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Facility Requirements

Chapter 3
Facility Requirements

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Trustees.

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3 Facility Requirements

3.1 Introduction

Airport facility requirements are based on the future aviation demand levels projected in the aviation demand forecast discussed in **Chapter 2, Aviation Demand Forecasts**. Facility upgrades, expansions, or removals can stem from changes in regulatory standards set forth by the Federal Aviation Administration (FAA), shifts in the airport's vision, or alterations in passenger demand and airport utilization. Replacement of outdated and inefficient facilities that are cost prohibitive to maintain can also influence facility needs. Such factors are integral to the analysis of future facilities throughout the 20-year planning horizon.

The aviation demand forecast for Sioux Gateway Airport / Brigadier General Bud Day Field (SUX or Airport) used data from the FAA's 2023 Terminal Area Forecast (TAF), socioeconomic data, and information gained from interviews with airport tenants and management to forecast commercial passenger enplanements and operations, general aviation operations, military operations, and the number of based aircraft.

The forecast encompasses activity levels for the base year of 2023, as well as projections for future years, including 2028, 2033, and 2043. While the forecast outlines aviation activity levels for these specific years, it's crucial to recognize that facility requirements are contingent upon the materialized demand levels of aircraft operations and passenger enplanements, which may or may not correspond exactly with those years. Therefore, to remove the association between demand levels and specific years, the threshold of demand that initiates a facility improvement, known as a Planning Activity Level (PAL), is divided into the following three levels:

- **PAL 1** – Base Year + 5 years
- **PAL 2** – Base Year + 10 years
- **PAL 3** – Base Year + 20 years

Table 3-1 summarizes the forecasted activity levels for enplaned passengers, aircraft operations, and based aircraft at SUX.

Table 3-1 Forecast Summary

	Base Year	Milestone Years		
	2023	2028	2033	2043
		PAL 1	PAL 2	PAL 3
Enplanements				
Total Enplanements	**26,380**	**29,644**	**31,426**	**35,317**
Operations[1]				
Passenger	1,419	1,581	1,676	1,884
General Aviation	13,305	23,800	24,300	25,600
Air Taxi	1,421	2,200	2,300	2,500
Military	1,819	3,800	3,800	3,800
Total Operations	**17,964**	**31,381**	**32,076**	**33,784**
Based Aircraft				
Single-Engine	41	51	51	51
Multi-Engine	3	3	3	3
Turbojet	11	11	13	17
Helicopter	2	2	2	3
Military	9	9	9	9
Total Based Aircraft	**66**	**76**	**78**	**83**

Note: The FAA's TAF designates the commercial CRJ-200 operations at SUX as "Air Taxi," whereas the Master Plan forecast identifies it as "Passenger" service.
Source: RS&H, 2024

3.2 Emerging Trends

When planning for the future of SUX, it's essential to consider the evolving trends in both commercial passenger service and general aviation activity, particularly those with the potential for significant and direct impacts on the Airport. The rapid pace of development in aviation is anticipated to continue, requiring airports to swiftly adapt to meet the demands generated by the latest trends and innovations. Gaining a comprehensive understanding of the industry landscape at a high level offers significant advantages in positioning for potential future changes involving pilots, aircraft types, new technologies, and airport management policies.

3.2.1 Commercial Aviation Trends

A notable trend among regional commercial air service carriers is the shift from smaller regional jets, such as the Bombardier CRJ-200 with 50 seats or fewer, to larger aircraft offering greater seat capacities, such as the Embraer ERJ-175. This shift towards larger aircraft was accelerated during the COVID-19 pandemic when the shortage of regional aircraft pilots required the deployment of larger aircraft with reduced frequency in smaller markets like SUX. In some cases, this led to the complete discontinuation of service to these markets due to concerns about profitability and efficiency. The growing utilization of larger aircraft heightens the peak passenger demand for the terminal and landside facilities of the affected airport.

SkyWest Airlines is currently the exclusive commercial passenger airline serving SUX, operating under an Essential Air Service (EAS) contract. The EAS program is designed to sustain scheduled air service for smaller markets like Sioux City. SkyWest currently operates CRJ-200 aircraft at SUX but is expected to replace them with larger aircraft such as the ERJ-175, aligning with the industry-wide trend towards larger aircraft. The trend is anticipated to have notable impact on the future of commercial service at SUX as well as associated airfield design requirements and needs discussed later in this chapter.

3.2.2 General Aviation Trends

In the realm of general aviation recreational flyers and student pilots, there has been a noticeable shift in pilot demographics. Over the past two decades, there has been a decline in the number of pilots in the 40 to 60-year-old age bracket, a group historically active in recreational flying. Concurrently, there has been a significant uptick in flight training, which is attributed to regulatory adjustments and a high demand for commercial airline pilots. As outlined later in this chapter, a new flight school began operating at SUX in early 2023, followed by the commencement of a second flight school in the fall of the same year. Conversations with tenants and feedback from airport personnel indicate a strong interest in flight training within the region.

According to the FAA's annual aerospace forecast, there's an expected decline in single-engine piston aircraft operations over the next two decades[1]. This reflects a broader shift in general aviation aircraft manufacturing and ownership, driven by a decrease in recreational flying and an increase in business-oriented operations. Consequently, there's a growing demand for larger corporate aircraft. These national trends do not fully represent the aviation market at SUX as the recent establishment of two flight schools at the airport is projected boost piston aircraft activity, alongside continued growth in larger turboprop and jet aircraft operations.

3.2.3 Sustainability

The momentum behind sustainability initiatives at airports has been steadily increasing, reflecting a growing commitment to environmental stewardship within the aviation industry. Emerging aviation trends, such as the advancement of alternative fuels, a focus on environmental stewardship, and the evolution of aircraft designs and uses, are poised to shape the future requirements of airport facilities.

[1] FAA Aerospace Forecast 2024-2044, Federal Aviation Administration; April 24, 2024

The integration of alternative power sources in aviation, including hydrogen and electric propulsion systems, has the potential to replace conventional fossil fuel aircraft commonly employed in flight training and recreational flying. Electric aircraft, currently undergoing certification testing, are expected to reduce operational costs, noise, and carbon dioxide emissions. However, this transition could potentially require infrastructure improvements at airports, including the installation of electric charging ports, upgrades or extensions of electrical lines, and the installation of new transmission sub-stations. As these industry developments progress, SUX should anticipate forthcoming changes by identifying strategic locations for electric aircraft battery charging stations, determining optimal timing for implementing improvements, and adjusting financial policies to offset operating revenue losses resulting from decreased fuel sales. As the Fixed Base Operators (FBOs) at the airport are responsible for the handling and fueling of aircraft, electrification improvements and alternative aircraft needs at SUX should be planned with FBO input with potential operational oversight in mind.

One opportunity the Airport can seize is enhancing utility system reliability by integrating sustainable energy sources like solar power. Airports are increasingly adopting renewable energy systems within microgrids[2] to achieve energy independence. This approach not only fosters financial self-sufficiency but also bolsters the airport's critical role in community resilience during disaster recovery efforts.

The future facility requirements outlined in the following sections are formulated considering the capacity of the existing airport configuration to meet forecasted demand levels while aligning with the Airport's facility and service objectives. These requirements will incorporate prevailing industry trends to address present-day operational needs while safeguarding the Airport's ability to meet future demands.

3.3 Land Use

A preliminary review was conducted on the existing land uses and zoning ordinances for the land at and around the airport to assess developmental compatibility. The master plan includes an Airport Layout Plan (ALP) that details both on-airport and off-airport land use plans, that analyzes existing land uses as well as identifies the land necessary to support forecasted growth within the planning period.

3.3.1 On-Airport Land Use

Land use within airport property is divided based on use, compatible operations, and airfield safety. The majority of aviation facilities are located on the eastern side of the airfield, east of Runway 13-31 and 18-36, with ease of access to the public road network (such as Interstate 29).

[2] Microgrid: Group of interconnected loads and distributed energy resources that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate independently (U.S. Department of Energy).

The northern, southern, and western portions of the airfield, bounded to the west by the Missouri River, are reserved for activity/development compatible with aviation activity such as agriculture and light industrial.

The airport facilities on the eastern side of the airfield are grouped according to use. The southern corridor is comprised of military use with the IANG's base of operations located near the Runway 31 threshold. North of the IANG's base, located at the center of the airfield is the airport's commercial and maintenance facilities comprised of the passenger terminal, landside facilities such as parking lots, and the maintenance and equipment storage buildings. The majority of facilities and development space north of the passenger terminal are reserved for general aviation (GA) activity. Facilities that generate revenue from both aviation and non-aviation activities are located here as well as vacant land available for forecasted growth development.

3.3.2 Off-Airport Land Use

Land uses surrounding the Airport include industrial areas to the north, agricultural land along the Missouri River to the west, a mix of agricultural and industrial uses to the south, and residential neighborhoods to the east. The residential area to the east is situated on the outskirts of Woodbury County within the town of Sergeant Bluff. See **Figure 1-14** in **Chapter 1, Inventory of Existing Conditions** for a depiction of land uses on and around the Airport.

3.4 Meteorological Conditions

Weather exerts a substantial influence on airport facility needs and design requirements. Factors such as ambient temperature, precipitation, wind speed, visibility, cloud ceiling, and atmospheric pressure all impact operational parameters and drive future facility needs at SUX. In Sioux City, July typically stands as the warmest month, averaging a high temperature of 85° Fahrenheit over the past 20 years. Additionally, prevailing winds at the airport predominantly originate from the south during mid-spring to late fall and from the north during late fall to mid-spring.[3]

3.4.1 Runway Orientation and Wind Analysis

According to FAA Advisory Circular (AC) 150/5300-13B, *Airport Design*, the primary factor in determining runway orientation is the direction of prevailing winds. A runway wind coverage analysis was performed for SUX using the FAA's Airport Data and Information Portal (ADIP) Windrose Tool, which incorporates ten years of historical meteorological data. The data utilized by this tool is sourced from the National Oceanic and Atmospheric Administration (NOAA) Integrated Surface Database (ISD) via the weather reporting station at SUX. This wind coverage

[3] All recorded weather data collected by the National Oceanic and Atmospheric Association (NOAA) National Centers for Environmental Information (NCEI), complied by RS&H in September 2023.

analysis examines all weather conditions to assess overall wind coverage needs as well as Instrument Flight Conditions (IFR), and Visual Flight Rules (VFR) separately.

Table 3-2 Runway Wind Data

ALL WEATHER WIND DATA				
Runway	Crosswind Component			
	10.5 Knots	13 Knots	16 Knots	20 Knots
13-31	91.91%	95.75%	98.56%	99.67%
18-36	88.74%	93.93%	97.77%	99.48%
Combined	97.85%	99.09%	99.73%	99.94%

IMC WIND DATA				
Runway	Crosswind Component			
	10.5 Knots	13 Knots	16 Knots	20 Knots
13-31	89.54%	93.90%	97.45%	99.32%
18-36	85.81%	91.67%	96.42%	99.04%
Combined	96.52%	98.35%	99.49%	99.91%

VFR WIND DATA				
Runway	Crosswind Component			
	10.5 Knots	13 Knots	16 Knots	20 Knots
13-31	92.11%	95.94%	98.70%	99.72%
18-36	89.00%	94.18%	97.94%	99.54%
Combined	97.99%	99.17%	99.75%	99.95%

Source: NOAA Integrated Surface Database (ISD)
All Weather Observations: 122,430
IMC Observations: 16,284
VFR Observations: 93,971
Station: 725570 SIOUX GATEWAY/COL BUD DAY FIE
Data Range: 2013-2022

FAA runway design standards recommend an airport's runway system provide a minimum of 95 percent wind coverage based on all weather wind conditions. The calculation of 95 percent wind coverage is based on ensuring that the crosswind component does not exceed the designated value[4] determined by the Runway Design Code (RDC). If a single runway fails to provide sufficient coverage, a crosswind runway is warranted to address the shortfall in crosswind component coverage. FAA runway design standards for SUX, discussed in further detail in **Section 3.5.2, Airport Design Criteria**, support a current RDC of D-II and future C-III, both requiring a minimum of 95 percent wind coverage for a 16-knot crosswind. Runway 13-31 satisfies the FAA's 95 percent coverage threshold for a 16-knot crosswind. However, it falls short

[4] Table B-1, FAA AC 50/5300-13B, *Airport Design*

of this requirement for a 10.5-knot crosswind under all weather conditions, Instrument Meteorological Conditions (IMC), and Visual Flight Rules (VFR). Therefore, the crosswind runway at SUX (Runway 18-36) is essential to accommodate smaller general aviation traffic that cannot utilize the primary runway during periods of substantial crosswind. The comprehensive runway system at SUX provides adequate wind coverage in all weather conditions for the current and forecasted aircraft fleet mix (see **Table 3-2**).

3.5 Airfield Requirements

This section analyzes the various elements of the airfield and their ability to accommodate forecasted demand.

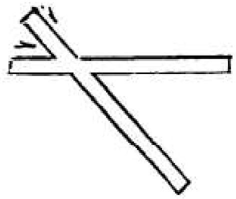
Since SUX is a shared-use airport serving both civilian and military purposes, there are designated design aircraft and associated airfield requirements for each sector. The FAA recognizes the significance of coordinating planning efforts for shared military-civilian airport facilities. However, the FAA lacks regulatory authority to provide financial assistance for infrastructure supporting military operations. Therefore, the effort of this master plan is to forecast and recommend implementation for current and future facility needs to accommodate growth of the civilian use of the airport. Throughout the course of this Master Plan, coordination with the Department of Defense occurred to ensure airfield requirements were met for both civil and military needs, including those outside the forecasted civil aviation activity and beyond FAA funding authority.

3.5.1 Airfield Capacity

Airfield capacity calculations use a metric referred to as the “mix index” calculated by assumptions and guidance outlined in FAA AC 150/5060-5, *Airport Capacity and Delay*. The mix index is utilized to determine the annual service volume (ASV) for an airfield and is computed as the sum of the percentage of large aircraft (such as the Embraer E175) in the typical fleet mix, plus three times the percentage of heavy aircraft (such as the Boeing 767) in the mix. The mix index percentage can vary between zero and 180, with lower percentages indicating a predominance of small aircraft in the operational fleet mix, while higher percentages denote a larger proportion of larger aircraft. The FAA's prescribed methodology for reflecting the impacts of the fleet mix on the ASV defines five ranges of mix index percentages (0 to 20, 21 to 50, 51 to 80, 81 to 120, and 121 to 130).

SUX is a two-runway system comparable to the No. 9 configuration depicted in FAA AC 150/5060-5, shown in **Table 3-3**.

Table 3-3 Two Runway Mix Index and ASV

Runway Configuration	Mix Index %(C+3D)	Hourly Capacity Ops/Hr		ASV
		VFR	IFR	
9. 	0 to 20	98	59	230,000
	21 to 50	77	57	200,000
	51 to 80	77	56	215,000
	81 to 120	76	59	225,000
	121 to 130	72	60	265,000

Source: FAA AC 150/5060-5, *Airport Capacity and Delay*

The objective of this analysis is to ascertain the airfield capacity and assess the adequacy of the runways to accommodate this capacity. The figures derived are then compared to the long-range forecasts for the Airport to identify any potential shortfalls. Based on the current and forecasted fleet mix at SUX, the mix index falls within the range of 21 to 50, at 30 percent; a prescribed airfield capacity of up to 200,000 annual operations. The industry benchmark for initiating plans to expand airfield capacity targets demand levels at 60 percent of the prescribed ASV (equivalent to 135,000 operations). Necessary upgrades are typically developed when demand reaches 80 percent of the ASV (equivalent to 180,000 operations). As shown in **Table 3-4**, the ASV ratio for SUX is not expected to reach 60 percent capacity within the planning horizon. This indicates the current runway system is adequate to accommodate current and forecast need for aviation activity at SUX.

