo area and west of the intersection of National Guard Drive and Minnesota Avenue. Appropriate space should be reserved for expansion of fuel storage facilities. Additional fuel facilities will be constructed by FBOs as demand arises.

3.6 Other Facilities

3.6.1 Airport Traffic Control Tower (ATCT)

The primary purpose of the air traffic control (ATC) system is to prevent a collision involving aircraft operating in the system and to provide for a safe, orderly, and expeditious flow of traffic. Terminal Radar Approach Control (TRACON) is co-located with the ATCT and provides navigational guidance and separation to aircraft within 40 nautical miles of FSD. Both facilities operate from 5 a.m. to 12:00 a.m. local time. ATC controls traffic within the airside movement areas and airspace within five miles of FSD. Non-movement and movement areas are divided by a double line on the pavement: dashed on one side and solid on the other.

FSD's ATCT cab floor is 60 feet above ground level (AGL), resulting in an eye height of 65 feet AGL (approximately 1,488 MSL). Per FAA guidance, visibility from the ATCT cab requires an unobstructed view of all controlled movement areas of an airport, including all runways, any other landing areas, and air traffic in the vicinity of the airport. The tower has reduced visibility to Taxiways G, H, and J along with difficulty viewing the Runway 3 approach end due the distance from the ATCT and inability to meet the threshold requirements for line of sight (LOS) angle of incidence. LOS angle of incidence analysis defines the minimum line-of-sight slant angle required to perform ATCT specialists' separation task.

The tower was originally constructed in 1965 and during the planning period will likely need to be replaced at the current site or at a different location. FAA Order 6480.4B, *Airport Traffic Control Tower Siting Process,* establishes requirements for determining site location, tower height, and cab orientation of a proposed new, replacement of existing, and modernization of ATCTs where the overall structure height is changed. Visibility performance issues at FSD were discussed above, but there are five other categories to consider as well. The FAA places the greatest emphasis on the following criteria, in order of criticality:

a. Impacts to instrument approach procedures (Terminal Instrument Procedures [TERPS])
b. Impacts to communications, navigation, and surveillance equipment
c. Visibility performance
d. Comparative Safety Assessment (CSA)
e. Operational requirements
f. Economic considerations

The anticipated decommissioning of Runway 9/27, combined with the potential addition of public access points to the west side of the airfield, could open new ATCT site options that have not previously been analyzed. Chapter 5, *Alternatives*, will evaluate alternative ATCT sites to help FSD determine if areas should be reserved on the Airport Layout Plan (ALP) for potential ATCT development.

Additional analysis will be required prior to actual site selection. An ATCT siting study initiated by the FAA is anticipated to be conducted at the FAA's Airport Facilities Terminal Integration Laboratory (AFTIL) in summer 2023. AFTIL review is mandatory for all new, replacement of existing, and modernization of ATCT projects where federal funds are received. The AFTIL develops a three-dimensional computerized terrain model of the airport and real-time simulation of airport operations. The ATCT operations simulation tool provides an environment for the siting team to collectively evaluate proposed ATCT sites. Results of the AFTIL study will be incorporated into the Master Plan and ALP as appropriate.

3.6.2 Snow Removal Equipment (SRE)

In June 2021 FSD and its consultant, HDR, began development of a Snow Operations Maintenance & Storage Facility Master Plan. Snow removal operations outgrew their current SRE facility and the maintenance facility was considered outdated and undersized. Projected requirements through the 2041 were developed and a preferred alternative to meet facility needs was selected. This Master Plan will incorporate preferred alternatives identified by the Snow Operations Maintenance & Storage Facility Master Plan as part of **Chapter 5 – Alternatives**.

3.6.3 Aircraft Rescue and Firefighting (ARFF)

The SDANG manages the ARFF building and operates its equipment. The facility is located east of Runway 3/21 in the southwest corner of the SDANG complex. The ARFF building was constructed in 2000 and later expanded from its original 13,000 square feet to over 17,000 square feet. The facilities and equipment meet the current standards for a Federal Aviation Regulation (FAR) Part 139 ARFF Index B, which applies to airports regularly serving air carrier aircraft less than 126 feet long. The ARFF index categories depicted in **Table 3-19** are determined by the length of the largest air carrier aircraft with at least five average daily departures from the Airport in a single index group.

Table 3-19 ARFF Index

Index	Aircraft Length
A	Less than 90 feet
B	At least 90 feet but less than 126 feet
C	At least 126 feet but less than 159 feet
D	At least 159 feet but less than 200 feet
E	At least 200 feet

Source: Code of Federal Regulations (CFR) 139.315, Aircraft rescue and firefighting: Index determination.

If ARFF index C is required, additional vehicles or extinguishing agents would be required to meet CFR Part 139 standards.

The Airport meets the requirement that at least one firefighting vehicle can reach the midpoint of the farthest runway from the ARFF facility within three minutes. There are no changes to ARFF facilities or the airfield that would preclude existing facilities from continuing to meet the three-minute requirement over the 20-year planning period.

3.6.4 Access, Circulation, and Parking

Design and layout alternatives developed in Chapter 5, *Alternatives*, should consider options to improve access, circulation, and parking to existing facilities as well as accommodating planned development. Alternatives for access to the airfield across the Big Sioux River should be analyzed. Access from the north (via West 60th Street North) and west (via West 54th Street North) are likely options.

3.6.5 Military Facilities

FSD is home to the 114th Fighter Wing of the SDANG as well as the 196th Maneuver Enhancement Brigade of the SDARNG. The SDANG and SDARNG are both FSD tenants, and each has planning authority for its own facilities. The SDANG completed its most recent facilities master plan in late 2014.

Focus group meetings with SDANG and SDARNG included discussions on potential space needs for facility expansion. Both SDANG and SDARNG indicated existing leaseholds are adequate for their respective missions.

3.7 Requirements Summary

Chapter 5 – Alternatives will consider the facility requirements presented in this chapter and summarized below when developing and analyzing development alternatives.

- Maintain existing lengths and widths of Runways 3/21 and 15/33, supporting operations of D-IV aircraft.
- Continue to plan for decommissioning of Runway 9/27 when appropriate. Review prior ALP recommendation that Runway 9/27 be converted to a taxiway and determine if the recommendation should be carried forward.
- Construct runway shoulders for those segments of Runways 3/21 and 15/33 which currently do not have paved shoulders.
- Increase size of the blast pad for Runway 33 to 200 feet by 200 feet.
- Increase hold line separation to 265 feet for runway and taxiway intersections associated with Runways 3/21 and 15/33.
- Review options to improve IAPs.
- Consider options to improve land use control within RPZs.
- Determine potential sites for ATCT and reserve space as appropriate.
- Meet ADG-IV, TDG-5 standards for taxiways used by critical aircraft, including construction of paved taxiway shoulders.
- Develop plans to eliminate remaining airfield geometry with direct access to runways from aprons.
- Review bypass and exit taxiway improvements depicted on the prior ALP and determine if adjustments should be made.
- Develop plans to accommodate terminal facility needs detailed in **Appendix C**, including expanding the terminal by 75,000 square feet to accommodate a peak hour of 685 enplanements and a 14-gate concourse.
- Consider expanding terminal vehicle parking to the north of existing facilities.
- Develop options to meet expansion needs for existing and potential air cargo operators.
- Reconfigure East Cargo and East GA areas to maximize use of developable space.
- Develop East GA concepts to accommodate larger aircraft.
- Consider alternative uses of developable space northwest of the West GA area.
- Plan for additional access roads to the airfield from the northwest and west.
- Consider options for access to the airfield from the northwest and west across the Big Sioux River.