Table 3-4 Airfield Capacity Analysis

	Base Year	Milestone Years		
	2023	2028	2033	2043
		PAL 1	PAL 2	PAL 3
Annual Service Volume	200,000	200,000	200,000	200,000
Annual Demand	17,964	31,381	32,076	33,784
ASV Demand/Capacity Ratio	9%	16%	16%	17%

Source: RS&H Analysis, 2024

3.5.2 Airport Design Criteria

Runways are constructed in alignment with the design specifications of the aircraft they aim to support. This involves meeting the needs of the "design aircraft," also known as the "critical aircraft," which represents either the most demanding individual aircraft or a group of aircraft with similar characteristics that regularly use the runway (at least 500 annual operations).[5] The design of the airfield must ensure that the facilities catering to the airport's design aircraft are fully accessible via the runways, taxiways, and ramps. FAA AC 150/5300-13B, *Airport Design*, outlines airport design standards and classifies aircraft based on geometric and performance metrics into the following categories:

- **Aircraft Approach Category (AAC)** – Relates to aircraft landing speeds.
- **Airplane Design Group (ADG)** – Relates to airplane wingspan and height.
- **Taxiway Design Group (TDG)** – Relates to the configuration and wheelbase of aircraft landing gear as affecting the aircraft's ability to negotiate turning movements.

An accurate design aircraft determination helps to ensure facilities are developed to maximize the service level of the airport. While airports have an overall design aircraft that serves as the basis for many of its paved surfaces, certain sections of the airfield may opt for a different design aircraft to accommodate specific uses in that particular area. According to FAA guidance, the use of multiple design aircraft across an airport is permitted. This allows for efficiently designed surfaces that are tailored to the intended uses of their associated support facilities.

3.5.2.1 Runway 13-31 Critical Aircraft

The most demanding aircraft conducting at least 500 annual operations at SUX identified in **Chapter 2, Aviation Activity Forecast** is the Bombardier CRJ-200 (D-II-1B). Considering forecasted growth and trends indicating an increase in the utilization of larger regional aircraft, it is projected that the future critical aircraft will be the Embraer E170/E175. The existing design aircraft for the Iowa Air National Guard (IANG) is the KC-135 Stratotanker while its future design aircraft is the KC-46 Pegasus. **Table 3-5** displays the AAC, ADG, and TDG classifications for both the existing and future design aircraft of Runway 13-31.

Table 3-5 Runway 13-31 Critical Aircraft Determination

	Representative Aircraft	AAC	ADG	TDG
Runway 13-31				
Existing Critical Aircraft	CRJ-200	D	II	1B
Future Critical Aircraft	ERJ-175	C	III	3
Existing Military Aircraft	KC-135 Stratotanker	C	IV	4
Future Military Aircraft	KC-46 Pegasus	C	IV	5

Source: RS&H Analysis, 2024

[5] FAA AC 150/5000-17, *Critical Aircraft and Regular Use Determination*

3.5.2.2 Runway 18-36 Critical Aircraft

Runway 18-36 underwent reconstruction from 2018 to 2020. The airline and fleet mix at the time, as well as the forecasted fleet evolution, indicated the design aircraft guiding the design standards for the rehabilitation of the runway should be the Embraer 145, a C-II-2B aircraft. However, based on industry trends, it is forecasted SkyWest (or other market entrant) would favor the larger regional jets in the future, such as the Embraer E170/E175. Recent data obtained from the Air Traffic Control Tower (ATCT) at SUX indicates that the crosswind runway historically receives around 300 annual commercial operations via small regional jets, falling short of the 500 annual operations threshold. Runway 18-36 also serves a notably high volume of traffic from large corporate aircraft and business jets such as the Bombardier Challenger 300, Dassault Falcon 900, and the Hawker 800, all falling within the C-II aircraft category. When aggregated, these aircraft surpassed the 500 annual operations threshold in 2023. Similarly, it is projected that commercial operations on Runway 18-36 will not meet the annual usage threshold within the planning period. Given that the most demanding TDG of these aircraft currently using, and forecasted to use, Runway 18-36 is a TDG 2A, the critical aircraft for Runway 18-36 were determined to be, and remain, a C-II-2A aircraft through the Forecast Period (further detailed in **Chapter 2**).

Currently, the Iowa Air National Guard (IANG) cannot operate on Runway 18-36 due to the length, width, and strength requirements of the based KC-135 aircraft at SUX. However, the long-range plan of the IANG could require the enhancement of Runway 18-36 for emergency redundancy purposes. Since this plan does not directly affect FAA processes or operational and development levels associated with the IANG, it is not an active planning component within the master plan. To ensure future compatibility, the Airport should plan to protect Runway 18-36 to meet RDC C-IV-5 design standards in order to facilitate future military operations. See **Table 3-6** for existing and future critical aircraft information for Runway 18-36.

Table 3-6 Runway 18-36 Critical Aircraft Determination

	Representative Aircraft	AAC	ADG	TDG
Runway 18-36				
Existing Critical Aircraft	Business Jets	C	II	2A
Future Critical Aircraft	Business Jets	C	II	2A
Future Military Aircraft[1]	KC-46 - Pegasus	C	IV	5

Note:
(1) Runway 18-36 does not currently support military aircraft operations.
Source: RS&H Analysis, 2024

3.5.3 Runway Design Requirements

The analysis of the runways evaluates their geometric characteristics to ensure compliance with FAA design standards, considering the critical aircraft for both current and projected demand. This assessment encompasses various elements, such as runway orientation and designation, geometric design, runway protective and visual zones, and pavement strength.

3.5.3.1 Runway Designation

Runway designations are assigned based on magnetic compass bearing, indicating the orientation of the runway relative to magnetic north. While the true heading, representing the physical orientation of the runway, remains constant, the magnetic heading varies over time due to the gradual movement of the Earth's magnetic poles. The magnetic heading of a runway is crucial for navigation equipment and instrument approaches, as they are designed with respect to magnetic heading rather than true heading. To anticipate potential changes in runway designations due to magnetic drift, it's essential to account for the calculated rate of magnetic declination. When the runway designation differs by more than five degrees from the established designated runway heading, it is advisable for the Airport to coordinate changing the designation with the FAA.

During the reconstruction of the crosswind runway at SUX in 2020, the designation of the runway was adjusted from Runway 17-35 to Runway 18-36 to account for the gradual drift in magnetic heading over time. As of September 2023, the magnetic declination at SUX is 2.43° E ± 0.39° changing annually by 0.08° W.[6] As shown in **Table 3-7**, all runway designations are anticipated to remain the same throughout the planning period.

Table 3-7 SUX Runway Designation

Runway Designation	True Alignment	True Bearing	Existing		Future (2043)		
			Magnetic Bearing	Runway Heading	Magnetic Bearing	Runway Heading	Runway Designation
13	136°	135° 40' 40.8"	133° 12' 28.8"	133°	134° 48' 28.8"	134°	13
31	316°	315° 40' 40.8"	313° 12' 28.8"	313°	314° 48' 28.8'	314°	31
18	181°	180° 40' 40.8"	178° 12' 28.8"	178°	179° 48' 28.8"	179°	18
36	001°	00° 40' 40.8"	358° 12' 28.8 "	358°	359° 48' 28.8"	359°	36

Source: RS&H Analysis, 2024

[6] National Centers for Environmental Information. *Magnetic Declination Calculator*. Retrieved September 18, 2023, from https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml

3.5.3.2 Runway Length Analysis

The analysis of runway length assessed the takeoff and landing requirements using the methodology specified in FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*. As SUX is an EAS market, the airport has commercial passenger service provided through contracts with carriers lasting five years. SkyWest, currently servicing the SUX market, began service to both Denver International Airport (DEN) and Chicago O'Hare International Airport (ORD) in April of 2021 following the SUX EAS contract fulfilled by American Airlines and provided by American Eagle (2016 – 2021).

The analysis of runway lengths at SUX was conducted using FAA computer modeling software and performance graphs for composite aircraft groups. This calculation considered SUX's mean maximum temperature (85°F), field elevation (1,098 feet above mean sea level), difference in runway centerline elevations (0.2 feet for Runway 13-31 and 2.3 feet for Runway 18-36), and an aircraft flight range of greater than 405 nautical miles per the current longest destination of DEN. **Table 3-8** showcases the results of the computed FAA length analysis.[7]

Table 3-8 SUX Runway Length Analysis

Aircraft	Maximum Payload Used			
	Bombardier CRJ-200LR	**Embraer E145LR**	**Embraer E175AR**	**Embraer E175LR**
Forecast Scenario	Existing	Existing	Future	Future
Farthest Destination	DEN (405 nm)	DEN (405 nm)	DEN (405 nm)	DEN (405 nm)
Take Off				
Existing 13-31 Length	9,002'	9,002'	9,002'	9,002'
Length Required 13-31	**5,105'**	**4,805'**	**6,155'**	**5,755'**
Existing 18-36 Length	6,401'	6,401'	6,401'	6,401'
Length Required 18-36	**5,125'**	**4,825'**	**6,175'**	**5,755'**
Landing				
Landing Length Required	**5,700'**	**5,400'**	**5,320'**	**5,350'**

Note: nm = Nautical Miles
Source: RS&H Analysis, 2024

[7] FAA runway length assumptions are based on a generic fleet mix which is not specific to SUX.

Per the requirements of the EAS contract, carriers are able to bid on the opportunity to provide air service to a market every five years following conclusion of the previous contract. SkyWest currently serves the SUX market with ORD and DEN destinations which succeeded American Eagle service to ORD. During American Eagles' contract, the potential for a second destination to Phoenix Sky Harbor International Airport (PHX) was considered before the conclusion of the EAS contract. With the potential of a new carrier with alternative destinations, some of which may exceed current destination distances, arriving at SUX in the Forecast Period, an analysis was performed on the previously considered PHX market to analyze the impacts of longer routes with the same aircraft projections (shown in **Table 3-9**).

Table 3-9 Alternative Runway Length Analysis

Aircraft	Maximum Payload Used			
	Bombardier CRJ-200LR	**Embraer E145LR**	**Embraer E175AR**	**Embraer E175LR**
Forecast Scenario	Alternative	Alternative	Future	Future
Farthest Destination	PHX (914 nm)	PHX (914 nm)	PHX (914 nm)	PHX (914 nm)
Take Off				
Existing 13-31 Length	9,002'	9,002'	9,002'	9,002'
Length Required 13-31	**5,705'**	**6,505'**	**6,905'**	**6,605'**
Existing 18-36 Length	6,401'	6,401'	6,401'	6,401'
Length Required 18-36	**5,725'**	**6,525'**	**6,925'**	**6,630'**
Landing				
Landing Length Required	**5,640'**	**5,350'**	**5,320'**	**5,320'**

Note: nm = Nautical Miles
Source: RS&H Analysis, 2024

3.5.3.2.1 Runway 13-31 Summary

Based on this analysis, it was determined that no additional runway length is required for Runway 13-31 throughout the planning period to accommodate the civilian critical aircraft to current or potential alternative destinations. However, the IANG requires a full 10,000 feet of runway length to meet the performance requirements of military critical aircraft for specific missions which will necessitate a runway extension. This extension for military operations will be discussed further in **Section 3.12.2** and in **Chapter 4, Identification and Evaluation of Development Alternatives**.

3.5.3.2.2 Runway 18-36 Summary

The analysis of current commercial air service destinations revealed Runway 18-36 is adequate in supporting both current and anticipated aircraft upgauging to the current destinations serviced by SkyWest at SUX. However, the alternative destination analysis to PHX determined that a future extension to Runway 18-36 could be necessary to accommodate larger future aircraft and/or enable longer stage lengths (primarily for takeoff operations as shown in **Table 3-9**). As primary Runway 13-31 would handle the majority of alternative destination traffic, a reassessment of the use of the crosswind runway should be conducted in the future with either the addition of destinations under the current carrier contract or with the entry of a new carrier into the market to ensure adequate capability of supporting commercial operations.

In addition to lengthening Runway 13-31, the IANG have expressed interest in lengthening Runway 18-36 to meet their future operational needs (further discussed in **Section 3.12.3** and **Chapter 4**). It's important to note that any development beyond the design requirements outlined by the FAA to support civilian aircraft would be funded by the direct benefactor. In the case of the IANG's runway modifications, funding would come from the United States Department of Defense.

3.5.3.3 Erosion Control Design Features Analysis

The primary method to control erosion caused by weather and jet blast adjacent to pavements at airports is through the design of runway shoulders and blast pads tailored to the specifications of the designated design aircraft for that surface. The FAA recommends paved shoulders and blast pads for runways that serve ADG-III and larger aircraft and stabilized shoulders and blast pads for those that serve ADG-I/II aircraft. Runway 13-31 meets existing and future design standards for the civilian design aircraft but would need to be improved to meet military critical aircraft design standards. It is recommended (but not required) that at minimum stabilized shoulders and blast pads be added to Runway 18-36 to meet C-II design standards and limit soil erosion. **Table 3-10** displays the required erosion control design features for each design category on both runways at SUX.

Table 3-10 SUX Runway Erosion Control Analysis

	Runway 13-31				
	Existing Condition	Existing Standard (D-II)	Adequate (✓) or Deficient (X)	Future Standard (C-III)	Adequate (✓) or Deficient (X)
Runway Pavement Width	**150'**	100'	✓	100'	✓
Runway Shoulder Width	**22'**	10'	✓	20'	✓
Runway Blast Pad Width	**150'**	120'	✓	140'	✓
Runway Blast Pad Length	**1,000'**	150'	✓	200'	✓

	Runway 18-36		
	Existing Condition	Existing/Future Standard (C-II)	Adequate (✓) or Deficient (X)
Runway Pavement Width	**100'**	100'	✓
Runway Shoulder Width	**N/A**	10'	X
Runway Blast Pad Width	**N/A**	120'	X
Runway Blast Pad Length	**N/A**	150'	X

Source: RS&H Analysis, 2024

3.5.3.4 Runway Protection Zones

For the protection of people and property on the ground, FAA standards identify a trapezoidal area of land to be protected at each runway end known as the Runway Protection Zone (RPZ). The size of these zones varies according to the characteristics of the design aircraft and the lowest instrument approach visibility minimum defined for each runway end (and associated approach/departure procedures). According to FAA AC 150/5300-13B, *Airport Design*, the FAA recommends that all areas within the RPZ should be cleared and owned by the airport or airport sponsor. In cases where this is not feasible, airport owners should ensure that the RPZ remains clear of any facilities supporting incompatible activities. **Table 3-11** presents the existing and future RPZ dimensions for the runways at SUX.

Table 3-11 Runway Protection Zone Analysis

	Runway 13-31[1]								Runway 18-36[2]					
	Existing				Future				Existing		Future			
	Civilian		Military		Civilian		Military		Civilian		Civilian		Military	
	RWY 13	RWY 31	RWY 13	RWY 31	RWY 13	RWY 31	RWY 13	RWY 31	RWY 18	RWY 36	RWY 18	RWY 36	RWY 18	RWY 36
Runway Reference Code	D-II	D-II	C-IV	C-IV	C-III	C-III	C-IV	C-IV	C-II	C-II	C-II	C-II	C-IV	C-IV
Visibility Minimums	3/4 mile	1/2 mile	3/4 mile	1/2 mile	1/2 mile	1/2 mile	1/2 mile	1/2 mile	3/4 mile	3/4 mile	3/4 mile	1/2 mile	3/4 mile	1/2 mile
Approach RPZ														
Standard Length	1,700′	2,500'	1,700′	2,500'	2,500'	2,500'	2,500'	2,500'	1,700′	1,700′	1,700′	2,500'	1,700′	2,500'
Standard Inner Width	1,000'	1,000'	1,000'	1,000'	1,000'	1,000'	1,000'	1,000'	1,000'	1,000'	1,000'	1,000'	1,000'	1,000'
Standard Outer Width	1,510′	1,750'	1,510′	1,750'	1,750'	1,750'	1,750'	1,750'	1,510′	1,510′	1,510′	1,750'	1,510′	1,750'
Departure RPZ														
Standard Length	1,700′	1,700′	1,700′	1,700′	1,700′	1,700′	1,700′	1,700′	1,700′	1,700′	1,700′	1,700′	1,700′	1,700′
Standard Inner Width	500'	500'	500'	500'	500'	500'	500'	500'	500'	500'	500'	500'	500'	500'
Standard Outer Width	1,010'	1,010'	1,010'	1,010'	1,010'	1,010'	1,010'	1,010'	1,010'	1,010'	1,010'	1,010'	1,010'	1,010'
Airport Control	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X

Notes:
(1)The future RPZ location may change based on the alternatives developed for the Runway 13-31 expansion.
(2) The amount of land not under Airport control will depend on how much and in which direction Runway 18-36 might be extended to support future military operations.
✓ = Airport has control over the full RPZ area.
X = Airport does not have control over the full RPZ area.
Source: RS&H Analysis, 2024

All land within the existing RPZs at SUX is under airport control and within airport property, with the exception of the Runway 31 RPZ which overlays Harbor Drive, a public roadway. Transportation facilities not limited to, but including, public roads/highways are identified by the FAA as examples of incompatible land uses within an RPZ.[8] This guidance is intended to protect against the introduction of new or modified land uses. Existing infrastructure does not require immediate mitigation, but the FAA does not support any expansion of incompatible uses within RPZs.

The potential expansion of both runways at SUX for either civil or military use could lead to future RPZs overlapping with districts that currently feature uses not compatible with aviation activities. Additionally, if lower visibility minimums are implemented on approach procedures for either runway to accommodate a higher level of civil or military activity, the RPZ could shift or enlarge. **Chapter 4** will discuss these scenarios in more detail. **Figure 3-1** shows the existing and potential future RPZ size requirements.

3.5.3.5 Runway Visibility Zone

The Runway Visibility Zone (RVZ), applicable to airfields with intersecting runways, is formed by connecting the line of sight (LoS) points of the two intersecting runways.[9] The RVZ enhances situational awareness for pilots and ground operations vehicles, helping to prevent potential hazards and collisions. For airports without continual Air Traffic Control (ATC) observation, such as SUX, the FAA requires maintaining an RVZ clear of any potential hazards or obstructions. As shown in **Figure 3-1**, SUX maintains a clear RVZ and does not need mitigation within the planning period.

3.5.3.6 Runway Geometric and Separation Standards

The existing runway geometric and separation distances for each runway at the airport were analyzed to ensure compliance with FAA design parameters. Ensuring compliance with geometric and separation standards is paramount for maintaining a safe airfield environment. Any non-standard conditions should be addressed and mitigated to the fullest extent possible before considering requesting modifications to standards from the FAA. **Table 3-12** details the existing and future standards requirements while **Figure 3-1** shows the layout of associated safety areas on each runway.

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[8] FAA AC 150/5190-4B, *Airport Land Use Compatibility Planning*

[9] Section 3.8.2, FAA AC 150/5300-13B, *Airport Design*

Table 3-12 SUX Runway Standards Analysis

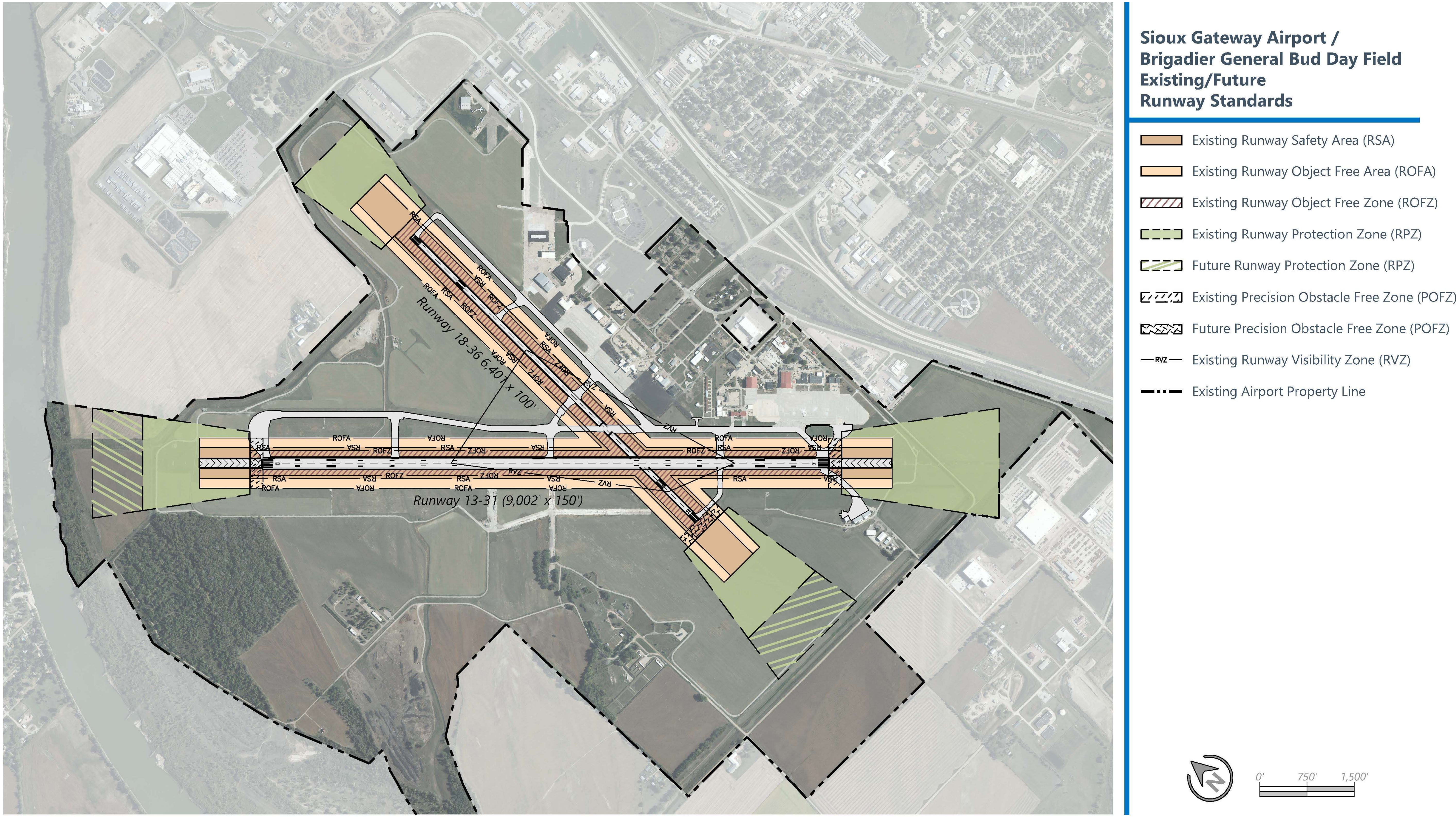
Airfield Components	Runway 13-31*					Runway 18-36*				
	Existing			Future		Existing			Future	
	Condition	Standard (D-II)	Standard Met (✓)	Standard (C-III)	Standard Met (✓)	Condition	Standard (C-II)	Standard Met (✓)	Standard (C-II)	Standard Met (✓)
Runway Separation										
Runway Centerline to:										
Holding Position[1]	256'-260'	250'	✓	250'	✓	256'-259'	200'	✓	250'	✓
Parallel Taxiway/Taxilane Centerline	536'-775'	400'	✓	400'	✓	538'-550'	240'	✓	300'	✓
Safety Areas										
Runway Safety Area (RSA)										
Length Beyond Departure End	1,000'	1,000'	✓	1,000'	✓	300'	300'	✓	1,000'	✓
Length Prior to Threshold	600'	600'	✓	600'	✓	300'	300'	✓	600'	✓
Width	500'	500'	✓	500'	✓	150'	150'	✓	500'	✓
Runway Object Free Area (ROFA)										
Length Beyond Runway End	1,000'	1,000'	✓	1,000'	✓	300'	300'	✓	1,000'	✓
Length Prior to Threshold	600'	600'	✓	600'	✓	300'	300'	✓	600'	✓
Width	800'	800'	✓	800'	✓	500'	500'	✓	800'	✓
Runway Obstacle Free Zone (ROFZ)										
Width	400'	400'	✓	400'	✓	400'	400'	✓	400'	✓
Precision Obstacle Free Zone (POFZ)										
Length	200'	200'	✓	200'	✓	N/A	N/A	N/A	200'	✓
Width	800'	800'	✓	800'	✓	N/A	N/A	N/A	800'	✓

* Visibility minimums for Runway 36 are currently and anticipated to remain at ¾ statute mile. Minimums for Runway 31 are currently and anticipated to remain at ½ statute mile. Minimums for Runway 13 and Runway 18 are currently at ¾ statute mile and anticipated to be lowered to ½ statute mile.

Note:
(1) Distance increases by 1' for every 100' above sea level per FAA AC 150/5300-13B, *Airport Design*

Source: RS&H Analysis, 2024

Figure 3-1 SUX Runway Standards



Source: RS&H, 2023

3.5.3.7 Runway Pavement Strength

Pavement strength is an important criterion in determining the utility of a paved surface. Pavement strength or bearing capacity is classified across multiple aircraft gear configurations that frequently traverse the same representative pavement section. **Table 3-13** shows existing runway pavement bearing capacities at SUX.

Table 3-13 SUX Existing Runway Pavement Strength

Main Gear Configuration	Pavement Bearing Capacity	
	Runway 13-31	Runway 18-36
Single Wheel (S)	100,000 lbs.	65,000 lbs.
Dual Wheel (D)	120,000 lbs.	80,000 lbs.
Dual Tandem Wheel (2D)	220,000 lbs.	130,000 lbs.

Source: Airport 5010; Compiled by RS&H, 2024

Aircraft that surpass the design pavement bearing capacities of a runway are not automatically prohibited from operating on the surface. A waiver or prior permissions for operational approval may be issued by the Airport to allow this activity as traffic surpassing the design strength of the pavement will accelerate the rate of degradation the pavement experiences.

As shown in **Table 3-14**, the maximum takeoff weight of the military design aircraft greatly exceeds the existing bearing capacity of Runway 13-31. As the KC-135 is based at SUX, their operation frequency is high and consequently this aircraft is unable to depart with a full payload. As part of a reconstruction program underway at the time of this writing[10] for Runway 13-31, the IANG is planning to extend the length of Runway 13-31 as well as strengthening the pavement section to enable departing military aircraft at their allowable maximum takeoff weight. The Runway 13-31 reconstruction program is further discussed in **Chapter 4**.

[10] June 2024

Table 3-14 SUX Pavement Strength Analysis

Aircraft	Aircraft Size (Passengers)	Runway Design Code	Gear Type	Maximum Takeoff Weight	Runway 13-31 Adequate (✓) or Deficient (X)	Runway 18-36 Adequate (✓) or Deficient (X)
General Aviation Aircraft						
Light/Small Business Jet	4-6 Passengers	B-I to B-II	Single-Wheel	8,000 to 20,000 lbs	✓	✓
Medium Business Jet	6 to 10 Passengers	B-II to C-II	Dual-Wheel	20,000 to 50,000 lbs	✓	✓
Large Business Jet	10 to 16 Passengers	C-II to D-III	Dual-Wheel	45,000 to 95,000 lbs	✓	✓
Boeing Business Jet	up to 150 Passengers	C-III	Dual-Wheel	up to 188,000 lbs	X	X
Air Carrier/Air Taxi Aircraft						
Turboprop	19-40 Passengers	B-II to A-III	Dual-Wheel	26,000 to 65,000 lbs	✓	✓
Regional Jet	50 to 90 Passengers	C-II	Dual-Wheel	53,000 to 85,000 lbs	✓	✓
Airbus 319/320	up to 180 Passengers	C-III	Dual-Wheel	up to 172,000 lbs	✓	✓
Boeing 737-800	up to 189 Passengers	D-III	Dual-Wheel	up to 174,200 lbs	X	X
Boeing 747-400	up to 524 Passengers	D-V	Dual-Tandem Wheel	up to 900,000 lbs	X	X
Military						
KC- 135 Stratotanker	up to 83,000 lbs cargo	C-IV	Dual-Tandem Wheel	up to 322,500 lbs	X	X
F-16	Fighter Jet	D-I	Single-Wheel	up to 37,500 lbs	✓	✓
Runway 13-31 Existing (E)/Future (F) Critical Aircraft						
Bombardier CRJ-200/700 (E)	up to 50 Passengers	D-II	Dual-Wheel	up to 72,750 lbs	✓	✓
Embraer ERJ-175 (F)	up to 76 Passengers	C-III	Dual-Wheel	up to 82,673 lbs	✓	X
Runway 18-36 Existing (E)/Future (F) Critical Aircraft						
Business Jets (E/F)[1]	up to 12 passengers	B-II	Dual-Wheel	up to 30,800 lbs	✓	✓

*Based on the Citation Longitude jet.

Source: FAA Aircraft Characteristics Database October 2023; RS&H Analysis, 2024

3.5.4 Taxiway Requirements

This taxiway analysis focuses on meeting specific requirements regarding the capacity of the existing taxiways to handle both current and projected demand at the Airport. Taxiways must ensure safe and efficient airfield circulation while adequately supporting the size and weight of aircraft. An effective taxiway system maintains traffic flow with minimal speed changes for aircraft taxiing and minimizes points that could potentially confuse pilots and controllers.

At SUX, there are a total of eight taxiways, including the runway threshold connectors. Taxiway C acts as a partial parallel taxiway to Runway 18-36, while Taxiway A serves as a full parallel taxiway to Runway 13-31. Taxiway G and Taxiway M are military-use only taxiways positioned close to the threshold of Runway 31.

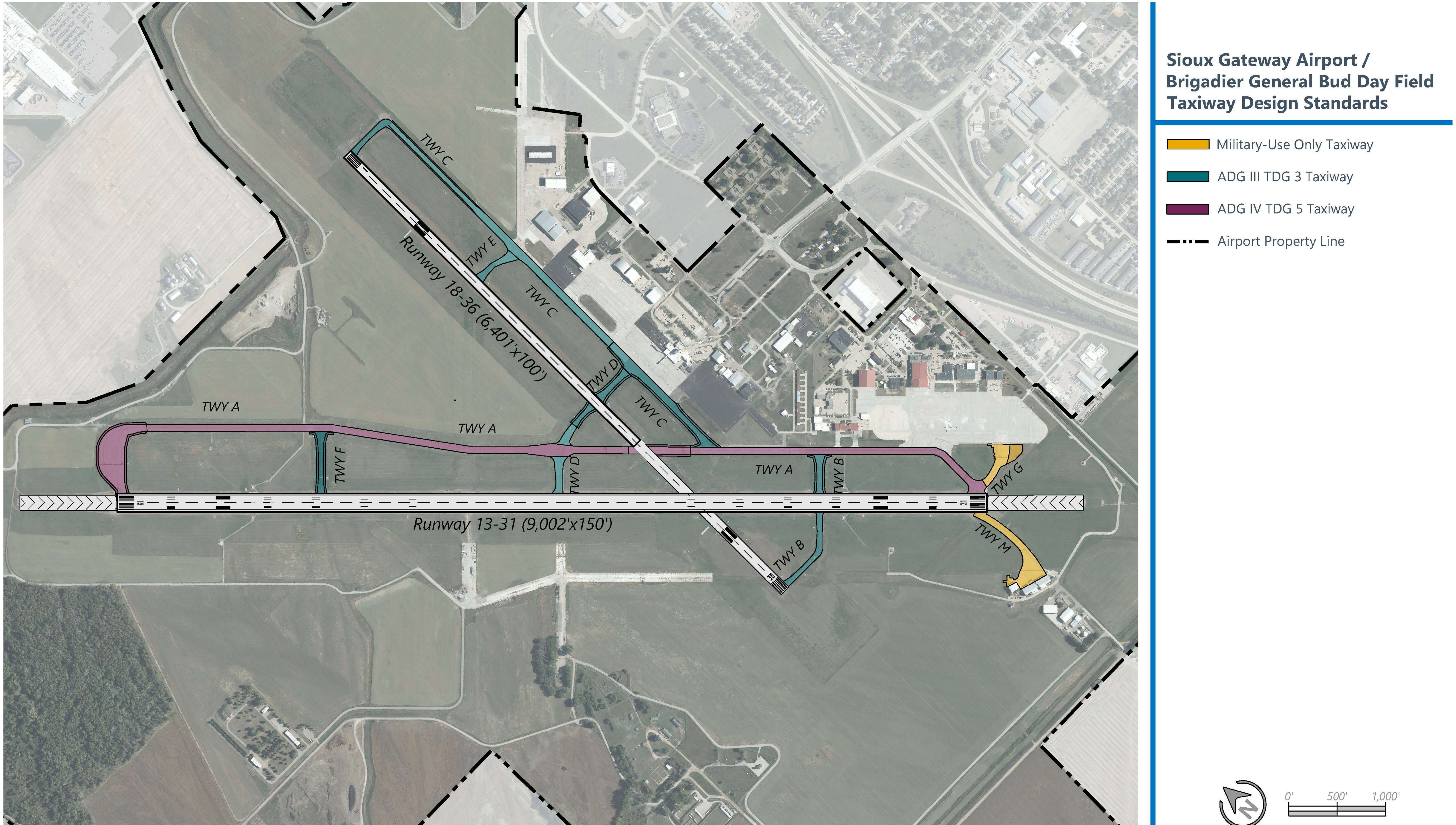
The design aircraft of an airport generally dictates taxiway design standards and dimensional criteria. Taxiway pavement width is determined by the TDG of the design aircraft, while separation standards are determined by the ADG. Depending on the demand and specific usage of a particular area, portions of the airfield may include taxiways or taxilanes designed for aircraft types different from the airport's designated design aircraft.

Much of the taxiway system serving Runway 13-31 at SUX supports ADG IV, TDG 5 standards to accommodate military operations. However, current and forecasted civil use aircraft are expected to only require ADG III, TDG 3 design standards. As previously mentioned, the FAA can only fund projects and infrastructure associated with civil-use surfaces and is unable to allocate funding for enhancements specific to military needs. Future improvements to the taxiway system must support the utility of civil operations but protect for the needs of military operations and development (ADG IV/TDG 5) to ensure compatibility.

The taxiway system linked to Runway 18-36 presently caters to ADG III/TDG 3 aircraft. Since the future design aircraft for Runway 18-36 is projected to remain unchanged within the planning period, future development projects must consider the same. However, any airport improvement plans should also incorporate a similar "protection" for military expansion on Runway 18-36 to ensure compatibility for ADG IV/TDG 5 military aircraft.

The existing design standards supported by each segment of the taxiway system at SUX are shown in **Figure 3-2**. Military-use only taxiways are presumed to support TDG 4 operations but are anticipated to be relocated as part of near-term airfield improvements discussed in **Chapter 4**.

Figure 3-2 Taxiway Design Standards



Source: RS&H, 2023

3.5.4.1 Runway Incursion Mitigation (RIM)

In 2015, the FAA launched a pilot program aimed at enhancing runway safety at airports. Known as the Runway Incursion Mitigation (RIM) program, it identified areas of heightened risk for runway incursions at specific airfield intersections. Utilizing runway incursion data, the FAA compiled a list of locations experiencing a higher-than-average frequency of these incidents. Locations where three or more runway incursions occurred within a single year, or where more than ten incursions were recorded over the evaluation period, were identified and published on the RIM Inventory List. As of the published FAA RIM Inventory list effective December 31, 2023, SUX does not have any identified RIM locations.

The FAA has designated specific locations at airports as "hot spots" to alert airport users to areas on the airfield that may be confusing to pilots and pose a higher risk of runway incursions. Hot spots and RIM locations share similarities but differ in their identification criteria. Hot spots are pinpointed based on feedback from local stakeholders and users' perceptions of potentially problematic areas on the airfield, whereas RIM locations are identified according to specific standards set by the FAA.

Currently, SUX has two identified hot spots, both attributed to line-of-sight issues with the air traffic control tower (ATCT) located just north of the passenger terminal as a result of ancillary buildings located on the airfield (see **Figure 3-3**).

- **Hot Spot 1**
  The ATCT has limited visibility of Taxiway A near the Aircraft Rescue and Fire Fighting (ARFF) building.

- **Hot Spot 2**
  Portions of the airfield (Taxiway G and IANG Ramp) are not visible from the ATCT (IANG base hangars).

Through the RIM program, the FAA has established geometry code keys, referred to as "Geocodes," to categorize specific geometry conditions that may contribute to an increase in runway incursions. A total of 19 geocodes have been defined, each describing a particular issue related to non-standard geometry. At SUX, several geocodes have been identified, each accompanied by a description of how these issues elevate the risk of runway incursions. A number of the geocodes at SUX also relate to various airfield nonstandard conditions described in the next section.

- **Geocode 1**
  Y-shaped taxiways crossing a runway. The intersection of Taxiway A and Taxiway G cross Runway 31.

- **Geocode 8**
  Direct taxiing access to runways from ramp areas. The design increases the risk of a pilot inadvertently taxiing onto the runway by mistake because no decision-making process, in the form of directional input, is required by the pilot before entering the runway. Taxiway D provides direct access from the apron to Runway 18-36 while Taxiway A and Taxiway G provide direct access from the IANG ramp to Runway 13-31.

- **Geocode 13**
  Taxiway intersects runway at other than right angle. Taxiways A, G, and M at the threshold of Runway 31.

- **Geocode 99** – Miscellaneous – Taxiway intersection along the middle third of a runway. Taxiway D crosses Runway 18-36 within the middle third.

Addressing each listed geocode would require substantial capital investment, potentially making it impractical as a standalone project. Instead, addressing individual deficiencies should be coordinated with major rehabilitation or development projects, as feasible. In the meantime, deficiencies and non-standard conditions can be temporarily mitigated through more practical measures, such as education initiatives and improved signage.

3.5.4.2 Non-Standard Conditions

An analysis of the existing taxiway system was conducted to identify any non-standard conditions in accordance with Section J.5.2 of FAA AC 150/5300-13B, *Airport Design*. The non-standard or deficient conditions identified are explained in more detail below and shown in **Figure 3-3**.

- **Middle Third Crossing**
  FAA design standards recommend that runway crossings be placed in the outer thirds of a runway, as the middle third is designated a "high energy" zone. This zone is characterized by aircraft arriving or departing at high speeds, making it difficult for pilots to perform evasive maneuvers to avoid a collision in the event of a runway incursion. Currently, Taxiway D is located within the middle third of both runways but is only considered a crossing of Runway 18-36.

- **Non-Standard Angle Taxiway**
  The FAA recommends that runway and taxiway intersections be designed perpendicular to runway intersections, except for high-speed exits necessary to maintain airfield capacity. Right-angle taxiways offer pilots the best visual perspective when approaching an intersection and provide the optimal orientation for runway holding position signs. Currently, Taxiways A, G, and M feature non-standard taxiway/runway intersection angles. Additionally, the intersection of Taxiways C and E features multiple angles that could be enhanced with a realignment. While not currently considered nonstandard according to FAA design principles, plans to realign this intersection per current design standards during a neighboring capital improvement project could enhance airfield safety.

- **Direct Access**
  Taxiways that provide direct access from the apron to the runway can increase the risk of runway incursions due to a loss of situational awareness for pilots and vehicle operators. According to FAA design standards, it is recommended that either the apron or runway entrance be offset so that pilots must make a series of turns before entering the runway from the apron. Currently, Taxiway D provides direct access to Runway 18-36 from the apron, while Taxiways A, G, and M provide direct access from the IANG ramps to Runway 13-31.

- **Non-Standard Taxiway Shoulder Widths**
  The FAA requires stabilized shoulders for taxiways serving ADG-I through ADG-III aircraft and paved shoulders for all aircraft larger. This stabilization helps control the erosion of soil (and creation of FOD) adjacent to the taxiway pavement edge from mechanical (jetblast) and chemical (runoff) means. Shoulder width is based on the TDG of the taxiway with the future TDG for Runway 13-31 civil operations (TDG 3) requiring 20 foot stabilized shoulders and for Runway 18-36 civil operations (TDG 2A) requiring 15 foot stabilized shoulders. For military use, the associated taxiway system would be required to meet TDG 5 standards requiring 30 foot paved shoulders. Many taxiways at SUX do not currently meet the shoulder width requirements. These deficiencies could be corrected strategically by pairing construction with an associated capital improvement project or alternatively as standalone projects to combat observed erosion.

- **Y-Shaped Taxiway Crossing a Runway**
  Y-shaped taxiways entering a runway can cause confusion and loss of situational awareness for pilots and vehicles. Taxiway A and Taxiway G form a Y-shape as they enter Runway 13-31 at the threshold of Runway 31. Removing this nonstandard crossing through taxiway realignment and/or relocation would befit design compliance focusing on airfield safety.

- **Taxiway Fillet Geometry**
  In 2012, the FAA updated the criteria for taxiway design dimensions and appropriate pavement fillet design. Previously, the standards used the Aircraft Design Group (ADG), based on the aircraft's wingspan and tail height, to determine suitable taxiway dimensions and fillet design. The current standards now require taxiway dimensions to be designed according to newly established Taxiway Design Groups (TDGs), which are based on the undercarriage dimensions, specifically the Main Gear Width (MGW) and the Cockpit to Main Gear (CMG) dimensions. Due to these revisions, all taxiway geometry at SUX that has not undergone rehabilitation or reconstruction since 2012 are presumed to not meet current standards. Updates to current design standards should be evaluated and addressed as practical over time as pavement surface maintenance is performed.

Another notable deficiency in the taxiway system at SUX pertains to Taxiway M. Currently, Taxiway M prohibits aircraft parking on the ramp to avoid penetrating the critical area of the Instrument Landing System (ILS). This taxiway is designated exclusively for military use. While any necessary improvements would typically be funded by the Department of Defense (DoD), the current condition of Taxiway M has the potential to impact civil operations. Therefore, it is essential for the Airport and the IANG to collaborate on establishing a coordinated mitigation plan that is mutually achievable.

Many of the items identified are not deficiencies requiring immediate action due to any critical safety risk but instead are the result of continual FAA design guidance updates. **Chapter 4** will address these non-standard conditions and establish a phased implementation plan.

Figure 3-3 Taxiway Design Standards Improvements

Source: RS&H, 2024

3.6 NAVAIDS and Lighting Requirements

Navigational aids and lighting, often referred to as NAVAIDs, are equipment systems designed to assist pilots in locating, and navigating to, airports. NAVAIDs provide pilots with critical information including the aircraft's geographic location, nearby airports, meteorological conditions, pavement status, and the vertical and horizontal position of approaching aircraft relative to the landing zone. SUX features three types of navigational aids: visual aids, electronic aids, and meteorological aids, as detailed in **Chapter 1**. The following sections describe the three types of NAVAIDs and any deficiencies in NAVAIDs and lighting infrastructure currently present at SUX. **Table 3-15** at the end of this section provides a list and assesses the adequacy of the NAVAIDs at SUX.

3.6.1 Visual Aids

Visual aids at SUX include systems specific to each runway and others that cover the entire airport, offering visual guidance to pilots both in flight and during ground operations. Analysis has confirmed that the Airport is equipped with all the necessary and recommended visual aids. However, some of these systems are dated, and upgrades will need to be considered within the planning period.

The Airport does not currently have a segmented circle. A segmented circle assists pilots in locating an airport and provides a centralized location for other indicators such as wind direction or traffic pattern. According to 14 CFR Part 139.323, *Traffic and Wind Direction Indicators*, a segmented circle is required at an airport with a right-hand traffic pattern that serves air carrier operations and has either no operational control tower or one that closes for a period of time. To adhere to the above regulation, a segmented circle, a landing strip indicator, and a traffic pattern indicator should be installed.

Runway 13 and Runway 31 are equipped with four-box Visual Approach Slope Indicators (VASIs), which are currently being phased out and replaced by Precision Approach Path Indicators (PAPIs). Per design recommendation, the VASIs on these runways are programmed to be replaced at the time of this writing with PAPIs during the programming Runway 13-31 Reconstruction project discussed further in **Chapter 4**. Retaining VASIs is not currently a safety concern but as the current VASIs age, maintenance costs could increase due to the NAVAID becoming obsolete and parts becoming more expensive and harder to procure/produce.

An assessment of ground-based visual aids and potential upgrades will be necessary if the Airport intends to achieve lower visibility minimums for runway instrument approaches.

3.6.2 Electronic Aids

Electronic aids at SUX encompass devices and equipment used for aircraft instrument approaches. These include glideslopes (GS) for vertical alignment, localizers (LOC) for horizontal alignment, distance-measuring equipment (DME), VHF omnidirectional range (VOR) for airport proximity, and GPS approaches (RNAV).

With the introduction and adoption of GPS-guided approaches, the necessity for VOR navigation has largely diminished. However, several VOR sites still exist and are being repurposed as navigational backups during GPS outages. In addition, the VOR serving the Airport, the Sioux City VORTAC, is a combination VOR and Tactical Air Navigation (TACAN) facility with the TACAN component serving military aircraft. The TACAN provides similar proximity data to military aircraft providing DME and azimuth information. Analysis of the current electronic aid equipment at the airport indicates no deficiencies, and all electronic aids are expected to adequately support forecasted aviation activity.

In the event the Airport seeks to achieve lower minimums for the Runway 13-31 instrument approaches or achieve new precision approaches on Runway 18-36, an assessment of electronic aids will be necessary. The installation of vertical and horizontal guidance equipment such as a localizer and glideslope would be recommended for Runway 18-36 to gain precision approaches and the upgrade of existing equipment (and new installations) on Runways 13 and 31 is anticipated for lower minimums.

3.6.3 Meteorological Aids

Meteorological aids at SUX include an Automated Surface Observing System (ASOS) and Runway Visual Range (RVR) equipment. The ASOS provides real-time weather updates to air traffic control personnel and pilots, and it records data used by the National Weather Service. The RVR equipment utilizes visibility sensors to assist in precision landing and takeoff operations by determining the lowest authorized Instrument Landing System (ILS) minimums. Both the ASOS and RVR equipment at SUX are reported to be in good condition and are expected to remain adequate throughout the planning period with routine maintenance.

Upgrades to any of the runway approaches as previously discussed would require an assessment of the based meteorological aids, mainly the RVR equipment, to assure the ability to support minimums requirements.

Table 3-15 SUX NAVAID Requirements

NAVAID	Primary Runway		Crosswind Runway		Adequate (✓) or Deficient (X)
	RWY 13	RWY 31	RWY 18	RWY 36	
Visual Aids					
Approach Lighting	MALS	MALSR	REIL	No	✓
Lighting System	HIRL	HIRL	MIRL	MIRL	✓
Runway Markings	Precision	Precision	Non-Precision	Non-Precision	✓
Runway Windcone	Yes	Yes	Yes	Yes	✓
Touchdown Zone Lighting	No	No	No	No	✓
Visual Slope Indicator	VASI	VASI	PAPI (P4L)	PAPI (P4L)	✓
Rotating Beacon[1]	Yes				✓
Segmented Circle[1]	No				X
Electronic Aids					
Glideslope	Yes	Yes	No	No	✓
LOC	Yes	Yes	No	No	✓
DME	No	Yes	No	No	✓
RNAV (GPS)	Yes	Yes	Yes	Yes	✓
VOR	Yes	Yes	Yes	Yes	✓
TACAN	Yes	Yes	No	No	✓
Meteorological Aids					
ASOS	Yes				✓
RVR Equipment	Yes				✓

Abbreviations: PAPI=Precision Approach path Indicator; P4L=PAPI 4 Light; MALSR=Medium Approach Light System with Runway Alignment Indicator Lights; HIRL=High Intensity Runway Lights; MIRL=Medium Intensity Runway Lights; REIL=Runway End Identifier Lights; RVR=Runway Visual Range
Source: FAA Chart Supplements, FAA 5010 Form, RS&H Analysis, 2024

3.7 Commercial Passenger Facilities

Commercial passenger terminal facilities are the interface between the public space and the commercial aircraft. The passenger terminal connects landside facilities (e.g., public access airport roads, public parking lots) and the airport sterile airside (e.g., aircraft apron and airfield). Understanding how this space and interface operate is key to evaluating the effectiveness of the existing commercial passenger facilities. The following sections analyze if the existing commercial passenger facilities meet current and future demand at SUX.

3.7.1 Commercial Terminal Building

The terminal building programmatic requirements are estimated based upon airport terminal planning best practices and recommended methodologies, which are derived from various industry resources. Two reputable industry resources, the international Air Transportation Association (IATA) and the Airport Cooperative Research Program (ACRP), have developed rating systems that discuss methodologies and recommendations for determining level of service. The methodologies and best practices used for this analysis can be found within the following resources:

- *Airport Passenger Terminal Planning and Design* – ACRP Report 25, Volumes 1 and 2, 2010
- *Resource Manual for Airport In-Terminal Concessions*, ACRP Report 54, 2011
- *IATA Airport Development Reference Manual*, 10th Edition, 2015
- FAA, AC 150/5360-13A, *Planning and Desing Guidelines for Airport Terminal Facilities*, 2018

Analysis of each functional terminal area has been performed to assess facility space needs to meet existing and forecasted demand throughout the planning period. The following sections describe the analysis of each functional space as well as assessment of the existing facility's ability to accommodate forecasted growth.

The terminal at SUX is approximately 26,000 square feet with the most recent renovation occurring in 2016. All operations related to commercial passenger activity is located on the first floor of the terminal with the second and third comprised of airport administration spaces. The functional area size allocations and descriptions of the terminal building and apron areas are outlined in **Table 3-16**.

Table 3-16 SUX Terminal Building Functional Areas

TOTAL TERMINAL AREA	Existing SF Existing
Total Terminal Area	**25,980**
Airline - Ticketing, Outbound Baggage, and Administration	
Ticket Counter Area	526
Ticket Counter Queuing	590
Airline Offices	1,470
Outbound Baggage Area	1,565
Inbound Baggage	1,204
Holdrooms	1,952
Boarding	902
Total Airline Space	**8,209**
Transportation Security Administration	
Passenger Screening	976
TSA Administration Offices	1,028
Total TSA Space	**2,004**
Concessions	
Vending	182
Café	1,018
Rental Car Office and Counter	437
Total Concessions Space	**1,636**
Public Space	
Vestibules	333
Public circulation	5,187
Lobby	2,981
Restrooms	888
Bag Claim Lobby	1,865
Total Public Space	**11,254**
Airport Administration	
Total Airport Administration Space	**2,400**
Building Systems and Storage	
Total Building Systems and Storage Space	**477**

*All measurements in square feet (SF)
Source: RS&H Analysis, 2024

This analysis determined the capacity of the existing terminal and identified additional areas required to meet the long-term forecast demand described in **Chapter 2**. The following two scenarios were examined.

- Scenario 1 (Base) – Baseline forecast which used existing conditions today using the CRJ-200 operations from Skywest Airlines.
- Scenario 2 (Alternate) – Alternate growth with the assumption of Skywest upgauging their aircraft to the Embraer 175 (E175).

Scheduled passenger service is provided by Skywest Airlines, operating as United, using 50-seat Bombardier CRJ-200 aircraft. With the understanding that the CRJ-200 aircraft are being phased out of service by airlines across the industry in favor of larger regional jets like the E175, the E175 was selected as the most likely candidate to replace the CRJ-200 at SUX in an alternate scenario.

Table 3-17 compares the projected number of enplaned passengers during the peak hour for each forecast scenario at a 90 percent load factor. Peak hour enplaned passengers will be used to assess space requirements for each terminal functional area.

Table 3-17 Terminal Scenario Sizing and Capability

Scenario	Aircraft Type	Seats	Peak Hour Enplanements	Load Factor
Base	CRJ-200	50	45	90%
Alternate	E175	76	68	90%

Source: RS&H, 2024

3.7.1.1 Ticketing/Baggage Handling

Airline ticketing is located on the non-secure side where passengers check-in, obtain boarding documentation, and check bags. This space includes airline ticket counters, a self-service kiosk, queue area, and airline ticket offices. This analysis validated and updated the ticketing requirements using the forecast peak hour enplanements and deplanements.

The ticket counter queuing area is in front of the ticket counter (i.e., side on which the passengers are processed) and represents the area in which passengers congregate while waiting to check bags or perform a transaction at the ticket counter or kiosk. The ticket counter active area includes the space in front of the counter where passengers are checking in. The airline ticket office area is administrative and support area used by airline ticket agents, located behind the ticket counters. **Table 3-18** assesses the existing ticket counter space in the base and alternate forecast scenarios. As shown, the current capacity is adequate for both scenarios.

Table 3-18 Ticket Counter Capacity

Program Space	Existing	Base	Alternate
	2023	2043	2043
Self-Serve Kiosks	1	1	1
Ticket Counters	3	2	3
Total Ticket Counter Area	526	180	255
Total Ticket Counter Active Area	526	180	255
Total Ticket Counter Queueing Area	590	450	638
Total Airline Ticket Office	2,984	540	765
Total Ticket Counter Area	**4,626**	**1,350**	**1,913**
Total Ticketing Area Surplus (Deficit)	**-**	**3,276**	**2,713**

*All measurements in square feet (SF)

Source: RS&H Analysis, 2024

The outbound baggage handling functional area is composed of two components – outbound bag screening and outbound bag make-up. Outbound bag screening is where the TSA officials screen checked bags prior to the bags being loaded onto the aircraft. The outbound bag make-up area is the area where bags are segregated into different areas based on outbound fight. In addition, the make-up area is where airline personnel collect checked bags to be loaded onto outbound flights.

The analysis for outbound baggage make-up area is based on ACRP Report 25 methodology. This methodology uses the Equivalent Aircraft (EQA) Index, which is calculated by determining the gates in use during the peak departure period. The concept of EQA is one way to look at the capacity of a gate. The EQA Index as described in **Table 3-19** normalizes each gate based on the seating capacity of the aircraft that can be accommodated. The basis of 1.0 EQA is 145 seats based on the Group III narrowbody jet, since it represents the majority of the industry's commercial aircraft fleet. The EQA of a medium regional aircraft with 50 seats (CRJ-200) is 0.4 and of a large regional aircraft with 75 seats (E175) is 0.5.

Table 3-19 EQA Index

ADG	Aircraft Class	Typical Aircraft	EQA Typical Seats	Index
I	Small Regional	(Metro, B99, J31)	25	0.2
II	Medium Regional	(SF340, **CRJ**)	50	**0.4**
III	Large Regional	(DHC8, **E175**)	75	**0.5**
III	Narrowbody	(A320, B737, MD80)	145	1.0
IV	757	(B757, B757 w/Winglets)	185	1.3
IV	Widebody	(MD-11, B767)	280	1.9
V	Jumbo	(B747, B777, B787, A330, A340)	400	2.8
VI	A380	(A380, B747-8)	525	3.6

Note: Totals may not sum due to rounding. Representative scenario aircraft bolded.
Source: ACRP Report 25, Passenger Terminal Planning and Desing – Volume 1: Guidebook, Table V-8, 2010

ACRP Report 25 indicates, that although checked baggage rations are a consideration for baggage area make-up, these ratios generally affect the total number of baggage carts/containers in use rather than the size of the make-up area. There is an estimated one departure per gate during a three-hour staging period to determine the number of staged baggage carts. Additional planning factors and assumptions include the following:

- 300 square feet per cart/container
- 10 percent additional allowance for baggage cart train circulation

As shown in **Table 3-20**, existing outbound baggage make-up area is sufficient to accommodate forecasted demand for both the base and alternate forecast scenarios.

Table 3-20 Outbound Baggage Make Up Requirements

Baggage Make-Up Area	Existing	Base	Alternate
	2023	2043	2043
Make Up Area	785	450	450
Bag Cart Train Circulation	80	30	30
Total Area	**865**	**480**	**480**
Total Area Surplus (Deficit)	**-**	**385**	**385**

*All measurements in square feet (SF)
Source: RS&H Analysis, 2024

3.7.1.2 Public Circulation and Concessions

Concession space at SUX allows for additional revenue generating opportunities and greater customer satisfaction. Currently, the concessions program at SUX is mostly pre-security with a café option. After the screening checkpoint, the only concession option for passengers is a vending machine located within the holdroom. With enplanements projected to increase each year, the amount of space required to meet passenger demand and level of service will increase.

Percentage splits for the public non-secure side and sterile side concession space from ACRP Report 54 were applied to an estimated number of people consuming the food and beverage concessions within the restaurant and designated eating area on the public and sterile side. It is generally assumed that roughly 70 percent of passengers purchase and consume food after passing through security on the sterile side of the terminal. The percentage split also considers that a number of passengers purchase food as "to-go" and eat outside of the food and beverage establishment (e.g., at the gate or on the plane). As growth continues in the Forecast Period and associated terminal development is proposed, it is recommended that post-security concessions be considered to keep up with industry trends. Based on these planning factors and assumptions, **Table 3-21** outlines concession space requirements.

Table 3-21 Concession Requirements

	Existing	Base	Alternate
		2043	2043
Public News and Gift	-	90	150
Public Side Food and Beverage	1,018	30	60
Total Concessions Public Side	*1,018*	*120*	*210*
Public Side Concessions Surplus / (Deficit)	-	898	808
Sterile Side News and Gift	-	70	140
Sterile Side Food and Beverage	120	210	350
Total Concessions Sterile Side	*120*	*280*	*490*
Sterile Side Concessions Surplus / (Deficit)	-	(160)	(370)
Total Concessions	1,138	**738**	**438**

*All measurements in square feet (SF)

Source: RS&H Analysis, 2024

The amount of public circulation space within the terminal building was calculated for secure area, non-public area, and general public areas. Secure circulation represents the secure concourse area. This is defined as circulation area accessible to passengers beyond the passenger security screening checkpoint. The secure circulation requirements analysis used methodology described in ACRP Report 25 with results shown in **Table 3-22**. Per the analysis, the terminal currently maintains adequate circulation space for the current and future condition under the base forecast scenario. However, in the event of an aircraft upgauge, the circulation space is not expected to support the forecasted need and a building expansion would be necessary.

Table 3-22 Terminal Building Circulation Requirements

	Existing 2023	Base 2043	Alternate 2043
Annual Enplaned Passengers	26,380	35,317	59,900
Peak Hour Passengers Combined	45	45	68
Peak Hour Enplanements	45	45	68
Peak Hour Deplanements	45	45	68
Secured Airside Circulation	264	1,950	3,300
Non-Secured Landside Circulation	4,923	2,480	4,200
Total Public Circulation	**5,187**	**4,430**	**7,500**
Public Circulation Surplus / (Deficit)	**-**	**757**	**(2,313)**

*All measurements in square feet (SF)

Source: RS&H Analysis, 2024

The circulation space in the non-secured side of the terminal far exceeds the required need but that of the secured side is far below the need generally designated for public spaces. Based on this, a reorganization of the internal building structure dividing the secured from non-secured would alleviate the cramped secured side spaces with the excess space on the non-secured side.

3.7.1.3 Security/TSA

The passenger security screening checkpoint is the area where Transportation Security Administration (TSA) officials screen passengers prior to entry into the sterile area of the terminal building. The passenger security screening checkpoint (SSCP) separates the public portion of the terminal building from the sterile area. The passenger security screening checkpoint consists of the screening area and administrative area. The administrative area accounts for TSA administrative offices, private passenger screening areas, support/file storage/break room/toilets, and internal circulation corridors.

The analysis considers the number of enplaned passengers during the peak period. The analysis also assumes no transfer passengers and all enplaning passengers are originating passengers that need to be screened. As shown in **Table 3-23**, the space currently allocated for TSA administration and the SSCP is anticipated to remain adequate for both the base and alternate forecast scenarios.

Table 3-23 Passenger Screening Checkpoint Requirements

	Existing	Base 2043	Alternate 2043
Security Checkpoint	2,192	1,939	2,180
TSA Administration	965	250	250
Total SSCP	3,157	2,189	2,430
SSCP Surplus	**-**	**968**	**727**

*All measurements in square feet (SF)
Source: RS&H Analysis, 2024

3.7.1.4 Gate and Holdroom

The holdroom area is the area where passengers congregate on the sterile side of the terminal to await aircraft boarding. These areas include seating area, standing area, an airline boarding podium, and queue area. The holdroom analysis was based on methodology identified in ACRP Report 25. Gate requirements are based on the forecast peak hour passenger aircraft arrivals throughout the planning horizon. The analysis estimates the amount of space sufficient to accommodate passengers sitting and standing in the boarding area awaiting departure. The number of seats and standing area is determined based on the type of aircraft expected to use each gate. The analysis also considers space required for airline staff podiums and associated support area. Due to the low number of flights, specific gate allocations to airlines are not considered. Instead, the analysis focuses on aggregate required holdroom space. A 90 percent load factor assumption is used based on average forecast load factor. The following space for seated and standing passengers is required, representing an optimal[11] level of service:

- Seated passenger area – 15 square feet
- Standing passenger area – 10 square feet

The analysis assumes 80 percent of passengers are seated and 20 percent of passengers are standing. The existing secured side holdroom is approximately 3,240 square feet and has sufficient space to accommodate the forecasted demand for both growth scenarios (see **Table 3-24**).

[11] Level of service (LOS) ranges from A to F, with A being the highest and F being the lowest. An LOS A facility is considered "overdesigned" whereas an LOS F facility is considered to be suboptimal. An optimal level of service is considered to be LOS C.

Table 3-24 Terminal Gate and Holdroom Requirements

	Existing	Base	Alternate
		2043	2043
Peak Hour Enplaned Passengers*	45	45	68
Peak Gates Occupied*	1	1	1
Aircraft Seats*	45	50	76
Passengers Sitting*	97	40	61
Departure Lounge Seating Area	1,952	600	915
Passengers Standing*	-	10	16
Departure Lounge Standing Area	-	100	160
Check-In Counters Positions*	2	2	2
Gate Check-In Counter Area	902	80	80
Gate Check-In Queuing Area	-	200	200
Deplaning/Enplaning Hall	-	350	350
Circulation	264	240	310
Structure	-	30	30
Allowance for Amenities	121	160	205
High Utilization Factor		240	307
Reduction Factor for Combined Lounges		*-68*	*-87*
Terminal Holdroom Area	**3,239**	**1,932**	**2,470**
Terminal Holdroom Surplus	**-**	**1,307**	**770**

Note: All calculated measurements in square feet (SF)
*Measurements in number of passengers/per each
Source: RS&H Analysis, 2024

3.7.1.5 Restrooms

The restroom requirements are determined based on industry-standard best practices. These have changed in recent years as accommodations are being provided to nursing mothers and family restrooms with ample space for parents and children or those requiring assistance. Restroom accommodations are generally based on design-hour demand but may also be conditional for basic secured/unsecured access requirements. Generally, the threshold for expanding restrooms exists at every additional 100 passengers per peak hour window. As even in the alternate forecast scenario with the upgauging of aircraft from the CRJ-200 (50 seats) to the E175 (78 seats), the increase of passenger throughput during peak hour is not substantial enough to require improvements to restroom facilities from a demand perspective. The existing facilities are anticipated to be adequate through the Forecast Period (see **Table 3-25**).

Table 3-25 Terminal Public Restroom Requirements

		Existing	Base 2043	Alternate 2043
Secured Side	Toilet Area	332	170	170
	Family Rooms Area		100	100
	Janitor Area		60	60
	Total Restrooms	**332**	**330**	**330**
	Restroom Surplus		**2**	**2**
Unsecured Side	Toilet Area	508	340	340
	Family Rooms Area	48	100	100
	Janitor Area	173	60	60
	Total Restrooms	**728**	**500**	**500**
	Restroom Surplus		**228**	**228**
Total	**Total Public Restroom Area**	**1,061**	**830**	**830**
	Restroom Surplus		**231**	**231**

*All measurements in square feet (SF)
Source: RS&H Analysis, 2024

3.7.1.6 Baggage Claim

The baggage claim system is used to support arriving flights. Baggage claim is the area in the terminal where arriving passengers retrieve their checked baggage. At SUX, this area includes one revolving baggage claim belt and the area surrounding the system. Bag claim frontage length is the linear length of the bag claim where passengers claim their baggage. The frontage length need is based on the number of passengers arriving during the peak 20-minute period. Generally, all passengers arrive at bag claim before bags are unloaded onto claim device and most bags are claimed on the first revolution of the claim unit, therefore, this analysis is based on the passenger count rather than baggage count. The existing number of bag claim devices and total device frontage length are both anticipated to be sufficient to accommodate demand throughout the planning period. However, in the alternate forecast scenario there is potential for a shortfall in public circulation space within the lobby of the baggage claim area (**Table 3-26**). The location, adjacent to the rental car counters, could become overcrowded if the airport were to realize the upgauging of aircraft per the alternate passenger forecast scenario and should be monitored for future improvements if this growth occurs.

There is no anticipated need to expand the secure side inbound baggage service area where airline employees load the baggage belts during the Forecast Period.

Table 3-26 Baggage Claim Requirements

	Existing	Base 2043	Alternate 2043
Inbound Baggage Service Area	1,204	899	1,109
Inbound Baggage Surplus	-	**305**	**95**
Bag Claim Lobby	1,864	1,270	1,920
Bag Claim Lobby Surplus / (Deficit)	-	**594**	**(56)**

*All measurements in square feet (SF)
Source: RS&H Analysis, 2024

3.7.1.7 Administrative Space

Airport administration requirements were determined based on the link to forecast annual enplaned passengers. Enplaned passengers are a level of representation of the overall activity level and administration space requirements correlate to roughly 0.025 square feet per one annual enplanement. The analysis shown in **Table 3-27** indicates the airport administration space is sufficient (from a demand perspective) throughout the Forecast Period. However, factors outside of this requirement metric such as useful life of the space, amount of staff present in the terminal, and other organizational needs may require the reconfiguration of existing space or new expansion and should be part of future terminal building expansion plans.

Table 3-27 Airport Administration Space Requirements

	Existing	Base 2043	Alternate 2043
Annual Enplaned Passengers	26,380	35,317	59,900
Space prorated at ~0.025 SF/annual enplanement			
Total Administrative Space	2,400	900	1,500
Total Administrative Space Surplus	-	**1,500**	**900**

*All measurements in square feet (SF)
Source: RS&H Analysis, 2024

3.7.1.8 Terminal Building Requirements Summary

Having just been renovated in 2016, the level of service provided in the existing commercial passenger terminal meets current and forecasted demand in the base forecast scenario. However, in the event larger regional aircraft begin operating commercially at SUX, there is potential for shortfall in a few areas in meeting the needs of greater peak hour passenger throughput (namely public circulation and space in the baggage claim). The airport should begin to monitor traffic patterns after this anticipated increase in service occurs to enable sufficient planning and implementation of the necessary improvements ahead of time.

Table 3-28 Terminal Space Requirements Summary

	Existing 2023	Base 2043	Alternate 2043
Ticket Counters and Airlines Space	✓	✓	✓
Outbound Baggage	✓	✓	✓
Concessions	✓	✓	✓
Terminal Passenger Circulation	✓	✓	X
TSA and SSCP	✓	✓	✓
Terminal Gate and Holdroom	✓	✓	✓
Public Restrooms	✓	✓	✓
Baggage Claim	✓	✓	X
Airport Administrative Space	✓	✓	✓

Source: RS&H Analysis, 2024

3.7.2 Commercial Service Apron

The commercial service apron provides space for the parking, loading, and offloading of commercial service passenger aircraft. The commercial service apron is located with the Security Identification Display Area (SIDA) requiring inspection of all entering baggage, vehicles, and personnel. The SIDA is only accessible to authorized personnel and safeguards of access from both the terminal and surrounding airfield should be maintained.

The terminal has two passenger boarding bridges that provide protected passage from the building to the aircraft. Bombardier CRJ-200 operations currently occur approximately twice daily in addition to a Boeing 737-800 charter operation that occurs monthly, but at times that do not overlap. However, due to the possibility of an unplanned event where aircraft maintenance or diversions related to weather occur and the anticipated growth over the planning period, two passenger boarding bridges remain optimal to keep operations efficient.

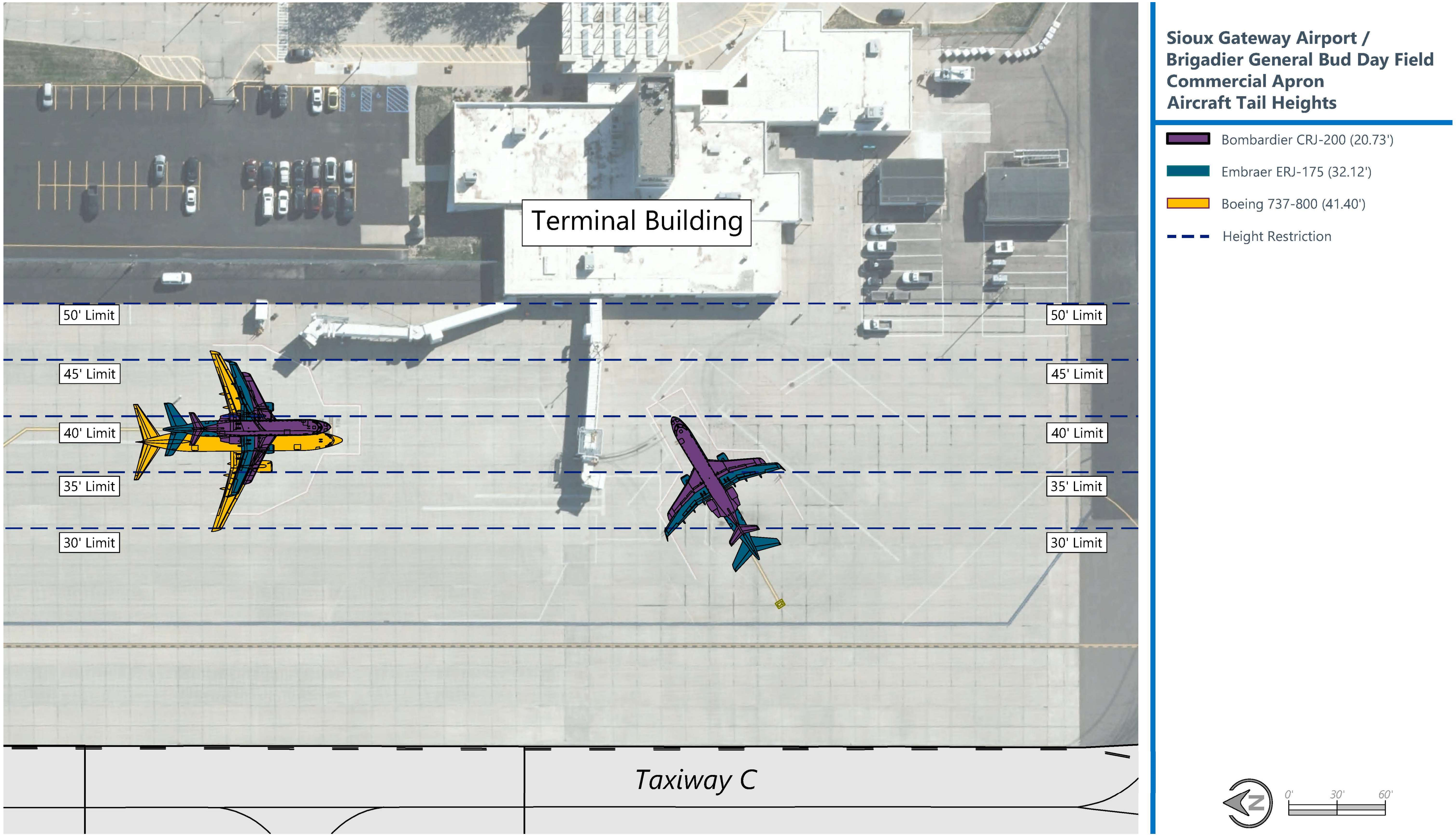
Title 14 of the Code of Federal Regulations (14 CFR), Part 77 outlines airspace "imaginary surfaces" based on runway utility type to protect navigable airspace. The Part 77 Transitional Surface extends upward and outward, perpendicular to the runway at a 7:1 slope from the primary surface[12]. Depending on the parking configuration, the tails of aircraft parked on the commercial service apron may pose an obstruction to the Transitional Surface of Runway 18-36. The tail height of the Boeing 737-800 utilized for charter activity is 41.4' and with a length of 130', parking a Boeing 737-800 at either gate without penetrating the transitional surface not operationally feasible. **Figure 3-4** shows existing and future anticipated aircraft to have regular

[12] As a non-precision runway with visibility at ¾ of a mile, the primary surface for Runway 18-36 is 1,000'.

operations out of SUX in the current lead in line locations on the commercial apron. Mitigation to LoS issues would be a driving factor in any terminal relocation plans and will be discussed further in **Chapter 4**.

Additionally, parked aircraft on the commercial ramp may cause LoS issues with the ATCT and the terminal ramp and adjacent Taxiway C. Based on the infrequency of commercial operations, this is not perceived to be a large safety issue requiring immediate action. The realignment gate parking positions or a future relocation of the passenger terminal itself would likely solve this issue.

Figure 3-4 Commercial Apron Aircraft Tail Heights



Source: RS&H, 2024

3.8 Landside Facilities

Airport landside facilities provide intermodal connections between the airport and a variety of ground transportation modes. These facilities include regional access connections, on-airport circulation roadways, public and employee parking facilities, and rental car ready/return. These facilities are described briefly in the following sections.

3.8.1 Regional Transportation Network

The primary access to the passenger terminal, GA facilities, and IANG base is through Interstate 29 (I-29). At the terminal entry/exit, there is a prominent location sign identifying the Airport, with only limited wayfinding signage indicating the location or direction to other Airport facilities.

Based on Airport observations, the regional roadway system providing access to SUX operates at adequate levels of service under current traffic volumes and is anticipated to remain adequate to support the forecasted operational and traffic volumes in the aviation activity forecast.

3.8.2 On-Airport Circulation Roadways

The terminal loop at SUX can be accessed via three separate roads: Ogden Ave, Aviation Blvd, or Niobrara Ave, with Aviation Blvd serving as the primary public entrance that feeds into I-29. Parking lots and meeter/greeter areas are centrally located around the terminal loop. Feedback from airport personnel indicates insufficient wayfinding signage for these facilities and the Transportation Network Companies (TNC)[13] waiting area. It is recommended that SUX conduct a basic wayfinding study and establish comprehensive guidance and standards for the Airport's landside road network. This coordinated approach aims to enhance the overall airport user experience by reducing stress and anxiety associated with traveling.

3.8.2.1.1 Terminal Curb

The key intermodal transfer between ground-mode and aviation-mode transportation occurs at the terminal curb. Spanning approximately 270 feet, the terminal curbfront is primarily utilized by privately owned vehicles, with a designated portion reserved for Transportation Network Companies (TNCs). Based on historical traffic observations, the terminal curbfront currently offers sufficient capacity for projected passenger traffic. However, it is recommended to enhance signage to clearly demarcate the area where passengers should wait for TNC services.

3.8.3 Vehicle Parking

The provision of adequate parking for airline passengers and airport users is guided by a quality-of-service standard, which is determined by the ease or difficulty of finding a parking

[13] A TNC is a prearranged transportation service for compensation such as Uber or Lyft

space during peak demand hours. For surface lots designated for long-term parking, it is typically considered "effectively full" when the lot reaches 90 percent occupancy, indicating challenges in finding available spaces.

Parking requirements are scaled up as annual demand increases. To determine parking needs for the airport's planning period, a ratio of annual enplanements to parking spots was applied based on current demand levels. Discussions with airport personnel and early-stage observations during the master planning process indicate that the parking lot at SUX reaches 25 percent capacity during peak months. Public parking requirements for SUX are shown in **Table 3-29**.

Table 3-29 Commercial Passenger Parking Needs

Terminal Area Parking	Existing (2023)	PAL 1	PAL 2	PAL 3
Enplanements	26,380	29,644	31,426	35,317
Total Spaces	389	389	389	389
Effective Capacity	351	351	351	351
Required Spaces	256	288	305	343
Parking Space Surplus	**95**	**63**	**46**	**8**

Source: RS&H Analysis, 2024

The current vehicle parking capacity at SUX meets present demand and is expected to continue to suffice throughout the planning period, however by a slim margin. It is recommended the Airport continue to monitor parking levels through the Forecast Period to begin the planning and implementation of parking lot expansion if the need arises.

The terminal parking lots at SUX are currently split into short-term and long-term parking but have the same parking rates in both. As future development occurs or demand for parking increases, the distinction of rates should be reassessed to capitalize on assets. Short-term parking areas typically provide closer proximity to the Terminal Building at a higher cost, enhancing convenience for passengers and visitors. A typical guideline suggests short-term parking should constitute 15-20 percent of the total long-term parking spaces available.

3.8.3.1 Electrical Vehicle Charging Stations

More electric vehicles (EVs) have come to market in recent years and their popularity among consumers has grown with even some states implementing an electric vehicle mandate. Electric vehicles require charging stations to keep batteries charged, and more public and private facilities have begun to install these charging stations to accommodate the increasing electric vehicle supply.

Currently, there are no charging stations available to the public at the airport. Planning for EV space requirements for a facility like SUX should allot approximately 1 percent of total allocated spaces for vehicle parking as EV charging stations by the end of the planning period. This would translate to approximately 4 EV charging spaces at SUX on the total parking accommodations shown in **Table 3-29**.

To be prepared for the demand of electric vehicle charging stations at the airport, an assessment of the existing electrical lines and their voltage/kilowatt capacity will need to be completed to evaluate what improvements to the existing system and sites are necessary.

3.9 General Aviation

This section outlines the requirements during the planning period for the general aviation (GA) facilities used for aircraft parking and storage. The GA facilities evaluated in this section include FBO capacity, fuel storage, aircraft hangar storage, and apron parking.

3.9.1 Fixed Based Operators (FBOs)

At the time of this writing[14], Hawthorne Global Aviation Services is the only FBO operating at SUX. The facility meets the overall needs of their clients, is in good condition, and is optimally located on the northern general aviation ramp north of the terminal. Hawthorne leases hangars from the City of Sioux City and advised during the information gathering stage they are at approximately 70 percent capacity. Hawthorne provides aircraft management, ground handling, and fueling services on the airfield.

Oracle Aviation is constructing a 45,000 square foot hangar on the north side of the airfield, scheduled to commence operations in 2024 as the Airport's second FBO. Oracle will offer services such as aircraft management, charter flights, fueling, hangar storage, and aircraft maintenance. Additionally, Oracle will collaborate with Morningside University in Sioux City to operate a flight school.

[14] June 2024

See **Section 3.10.5** for details on the fueling services and associated facilities offered by the FBOs at SUX for transient, based, and commercial aircraft.

3.9.2 Based Aircraft Parking and Storage

The quantity and type of hangar space are influenced by various factors, including the total number of based aircraft, fleet composition, local weather conditions, airport security, user preferences, and market forces. This section delineates requirements for T-hangars, conventional hangars, and the anticipated demand for additional storage space over the planning period. These terms denote different hangar sizes with distinct uses. The following provides general definitions for hangar types and their intended purposes within the context of this Master Plan:

- **T-Hangars** – Small hangars typically arranged so that small aircraft are "nested" next to each other in alternating directions. These hangars are often used to store smaller single-engine aircraft and light multi-engine aircraft.

- **Conventional Hangars** – Hangars larger than T-hangars and have the potential to accommodate multiple smaller aircraft. The size of a conventional hangar, also referred to as a box hangar, typically ranges from 5,000 to 30,000 square feet. Additional space is needed for apron frontage needs, landside/parking, buffers, safety area offsets, and various other site development elements.

- **Corporate Hangars** – Hangars larger than 40,000 square feet, typically used by businesses or private individuals with aircraft. They are often accompanied by space for offices, conference rooms, lounges, and other desired amenities.

The aviation activity forecast indicates a modest amount of growth in based aircraft that will require additional storage throughout the planning period. In addition to the quantified aircraft storage needs projected from the forecast, it is crucial to consider potential variability in demand for hangars over time. This includes factors such as changes in aircraft types, influenced by emerging industry trends.

Among the five aircraft types included in the forecast, there is a projected moderate increase in the number of jets and a slight rise in single-engine aircraft by PAL 1. By PAL 3, an additional 17 aircraft beyond the 2023 baseline are anticipated at SUX and may necessitate storage accommodation, as detailed in **Table 3-30**.

Table 3-30 SUX Based Aircraft Forecast

	Base Year	Milestone Years		
	2023	2028	2033	2043
		PAL 1	PAL 2	PAL 3
Single-Engine Piston	41	51	51	51
Multi-Engine Piston	3	3	3	3
Turboprop	0	0	0	0
Jet	11	11	13	17
Helicopter	2	2	2	3
Total	**57**	**67**	**69**	**74**

Note: Military based aircraft not forecasted.
Source: RS&H, 2024

To determine the hangar requirements for the planning period at SUX, the following assumptions were made based on conversations with the Airport and observations made during site visits.

- **Based Aircraft**
  - Single engine
    - 20 percent tie down on the ramp
    - 60 percent stored in T-hangars
    - 20 percent stored in conventional hangars
  - Multi Engine, turboprop/jet, and helicopters all stored in conventional or corporate hangars.

- **Transient Aircraft**
  - Single engine aircraft all tie down on the ramp.
  - Muli engine aircraft all tie down on the ramp.
  - Turboprop/jet: 10 percent stored in conventional hangars, the rest tie down on the ramp.
  - Helicopters all tie down on the ramp.

- **Fleet Mix**
  - Determined based on FAA OPSNET data from the past 10 years and airport observations (See **Table 3-31**).

Table 3-31 Fleet Mix

Aircraft Type	% of Fleet
Single Engine	17%
Multi Engine	40%
Jet	40%
Helicopter	3%

Source: RS&H, 2024

3.9.2.1 T-Hangars

SUX currently has a total of 30 T-hangar units, with another 20 under construction at the time of this writing[15]. However, 20 of the units located south of the terminal are in poor condition and the site could be repurposed for either airport or IANG needs in the future. Furthermore, the existing 10 T-hangar units on the north side of the airfield will need to be relocated due to proximity to anticipated FBO and conventional hangar development. This will be discussed further in **Chapter 4**. Based on based and transient aircraft storage assumptions, the 30 T-hangar units expected to remain are adequate for the planning period.

3.9.2.2 Conventional Hangars

To develop the required conventional hangar space, an average hangar area square footage was calculated based on length and width of representative aircraft for each aircraft design group (ADG I/II). Additional space was added to each aircraft for operational safety clearance. The average square footage per aircraft is multiplied by number of aircraft anticipated to be stored in a hangar previously detailed in **Section 3.9.2**. See **Table 3-32** for anticipated (conventional) hangar space needed throughout the planning period.

3.9.2.3 Corporate Hangars

Corporate hangars, typically consisting of proprietary use by one corporation and featuring numerous amenities such as office and lounges spaces are harder are also expected to gain interest at SUX, though planning for growth is difficult. Based on the cost for development and maintenance it is difficult to characterize if current of future tenants would be interested in the added cost to maintain their own facility as opposed to leasing space from an FBO or storing in them a common-use facility. Planning for at least one corporate hangar to be developed on the airfield in the Forecast Period will be carried forward and many of the alternatives developed and analyzed in **Chapter 4** will feature hangar development sites compatible with either conventional or corporate hangar options.

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Table 3-32 Conventional Hangar Requirements

Aircraft Type	Existing	Hangar Demand		
		PAL 1	PAL 2	PAL 3
Single/Multi Engine Aircraft Count	-	10	10	10
Single/Multi Engine Aircraft Area*	-	18,800	18,800	18,800
Turboprop/Jet Aircraft Count	-	11	13	17
Turboprop/Jet Aircraft Area*	-	67,800	80,200	105,000
Helicopter Count	-	2	2	3
Helicopter Area*	-	1,800	1,800	2,700
Total Conventional Hangar Area*	239,390	88,400	100,800	126,500
Surplus*	-	**150,990**	**138,590**	**112,890**

*Measurements in square feet (SF)
Source: RS&H Analysis, 2024

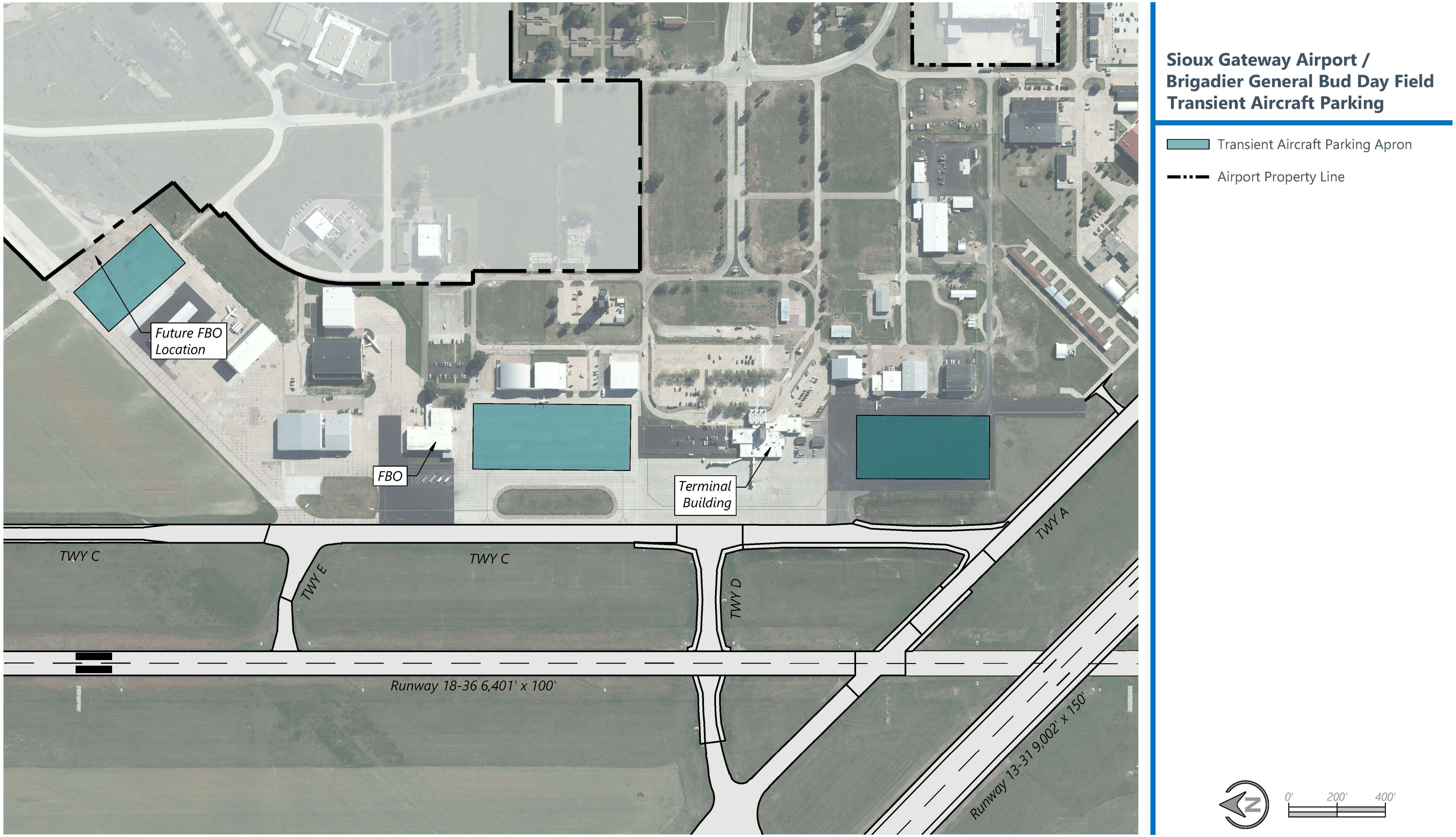
The numbers from this analysis indicate more than sufficient conventional hangar space already existing at SUX to satisfy the demand. Airport management has indicated multiple existing and potential tenants have expressed interest in constructing various size private hangars. As the interest in hangar development becomes more imminent it may benefit the Airport to conduct a market study of hangar preference within the industry to accurately plan and optimize multiple developments at once. It is also important to note that during inclement weather conditions, the need for hangar space significantly increases for transient aircraft.

3.9.3 Transient Aircraft Parking Apron

Transient aircraft are those aircraft not based at SUX. Apron requirements were determined based on the assumptions in **Section 3.9.2**. See **Figure 3-5** for existing transient parking locations at SUX.

There are currently 12 tie-down locations on the south ramp and 14 tie-down locations on the north ramp. As shown in **Table 3-33**, SUX has adequate apron space to satisfy the demand throughout the planning period.

Figure 3-5 Transient Aircraft Parking



Source: RS&H, 2024

Table 3-33 Apron Requirements

Aircraft Type	Existing	Apron Demand		
		PAL 1	PAL 2	PAL 3
Single/Multi Engine Aircraft Count		24	24	26
Single/Multi Engine Aircraft Area*	-	45,120	45,120	48,880
Turboprop/Jet Aircraft Count	-	15	15	16
Turboprop/Jet Aircraft Area*	-	92,500	92,500	98,667
Helicopter Count	-	1	1	1
Helicopter Area*	-	900	900	900
Total Parking Area*	-	138,520	138,520	148,447
Apron Circulation Area8	-	55,400	55,400	59,400
Total Apron Area8	415,550	193,920	193,920	207,847
Surplus	**-**	**221,630**	**221,630**	**207,703**

*Measurements in square feet (SF)
Source: RS&H Analysis, 2024

3.10 Support Facilities

Support facilities at an airport encompass a broad set of functions that exist to ensure the airport can fulfill its primary role and mission in a safe and operationally efficient manner. The following sections outline the requirements for various supporting facilities at the airport.

3.10.1 Air Cargo Capacity and Requirements

SUX currently lacks dedicated cargo operations likely due to its proximity to two other airports within 90 miles that serve major air cargo carriers: Omaha Eppley Airfield (OMA) and Sioux Falls Regional Airport (FSD). If potential cargo operators express interest in using SUX, it is advisable to conduct further assessments to ensure there is sufficient space and capacity to accommodate their operations, taking into consideration other planned airport development projects.

3.10.2 Airport Rescue and Fire Fighting (ARFF)

The IANG oversees all ARFF operations at SUX, ensuring that the facility and related activities comply with both FAA and military standards. The ARFF facility at SUX is classified as an Index B facility under 14 CFR Part 139. However, it has the capability to accommodate Index E operations upon request, facilitated by additional equipment maintained by the IANG for their operations.

The ARFF index classification is established according to criteria specified in 14 CFR Part 139, which considers both the number of commercial passenger aircraft departures and the length of those aircraft. An airport classified as Index B is equipped to handle commercial aircraft that are at least 90 feet but less than 126 feet in length. This classification encompasses the CRJ-200, which has been identified as the existing critical aircraft at SUX.

Under Title 14 CFR Part 139, an Index B airport must meet specific requirements regarding the readiness of equipment and personnel to respond to aircraft emergencies. Index B airports must adhere to one of the following scenarios:

- **Two ARFF Vehicles**
  - One vehicle carrying at least 500 pounds of sodium-based dry chemical, halon 1211, or clean agent; or one vehicle carrying at least 450 pounds of potassium-based dry chemical and water with a commensurate quantity of aqueous film forming foam agent (AFFF) to total 100 gallons for simultaneous dry chemical and AFFF application; and
  - One vehicle carrying an amount of water and the commensurate quantity of AFFF so the total quantity of water for foam production carried by both vehicles is at least 1,500 gallons.

- **One ARFF Vehicle**
  - One vehicle carrying at least 500 pounds of sodium-based dry chemical, halon 1211, or clean agent and 1,500 gallons of water and the commensurate quantity of AFFF for foam production.

The ARFF facility at SUX, built in 2006 and currently in good condition, faces a LoS challenge with the ATCT, hindering visibility of aircraft on a section of Taxiway A nearby. Preliminary discussions with the Airport and IANG suggest relocating the ARFF facility as a solution to this issue. Further assessment is required to identify a new site that ensures compliance with current and potentially reduced response time requirements specified in 14 CFR Part 139.

The life expectancy of ARFF equipment can differ based on factors such as manufacturer, model, and operational intensity. According to FAA AC 150/5220-10E, *Guide Specification for ARFF Vehicles*, most ARFF vehicles are estimated to have a service life of 10 to 12 years. Lightly used ARFF vehicles can remain in service longer than those subjected to heavy use. However, once repair parts become scarce or the annual operating costs exceed 75 percent of the current estimated value, replacement is recommended. Depending on the usage levels of all ARFF equipment detailed in **Chapter 1**, the Airport should assess the need for replacing ARFF vehicles within the planning period to maintain effective emergency response capabilities.

3.10.3 Air Traffic Control Tower

The Airport's ATCT was built in 1995 and is situated northeast of the passenger terminal facility. The facility is owned and operated by the FAA and understood to be in good condition. The ATCT is staffed from 0500 to 2200 local time.

The location of the ATCT presently has LoS issues associated with Taxiway A and Taxiway G (as discussed in **Section 3.5.4**). To alleviate both LoS issues, a common solution would be to relocate the tower or raise the cab height, or conversely move the other facilities causing the LoS issues. These options will be discussed further in **Chapter 4** with preferred development alternatives identified for subsequent LoS studies and implementation.

3.10.4 Airport Snow Removal Equipment and Maintenance Facilities

The equipment requirements and activity for airport maintenance facilities are not tied to aviation activity metrics. Instead, the need for airport maintenance equipment strongly correlates to the amount of pavement, buildings, and overall grounds maintained by an airport and is funded and staffed at the airport's discretion. The future coverage area and hence, airport maintenance activity at SUX, is not expected to change substantially beyond existing demand, but the utilize and operating requirements of new equipment may be more restrictive and an future growth to accommodate these needs is anticipated.

The main maintenance and SRE equipment storage building, located southeast of the passenger terminal, is approximately 20,000 square feet with approximately 2,000 square feet of office/admin space attached to the north. There are three additional maintenance facilities, two to the east for storage and maintenance operations and one to the south for storage that are approximately 3,000 square feet each. All these facilities are reaching the end of their life span and not adequate for their intended purposes. Airfield maintenance equipment, such as mowers, are being stored outdoors exposed to the elements due to the lack of storage capacity. The range of temperatures, periods of precipitation, and extended periods of direct sun exposure in the summers can accelerate wear on equipment requiring and advanced replacement plan. The need for a right-sized maintenance and storage facility(s) based on the airport's perceived need for growth in maintenance operations to accommodate the forecast will be examined through development alternatives in **Chapter 4**.

3.10.5 Aircraft Fuel Storage

Fuel storage at the airport is managed through the fuel farm located south of the passenger terminal and west of the maintenance facility with three above-ground storage tanks. Hawthorne Global Aviation Services currently operates the fuel farm with two 10,000-gallon Jet-A tanks and one 10,000-gallon 100LL aviation gas (AvGas) tank. Oracle Aviation anticipates offering fueling services with the installation of one 20,000-gallon Jet-A tank and one 12,000-gallon 100LL AvGas tank. With this expansion, the fuel storage capacity will easily meet current airport needs and allows for future expansion.

Currently, all general aviation and commercial aircraft fueling at SUX is managed exclusively by Hawthorne. The IANG independently handles their fueling operations using their own trucks and fuel farm. The Airport does not provide any self-fueling options and has implemented restrictions on privately owned fuel tanks.

3.10.6 Airline Glycol Storage and Recovery Facilities

The Airport currently maintains four 2,400-gallon tanks and one 3,000-gallon tank to store E-36 for deicing the airfield during inclement weather. These tanks are housed in the southern maintenance facility, which is approaching the end of its expected useful life. Although the glycol capacity is adequate for current and future planning needs, constructing a new storage facility is advised. Currently, Hawthorne provides aircraft deicing services for both GA and commercial service aircraft. Upon commencing operations, Oracle will also provide aircraft deicing services for these aircraft types.

3.10.6.1 Deicing Application, Collection and Treatment Facilities

Currently, there are no glycol catchment systems in place at SUX. Conversations with airport staff suggest that there have been no exceedances of stormwater benchmarks due to glycol usage. However, it is advisable for the Airport to maintain ongoing monitoring and take measures to protect stormwater discharge into nearby water basins.

3.10.7 Airline Maintenance

Currently, SkyWest Airlines is the sole airline operating at SUX. The maintenance provider, 1 Vision Aviation, is located on-site at SUX and handles contract maintenance for SkyWest. If an issue arises beyond the capabilities of 1 Vision Aviation, SkyWest's nearest maintenance facility is in Minneapolis, Minnesota. The airline's maintenance facility is deemed sufficient for the planning period.

3.10.8 Electrical Vault

The airfield electrical vault at SUX is currently located south of the Terminal Building and is in need of an upgrade, as indicated by Airport personnel. While the vault's capacity can accommodate future growth, its current placement on the airfield is seen as more suitable for revenue-generating opportunities. **Chapter 4** will investigate alternative locations for the airfield electrical vault.

3.11 Utilities

The presence and capacity of existing utilities at an airport are vital for its daily operations and future growth. This section explores the location and anticipated utility needs at SUX throughout the planning period. **Figure 3-6** provides a general overview of the existing utilities at SUX, highlighting their current locations and assessing their accessibility for future development projects. A more detailed evaluation at the project level will be necessary to ascertain if additional services or expansion of existing services are necessary.

3.11.1 Sanitary Sewer

Sanitary sewer services at SUX are supplied by the City of Sioux City, with lines running from South Bridge Road into the Airport to serve all facilities. The current capacity and service provided by the sanitary sewer system are expected to be sufficient to meet the demands throughout the planning period.

3.11.2 Water and Firewater

Water services at SUX are supplied by the City of Sioux City. The primary water line enters the airport along South Bridge Road and branches into secondary lines to serve all airport facilities. This water service infrastructure extends into areas earmarked for potential future development and is deemed adequate for the planning period. No significant relocations or increases in capacity are anticipated at this time.

3.11.3 Natural Gas

Natural gas service at SUX is provided by MidAmerican Energy, with the main gas line running along South Bridge Road before entering the airport to service its facilities. The current natural gas service is considered adequate for the planning period.

3.11.4 Electricity

Electricity services are supplied by MidAmerican Energy at SUX, with current capacity sufficient to meet today's demand. However, future planning should include the rising popularity of electric vehicles (EVs) that may necessitate the installation of electric vehicle charging stations at SUX. As discussed in **Section 3.2.3**, the introduction of redundancy into the utility system through the implementation of sustainable energy generated from clean, renewable sources such as solar energy systems could help support this load requirement. Airports are beginning to integrate renewable energy systems into airport-wide microgrids to establish airport energy independence, thereby promoting financial self-sufficiency and protecting the airport’s central role in community resiliency during disaster recovery.

To assist with the growing trend, the FAA has prepared guidance on solar energy systems on airport property (*Technical Guidance for Evaluating Selected Solar Technologies on Airports*). Solar energy displays a dedication to environmental responsibility and is a way to reduce airport operating costs.

There are other emerging trends in the aviation industry that may require increases in electricity consumption like Advanced Air Mobility (AAM) which includes electric vertical takeoff and landing (eVTOL) aircraft and similar advanced aviation concepts. Although specific implementation needs for AAM are still evolving, both land use planning and utility infrastructure planning should be considered in future airport expansion plans. High level analysis for accommodating these new trends or continuing existing trends (such as solar implementation) will be discussed in **Chapter 4**.

3.11.5 Telephone/Communications

SUX is serviced by multiple telecommunication providers, such as CenturyLink and FiberComm. The primary telecommunication lines originate at South Bridge Road before entering the airport. The current service from these providers is anticipated to adequately meet demand throughout the planning period, encompassing expected future development on the north side of the Airport.

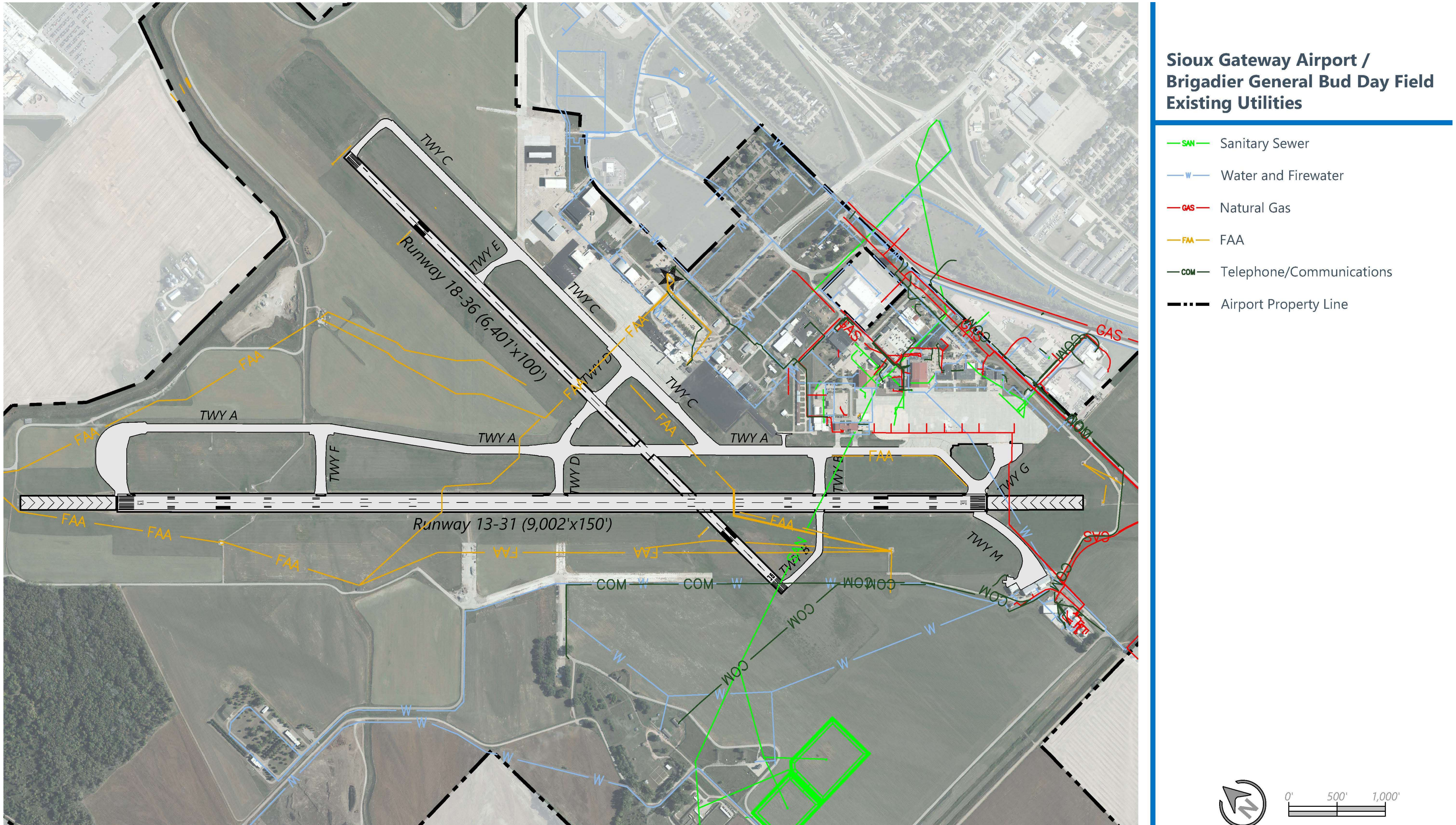
3.11.6 Utilities Summary

Apart from concerns about future and ultimate electrical capacity due to increased usage by vehicles and aircraft, there are no expected requirements for utility expansion or relocation within the planning period at SUX. However, it is important to note that the utility infrastructure is aging and should be monitored and improved as developments associated with the airport progress.

As referenced in **Section 3.2.3**, future general aviation facility planning should consider the infrastructure, utilities, and space necessary for electric aircraft and vehicle charging stations. There is anticipated demand for such facilities over the planning horizon, particularly from electric training aircraft based at the airport. An electric aircraft charging facility should ideally be situated adjacent to a hangar large enough to accommodate multiple aircraft. Safety planning is crucial to ensure the facility is located at an adequate distance from fuel trucks, fuel tanks, or other potentially ignitable chemicals.

Any development of electrical charging stations, whether for aircraft, vehicles, or equipment, must undergo thorough engineering analysis to assess whether the system has the capacity to handle additional load requirements effectively. This engineering analysis is essential to ensure the infrastructure remains reliable and safe while meeting the increasing demand for electric-powered operations at the airport.

Figure 3-6 Existing Utilities



Source: RS&H, 2024

3.12 Iowa Air National Guard (IANG)

The Airport is not responsible for maintaining IANG facilities nor the pavements within the IANG's base of operations. However, it's crucial to include IANG's future initiatives in this Master Plan as they impact airport facilities, especially the airfield.

FAA funding covers pavement rehabilitation for civilian activity and meets civilian design aircraft standards. Per **Section 3.5**, the IANG maintains their own design aircraft standards to support he full mission capability of the base and airfield. The DoD is responsible for funding any and all airport improvements required by the IANG's mission that either exceed, or exist, alongside civil operations of the airport. The projects discussed in this section are initiatives proposed by the IANG that will largely be funded by the DoD and are included here for planning purposes as they have airport operations implications.

3.12.1 Entry Control Point (ECP)

According to discussions with the IANG, the current Entry Control Point (ECP) along South Bridge Drive lacks adequate queuing space and does not meet current guard requirements. The IANG has a conceptual design that involves cutting through airport maintenance property to establish a new ECP, necessitating the relocation of an airport gate that serves as an emergency access point. As this relocation is anticipated to impact the airport's primary emergency access gate and airport maintenance and storage facilities, alternatives for facility relocation are developed and analyzed further explored in **Chapter 4**. Additionally, the proposed location of the ECP will require land transfer between the IANG and the City of Sioux City.

3.12.2 Runway 13-31 Reconstruction Program

While the current length of 9,002 feet on Runway 13-31 at SUX is sufficient for the existing civil fleet mix and design aircraft, it does not meet the operational requirements of the 185th Air Refueling Wing necessary to support specific missions. To meet IANG requirements, the runway must be expanded to enable 10,000 feet of takeoff and landing distance and designed to handle an aircraft stress load of 322,500 pounds through KC-135 traffic. The program, under design at the time of this writing[16], includes additional improvements to the IANG's aircraft apron and a realignment/replacement of a number of airport surfaces (taxiways and roadways) and NAVAIDs. A detailed analysis for this programmed expansion is provided in **Chapter 4**.

3.12.3 Runway 18-36 Expansion

When Runway 13-31 is closed, the IANG is unable to operate aircraft in and out of SUX as Runway 18-36 and its associated taxiways cannot support large aircraft activity and lack the

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arresting system required for fighter jets. An arresting system is necessary on runways shorter than 8,000 feet for military fighter jets to land and abort takeoffs safely. The IANG seeks redundancy in runway use to maintain accessibility to IANG airport-based facilities.

Preliminary concepts for Runway 18-36 expansion suggest the IANG could extend Runway 18-36 to at least 7,000 feet by 150 feet, with an ultimate goal of reaching 8,000 feet by 150 feet, thereby eliminating the need for an arresting system. Discussion with the IANG during the master planning process indicate the extension of Runway 18-36 to be beyond the guard's planning horizon and, as a result, will not be include in the alternatives development or evaluation criteria found in **Chapter 4**.

3.12.4 Facility Expansion

In addition to runway enhancements, the IANG has initiatives to expand their apron and facilities. Conversations with the IANG have indicated future plans to potentially replace the existing fleet of KC-135s with the next-generation KC-46 refueling aircraft (a C-IV/TDG 5 aircraft). The KC-46 has larger dimensions in wingspan, length, and tail height compared to the KC-135, necessitating an expansion of the existing apron to the east to accommodate eight (8) aircraft parking spaces. Further plans include considerations for land acquisition and the construction of a hangar capable of housing the KC-46 aircraft and simulator, although these plans have not been finalized yet.

On IANG property south of Runway 13-31, there is a proposal to construct a radar testing facility for the F-35 aircraft. This project also includes the construction of a new taxiway that would allow military aircraft to cross Runway 13-31 from the IANG ramp to the south airfield facilities. This taxiway would ensure that these aircraft can access the south ramp area without entering the Instrument Landing System (ILS) critical area.

With these and other prospective IANG improvements on the horizon for SUX, the alternatives generated in **Chapter 4** will seek to reserve a portion of the airfield for the growth of IANG operations or at least propose airport develop that would be compatible with IANG activity. Continued development in the future by either airport or the IANG should include a routine update to either entity's long-range development plan(s) to ensure continued compatible planning and operation.

3.13 Summary

Table 3-34 provides a summary of the requirements determined in this study for SUX. The next chapter of the master plan details the alternatives analysis conducted for facilities that required further examination.

Table 3-34 Facility Requirements Summary

SUX Facility Requirements Summary Table	
Component	**Description of Need or Recommendation**
Runways	
Runway 13-31	
Length	(*IANG*) Runway 13-31 needs to be lengthened to accommodate the IANG missions at 100%.
Pavement Strength	(*IANG*) Bearing capacity needs to be strengthened to accommodate the IANG missions at 100%.
Design Standards	(*IANG*) Blast pad dimensions do not meet requirements for the IANG design aircraft (C-IV).
Runway 18-36	
Length	Runway Length is adequate across Forecast Period.
Pavement Strength	Bearing capacity is adequate to support forecasted activity.
Design Standards	Blast pad and shoulder dimensions do not meet FAA requirements for a C-II aircraft.
Taxiways	
Nonstandard Conditions	Address nonstandard safety conditions in alignment with capital development. (*IANG*) Runway 13-31 Reconstruction Program can alleviate a number of taxiway nonstandard conditions.
Runway Incursion Mitigation (RIM)	Mitigate airfield hotspots through facility relocation. (*IANG*) Runway 13-31 Reconstruction Program can alleviate at least one hotspot.
NAVAIDS	
Segmented Circle	A segmented circle is required by the FAA for an airport that either does not have an ATCT or one that closes for a period of time.
PAPIs	Recommended replacement of Runway 13-31 VASIs with PAPIs.
Commercial Passenger Terminal	
Terminal Building	Increases in Public Circulation and Baggage Claim spaces recommended within the planning period.
Terminal Apron	Parking positions on the commercial apron need to be reconfigured due to the tail height of the existing commercial aircraft penetrating the transitional surface.
Terminal Parking	Parking for commercial service passengers will need to increase within the planning period.
Aircraft Parking and Storage	
Hangars	Additional aircraft storage (conventional and corporate hangars) is desired within the planning period.
Apron Parking	Apron capacity adequate across Forecast Period.
Landside	
Parking Lots	Parking lot capacity adequate through Forecast Period but should be monitored with increased activity.
Support Facilities	
Aircraft Rescue and Fire Fighting (ARFF)	Building creates a hotspot and LoS issue with ATCT, needs to be relocated.
Air Traffic Control Tower (ATCT)	Alternative for LoS issues is to relocate ATCT or raise cab height.
Airport Maintenance and SRE Storage	Maintenance and storage facilities undersized and near useful life. Need to be expanded. (*IANG*) Optimal site for ECP relocation is the maintenance campus. Relocation of airport facilities to be analyzed.
Airline Maintenance Hangar	It is recommended an additional airline maintenance hangar be planned to accommodate additional airline service in the Forecast Period.
Electrical Vault	The electrical vault is near useful life and in a location more suitable for a revenue generating facility. Needs relocation.
IANG	
Apron Expansion	(*IANG*) IANG expansion to existing apron as part of the Runway 13-31 Reconstruction Program. May have future expansion.
Taxiway Configuration	(*IANG*) Taxiways A, G, and M all modified as part of Runway 13-31 Reconstruction Program.
Facility Expansion	Protect land for continued IANG growth.

Source: RS&H, 2024